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

May 11, 2003

L-2003-129
EA-03-009(IV)(F)(2)

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

Re: St. Lucie Unit 2
Docket No. 50-389
Order (EA-03-009) Interim RPVH Inspection Requirements
Revised Relaxation Requests 1 and 2 - Supplement 4

On February 11, 2003, the NRC issued Order (EA-03-009) requiring specific inspections of the reactor pressure vessel head (RPVH) and associated penetration nozzles at pressurized water reactors. By FPL letter L-2003-086 on March 28, 2003, Florida Power & Light Company (FPL) submitted Relaxation Requests 1 and 2 requesting relaxation from the requirements specified in Section IV, paragraph C.(1)(b)(i) for St. Lucie Unit 2 for the RPVH penetration nozzles for which ultrasonic testing (UT) requirements can not be completed as required. Relaxation Request 1 was supplemented by FPL letters L-2003-101, L-2003-113, and L-2003-117 on April 18, 2003, April 29, 2003, and May 4, 2003, respectively. Relaxation was 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. Relaxation Request 2 was supplemented by FPL letter L-2003-113 on April 29, 2003.

On April 14, 2003, May 1, 2003, May 6, 2003, and May 8, 2003, FPL discussed a proposed modification to the UT coverage requested for Relaxation Request 1. Attachment 1 provides Revision 2 of Relaxation Request 1 and is a complete replacement for the previous submittals. Relaxation Request 1 was revised based on UT examination results and supplemental dye penetrant testing of the base metal material in those instances where UT coverage was less than 0.41 inches below the weld. In addition, this revision responds to NRC requests for additional information necessary for the NRC to complete the review that were identified during the May 6 and May 8, 2003 conference calls.

A101

During the May 8, 2003 conference call, the NRC requested FPL to update Relaxation Request 2 to discuss the actual RPVH visual examination results. Attachment 2 is Revision 1 of Relaxation Request 2 and is a complete replacement for the previous submittal.

For any additional questions about these relaxation requests, please contact George Madden at (772) 467-7155.

Very truly yours,

William Jefferson, Jr.
Vice President
St. Lucie Plant

WJ/GRM

Attachments

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

Hardship or Unusual Difficulty Without Compensating Increase in Level of Quality or Safety

1. ASME COMPONENTS AFFECTED

St. Lucie (PSL) Unit 2 has 102 ASME Class 1 reactor pressure vessel (RPV) head penetrations (including the vent). The scope of this relaxation is only applicable to the 91 RPV head penetrations with attached threaded guide funnels.

The St. Lucie Unit 2 Order Inspection Category in accordance with Section (IV.A.) is currently determined as "high" based on 14.0 EDY at this refueling outage[1] (RFO).

FPL Drawing No. 2998-3130, Rev. 3 (PSL-2)

2. APPLICABLE EXAMINATION REQUIREMENTS:

The NRC issued an Order[2] on Februay 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,

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[1] 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.

[2] 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, February 11, 2003.

OR

(ii) Eddy current testing (ECT) 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.

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. Specifically, the relaxation is related to UT examination of the end of the RPV penetration nozzle.

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 2. There are 91 RPV head penetrations that contain areas of coverage less than that required by the NRC Order. The Order requires examination from 2 inches above the J-groove weld to the bottom of the RPV head penetration nozzle. The reduced coverage is caused by the nozzle configuration, the size of the fillet weld associated with the J-groove weld, and the limitations of probe design used for the ultrasonic testing (UT) examination. Specifically, actual coverage below the weld, in the non-pressure boundary portion of the nozzle does not extend to the "bottom of the nozzle" as identified below:

- The bottom inside diameter (ID) of the nozzle is internally threaded to accept a guide funnel. Available UT can not examine this area. Dye penetrant test (PT) inspection, while not applicable to the ID threaded region, can be used for the outside diameter (OD) surface, however, it is a high dose manual process.

- The distance between the bottom of the weld and the top of the threads is smaller than anticipated. The fillet weld associated with the partial penetration J-groove weld extends near the top of the threads. This condition may be caused by the combination of a shorter length of the penetration nozzle extending below the bottom head surface and the tolerances associated with the fillet weld leg size.

The configuration described above does not allow for inspection of a minimum of 1 inch below the weld, as proposed in Revision 0 of Relaxation Request 1.[3,4] A typical example of the internally threaded nozzle, including the externally threaded guide funnel, at a high hillside angle is shown in Figure 1.

The hardship is based on the following points:

- There is no available inspection method (including the available UT) that can inspect the threaded portion of the nozzle.
- The threaded funnels are permanently attached in place with a weld.
- Access to the OD of the nozzles is limited by the adjacent nozzles and attached funnels. The nozzles follow the curvature of the head as do the attached funnels. The 91 RPV nozzle penetrations connected to control element drive mechanisms (CEDM), are on 11.57-inch square pitch centers, with a 10.3-inch diameter funnel attached to the ends. This results in just over 1 inch of spacing between the funnels in the horizontal plane at the closest point.
- Methods for performing nozzle OD examinations are either dose intensive for PT or not completely developed for field deployment by the current FPL vendor for ECT.
- This condition of reduced coverage (less than the 1 inch below the weld[3,4]) was found during the inspection and was unanticipated prior to the refueling outage (SL2-14).
- Performing an OD PT surface examination is a manual dose intensive operation. Surface PT examinations were performed on 9 nozzles (Nozzle Nos. 54, 59, 66, 70, 78, 86, 87, 88, and 91) on the downhill quadrant to supplement the limited UT inspection coverage. The dose for this evolution was approximately 2.45 person Rem. Therefore, the total number of nozzles examined with PT should be kept to a minimum, and the exam area limited to the downhill quadrant only. This approach, which is supported, by the flaw evaluation approach, reduces preparation and examination time and the corresponding dose.

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.

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[3] FPL letter L-2003-086, St. Lucie Unit 2, Docket No. 50-389, Order (EA-03-009) Relaxation Requests 1 and 2, Examination Coverage of Reactor Pressure Vessel Head Penetration Nozzles, Supplemental Data, D. E. Jernigan to NRC, March 28, 2003.

[4] FPL letter L-2003-101, St. Lucie Unit 2, Docket No. 50-389, Order (EA-03-009) Relaxation Requests 1 and 2, Examination Coverage of Reactor Pressure Vessel Head Penetration Nozzles and Visual Inspection, Supplement, W. Jefferson to NRC, April 18, 2003.

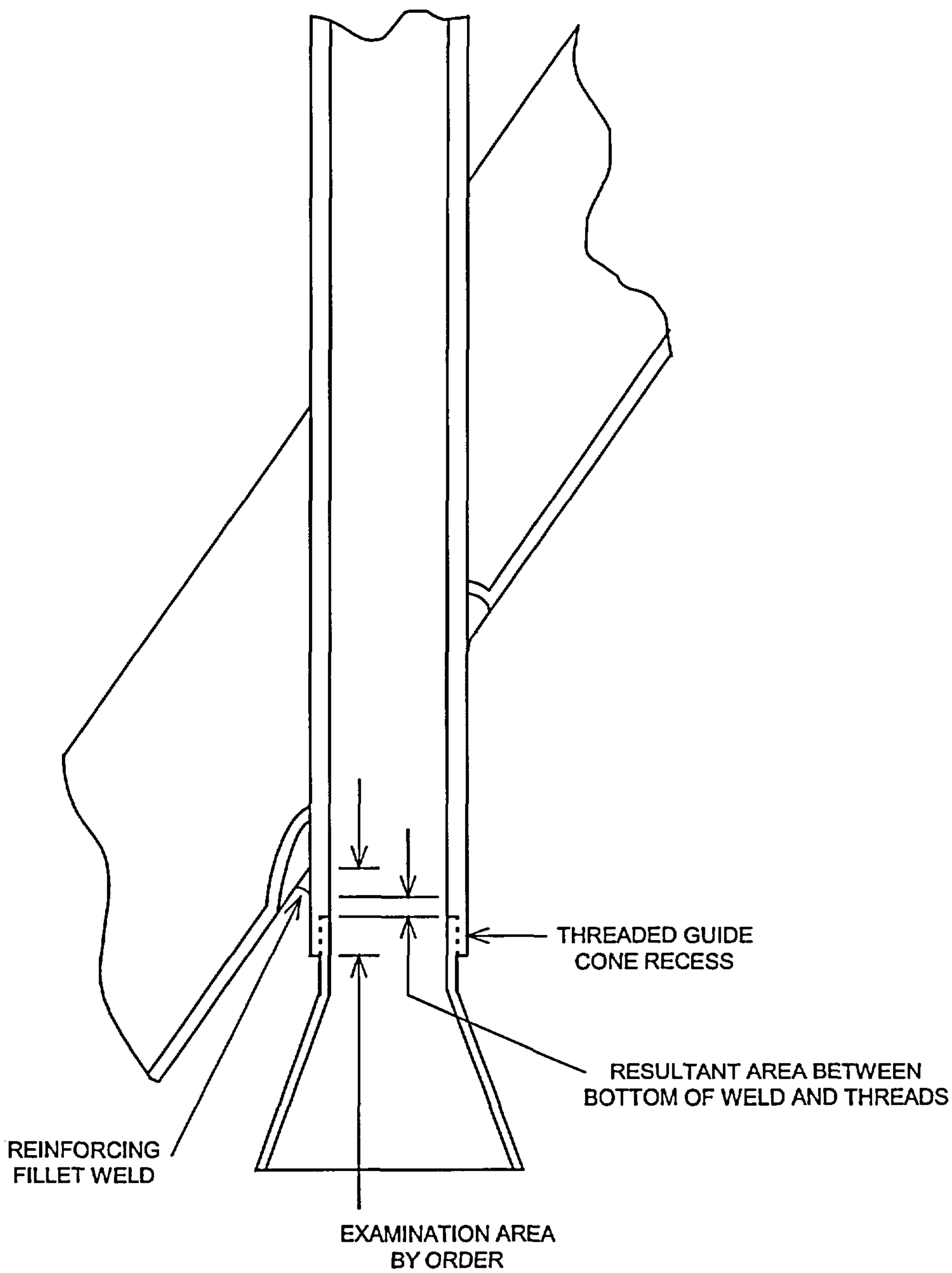


Figure 1
Typical St. Lucie Unit 2 CEDM Nozzle Configuration

4. PROPOSED ALTERNATIVE AND BASIS FOR USE:

The proposed alternative is to perform the UT examination to the extent practical. This is defined as follows:

- Perform UT examination to include the nozzle base material from 2 inches above the weld down to the bottom of the weld.
- Perform UT examination from the bottom of the weld to the maximum extent possible below the weld (≥ 0.41 inches below the weld).
- In the areas below the weld where the coverage is <0.41 inches, the examination will be supplemented by an OD surface method. The surface examination will, as a minimum, extend from the end of the UT coverage to the bottom of the nozzle.

Basis for the Relaxation:

Area From 2 Inches Above the Weld to the Bottom of the Weld:

The NRC Order required the area from 2 inches above the weld to the bottom of the weld to be examined 100% by UT. This includes 100% of the pressure-retaining portion of the nozzle base material, in which a safety significant circumferential flaw could result in ejection of a nozzle. This portion of the examination also includes the leak path assessment. No relaxation is requested in this area.

UT Examination of Area From the Bottom of the Weld to ≥0.41 Inches Below the Weld:

For the limiting nozzle location, a postulated axial through wall flaw, a distance of 0.28 inches from the bottom of the weld, will take 18 months of operation to reach the weld. Therefore, the proposed ≥0.41 inches extent of UT inspection below the weld will support one 18-month period of operation (one refueling cycle) for St. Lucie Unit 2 with at least an additional 19.4 months of operating margin (37.4 months total), as described below.

A flaw tolerance approach was developed to determine the minimum coverage distance below the weld required to assure that a postulated flaw would not grow into the weld in one 18-month period of operation. The basis for the approach is documented in WCAP–16038-P[5] (previously transmitted to the NRC[4]) and shown in WCAP Figures 6-12 through 6-18. These figures show, that for all nozzle intersection angles evaluated, if an axial through wall flaw were to exist 0.50 inches below the end of the weld, the predicted time for the flaw to grow to a point of contacting the weld would take greater than 5 years of operation.

[5] Westinghouse Electric Co. LLC, Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: St. Lucie Unit 2, WCAP-16038-P Revision 0, March 2003.

To determine the limiting distance for an assumed flaw to exist below the weld and not grow to contact the bottom of the weld within one 18-month period of operation (the minimum inspection area), the downhill side of the nozzle will be evaluated. Due to the horizontal plane of the threads, and the angle of the nozzle intersection with the RPV head, the extent of UT coverage is greater on the uphill side. The 0° nozzle was not evaluated for a limiting distance since the UT coverage for this nozzle was greater than 0.50 inches below the weld. The same calculation data used to produce figures 6-14, 6-16, and 6-18 in WCAP-16038-P was evaluated to determine the limiting nozzle location. At the limiting nozzle location, a postulated axial through wall flaw, a distance of 0.28 inches from the bottom of the weld, will take 18 months of operation to reach the lower portion of the weld. The same approach was repeated for the proposed 0.41 inch distance proposed as a UT exam limit for the downhill side. This 0.41 inch dimension envelops the UT extent of coverage for 82 of the 91 CEDMs, as shown in Table 2. A summary of the results is given in Table 1.

Table 1
Inspection Coverage Distance Below the Weld to Support an 18-Month Operation Period (Locations Shown Bound All Others in Between) and Additional Margin Periods for 0.41 Inches.

Nozzle Intersection Angle in Degrees	Upper Crack Tip (Distance in Inches From Bottom of Weld)	Period (months)
7.8° Downhill (Figure 6-14, WCAP-16038-P)	0.27	18.0
	0.41	37.8
29.1° Downhill (Figure 6-16, WCAP-16038-P)	0.28	18.0
	0.41	37.4
49.7° Downhill (Figure 6-18, WCAP-16038-P)	0.27	18.0
	0.41	45.6

Figure 2 provides a check of the determination in Table 1, using the 29.1° nozzle example.

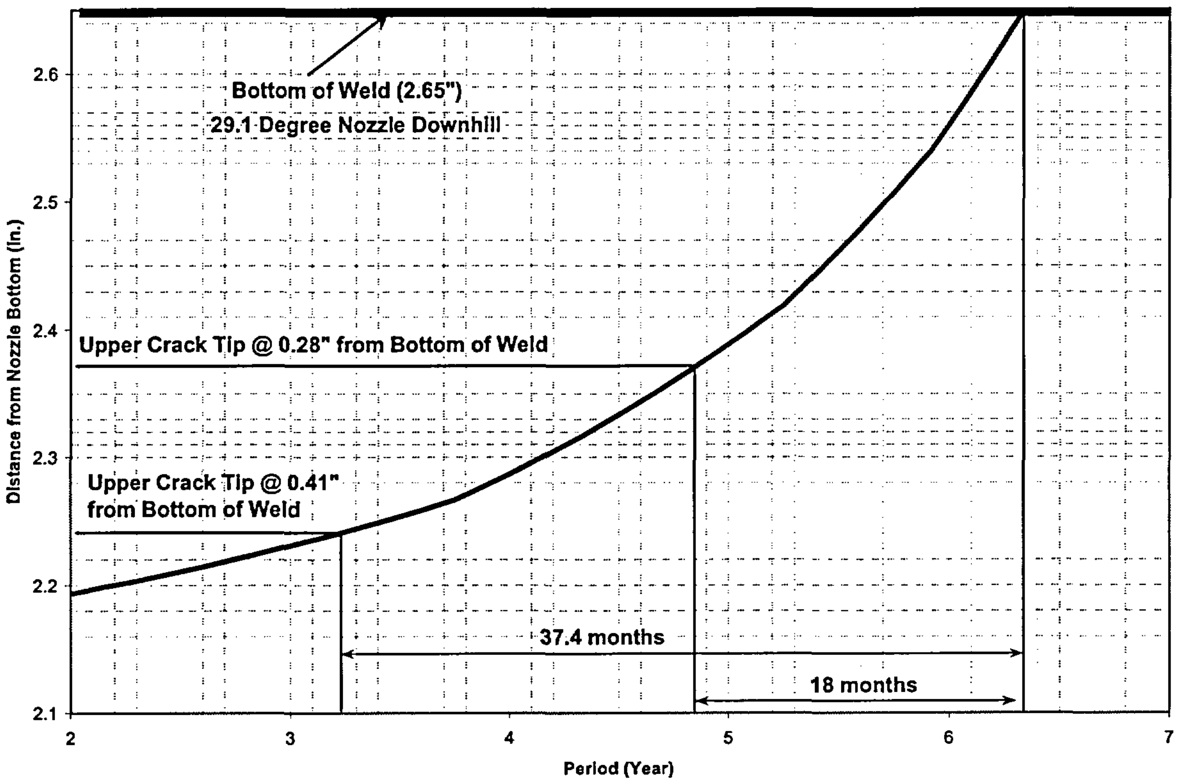


Figure 2: Graphical Determination of Minimum Inspection Coverage Distance Below the Weld to Support an Additional 18-Month Operation Period, and Additional Margin at a UT Inspection Coverage Distance of 0.41 Inches (exploded section from Figure 6-16 of WCAP-16038-P).

An added conservatism is that no credit is taken for the time that it will take for the postulated flaw to grow through the weld to the point of initiating a leak, or initiation of a circumferential flaw.

If the Extent of the UT Examination Below the Bottom of the Weld is <0.41 Inches, a Surface Examination is Proposed:

FPL has performed a PT examination of the downhill side OD surface of 9 nozzles that had UT exam coverage <0.41 inches below the bottom of the weld. The vertical height of the PT surface examined overlapped the end of the UT coverage area and extended down to the end of the nozzle. The circumferential width of the PT was limited to 45° on each side of the 0° downhill location. The 9 nozzles, listed in increasing order of UT coverage in Table 2, were Nozzle Nos. 88, 59, 87, 86, 66, 78, 54, 70, and 91. The results of all 9 PT examinations were no recordable indications (PT white).

The PT width envelops the width of UT coverage that was less than 0.50 inches below the weld, as identified in Table 2. The minimum width is selected based on the through wall flaw evaluation presented in WCAP-16038-P, Figures 6-14, 6-16, and 6-18, for an operational period of greater than 5 years. The surface examination is limited to the nozzle OD on the downhill side, since the hoop stresses are the highest on the nozzle OD directly adjacent to the weld, as shown in Figures E-1 through E-7 of WCAP-16038-P. In addition, the UT coverage on the uphill side of the 91 CEDM nozzles ranged from 1.00 inch to over 6.00 inches below the weld. No flaws were identified on the uphill side of the nozzles. The stress distributions for the nozzles are shown in Figures 5-4 through 5-7 of WCAP-16038-P. These figures show that the OD stress levels drop off quickly as the distance below the weld increases. This reduces the potential for cracking to exist in the uninspected area, greater than 0.50 inches below the weld, on the downhill side of the nozzle.

Interaction of Nozzle Insertion Distance (Non-Pressure Boundary Portion), Fillet Weld Size, and Funnel Threaded Region:

Revision 0 of Relaxation Request 1[6] identified that the UT scan would be completed a minimum of 1 inch below the weld on the down hill side. The minimum 1 inch exam length below the weld was determined based on a "reference" nozzle insertion dimension below the head ID surface of 2.9 inches. This dimension was obtained from a generic Combustion Engineering Owners Group (CEOG) report. To determine the minimum UT examination length for the relaxation request, the funnel thread length, and minimum reinforcing fillet radius, was subtracted from the 2.9-inch "reference" insertion dimension. "Reference" dimensions are specified for non-critical measurements, when the actual dimension is the result of a stack up of tolerances of other dimensions.

"Design" dimensions are specified for critical measurements, typically for mating parts. The "design" dimensions for the insertion of the RPV head penetration nozzles are specified as a fixed height from the top of the RPV head penetration nozzle to the RPV head flange surface. The actual "reference" dimension that the non-pressure boundary portion of the nozzle extends below the RPV head ID surface is not critical, and is determined by a stack up of dimensions. The result is that the actual curvature of the head, clad thickness, and head thickness can all reduce the length that the non-pressure boundary portion of the nozzle penetrates below the head surface.

The actual extent of nozzle base material below the weld that can be inspected with the available UT method is a function of the actual nozzle insertion distance, funnel thread length, and fillet weld leg size. To determine if the fillet weld leg

[6] FPL letter L-2003-086, St. Lucie Unit 2, Docket No. 50-389, Order (EA-03-009) Relaxation Requests 1 and 2, Examination Coverage of Reactor Pressure Vessel Head Penetration Nozzles, Supplemental Data, D. E. Jernigan to NRC, March 28, 2003

size is abnormally large at St. Lucie Unit 2, the weld face dimensions (partial penetration weld plus the fillet leg size), determined by UT for several St. Lucie Unit 2 CEDM nozzles, were compared to those of other RPV heads inspected by our vendor (including CE penetrations). The result was that our weld size was typical of those identified at other plants.

FPL measured the actual insertion depth at nozzle location 91, and determined it to be approximately 1.75 inches. This actual dimension is significantly less than the 2.9 inches provided in the original CEOG report. Since the reduced coverage is relatively uniform throughout the head, the reduced inspection coverage appears to be less the result of a large fillet weld leg than the result of decreased nozzle insertion below the ID surface of the RPV head.

Stress Model Basis Compared with Field Conditions:

The finite element analysis applies a best estimate approach to model the penetration nozzle J-groove weld regions. In the EPRI Report TR-103696, dated July 1994, the measured ovality at the penetration nozzles, based on experimental/field data, have been found to correlate well with the analytically predicted ovality. The finite element analysis results for the penetration nozzle J-groove weld regions used in WCAP-16038-P were derived from the nominal weld sizes specified on the fabrication drawings. The purpose of the fillet weld at the bottom of the J-groove weld is to reduce the notch effects, or stress risers. It does not serve any structural purpose. The residual stresses resulting from the weld fabrication process are due primarily to the shrinkage of the partial penetration J-groove weld, and not the fillet weld leg. Unlike the J-groove weld, the fillet weld cap is not constrained by the reactor vessel head. Assuming the fillet weld leg dimension were to increase, the stress distribution below the partial penetration J-groove weld would not be impacted beyond the calculation accuracy of the finite element analysis. Therefore, the flaw evaluation tables identified in WCAP-16038-P would not be affected.

UT Inspection Results for 102 RVH Nozzles (Including 91 CEDM Nozzles):

The UT coverage for a typical CEDM nozzle is shown in Figure 3. Since all of the 91 CEDM penetrations are unobstructed on the ID, 100% scan coverage can be obtained above the threaded area. This includes 100% of the area adjacent to the interference fit region between the nozzle and the head, for assessment of a potential "leak path." In the example below, the extent of UT coverage below the weld ranges from 0.79 inches at the downhill side to a maximum of 3.33 inches on the uphill side.

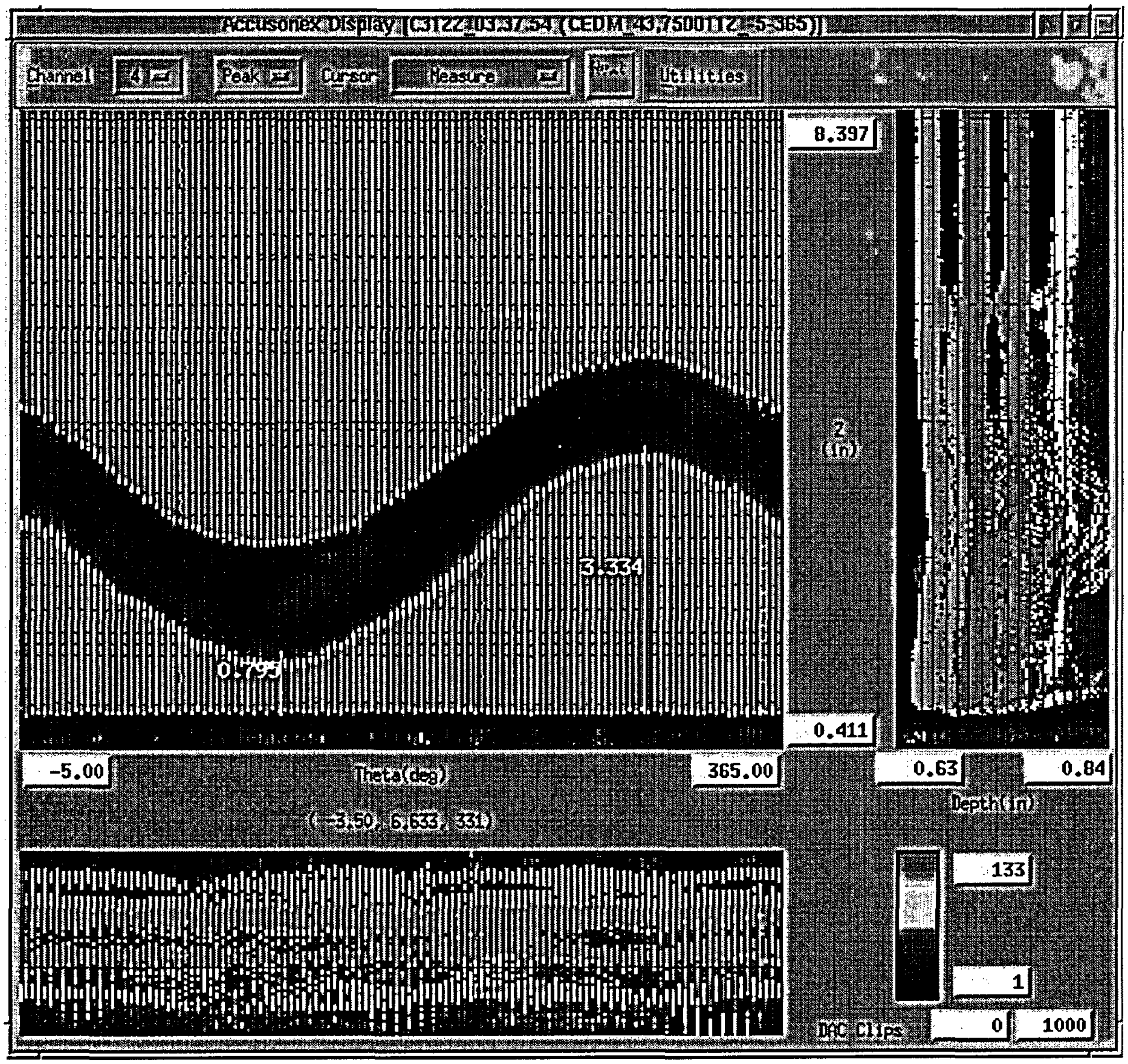


Figure 3: Typical UT "C" Scan of Nozzle 43 Showing Minimum and Maximum Coverage Area Below the Weld

Table 2 shows the extent of UT coverage for all 102 RVHP nozzles. The extent of coverage on the downhill side is noted in the table. See Table 2 at the end of this Attachment.

Additional Information Requested by the NRC:

During follow-up calls with the NRC on May 6, 2003 and May 8, 2003, requests for additional information were made based on Relaxation Request 1, Revision 1.

Additional detail was provided in the sections above, where appropriate, and responses to specific questions are addressed below:

NRC Question 1: Discuss the sensitivity of the material in the two penetrations that were identified with flaws (Nos. 18 and 72) at St. Lucie Unit 2, relative to the 18 nozzles with limited coverage less than ½ inch. Include in your discussion, other plants with the same heat and the corresponding inspection results.

FPL Response to Question 1: A review of the database of reactor pressure vessel (RPV) upper head nozzle heats[7] was performed to identify other plants with the same nozzle material supplier and heat number as those used at St. Lucie Unit 2. This database includes all Combustion Engineering (CE) and Westinghouse designed RPV heads. A sort of the database identified seven other plants (all CE designed plants) that had RPV nozzles supplied by Standard Steel, the same nozzle material supplier that supplied the 91 CEDM nozzles at St. Lucie. A review of the nozzle supplier data in MRP-48 also identified that no B&W designed plants have RPV upper head penetrations supplied by Standard Steel.

Seven CE plants were supplied with Standard Steel nozzles. Of the seven plants identified, six have completed a 100% UT inspection and the other completed a bare metal visual. No cracking of Standard Steel nozzles has been identified except for the two nozzles identified at St. Lucie Unit 2. Only four of these CE plants have the same heats of material installed as St. Lucie Unit 2. All four of these plants also have at least one nozzle with one of the heats (Heat Nos. A6785 and EO3045) identified with a flaw at St. Lucie Unit 2 (Table 3). St. Lucie 2 ranks slightly below plants B and C based on the effective degradation years (EDY) in MRP-48 Table 2.1, but slightly above plants A and D.

7 MRP Letter 2002-112, Alloy 600 RPV Head Nozzle Heats of Material, Christine King (EPRI) to Alex Marion (NEI) to be emailed to Richard Barrett NRC in response, December 19, 2002

Table 3: List of Plants With Same Heat as the Heat With Flaws at St. Lucie 2								
Plant	Nozzle Function	Qty	Heat #	Form	Supplier	Inspection Date	Inspection Type	Results
St. Lucie 2	CEDM	9	A6785	SB166	Standard Steel	Spring 2003	100% UT	1 of 9 cracked (Nozzle #18)
Plant A	CEDM	2	A6785	SB-166	Standard Steel	Spring 2002	100% UT, Part ECT and PT	No detectable defects
Plant B	CEDM	1	A6785	SB-166	Standard Steel	Spring 2002	100% UT, 46 of 91 Weld ECT	No detectable defects
Plant C	CEDM	3	A6785	SB-166	Standard Steel	Spring 2003	100% UT, 100% Weld ECT	No detectable defects
Heat Total		15						
St. Lucie 2	CEDM	35	E03045	SB166	Standard Steel	Spring 2003	100% UT	1 of 35 cracked (Nozzle #72)
Plant B	CEDM	1	E03045	SB-166	Standard Steel	Spring 2002	100% UT, 46 of 91 Weld ECT	No detectable defects
Plant C	CEDM	16	E03045	SB-166	Standard Steel	Spring 2003	100% UT, 100% Weld ECT	No detectable defects
Plant D	CEDM	5	E03045	SB-166	Standard Steel	Spring 2002	100% UT	No detectable defects
Heat Total		57						

A review of the industry wide experience with the same heats of Standard Steel penetrations as St. Lucie Unit 2 (including heats A6785 and EO3045) indicates the following:

- 100% of the population of the material heats used at St. Lucie Unit 2 have had a UT inspection within the last year with no flaws indicated (outside of St. Lucie Unit 2).
- The other inspected plants have similar EDY.
- St. Lucie Unit 2 has the largest population of heats A6785 and EO3045 but only had one nozzle of each heat affected.
- Each St. Lucie Unit 2 nozzle had a single axial flaw identified. No circumferential or multiple flaws were identified.
- The flaws were OD initiated and found in the high stress area, in close proximity to the weld (WCAP-16038-P, Appendix E). There were no flaws identified only in low stress areas.

A sort of the St. Lucie 2 nozzles of heat A6785 (same as the flaw in nozzle 18) determined that all had UT coverage at least 0.71 inches or greater below the weld on the downhill side. A sort of the St. Lucie 2 nozzles of heat EO3045 (same as the flaw in nozzle 72) determined that 32 of 35 had UT or PT examination coverage at least 0.50 inches or greater below the weld on the downhill side.

Therefore, there is reasonable assurance that any flaw in the nozzles represented by these two heats would be detected in the examination area.

The population of nozzles with less than 0.50 inches of coverage below the weld (without a supplemental PT) also includes heats EO1749 and EO1689. These two heats are well represented in the population of nozzles inspected to greater than 0.50 inches below the weld, in which no flaws were identified. Heat EO1749 is also represented by one nozzle in Plant B. This nozzle has been inspected and found to be free of flaws. Heat EO1689 is unique to St. Lucie Unit 2.

NRC Question 2: Provide additional extent of UT coverage data for each penetration, including the angle of intersection of each nozzle, material heat, yield strength, and width of area with coverage of less than ½ inch below the weld.

FPL Response to Question 2: Table 2 above has been revised to include this data.

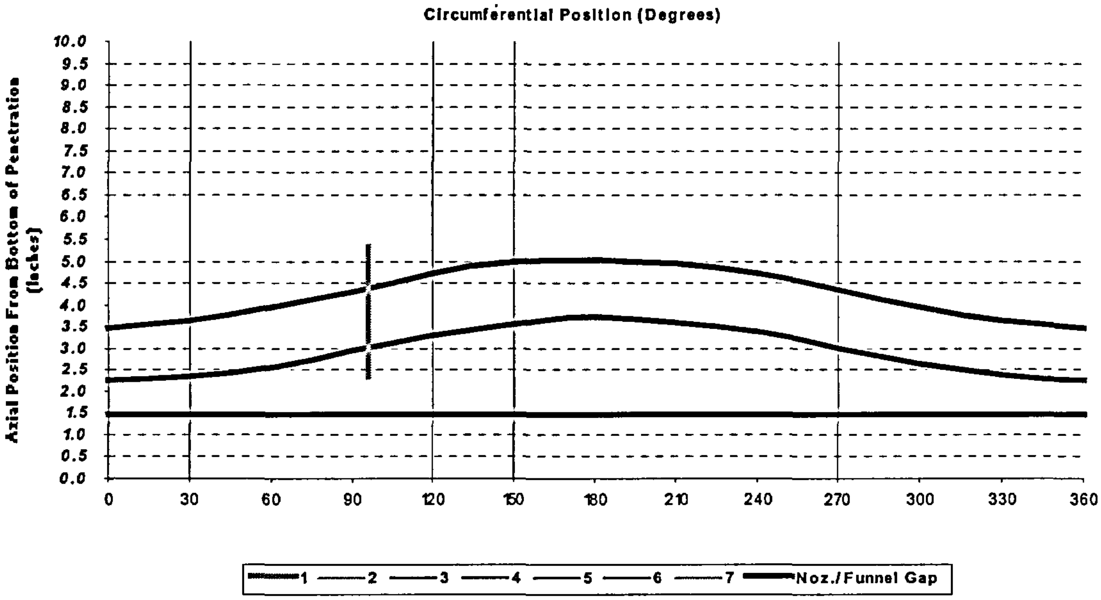
NRC Question 3: Provide the location of the flaw for Penetration Nos.18 and 72 relative to the weld and azimuthal angle around the nozzle.

FPL Response to Question 3: A single flaw was identified in Nozzle Nos. 18 and 72 at St. Lucie Unit 2. The details of each are provided in the table below. A graphical weld profile and flaw orientation is also provided. The 0° is identified as lowest downhill position of the weld.

Nozzle #	Flaw Location /Type	Azimuthal Location	Flaw Length	Flaw Depth	Distance Below Weld
18	OD Axial	96°	2.98"	0.26"	0.71"
72	OD Axial	354°	0.96"	0.28"	0.35"

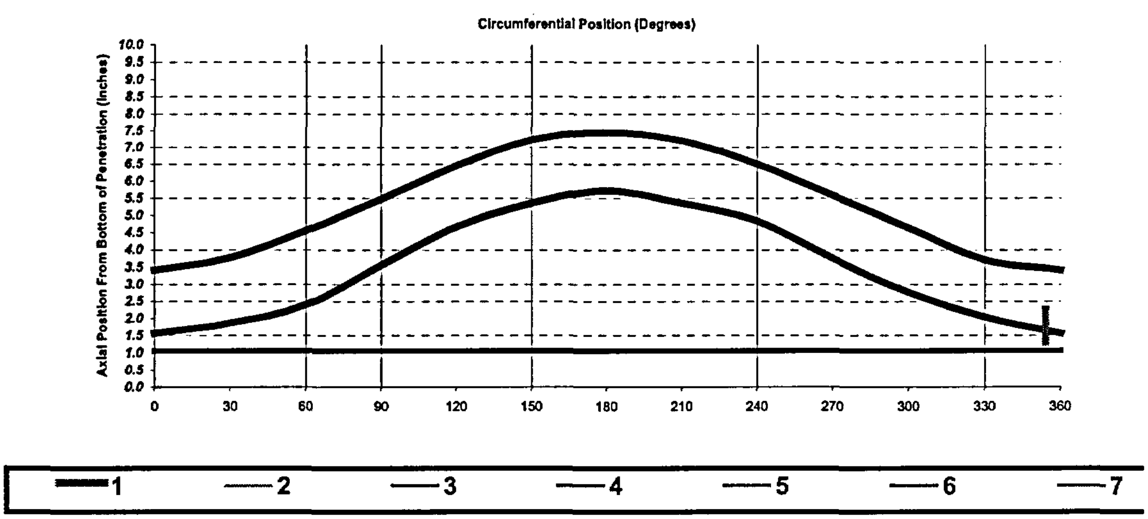
FRAMATOME ANP

Weld Profile
Penetration #18



FRAMATOME ANP

Weld Profile
Penetration #72



NRC Question 4: Provide an explanation of why flaws would not exist in the uninspected low stress area, without some part of it extending into the inspected region.

FPL Response to Question 4: Over 10 years of inspection experience with reactor vessel head penetrations has shown that cracks have only initiated in regions where the stresses have been at or near the material yield strength. The source of these stresses, in this case, is the J-groove attachment weld. The stresses decrease rapidly with distance away from the weld.

In the 10 years of inspections, there has never been a case where a flaw existed only in the low stress region of the head penetration, without also extending into the high stress region. The only cases where cracks have been found near the bottom of the reactor vessel head penetrations have been in B&W designed plants, where multiple cracks were found. In these B&W plants inspected with UT, there were no cases where indications were recorded in the base material below the weld region that were not associated with other cracking extending from the high stress weld region. The Standard Steel materials used for the St. Lucie penetrations have shown significantly more resistant to cracking than the B&W Tubular product heats used in the B&W designed plants.

NRC Question 5: Provide a discussion of the range of uncertainty/margin of the major inputs into the WCAP-16038-P flaw analysis approach. These include:

- The model stress analysis results.
- The stress intensity factor calculation.
- The crack growth rate curve.
- Flaw sizing.

FPL Response to Question 5: The stress analysis was performed using a refined mesh, and was set up to model the actual fabrication process. As such, the results are expected to be a best estimate of the stresses, with very small uncertainties.

The stress intensity factor calculation is from a published reference[8], and is also expected to be a best estimate, with very small uncertainty.

The crack growth rate used for the evaluation is from EPRI Report, MRP-55, and is a 75th percentile curve for all the data. This curve is actually an upper bound of the Huntington and Standard Steel data for St. Lucie, and for CE designed plants in general. An equivalent 75th percentile curve for these materials would be at least a factor of 2 lower.

[8] Paul Paris, "The Handbook"

The crack size is postulated, so there is no uncertainty. The throughwall nature of the postulated flaw conservatively bounds any flaw that could exist in the head penetration.

The yield strength may have an effect on the crack initiation time, but has been shown to have no impact on the PWSCC growth rate[9]. Further, the effect of the material yield strength has been accounted for, conservatively, in the stress analysis by the use of a cyclic stress strain curve, to account for the multiple weld passes that are involved in the creation of the J-groove attachment weld.

The combination of all these factors result in a generally conservative approach. Using the cumulative uncertainties gives results (reported in the WCAP) which are likely to be conservative by a factor of two, compared to a best estimate of the total time for crack growth. In addition, the examination area below the weld exceeds the minimum value calculated by the WCAP-16038-P flaw evaluation approach to justify an 18-month cycle of operation. The calculated value based on 0.41inches of coverage below the weld is 37.4 months.

There is also added margin in the flaw analysis acceptance criteria in that the identified limit is the time projected for the postulated flaw to grow in the nozzle material to the lowest point of contact with the toe of the fillet weld. A leak can not occur until the flaw grows in the material to above the root of the partial penetration weld, a significant distance (and time) further.

NRC Question 6: Provide the actual OD stress levels from the figures in WCAP-16038-P at the proposed UT examination limit below the weld.

FPL Response to Question 6: The actual stresses from the applicable downhill figures in Appendix E of WCAP-16038-P at 0.41 inches below the weld are shown below:

Nozzle Intersection Angle in Degrees	ID Hoop Stress at 0.41 Inches Below Weld (psi)	OD Hoop Stress at 0.41 Inches Below Weld (psi)
7.8° Downhill	37,510	29,339
29.1° Downhill	30,988	29,317
49.7° Downhill	15,308	24,553

The identified OD hoop stresses at 0.41 inches below the weld on the downhill side are below the yield stress for all the RPV head CEDM nozzles installed at St. Lucie Unit 2, as shown in Table 2.

[9] Foster, Bamford, and Pathania, Proc. Eighth Int. Conf. On Environmental Degradation, NACE,1997.

Conclusion:

Compliance with the requirement for UT coverage to the bottom of the nozzle is unnecessary to show structural integrity of the reactor vessel and RPV nozzle penetrations. Inspection to a point ≥0.41 inches below the weld will provide reasonable assurance of structural integrity and no pressure boundary leakage for an additional period of 37.4 months which provides a significant margin over the 18-month operating cycle.

This conclusion is based on the following conditions:

- UT inspection of the most highly stressed pressure boundary portion of the nozzle (the area adjacent to the weld zone) is unaffected by the lack of coverage below the weld.
- UT of the interference fit zone above the weld (for leakage assessment) is unaffected by the lack of coverage below the weld.
- Cracks initiating in the unexamined bottom portion (non-pressure boundary area) of the nozzle would be of minimal safety significance with respect to pressure boundary leakage or nozzle ejection. This portion of the nozzle is below the pressure boundary and any cracks would have to grow through the examined portion of the tube to reach the pressure boundary.
- Based on the extent of UT coverage obtained, and the supplemental PT examinations, the time to reach the pressure boundary has been calculated to be 37.4 months for the worst case location. This period significantly exceeds the 18-month operating cycle after which another reactor head inspection will be implemented.

Additional efforts to achieve the Order required examination area (below the weld) will result in a hardship due to unusual difficulty without a compensating increase in the level of quality and safety.

5. DURATION OF PROPOSED ALTERNATIVE:

This relaxation is applicable to the April/May 2003 refueling outage (SL2-14) for St. Lucie Unit 2.

6. PRECEDENTS:

1) Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2, Relaxation of the Requirements of Order (EA-03-009), Regarding Reactor Pressure Vessel Head Inspections (Tac Nos. MB7752 And MB7753, April 18, 2003)

   Calvert Cliffs used a flaw tolerance approach to address a postulated through wall flaw in the uninspected non-pressure boundary portion of the RPV head penetration, which starts no less than 0.40 inches (specifically, 0.376 inches) from the J-groove weld for an operational period of 2 years. This request was

for 6 months longer than the period of operation requested for St. Lucie Unit 2 by this relaxation request.

2) Turkey Point Unit 3, Relaxation of the Requirements of Order (EA-03-009) Regarding Reactor Pressure Vessel Head Inspections (Tac No. MB7990, March 20, 2003)

   Turkey Point 3 used a flaw tolerance approach to address a postulated through wall flaw in the uninspected non-pressure boundary portion of the RPV head penetration which starts no less than 1.00 inch from the J-groove weld for an operational period of 18 months for 9 nozzles.

Table 2
Extent of UT Coverage in RVHP Nozzle Material
Sorted by Minimum Distance Below the Weld for the 91 CEDMs (St. Lucie 2-14 RFO)

Pen Type	Pen #	Penetration Angle (Degrees)	Min. Distance Above Weld Root on uphill side(Inches)	Coverage Above Weld Root (Theta)	Coverage @ Weld Root (Theta)	Weld Region Coverage (Theta)	Below Weld Coverage (Theta)	Min Distance Below Weld Toe on downhill side (Inches)	Theta range <1/2" of coverage on downhill side of weld	Min Distance Below Weld on uphill side of weld (Inches)	Heat Material	Yield Strength
CEDM	88	49.7	6.58	360	360	360	360	0.30	52	5.77	M-4119-2 /EO1547	46000
CEDM	59	34.9	6.15	360	360	360	360	0.31	76	4.05	EO3045	37500
CEDM	87	43.4	6.00	360	360	360	360	0.31	82	4.72	EO1689	40000
CEDM	86	43.4	6.62	360	360	360	360	0.32	86	4.83	EO1689	40000
CEDM	66	37.1	6.28	360	360	360	360	0.36	27	4.12	EO3045	37500
CEDM	78	42.4	6.39	360	360	360	360	0.36	18	4.83	EO3045	37500
CEDM	54	33.8	6.74	360	360	360	360	0.39	43	3.77	EO3045	37500
CEDM	70	42.4	6.65	360	360	360	360	0.39	11	4.76	EO3045	37500
CEDM	91	49.7	6.73	360	360	360	360	0.39	68	5.89	C-6449-1 /EO1547	49000
CEDM	90	49.7	5.87	360	360	360	360	0.41	36	6.21	EO1749	43000
CEDM	79	42.4	7.19	360	360	360	360	0.43	12	4.71	EO3045	37500
CEDM	50	33.8	5.50	360	360	360	360	0.45	24	3.83	EO3045	37500
CEDM	83	43.4	6.30	360	360	360	360	0.45	39	4.96	EO1689	40000
CEDM	77	42.4	7.19	360	360	360	360	0.47	32	4.95	EO3045	37500
CEDM	81	43.4	6.76	360	360	360	360	0.47	24	5.30	EO1689	40000
CEDM	82	43.4	5.33	360	360	360	360	0.47	19	5.07	EO1689	40000
CEDM	80	43.4	6.36	360	360	360	360	0.48	14	4.83	EO1689	40000
CEDM	89	49.7	6.04	360	360	360	360	0.48	79	5.76	EO1749	43000
CEDM	42	29.1	6.33	360	360	360	360	0.50	N/A	3.23	EO3045	37500
CEDM	62	37.1	6.13	360	360	360	360	0.51	N/A	4.08	EO3045	37500
CEDM	65	37.1	6.21	360	360	360	360	0.51	N/A	4.18	EO3045	37500
CEDM	69	42.4	6.83	360	360	360	360	0.51	N/A	4.75	EO2845	38500
CEDM	73	42.4	6.49	360	360	360	360	0.51	N/A	4.88	EO3045	37500
CEDM	52	33.8	6.10	360	360	360	360	0.52	N/A	3.89	EO3045	37500

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Pen Type	Pen #	Penetration Angle (Degrees)	Min. Distance Above Weld Root on uphill side(Inches)	Coverage Above Weld Root (Theta)	Coverage @ Weld Root (Theta)	Weld Region Coverage (Theta)	Below Weld Coverage (Theta)	Min Distance Below Weld Toe on downhill side (Inches)	Theta range <1/2" of coverage on downhill side of weld	Min Distance Below Weld on uphill side of weld (Inches)	Heat Material	Yield Strength
CEDM	48	33.8	6.37	360	360	360	360	0.53	N/A	3.73	EO3045	37500
CEDM	75	42.4	7.07	360	360	360	360	0.55	N/A	5.12	EO2845	38500
CEDM	76	42.4	7.32	360	360	360	360	0.55	N/A	5.10	EO2845	38500
CEDM	85	43.4	7.05	360	360	360	360	0.55	N/A	5.05	EO1689	40000
CEDM	74	42.4	4.28	360	360	360	360	0.60	N/A	4.88	EO3045	37500
CEDM	7	11.0	7.03	360	360	360	360	0.61	N/A	1.99	A5849	59000
CEDM	51	33.8	6.06	360	360	360	360	0.61	N/A	3.92	EO3045	37500
CEDM	84	43.4	6.48	360	360	360	360	0.61	N/A	5.06	EO1689	40000
CEDM	53	33.8	7.19	360	360	360	360	0.63	N/A	3.77	EO3045	37500
CEDM	61	37.1	6.03	360	360	360	360	0.63	N/A	4.20	EO3045	37500
CEDM	68	42.4	6.38	360	360	360	360	0.64	N/A	4.95	EO2845	38500
CEDM	60	37.1	6.71	360	360	360	360	0.65	N/A	4.24	EO3045	37500
CEDM	41	29.1	6.81	360	360	360	360	0.67	N/A	3.26	EO3045	37500
CEDM	44	32.6	6.70	360	360	360	360	0.67	N/A	3.67	EO2845	38500
CEDM	55	33.8	6.21	360	360	360	360	0.70	N/A	3.74	EO3045	37500
CEDM	23	22.4	6.53	360	360	360	360	0.71	N/A	2.66	A6785	56000
CEDM	46	32.6	6.82	360	360	360	360	0.71	N/A	3.69	EO2845	38500
CEDM	49	33.8	6.87	360	360	360	360	0.71	N/A	3.80	EO3045	37500
CEDM	67	37.1	6.90	360	360	360	360	0.71	N/A	4.16	EO3045	37500
CEDM	47	32.6	6.01	360	360	360	360	0.72	N/A	3.71	EO2845	38500
CEDM	34	25.2	6.63	360	360	360	360	0.73	N/A	2.94	EO1689	40000
CEDM	71	42.4	6.33	360	360	360	360	0.74	N/A	4.57	EO3045	37500
CEDM	26	23.9	6.72	360	360	360	360	0.75	N/A	2.63	M-4119-2 /EO1547	46000
CEDM	56	34.9	6.81	360	360	360	360	0.75	N/A	4.04	EO3045	37500
CEDM	57	34.9	6.10	360	360	360	360	0.75	N/A	3.62	EO3045	37500

Table 2
Extent of UT Coverage in RVHP Nozzle Material
Sorted by Minimum Distance Below the Weld for the 91 CEDMs (St. Lucie 2-14 RFO)

Pen Type	Pen #	Penetration Angle (Degrees)	Min. Distance Above Weld Root on uphill side(Inches)	Coverage Above Weld Root (Theta)	Coverage @ Weld Root (Theta)	Weld Region Coverage (Theta)	Below Weld Coverage (Theta)	Min Distance Below Weld Toe on downhill side (Inches)	Theta range <1/2" of coverage on downhill side of weld	Min Distance Below Weld on uphill side of weld (Inches)	Heat Material	Yield Strength
CEDM	20	22.4	7.03	360	360	360	360	0.78	N/A	2.82	A6777	35000
CEDM	33	25.2	7.13	360	360	360	360	0.78	N/A	2.94	EO1689	40000
CEDM	29	25.2	6.64	360	360	360	360	0.79	N/A	2.76	EO1689	40000
CEDM	36	29.1	6.81	360	360	360	360	0.79	N/A	3.22	C-6449-1 /EO1547	49000
CEDM	43	29.1	7.06	360	360	360	360	0.79	N/A	3.33	EO3045	37500
CEDM	37	29.1	5.90	360	360	360	360	0.82	N/A	3.18	EO3045	37500
CEDM	39	29.1	5.80	360	360	360	360	0.82	N/A	3.32	EO3045	37500
CEDM	8	15.6	6.76	360	360	360	360	0.83	N/A	2.24	EO1749	43000
CEDM	24	23.9	6.89	360	360	360	360	0.83	N/A	2.87	M-4119-2 /EO1547	46000
CEDM	35	25.2	6.48	360	360	360	360	0.83	N/A	2.95	EO1689	40000
CEDM	72	42.4	6.57	360	360	360	360	0.84	N/A	4.85	EO3045	37500
CEDM	11	15.6	6.26	360	360	360	360	0.86	N/A	2.14	EO1749	43000
CEDM	27	23.9	6.29	360	360	360	360	0.86	N/A	2.77	M-4119-2 /EO1547	46000
CEDM	45	32.6	6.87	360	360	360	360	0.86	N/A	3.82	EO2845	38500
CEDM	40	29.1	6.52	360	360	360	360	0.87	N/A	3.25	EO3045	37500
CEDM	25	23.9	7.41	360	360	360	360	0.88	N/A	2.71	M-4119-2 /EO1547	46000
CEDM	58	34.9	6.52	360	360	360	360	0.90	N/A	4.12	EO3045	37500
CEDM	63	37.1	6.06	360	360	360	360	0.90	N/A	4.23	EO3045	37500
CEDM	28	25.2	7.09	360	360	360	360	0.91	N/A	3.06	EO1689	40000
CEDM	38	29.1	5.80	360	360	360	360	0.91	N/A	3.30	EO3045	37500
CEDM	9	15.6	7.18	360	360	360	360	0.92	N/A	2.29	EO1749	43000
CEDM	4	11.0	6.76	360	360	360	360	0.94	N/A	1.92	A5849	59000
CEDM	6	11.0	6.94	360	360	360	360	0.94	N/A	2.08	A5849	59000

Table 2
Extent of UT Coverage in RVHP Nozzle Material
Sorted by Minimum Distance Below the Weld for the 91 CEDMs (St. Lucie 2-14 RFO)

Pen Type	Pen #	Penetration Angle (Degrees)	Min. Distance Above Weld Root on uphill side(Inches)	Coverage Above Weld Root (Theta)	Coverage @ Weld Root (Theta)	Weld Region Coverage (Theta)	Below Weld Coverage (Theta)	Min Distance Below Weld Toe on downhill side (Inches)	Theta range <1/2" of coverage on downhill side of weld	Min Distance Below Weld on uphill side of weld (Inches)	Heat Material	Yield Strength
CEDM	15	17.6	7.10	360	360	360	360	0.94	N/A	2.43	A6777	35000
CEDM	17	17.6	7.03	360	360	360	360	0.94	N/A	2.44	A6785	56000
CEDM	21	22.4	6.40	360	360	360	360	0.94	N/A	2.25	A6785	56000
CEDM	22	22.4	6.58	360	360	360	360	0.94	N/A	2.93	A6785	56000
CEDM	32	25.2	6.95	360	360	360	360	0.94	N/A	3.26	EO1689	40000
CEDM	64	37.1	6.54	360	360	360	360	0.94	N/A	4.13	EO3045	37500
CEDM	3	7.8	6.60	360	360	360	360	0.96	N/A	1.50	A6785	56000
CEDM	14	17.6	6.79	360	360	360	360	0.98	N/A	2.31	A6785	56000
CEDM	31	25.2	6.72	360	360	360	360	0.98	N/A	3.12	EO1689	40000
CEDM	1	0.0	6.26	360	360	360	360	1.00	N/A	Uphill = Downhill	A6785	56000
CEDM	10	15.6	6.63	360	360	360	360	1.00	N/A	2.22	EO1749	43000
CEDM	19	17.6	6.90	360	360	360	360	1.00	N/A	2.38	A6785	56000
CEDM	5	11.0	7.41	360	360	360	360	1.01	N/A	1.96	A5849	59000
CEDM	12	17.6	7.47	360	360	360	360	1.01	N/A	2.55	A6777	35000
CEDM	30	25.2	7.06	360	360	360	360	1.04	N/A	2.96	EO1689	40000
CEDM	16	17.6	7.67	360	360	360	360	1.06	N/A	2.59	A6777	35000
CEDM	18	17.6	6.77	360	360	360	360	1.06	N/A	2.37	A6785	56000
CEDM	2	7.8	7.34	360	360	360	360	1.12	N/A	1.71	A6926	52000
CEDM	13	17.6	7.34	360	360	360	360	1.14	N/A	2.67	A6777	35000
ICI	92	55.3	5.03	360	360	360	N/A	N/A	N/A	N/A		
ICI	93	55.3	4.09	360	360	360	N/A	N/A	N/A	N/A		
ICI	94	55.3	4.10	360	360	360	N/A	N/A	N/A	N/A		
ICI	95	55.3	4.82	360	360	360	N/A	N/A	N/A	N/A		
ICI	96	55.3	4.92	360	360	360	N/A	N/A	N/A	N/A		
ICI	97	55.3	3.54	360	360	360	N/A	N/A	N/A	N/A		

Table 2
Extent of UT Coverage in RVHP Nozzle Material
Sorted by Minimum Distance Below the Weld for the 91 CEDMs (St. Lucie 2-14 RFO)

Pen Type	Pen #	Penetration Angle (Degrees)	Min. Distance Above Weld Root on uphill side(Inches)	Coverage Above Weld Root (Theta)	Coverage @ Weld Root (Theta)	Weld Region Coverage (Theta)	Below Weld Coverage (Theta)	Min Distance Below Weld Toe on downhill side (Inches)	Theta range <1/2" of coverage on downhill side of weld	Min Distance Below Weld on uphill side of weld (Inches)	Heat Material	Yield Strength
ICI	98	55.3	3.79	360	360	360	N/A	N/A	N/A	N/A		
ICI	99	55.3	4.75	360	360	360	N/A	N/A	N/A	N/A		
ICI	100	55.3	3.60	360	360	360	N/A	N/A	N/A	N/A		
ICI	101	55.3	4.60	360	360	360	N/A	N/A	N/A	N/A		
Vent	Vent		2.50	360	360	360	N/A	N/A	N/A	N/A		

Notes:
1) Nozzle 18 and Nozzle 72 have been identified with a single axial flaw each.
2) Nozzle 18 is heat A6755.
3) Nozzle 72 is heat EO3045.

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

Hardship or Unusual Difficulty Without Compensating Increase in Level of Quality or Safety

1. ASME COMPONENTS AFFECTED

St. Lucie (PSL) Unit 2 has 102 ASME Class 1 reactor pressure vessel (RPV) head penetrations (including the vent).

The St. Lucie Unit 2 Order Inspection Category in accordance with Section (IV.A.) is currently determined as "high" based on 14.0 EDY at this refueling outage[1] (RFO).

FPL Drawing No. 2998-1714, Rev. 3
FPL Drawing No. 2998-4331, Rev. 2
FPL Drawing No. 2998-4318, Rev. 2
FPL Drawing No. 2998-4319, Rev. 3
FPL Drawing No. 2998-4332, Rev. 2

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

The NRC issued an Order[2] on Februay 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

[1] 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.

[2] 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, February 11, 2003.

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.

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 2. Specifically, FPL is unable to completely comply with this requirement due to inaccessibility to a small portion of the RPV head surface. The inaccessible areas are behind the twelve 6-inch wide shroud lugs and under the horizontal reflective metal insulation (RMI) support legs.

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." FPL is requesting this relaxation for St. Lucie Unit 2. FPL is unable to comply with the requirement for 100% visual examination coverage due to lack of access. The requirement is considered to be unnecessary in this case. The inaccessible areas are located underneath the vertical insulation panels at the shroud lugs, and under the horizontal insulation panel support legs. The lack of access to these small areas does not preclude performance of an effective bare metal visual examination of 100% of the nozzle-to-top-of-head interface region, the RPV head to identify evidence of wastage or determine if corrosive product has entered the shroud ring-to-vessel area behind the shroud lugs. Side views of the RPV head showing the shroud lugs (Figure 1) and horizontal RMI support feet (Figure 2) are included below. The limitations described above are less restrictive than those identified prior to the actual examination, as proposed in Revision 0 of Relaxation Request 2[3,4].

[3] FPL letter L-2003-086, St. Lucie Unit 2, Docket No. 50-389, Order (EA-03-009) Relaxation Requests 1 and 2, Examination Coverage of Reactor Pressure Vessel Head Penetration Nozzles, Supplemental Data, D. E. Jernigan to NRC, March 28, 2003.

[4] FPL letter L-2003-101, St. Lucie Unit 2, Docket No. 50-389, Order (EA-03-009) Relaxation Requests 1 and 2, Examination Coverage of Reactor Pressure Vessel Head Penetration Nozzles and Visual Inspection, Supplement, W. Jefferson to NRC, April 18, 2003.

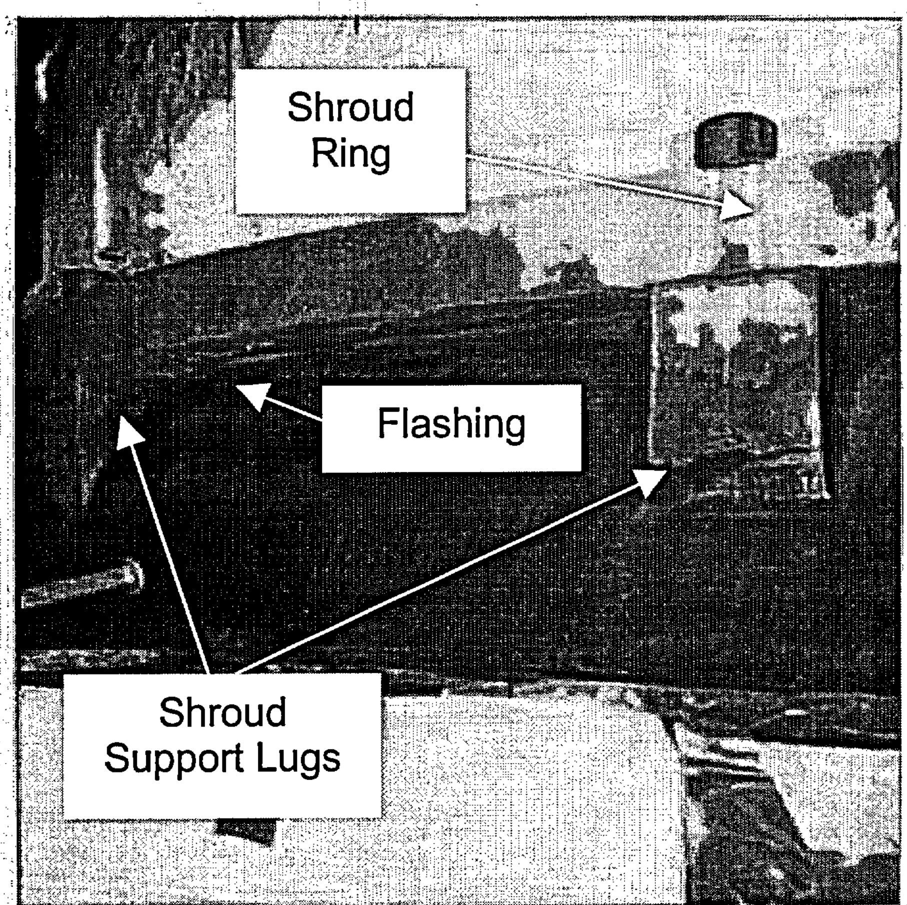

Figure 1: Picture Showing Shroud Support Lug and Flashing Location

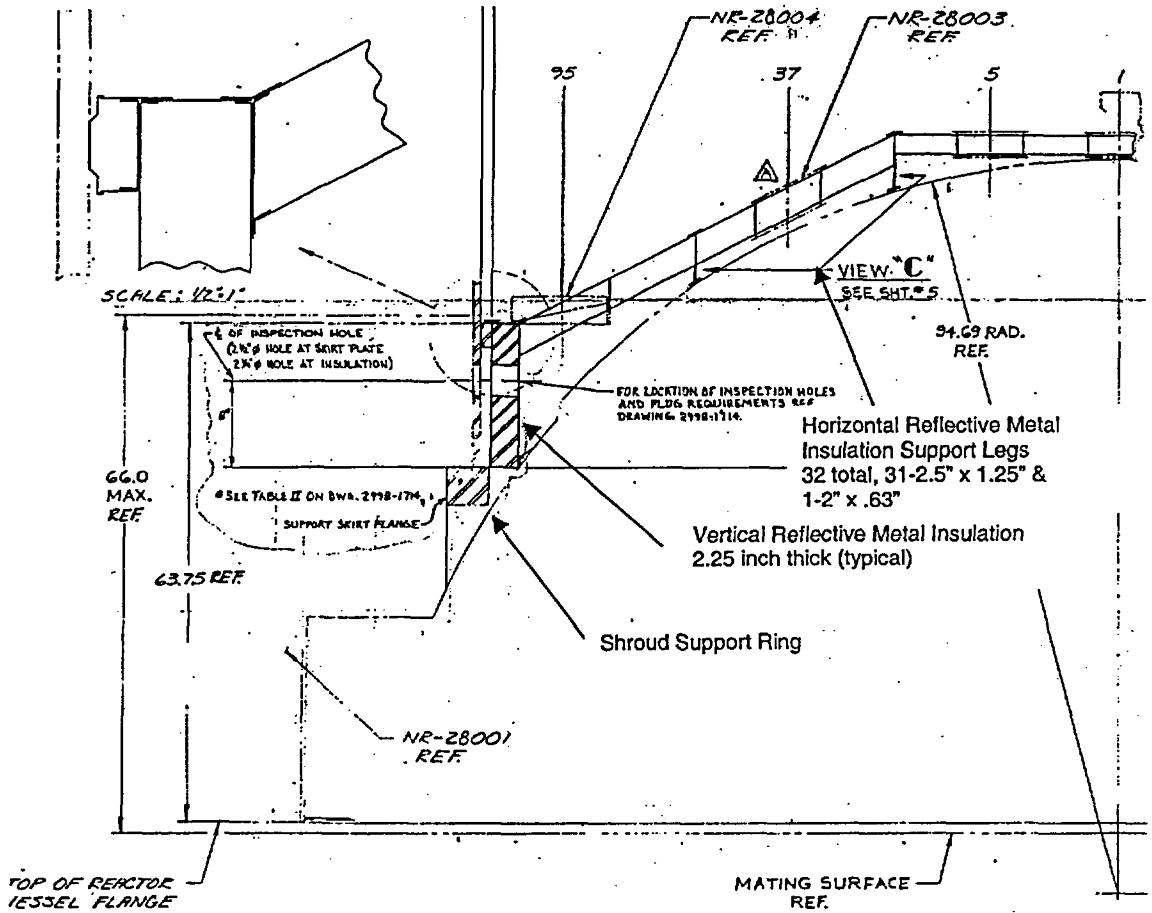

Figure 2: RPV Head Side View Showing Horizontal Insulation Support Leg Location

4. PROPOSED ALTERNATIVE AND BASIS FOR USE:

FPL has achieved substantial compliance with the 100% requirement by conducting a bare metal visual examination of the RPV head surface to the extent practical, excluding the inside of the 54 RPV stud holes. Specifically, the examination included a visual examination of 100% of the nozzle-to-top-of-head interface region (360°) of each RPV head penetration nozzle for evidence of leakage and an examination of the bare head surface for evidence of wastage or corrosive products.

BASIS FOR RELAXATION:

The scope of the examination was 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 2 RPV top head surface has areas of inaccessibility due to the presence of the twelve 6-inch shroud lugs and the horizontal RMI support legs. Improving access to these inaccessible areas, including removal of the horizontal panel support legs, for visual examination would require major disassembly of the CEDM coil stacks and lifting of the shroud and shroud ring to allow access for the destructive RMI removal causing a substantial increase in radiation dose and the potential for damage to removed components. The performance of this disassembly is not practical and does not enhance the quality of the examination because the RPV head penetration nozzles, where leakage would originate, are not located in or adjacent to the inaccessible area: the required 360° visual examination around each RPV head penetration nozzle is unaffected by the this limitation. Also, the head surfaces immediately uphill and downhill of the inaccessible areas were examined for evidence of boric acid leakage under the RMI or shroud support lugs. No evidence of corrosive products were identified.

In November 2001, during refueling outage SL2-13, FPL performed a bare metal visual examination of the accessible portions of the RPV head inside the RMI, including 360° visual examination around each RPV head penetration nozzle, to identify any evidence of leakage from the 102 penetrations. There were no indications of staining leading downhill on the head surface or evidence of leakage identified around the 102 penetrations.

During April/May 2003 refueling outage SL2-14, FPL performed a bare metal visual examination of the accessible portions of the RPV head inside the RMI, including 360^0 visual examination around each RPV head penetration nozzle, to identify any evidence of leakage from the 102 penetrations. The examination coverage was increased from that requested in revision 0 of this relaxation request by removal of the 12 flashing panels attached directly under the shroud support ring, and lifting of the vertical insulation panels that were in contact with the RPV head base material to obtain visual access for the remote equipment to areas previously thought to be inaccessible. Additionally, as shown below in

Figure 3, many of the horizontal BMI support legs were tilted allowing additional visual access to the RPV head base material. The ability to remove the flashing panel beneath the shroud ring, and slightly lift the vertical RMI panels, resulted in inspection of approximately 99% of the RPV head. This percentage does not take credit for the additional coverage obtained by the tilted support legs.

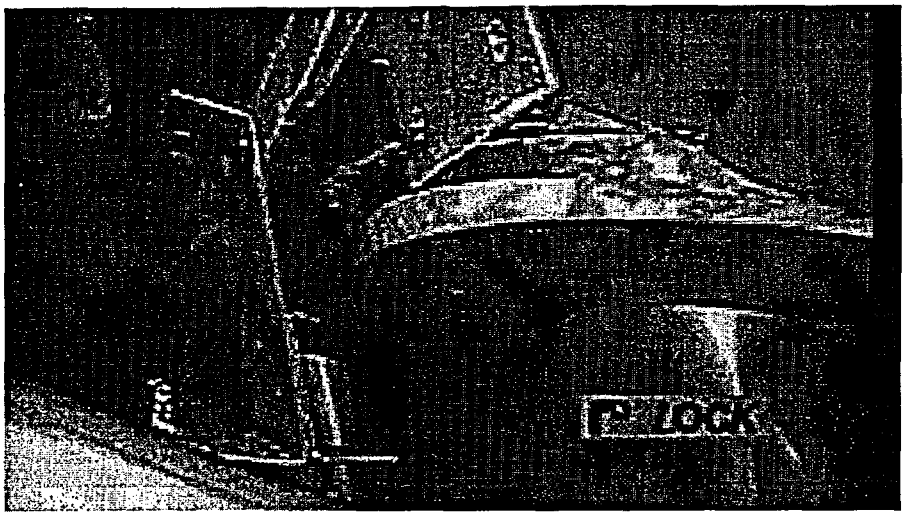

Figure 3: Picture Showing Horizontal RMI Support Leg

It can be concluded that a hardship or unusual difficulty without a compensating increase in level of quality or safety would result if physical modifications were performed to achieve the complete coverage of the RPV head base material required by the Order. These modifications would include coil stack disassembly, to accommodate lifting of the shroud ring, and removal of the vertical RMI panels to permit examination.

This conclusion is based on the following results:

- The visual examination performed during SL2-14 of the base material adjacent to the 102 penetration nozzle-to-top-of-head interface region (360° coverage was obtained) identified no evidence of leakage.
- The visual examination performed during SL2-14 of the RPV head base material with the exception of the areas under the vertical insulation panels at the 12 shroud lug locations, and horizontal RMI panel legs identified no evidence of wastage of the head base material or staining leading into the inaccessible areas.
- The visual examination performed during SL2-14 of the RPV head base material, with the exception of the areas under the vertical panels at the 12 shroud lug locations and horizontal RMI panel legs, identified no evidence of corrosive products on the head base material.

- The assessment of UT data performed during SL-2-14 to determine if leakage had occurred into the interference fit zone identified no evidence of leakage.

5. **DURATION OF PROPOSED ALTERNATIVE:**

This relaxation is applicable to the April/May 2003 refueling outage SL2-14 for St. Lucie Unit 2.