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

FPL

November 21, 2003

L-2003-283
EA-03-09(IV)(F)(2)

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

Re: St. Lucie Unit 1
Docket No. 50-335
Order (EA-03-009) Relaxation Requests 1 and 2
Examination Coverage of Reactor
Pressure Vessel Head Penetration Nozzles

On February 11, 2003 the NRC issued Order (EA-03-009) requiring specific inspections of the reactor pressure vessel (RPV) head and associated penetration nozzles at pressurized water reactors. Pursuant to the procedure specified in Section IV, paragraph F of the Order, Florida Power & Light (FPL) requests relaxation from the requirements specified in Section IV, paragraph C (1)(b)(i) for St. Lucie Unit 1 for the reactor pressure vessel head (RPVH) penetration nozzles for which ultrasonic testing requirements can not be completed as required. Relaxation is also requested from the requirements specified in Section IV, paragraph C (1)(a) for an area of the reactor head surface that is inaccessible for visual inspection.

Attachments 1 and 2 to this letter provide relaxation requests. As demonstrated in the attachment hereto, the requested relaxation meets item IV.F (2) of the Order, as compliance with this Order for the specific areas described in the requests would result in hardship or unusual difficulty without a compensating increase in the level of quality or safety.

FPL requests approval of the subject relaxation by March 22, 2004, the currently scheduled start date for St. Lucie Unit 1 refueling outage SL1-19.

Please contact George Madden at (772) 467-7155 if there are any questions about the relaxation.

Very truly yours,

William Jefferson, Jr.
Vice President
St. Lucie Plant

Attachments

A101

ST. LUCIE UNIT 1 RELAXATION REQUEST NO. 1 Revision 0 FROM US NRC Order EA-03-009

1. ASME COMPONENTS AFFECTED

St. Lucie (PSL) Unit 1 has 78 ASME Class 1 reactor pressure vessel (RPV) head penetrations.

The St. Lucie Unit 1 Order Inspection Category in accordance with Section (IV.A.) is currently determined as "high" based on an approximate 16.7 EDY at the SL1-19 refueling outage (RFO).

2. US NRC ORDER EA-03-009 APPLICABLE EXAMINATION REQUIREMENTS:

The NRC issued an Order[1] on February 11, 2003, establishing interim inspection requirements for reactor pressure vessel heads of pressurized water reactors. Section IV.C. of the Order states the following:

All Licensees shall perform inspections of the RPV head using the following techniques and frequencies:

(1) For those plants in the High category, RPV head and head penetration nozzle inspections shall be performed using the following techniques every refueling outage:

(a) Bare metal visual examination of 100% of the RPV head surface (including 360° around each RPV head penetration nozzle), AND

(b) Either:

(i) Ultrasonic testing of each RPV head penetration nozzle (i.e., nozzle base material) from two (2) inches above the J-groove weld to the bottom of the nozzle and an assessment to determine if leakage has occurred into the interference fit zone,

OR

(ii) Eddy current testing or dye penetrant testing of the wetted surface of each J-Groove weld and RPV head penetration nozzle base material to at least two (2) inches above the J-groove weld.

[1] US NRC Letter EA-03-009, "Issuance Of Order Establishing Interim Inspection Requirements For Reactor Pressure Vessel Heads At Pressurized Water Reactors," from Samuel J. Collins (NRC) to all Pressurized Water Reactor Licensees, dated February 11, 2003.

The NRC later clarified the definition of "bare metal visual examination of 100% of the RPV head surface (including 360° around each RPV head penetration nozzle)" within Temporary Instruction 2515/150[2].

Relaxation is requested from part IV.C.(1)(a) of the Order to perform "bare metal visual examination of 100% of the RPV head surface (including 360° around each RPV head penetration nozzle)" at St. Lucie Unit 1. Specifically, FPL is unable to completely comply with this requirement due to inaccessibility of two small areas of the RPV head surface. The inaccessible areas consist of a small section of the circumference of penetration #2 (approximately 45 degrees) and some limited base material areas between penetrations.

3. REASON FOR REQUEST:

Pursuant to Order Section IV.F "all Licensees shall notify the Commission if: (1) they are unable to comply with any of the requirements of Section IV, or (2) compliance with any of the requirements of Section IV is unnecessary." Additionally, the NRC Order requires FPL to address the criteria that (2) "compliance with the Order for specific nozzles would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety." FPL is requesting this relaxation for St. Lucie Unit 1. The Order requires "bare metal visual examination of 100% of the RPV head surface (including 360 degrees around each RPV head penetration nozzle)." FPL is unable to comply with the requirement for 100% visual examination coverage due to lack of access.

The insulation covering the RPV head at St. Lucie Unit 1 is metal reflective encapsulated mineral wool. The insulation conforms to the head as do the lower CEDM pressure housings. The insulation is made up of 33 panels, 21 of which encircle the 1 (1.050-inch OD) vent, 69 (3.85-inch OD) CEDM, and 8 (5.563-inch) ICI nozzles. Holes of 8.125-inch diameter for CEDM penetrations, 16.625-inch diameter for the ICI penetrations, and a 2-inch square hole for the vent line are cut in the insulation panels. The encircling panels were installed over the lower CEDM pressure housing flanges during initial construction. The gap between the insulation panels and the CEDM/ICI penetrations is filled with blanketed plug rings (4-inch ID and 8-inch OD for CEDM and 5.625-inch ID and 16.5-inch OD for ICI) made up of calcium-silicate wrapped in asbestos cloth. These rings were installed prior to the panels and secured with a metal band. A side view of the RPV head showing the blanket rings and the close conforming insulation panels (Figure 1) is included below.

The examination for evidence of leakage is performed by accessing the top head surface through the gap between the head surface and the close conforming insulation panels using remote video equipment (videoscope/borescope). Access is gained by lifting the shroud and removing the outside row of vertical panels. The

[2] US NRC Inspection Manual, Temporary Instruction 2515/150, Revision 2, "Reactor Pressure Vessel Head And Vessel Head Penetration Nozzles (NRC Order EA-03-009)", Issue date August 4, 2003.

inaccessible areas are a result of the blanket rings that fill the gap between the insulation panels and the penetrations. Some of these blanket rings have partially dropped and are in contact with the head base material in areas between the penetrations that will be inspected for evidence of leakage. The lack of access to these small areas (less than 1% of the total surface area) does not preclude performance of an effective bare metal visual examination of the nozzle-to-top-of-head interface region or the RPV head to identify evidence of wastage and/or leakage.

FPL implemented the NDE examination requirements at St Lucie Unit 1 RPV penetrations in accordance with commitments made in the Licensee response to NRC Bulletin 2002-02.[3] The Bulletin examination results were documented in the 30-day response required after the outage in which the examinations were performed. The results are summarized as follows:

In October 2002, SL-1-18, FPL performed a bare metal visual examination of the accessible portions of the RPV head inside the reflective metal insulation, including 360° visual examination around each RPV head penetration nozzle, to identify any evidence of leakage from the 78 penetrations. The visual examination of the intersection of the 78 reactor pressure vessel head penetrations (RPVHP) with the bare metal head was broken down into quadrants for documentation. All four quadrants of each of the 78 penetrations were reached for visual inspection. However, a limitation was noted on one quadrant of nozzle #2. The blanket ring of insulation that fills the gap between the RPVHP and the close fitting metal insulation panels obstructed this quadrant. Several attempts were made to move the 2-inch thick insulation ring, but the best that could be obtained was a view of the intersection of the nozzle at the RPV head at three complete quadrants and 50% of the 4th quadrant. While a 360° view at the intersection of the nozzle was not obtained around this nozzle at the intersection of the RPV head, a large portion was viewed directly (~315°) and 360° was viewed just outside the insulation ring with no evidence of boric acid leakage, accumulation, or wastage. In addition to the insulation limitation noted for RPVHP #2, light to moderate debris was noted at or near several of the RPVHPs. The debris was characterized as paint chips, dust, or small construction items such as wire, bolts, washers, etc. Swipe samples were taken of the dust particles around two different penetrations and the presence of boric acid residue was detected, but isotopic analysis confirmed that it is was not from recent or active leakage. An air sample of the head area also detected low levels of asbestos. Condition Report (CR) #02-2439 was generated to further characterize the debris and to document the final disposition of whether the debris or insulation hindered the inspection. Some debris was removed and several locations were reevaluated or reinspected. FPL concluded in the CR that the RPV head was clean enough to facilitate a meaningful exam and the examination results support the conclusion that the RPV head was free of wastage or RPVHP leakage. In addition, based on the large area observed around nozzle #2, there was reasonable

[3] FPL Licensing Letter Number L-2002-233, St. Lucie Units 1 and 2 Docket Nos. 50-335 and 50-389 Reactor Pressure Vessel Head (RPVH) Inspection NRC Bulletin 2002-02 Supplemental Response.

assurance that no wastage or leakage has occurred at that location. Since boric acid leakage is required for wastage of the RPV head carbon steel to occur, FPL concluded, based on the lack of boric acid leakage or accumulation, that there was no wastage present on the St. Lucie Unit 1 RPV head.

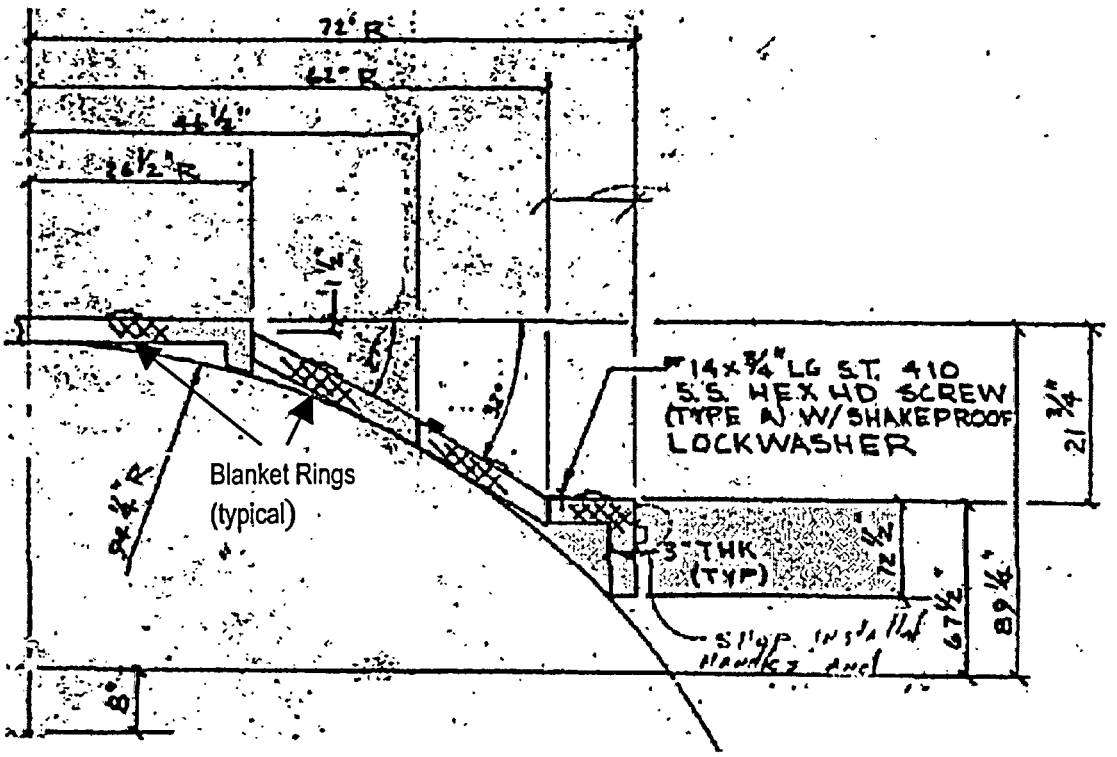

Figure 1: RPV Head Side View showing close conforming Insulation Panel Layout

4. PROPOSED ALTERNATIVE AND BASIS FOR USE:

FPL will achieve substantial compliance with the 100% Order requirement by conducting a bare metal visual examination of the RPV head surface to the maximum extent practical, excluding the inside of the 54 RPV stud holes, under the cooling shroud ring, the underside of the head, or the inside of the RVH lifting lug bolt holes. Specifically, the examination will include a visual examination of 100% of the nozzle-to-top-of-head interface region (360°) of at least 77 of the RPV head penetration nozzles for evidence of leakage and the maximum extent possible of penetration #2 (expected to be approximately 315 degrees). Additionally, the examination will include all base material uphill and downhill of any of the limitation areas encountered for evidence of wastage, or corrosive products entering or exiting the area.

BASIS FOR RELAXATION:

The scope of the examination is to perform a bare metal visual examination of 100%

of the RPV head surface (including 360° around each RPV head penetration nozzle). The St. Lucie Unit 1 RPV top head surface has areas of inaccessibility due to the presence of partially dropped blanket rings that are in contact with portions of the head base material. Improving access to these inaccessible areas for visual examination would require major disassembly, including destructive removal of the close conforming metal reflective insulation panels, to allow access. This effort will result in a substantial increase in radiation dose, asbestos exposure, and the potential for damage to associated components. The performance of this destructive disassembly is not practical and does not enhance the quality of the examination. The required 360° visual examination around 77 of the 78 RPV head penetration nozzles, where leakage would originate, is unaffected by this limitation. Also, the inaccessible area around penetration #2 is very limited, and the head surfaces immediately uphill and downhill of the inaccessible areas will be examined for evidence of boric acid leakage.

It can be concluded that a hardship or unusual difficulty without a compensating increase in level of quality or safety would result if destructive removal of the existing insulation were performed to achieve the complete coverage of the RPV head base material required by the Order.

This conclusion is based on the following results:

- The visual examination performed during SL1-18 of the 78 penetration nozzle-to-top-of-head interface regions (360° coverage was obtained on all except penetration #2 as stated above) identified no evidence of leakage.
- The visual examination performed during SL1-18 of the RPV head base material adjacent to 78 penetrations, with the exception of the small area adjacent to penetration #2 under the blanket ring of insulation in a portion of 1 quadrant, identified no evidence of wastage of the head base material or staining leading to or from the inaccessible area.
- The UT examination performed during SL1-18 of the 78 penetrations identified no indications or flaws recorded in any of the nozzle exam areas that were scanned.
- FPL will perform UT examinations of the 78 penetrations including an assessment to determine if leakage has occurred into the interference fit zone as required by NRC Order EA-03-009 during SL1-19.

5. DURATION OF PROPOSED ALTERNATIVE:

This relaxation is applicable to the spring 2004 refueling outage (SL1-19) for St. Lucie Unit 1.

ST. LUCIE UNIT 1 RELAXATION REQUEST NO. 2 FROM US NRC Order EA-03-009

1. ASME COMPONENTS AFFECTED

St. Lucie (PSL) Unit 1 has 78 ASME Class 1 reactor pressure vessel (RPV) head penetrations (including the vent). The scope of this relaxation is only applicable to the 69 RPV Control Element Drive mechanism (CEDM) head penetrations.

The St. Lucie Unit 1 Order Inspection Category in accordance with Section (IV.A.) is currently determined as "high," based on an approximate 16.7 EDY at the SL1-19 refueling outage (RFO).

2. APPLICABLE EXAMINATION REQUIREMENTS:

The NRC issued an Order[1] on February 11, 2003, establishing interim inspection requirements for reactor pressure vessel heads of pressurized water reactors. Section IV.C. of the Order states the following:

All Licensees shall perform inspections of the RPV head using the following techniques and frequencies:

(1) For those plants in the High category, RPV head and head penetration nozzle inspections shall be performed using the following techniques every refueling outage:

(a) Bare metal visual examination of 100% of the RPV head surface (including 360° around each RPV head penetration nozzle), AND

(b) Either:

(i) Ultrasonic testing of each RPV head penetration nozzle (i.e., nozzle base material) from two (2) inches above the J-groove weld to the bottom of the nozzle and an assessment to determine if leakage has occurred into the interference fit zone,

OR

(ii) Eddy current testing or dye penetrant testing of the wetted surface of each J-Groove weld and RPV head penetration nozzle base material to at least two (2) inches above the J-groove weld.

[1] US NRC Letter EA-09-009, "Issuance Of Order Establishing Interim Inspection Requirements For Reactor Pressure Vessel Heads At Pressurized Water Reactors," from Samuel J. Collins (NRC) to all Pressurized Water Reactor Licensees, dated February 11, 2003.

Relaxation is requested from part IV.C.(1)(b)(i) of the Order to perform ultrasonic testing (UT) of the RPV head penetration inside the tube from 2 inches above the J-groove weld to the bottom of the penetration. It is FPL's intent to perform the examination to the maximum extent possible. Specifically, the relaxation requested is that the UT examination distance be changed to a minimum of ¾ inch above the weld on the uphill side and ¾ inch below the weld on the downhill side.

3. REASON FOR REQUEST:

Pursuant to Order Section IV.F.(2) "Compliance with the Order for specific nozzles would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety." FPL is requesting this relaxation for St. Lucie Unit 1. The Order requires examination from 2 inches above the J-groove weld to the bottom of the RPV head penetration nozzle

FPL implemented the NDE examination requirements at St Lucie Unit 1 for RPV penetrations in accordance with commitments made in the Licensee response to NRC Bulletin 2002-02[2] in the fall of 2002. The actual extent of the nozzle examinations were found to be significantly less than that required by the subsequent NRC Order. The Bulletin examination results were documented in the 30-day response required after the outage in which the examinations were performed.[3] The results are summarized as follows:

> There were no indications of leakage, wastage, or cracking shown by any of the examination methods performed. There were reduced examination coverage issues, which did not preclude the ability of FPL to assess the structural integrity of the RPVH or RPVH penetration nozzles.

The areas of reduced coverage from the SL1-18 refueling outage inspection are summarized below:

Table 1: Summary of the UT Coverage Results	
Area of UT Coverage	**Number of Penetrations with 360° Coverage**
Above the weld	76 of 78 exams
At the weld root	72 of 78 exams
In the area adjacent to the weld	17 of 78 exams

[2] FPL letter L-2002-185, "St. Lucie Units 1 and 2, Docket Nos. 50-335, 50-389, Turkey Point Units 3 and 4, Docket Nos. 50-250 and 50-251, Response to NRC Bulletin 2002-02, Reactor Pressure Vessel Head Penetration Nozzle Inspection Programs," R. S. Kundalkar to NRC, September 11, 2002.

[3] FPL Licensing Letter Number L-2002-233, St. Lucie Units 1 and 2 Docket Nos. 50-335 and 50-389 Reactor Pressure Vessel Head (RPVH) Inspection NRC Bulletin 2002-02 Supplemental Response.

Table 1: Summary of the UT Coverage Results	
Area of UT Coverage	**Number of Penetrations with 360° Coverage**
Below the weld	14 of 69 (The 8 ICI & vent are not included in this total since the portion of the nozzle that extends below the head has a fillet weld on the OD surface or the nozzle is flush with the head surface.)

FPL was successful in obtaining most of the data at or above the weld, which was the area of prime concern for the prevention of nozzle ejection. Since then, the examination vendor, Framatome ANP, has made significant improvements in tooling and NDE probe design such that contact is maintained in the area adjacent to and below the weld. These enhancements, deployed for Calvert Cliffs in 2003, resulted in better examination coverage than that obtained at St. Lucie Unit 1 during the fall 2002 inspection.

FPL and Framatome ANP recently reviewed the St. Lucie Unit 1 examination data collected in 2002. Using the improvements developed for Calvert Cliffs (i.e. modified probes and delivery equipment), it is expected that 360° coverage of all penetrations will be successfully obtained. However, it is not expected that the full extent of ultrasonic testing from 2 inches above the J-groove weld to the bottom of the nozzle will be achieved. Based on the experience at both St. Lucie and Calvert Cliffs, there will be some penetrations that cannot be inspected to the entire length mandated by the Order because of configuration and/or access issues. Configuration issues would be caused by weld distortion or local blending. Access issues could be caused by guide sleeve position. It is FPL's intent to perform the examination to the maximum extent possible.

In addition, all RPV head penetrations inspected with the UT blade probe contain an area of coverage less than that required by the NRC Order due to the probe design. The Order requires examination from 2 inches above the J-groove weld to the "bottom of the nozzle." The circumferential blade UT probe used at St. Lucie Unit 1 has been demonstrated for detection of circumferential, off-axis, and axial flaws. This probe has separate transducers (50° longitudinal time of flight diffraction, L-TOFD) for sending and receiving the UT signal. The transducers are arranged vertically approximately 0.787 inches apart. The scanning process requires both transducers to be in contact with the ID surface of the nozzle. Based on the nominal arrangement of the transducers, the portion that can not be scanned is a triangular portion extending from the bottom of the nozzle upward for a distance of approximately 0.39 inches (half the transducer separation) measured on the nozzle OD. The nozzle ID surface is fully interrogated by the UT transducer to the end of the nozzle.

The hardship is based on the following points:

- The circumferential UT blade probe design was selected based on its ability to detect and size axial, off-axis, and circumferential flaws. It was also selected for its robustness and ability to obtain more consistent surface contact. The deployment of the axial UT blade probes in addition to the currently deployed circumferential blade probe does not significantly increased coverage. The axial probe also has limitations, due to element size, that prohibit interrogation to the

bottom of the nozzle, and it has no increased coverage capabilities for areas of distortion above the weld. Deployment of both probes provides little additional information and no commensurate increase in safety.

- To employ a rotating UT probe, capable of interrogating all the material from 2 inches above the weld to the bottom of the nozzles in penetrations that are not open, would require removal and replacement of the permanently installed thermal sleeves. The removal and reinstallation of 2 thermal sleeves during the fall 2002 St. Lucie Unit 1 inspection resulted in approximately 4.8 man-Rem of exposure. This effort would be time and dose intensive, without a resultant commensurate increase in safety.

- Manual PTs of the missed OD areas of the penetration base material would be time and dose intensive without a compensating increase in safety. The dose estimate to perform manual PT surface examination of the 69 RPV nozzle ends examined by blade probe UT would be approximately 19 man-Rem. This estimate is based on the dose rates of the St. Lucie Unit 1 head compared to dose rates and actual surface examinations of the vent line at Turkey Point Units 3 and 4 and portions of 9 RPV nozzles ends at St. Lucie Unit 2. The PT examination of the remaining 69 penetration base material OD would result in excessive dose without a resultant commensurate increase in safety. The installed thermal sleeves prevent manual PT of the ID surfaces.

Accordingly, FPL is requesting a reduction of the examination coverage area based on a flaw tolerance analysis approach. As discussed below, this approach will provide an acceptable level of quality and safety with respect to reactor vessel structural integrity and leak integrity.

4. PROPOSED ALTERNATIVE AND BASIS FOR USE:

It is FPL's intent to perform the examination to the maximum extent possible. However, FPL proposes to inspect a minimum of 0.75 inches above the weld on the uphill side to a minimum of 0.75 inches below the weld on the downhill side. A 0.75 inch limit bounds all but 5 CEDM penetrations based on a review of the 2002 examination coverage data, and the new examination could bound all CEDM penetrations with the improved probe design and tooling. If the proposed level of coverage can not be obtained at all penetrations, the specific situations will be evaluated and a revised relaxation request will be submitted, or modifications will be implemented to obtain the required coverage, as appropriate. This relaxation is applicable to the CEDM penetrations only. This proposal is consistent with the analysis submitted in the industry topical report MRP-95[4,5] and the site-specific

[4] NEI Letter from Alexander Marion to Dr. Brian Sheron, "Generic Relaxation request for Order EA-03-009, Project Number: 689," September 26, 2003.

[5] MRP-95, Materials Reliability Program Generic Evaluation of Examination Coverage Requirements for Reactor Pressure Vessel Head Penetration Nozzles, EPRI Topical Report, September 2003.

analysis previously submitted in WCAP-15945[6]. The zones of inspection selected are such that the stresses in the remaining uninspected zones are at levels at which primary stress corrosion cracking is considered highly unlikely.

Axial Crack Stability

As confirmation that the inspection zone defined above provides an acceptable level of safety, flaw tolerance analyses were run using the St. Lucie Unit 1 structural integrity evaluation, WCAP-15945-P, Section 6, for the 0°, 29.1°, 37.1°, and 42.5° penetrations. This demonstrated that flaws, which could be missed because they are just outside the inspection zone, would not grow to unacceptable sizes during one fuel cycle of plant operation.

Through-wall axial flaws were assumed to exist in the penetration and terminate at the 0.75-inch distance below the weld for downhill side. No cracks violated the weld in the 18-month operating cycle. The minimum time exceeded 5 years.

Industry Experience

MRP-95 reviewed head inspection results for U. S. PWRs to determine if flaws were found in prior inspections that were outside the proposed inspection area. Of 237 data points, 3 flaws begin at a distance greater than 0.75-inch above the weld uphill and 22 begin at a distance greater than 0.75-inch below the weld downhill. However, a portion of all these 25 flaws are within the proposed inspection zone and would be detected.

Materials of Construction

The following penetration materials were used at St. Lucie Unit 1:

Quantity	Heat	Manufacturer	Yield(KSI)	Application
21	NX 8623	Huntington	45.5	CEDM
20	NX 8251	Huntington	39.5	CEDM
26	NX 9967	Huntington	46.0	CEDM
2	NX 1405	INCO	54.0	CEDM

There have been no instances of cracked CRDMs from these heats reported in the industry.

Conclusion

The proposed inspection ensures that there are no concerns with the structural integrity of the St. Lucie Unit 1 RPV penetration nozzles that could be caused by cracking in the excluded NRC Order coverage areas.

[6] WCAP-15945, "Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: St. Lucie Unit 1," Westinghouse Electric Co. LLC, September 2002.

This conclusion is based on the following:

- UT inspection will be performed for the higher stressed areas of all 69 CEDM penetrations. The stresses in the remaining uninspected zones are at levels at which primary stress corrosion cracking is considered highly unlikely.

- All flaw indications reported in the industry to date would have been detected had the inspection been limited to the examination scope proposed in this relaxation request.

- There have been no instances of cracking in the St. Lucie Unit 1 materials.

- The combination of leak path and visual inspection will provide assurance that no leaks that could cause OD initiated circumferential cracking above the weld exist. All previously identified circumferential cracks have initiated from the OD of the material, where the higher stresses exist.

5. DURATION OF PROPOSED ALTERNATIVE:

This relaxation is applicable to the spring 2004 refueling outage (SL1-19) for St. Lucie Unit 1.