FPL

MAR 1 4 2003

L-2003-068
EA-03-09(IV)(F)(2)

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

Re: Turkey Point Unit 3
Docket No. 50-250
Order (EA-03-009) Relaxation Request
Examination Coverage of Reactor Pressure Vessel Head
Penetration Nozzles - Supplemental Data

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. By letter L-2003-067, pursuant to the procedure specified in Section IV, paragraph F of the Order, Florida Power & Light (FPL) requested relaxation from the requirements specified in Section IV, paragraph C.(l)(b)(i) for Turkey Point Unit 3 for the Reactor Vessel Head (RPVH) penetration nozzles for which ultrasonic testing requirements could not be completed as required. As stated on FPL letter L-2003-067, inspection of the RPVH penetration nozzles was in progress at the time of the submittal, and if required, supplemental data would be provided upon completion of the inspection.

FPL has completed the RPVH penetration nozzle inspection and has identified three additional RPVH penetration nozzles to be included in the referenced relaxation request. Attachment 1 to this letter is a supplement to the original relaxation request and includes the complete order relaxation request, incorporating the three additional RPVH penetration nozzles. Changes to the order relaxation request submitted by L-2003-067 are identified by a change bar on the left margin of the page.

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 nozzles would result in hardship or unusual difficulty without a compensating increase in the level of quality or safety.

Attachment 2 provides the responses to the request for additional information as discussed with your staff on March 13, 2003.

FPL requests approval of the subject relaxation by March 16, 2003, the currently scheduled date for Turkey Point Unit 3 reactor re-assembly. The refueling outage completion is currently scheduled for March 21, 2003.

Please contact Walter Parker at (305) 246-6632 if there are any questions about the relaxation.

Very truly yours,

William Jefferson, Jr.
Vice President
Turkey Point Plant

Attachment

cc: Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, Turkey Point Plant
Florida Department of Health and Rehabilitative Services

TURKEY POINT UNIT 3 RELAXATION REQUEST FROM US NRC Order EA-03-009

"Hardship or Unusual Difficulty without Compensating Increase in Level of Quality or Safety"

1. ASME COMPONENTS AFFECTED

Turkey Point (PTN) Unit 3 has 66 ASME Class 1 reactor pressure vessel (RPV) head penetrations (including the vent).

The Turkey Point Unit 3 Order Inspection Category in accordance with Section (IV.A.) is currently determined as "high" based on 18.3 EDY at this refueling outage[1] (RFO).

FPL Drawing No. 5610-M-400-57, Sheet 1, Rev. 2 (PTN-3)

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 to the bottom of the nozzle and an assessment to determine if leakage has occurred into the interference fit zone, OR

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[1] FPL letter L-2002-1 85, "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-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.

(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)(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 at Turkey Point Unit 3. Specifically, the relaxation is related to UT examination of a limited portion of the non-pressure boundary portion of the RPV penetration nozzle greater than 1 inch below the weld to the bottom of the 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 Turkey Point Unit 3. There are 9 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 nozzle configuration, and limitations of the probe design used for the Ultrasonic (UT) examination. Specifically, actual coverage below the weld, in the non-pressure boundary portion of the nozzle, did not in all cases, extend to the "bottom of the nozzle." A typical example of the UT coverage area, with the area of missed coverage identified, is shown in Figure 1.

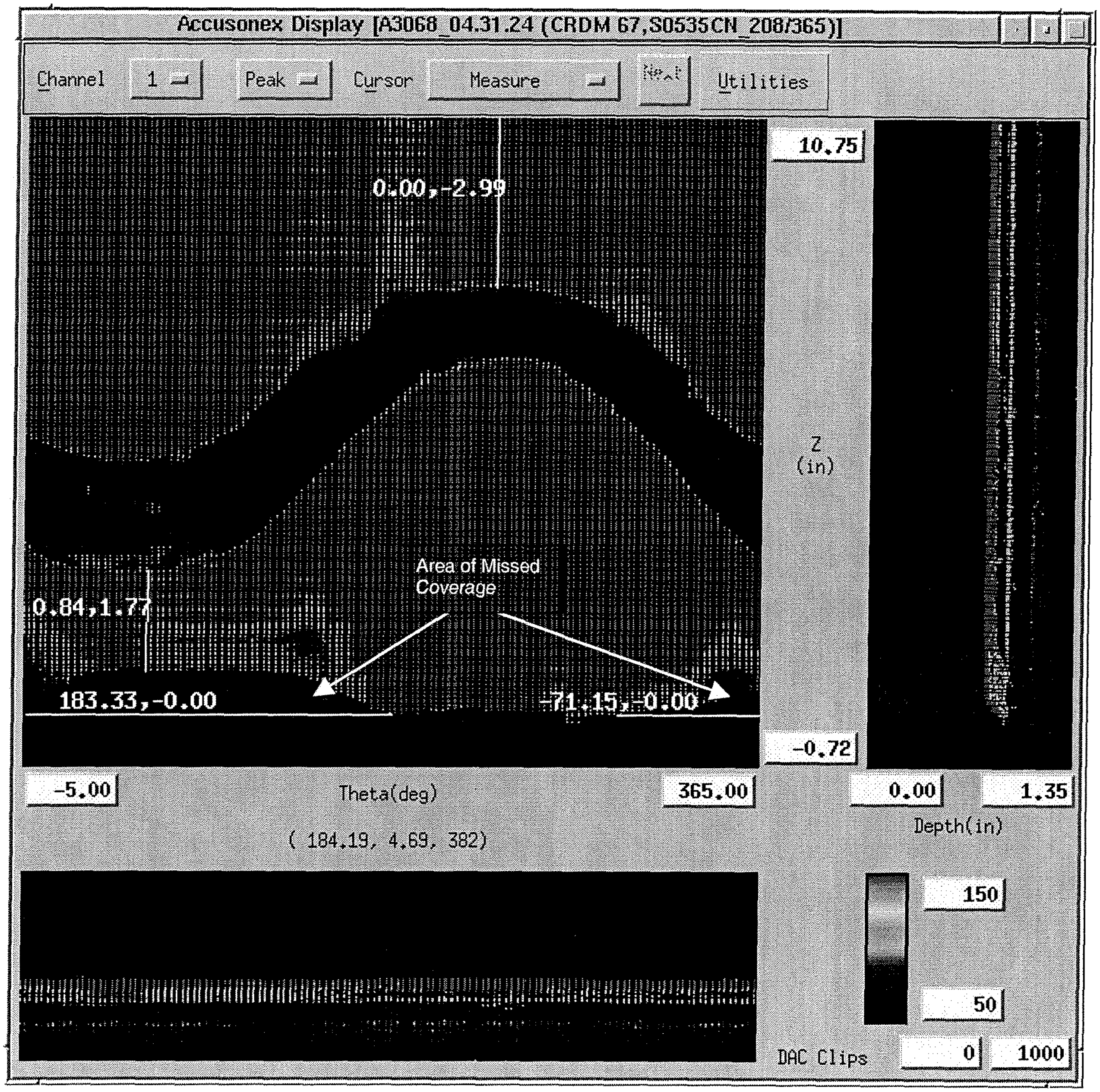


Figure 1: Typical RPV Nozzle UT Inspection "C" Scan with area of missed coverage identified by arrows and above the white horizontal line.

4. PROPOSED ALTERNATIVE AND BASIS FOR USE:

The proposed alternative is to perform the UT examination to the extent practical. This is defined as "the examination shall be performed to include 2 inches above the weld to $\geq$ 1 inch below the weld." This relaxation request documents and submits to the NRC, deviations from the NRC Order required inspection coverage area along with a justification as to their acceptability.

BASIS FOR RELAXATION:

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.

The scope of the examination was to perform a 360" volumetric examination from 2 inches above the J-groove weld down to the bottom of the RPV penetration nozzles. The 66 Turkey Point Unit 3 RPV penetration nozzles are used for a variety of functions and present a variety of examination conditions. The 45 RPV penetration nozzles that are attached to active control rod drive mechanisms (CRDMs) have funnel-ended guide sleeves permanently attached inside the nozzles leaving only a narrow annulus available for inspection. The 6 RPV penetration nozzles attached to part length CRDMs have the threaded guide sleeve permanently retracted and pinned inside the RPV penetration nozzles. The two RPV penetration nozzles modified for the reactor vessel level measurement system (RVLMS) have a guide sleeve installed along with a welded end plate (that required removal for inspection). The other 13 RPV penetration nozzles (8 spares, 4 instrument penetrations, and 1 small bore vent line) are open once the RPV head is removed from the vessel for inspection and require a special centering adapter (except the vent) for scanning with the current UT equipment. These various design conditions, and the normal distortion of the RPV penetration nozzles caused by the welding into the sloped hemispherical head, result in a variety of examination conditions. The UT probes are optimized for these examination conditions, however, not all the conditions can be anticipated. The UT examination technology currently available for the Turkey Point Unit 3 RPV penetration nozzle inspections, has resulted in some areas of missed inspection > 1 inch below the weld. A hardship or unusual difficulty, without a compensating increase in level of quality or safety, would result if physical modifications, such as removal of RPV nozzle penetration sleeves or new UT equipment would have to be developed, to achieve the complete coverage in the non pressure boundary portion of the RPV nozzle material > 1 inch below the weld required by the Order.

To evaluate the significance of the lack of UT inspection coverage, the inspection coverage data was broken into 2 distinct regions. Those regions include the nozzle base material from 2 inches above the weld to a minimum of 1 inch below the weld, and from > 1 inch below the weld. A summary of these 2 UT coverage areas, and the total number of nozzles affected is provided in Table 1 below.

Table 1: Summary of Complete and Incomplete Inspection Coverage

Area of UT Coverage	Number of Penetrations Inspected
Complete coverage from 2” above the weld to a minimum of 1” below the weld	65 of 65 (Additionally full coverage was obtained for the vent line which does not extend below the weld)
Complete coverage from 1” below the weld to the bottom of the nozzle	56 of 65
Incomplete coverage from 1” below the weld to the bottom of the nozzle	9 of 65

A complete matrix of the UT inspection coverage areas, UT inspection results and the “leak path” results is provided in Table 2.

Table 2: Turkey Point Unit 3 UT Data Coverage Matrix for RPV Nozzles

CRDM	Turkey Point Unit 3 Cycle 20 – Extent of UT Coverage in RPV Nozzle Material							Leak Path Data	
fen #	Min. Distance Above Weld Root (Inches)	Coverage Above Weld Root (Theta)	Coverage @ Weld Root (Theta)	Weld Region Coverage (Theta)	Below Weld Coverage (Theta)	Min Distance Below Weld Toe when incomplete coverage (Inches)	Comments	Determination Possible?	Leak Path Results
1	3.11	360	360	360	360	N/A	NRI	Yes	No LP
2	3.02	360	360	360	360	N/A	NRI	Yes	No LP
3	3.12	360	360	360	360	N/A	NRI	Yes	No LP
4	2.12	360	360	360	360	N/A	NRI	Yes	No LP
5	3.02	360	360	360	360	N/A	NRI	Yes	No LP
6	3.43	360	360	360	360	N/A	NRI	Yes	No LP
7	2.45	360	360	360	360	N/A	NRI	Yes	No LP
8	3.54	360	360	360	360	N/A	NRI	Yes	No LP
9	3.35	360	360	360	360	N/A	NRI	Yes	No LP
10	3.50	360	360	360	360	N/A	NRI	Yes	No LP
11	3.38	360	360	360	360	N/A	NRI	Yes	No LP
12	3.36	360	360	360	360	N/A	NRI	Yes	No LP
13	3.35	360	360	360	360	N/A	NRI	Yes	No LP
14	3.09	360	360	360	360	1.13	NRI Incomplete coverage below weld for 154".	Yes	No LP
15	3.43	360	360	360	360	N/A	NRI	Yes	No LP
16	3.27	360	360	360	360	1.54	NRI Incomplete coverage below weld for 324".	Yes	No LP
17	3.20	360	360	360	360	N/A	NRI	Yes	No LP
18	3.19	360	360	360	360	N/A	NRI	Yes	No LP
19	3.44	360	360	360	360	N/A	NRI	Yes	No LP
20	2.54	360	360	360	360	N/A	NRI	Yes	No LP
21	3.40	360	360	360	360	N/A	NRI	Yes	No LP
22	3.11	360	360	360	360	N/A	NRI	Yes	No LP
23	3.17	360	360	360	360	N/A	NRI	Yes	No LP
24	3.10	360	360	360	360	N/A	NRI	Yes	No LP
25	3.27	360	360	360	360	1.04	NRI Incomplete coverage below weld for 311°.	Yes	No LP
26	2.99	360	360	360	360	N/A	NRI	Yes	No LP
27	2.83	360	360	360	360	N/A	NRI	Yes	No LP
28	3.22	360	360	360	360	1.06	NRI Incomplete coverage below weld for 311°.	Yes	No LP
29	2.88	360	360	360	360	N/A	NRI	Yes	No LP
30	3.35	360	360	360	360	N/A	NRI	Yes	No LP

31	3.62	360	360	360	360	1.30	NRI Incomplete coverage below weld for 54".	Yes	No LP
32	2.45	360	360	360	360	N/A	NRI	Yes	No LP
33	3.04	360	360	360	360	N/A	NRI	Yes	No LP
34	3.31	360	360	360	360	N/A	NRI	Yes	No LP
35	3.40	360	360	360	360	N/A	NRI	Yes	No LP
36	3.38	360	360	360	360	N/A	NRI	Yes	No LP
37	3.55	360	360	360	360	N/A	NRI	Yes	No LP
38	3.42	360	360	360	360	N/A	NRI	Yes	No LP
39	2.79	360	360	360	360	N/A	NRI	Yes	No LP
40	2.90	360	360	360	360	N/A	NRI	Yes	No LP
41	2.95	360	360	360	360	N/A	NRI	Yes	No LP
42	3.21	360	360	360	360	N/A	NRI	Yes	No LP
43	3.40	360	360	360	360	1.07	NRI Incomplete coverage below weld for 285".	Yes	No LP
44	2.81	360	360	360	360	N/A	NRI	Yes	No LP
45	2.82	360	360	360	360	N/A	NRI	Yes	No LP
46	2.41	360	360	360	360	N/A	NRI	Yes	No LP
47	2.71	360	360	360	360	N/A	NRI	Yes	No LP
48	2.16	360	360	360	360	N/A	NRI	Yes	No LP
49	2.47	360	360	360	360	N/A	NRI	Yes	No LP
51	2.55	360	360	360	360	N/A	NRI	Yes	No LP
53	2.40	360	360	360	360	N/A	NRI	Yes	No LP
55	2.37	360	360	360	360	N/A	NRI	Yes	No LP
57	2.55	360	360	360	360	N/A	NRI	Yes	No LP
58	3.19	360	360	360	360	N/A	NRI	Yes	No LP
59	2.15	360	360	360	360	N/A	NRI	Yes	No LP
60	3.02	360	360	360	360	N/A	NRI	Yes	No LP
61	3.80	360	360	360	360	N/A	NRI	Yes	No LP
62	3.12	360	360	360	360	N/A	NRI	Yes	No LP
63	2.09	360	360	360	360	1.83	NRI Incomplete coverage below weld for 83°.	Yes	No LP
64	2.52	360	360	360	360	1.53	NRI Incomplete coverage below weld for 76".	Yes	No LP
65	2.89	360	360	360	360	N/A	NRI	Yes	No LP
66	3.13	360	360	360	360	N/A	NRI	Yes	No LP
67	2.99	360	360	360	360	1.77	NRI Incomplete coverage below weld for 254".	Yes	No LP
66	3.30	360	360	360	360	N/A	NRI	Yes	No LP
69	2.72	360	360	360	360	N/A	NRI	Yes	No LP
Vent	2.00	360	360	360	N/A	N/A	NRI	N/A	N/A

Note: Leak path determination is not applicable to the vent line, because it has a clearance fit.

To determine the significance of the lack of UT examination coverage, the effect of a postulated axial and circumferential flaw in the nozzle material was evaluated relative to the areas of examination coverage identified above.

From 2 inches above the weld to 1 inch below the weld: The areas of prime interest because of the safety concern for nozzle ejection and LOCA are circumferential cracks located in the nozzle material at the weld root and above the weld. This is also the area that axial cracks would have to propagate to in order for a leak to occur through the RPV penetration nozzle material. The UT examinations of the RPV penetration nozzles have bounded this area (the safety significant region), by providing complete 360° coverage of the nozzle base material (from 2 inches above the weld to 1 inch below the weld) for all the RPV nozzle penetrations currently inspected. Therefore, reliable assurance is provided to conclude that safety significant circumferential flaws do not exist at or above the weld root.

Greater than 1 inch below the weld to the bottom of the nozzle: Axial flaws in the area of non-coverage in the non-pressure boundary nozzle base material below the weld are of no structural significance, however, a postulated flaw could grow above the weld to the point of leakage followed by wastage and/or potential initiation of an OD circumferential flaw.

To determine the significance of an axial flaw that is contained in the non-pressure boundary nozzle material in the un-inspected region >1 inch below the weld, a flaw tolerance approach is used. A flaw evaluation was performed postulating an axial flaw in the area of missed coverage below the weld using WCAP-16027-P [3]. A through wall flaw is postulated in the nozzle material from the bottom of the penetration to 1" from the bottom of the weld. The flaw evaluation in WCAP-16027-P is based on Turkey Point Unit 3 and 4 specific stresses in the nozzle penetrations. Since the stresses >1" below the weld are too low to propagate an axial flaw, the WCAP-16027-P flaw evaluations start at ½" below the weld, and evaluate the time to propagate the flaw in the nozzle to the bottom of the weld (start of the pressure boundary portion of the nozzle material or toe of the J-groove weld). Assuming a through wall flaw below the weld, with the flaw end located at ½" below the weld (which is in the area of complete UT examination coverage), an axial flaw would take greater than 5 years of operation (Figures 6-12 through 6-20 in WCAP-16027-P) in any nozzle location to grow to the point of contact with the weld. This time period is significantly greater than the current inspection frequency of every refueling cycle (18 months for Turkey Point Unit 3) identified in NRC Order EA-03-009. As an added conservatism, this evaluation does not attempt to evaluate the time for the axial flaw to grow from the bottom of the weld through the pressure boundary.

[3] "Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: Turkey Point Units 3 & 4," Westinghouse Electric Co. LLC, WCAP-16027-P Revision 0, Draft, February 2003.

Figure 2 provides a graphical presentation of the above flaw evaluation discussion for the outer most penetration location.

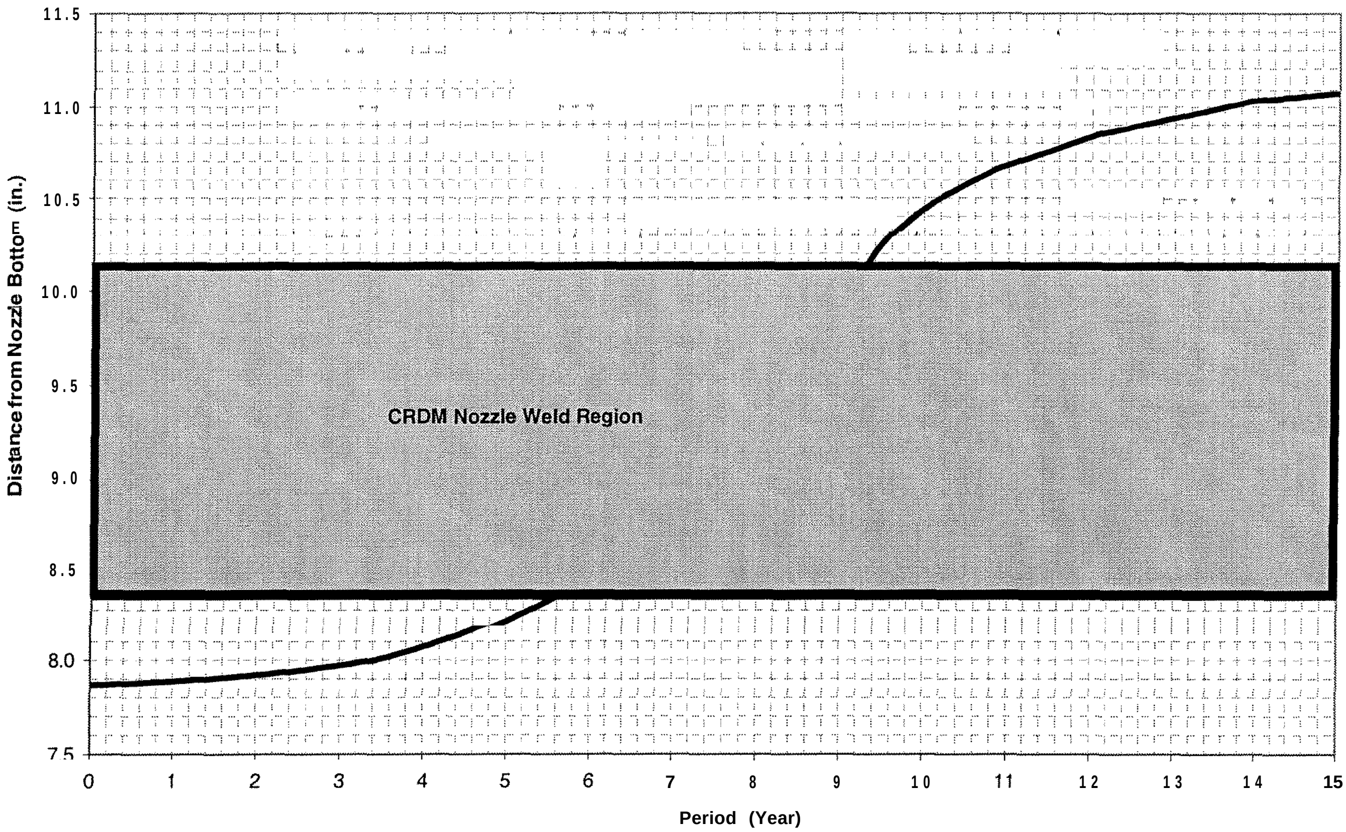


Figure 2: Through-Wall Axial Flaws Located in the 42.6 Degree Row of Penetrations, Uphill Side - Crack Growth Predictions (From Figure 6-19, WCAP-16027-P)

Therefore, there are no concerns with the structural integrity of the RPV penetration nozzles that could be caused by axial cracking in the missed coverage areas in the non-pressure boundary portion of the nozzle material > 1" below the weld for a period of > 5 years of operation.

This conclusion is based on the following results:

- UT inspection results of no indications in the nozzle areas examined from a minimum of 1” below the weld to 2” above the weld (100% coverage obtained)
- Acceptable assessment of no “leak path” present into interference fit zone (100% coverage obtained)
- UT inspection results of no indications in the nozzle areas examined greater than 1” below the weld (coverage per Table 2)
- Acceptable bare metal visual examination results of no leakage or wastage of the RPV head

5. DURATION OF PROPOSED ALTERNATIVE:

This relaxation is applicable to the March 2003 refueling outage for PTN-3. After one operating cycle from the 2003 identified refueling outage, the PTN-3 RPV head will be re-inspected as per the Order, or the RPV head will be replaced.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

The NRC supplied the following questions to Turkey Point on March 13, 2003.

Question 1. In Figures 5-3 through 5-9 of WCAP-16027-P, what is the maximum hoop stress in the nozzle base material greater than one inch from the bottom of the weld? What material properties (i.e., yield strength) were used in these calculations?

Hoop Stress Distribution

The hoop stress distribution as a function of distance from the bottom of the weld shown in Figures 5-3 through 5-7 of WCAP-16027-P are provided in Figures 1 to 9. Hoop stress in Figure 5-8 of WCAP-16027-P for the head vent penetration below the weld is not available because the penetration does not extend beyond the attachment weld. Figure 5-9 of WCAP-16027-P is an axial stress distribution plot of CRDM (42.6”) and the corresponding hoop stress distribution as a function of distance from the bottom of the weld for this nozzle is given in Figures 8 and 9. Note that the minimum distance below the weld toe depicted on Table 2 typically occurs at the downhill side of the welds. Coverage at the uphill side is greater, and varies with the angle of the penetration. This difference in distance below the weld is approximated in Figures l-9 contained herein.

Effect of Yield Stress Level on The Trend In Stresses Below The Weld

The trend in stresses in a typical head penetration is not affected by the yield stress used in the analysis. Westinghouse stress evaluations are done using a cyclic stress-strain curve, determined from laboratory tests carried out on actual head penetration material. The equivalent 0.2% offset yield for this curve is about 50 ksi.

Calculations have been performed to compare the results obtained for a lower stress strain curve, corresponding to a monotonic yield strength of 42.5 ksi, on the exact same geometry. The results of the comparison for one of the outermost penetrations is shown in Figures 10 and 11.

The trend in stresses, decreasing with distance below the weld, is the same regardless of the yield strength used. In three of the four cases, the actual stress values are higher for the cyclic stress-strain curve.

Note that the plant depicted in Figures 10 and 11 for this example is not Turkey Point, but the results are typical regardless of the geometry.

Figure 1

Hoop Stress in Figure 5-7 vs. Distance from Bottom of Weld, 0 degrees Uphill and Downhill

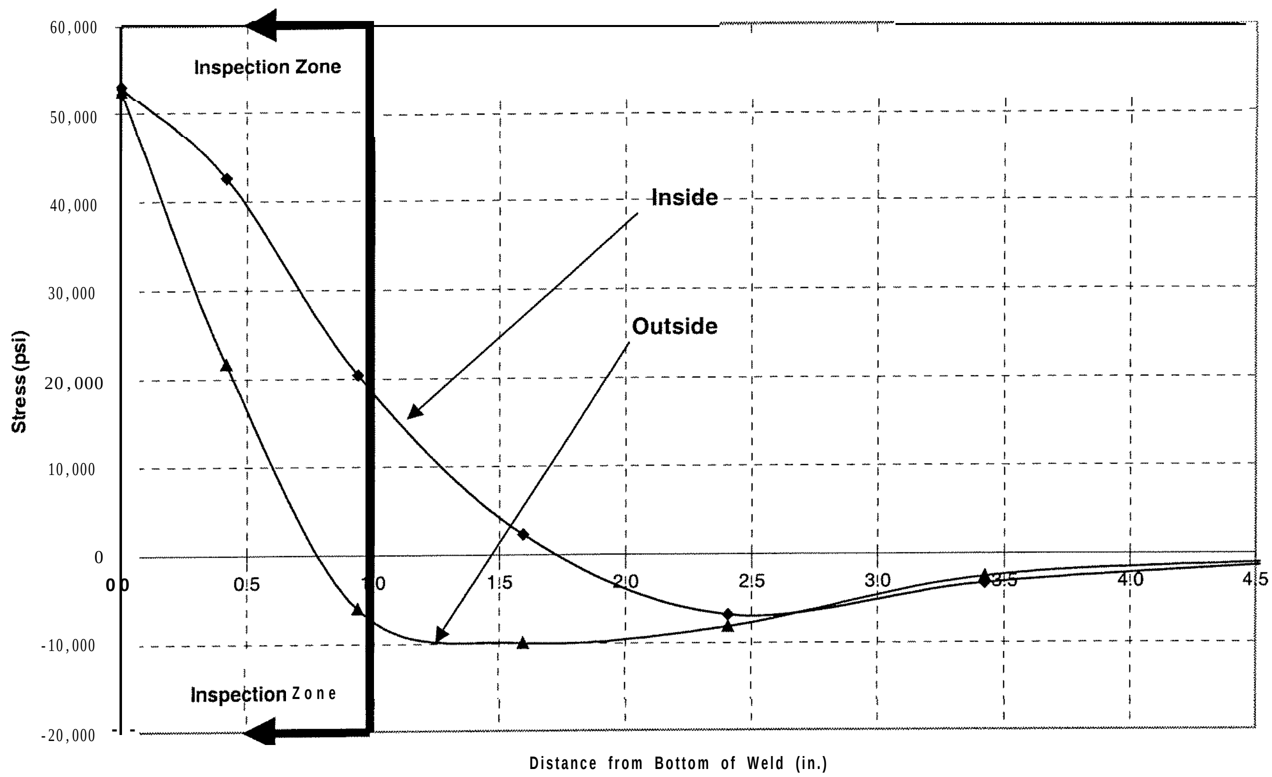


Figure 2

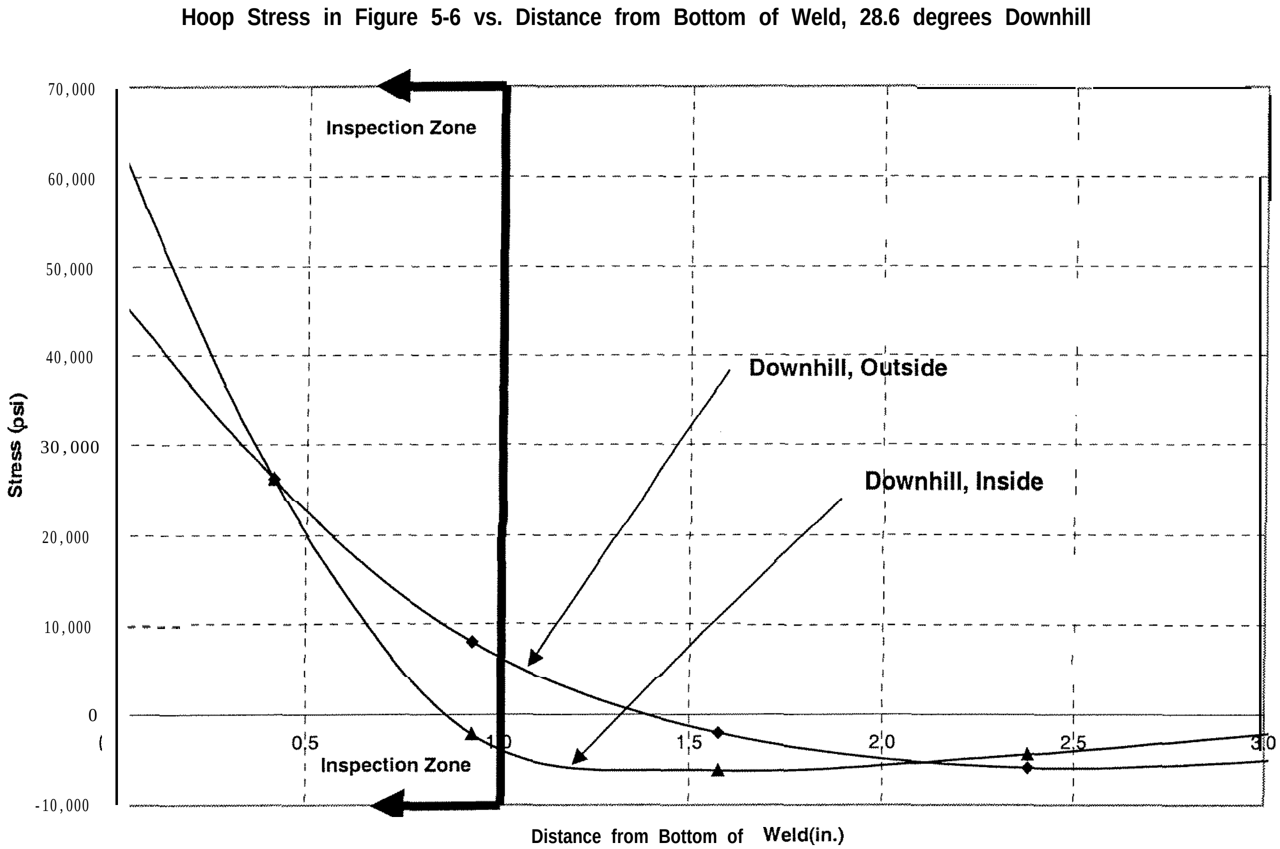

Hoop Stress in Figure 5-6 vs. Distance from Bottom of Weld, 28.6 degrees Downhill
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
-10,000
Stress (psi)
Inspection Zone
Downhill, Outside
Downhill, Inside
0.5
1.0
1.5
2.0
2.5
3.0
Inspection Zone
Distance from Bottom of Weld(in.)

Figure 3

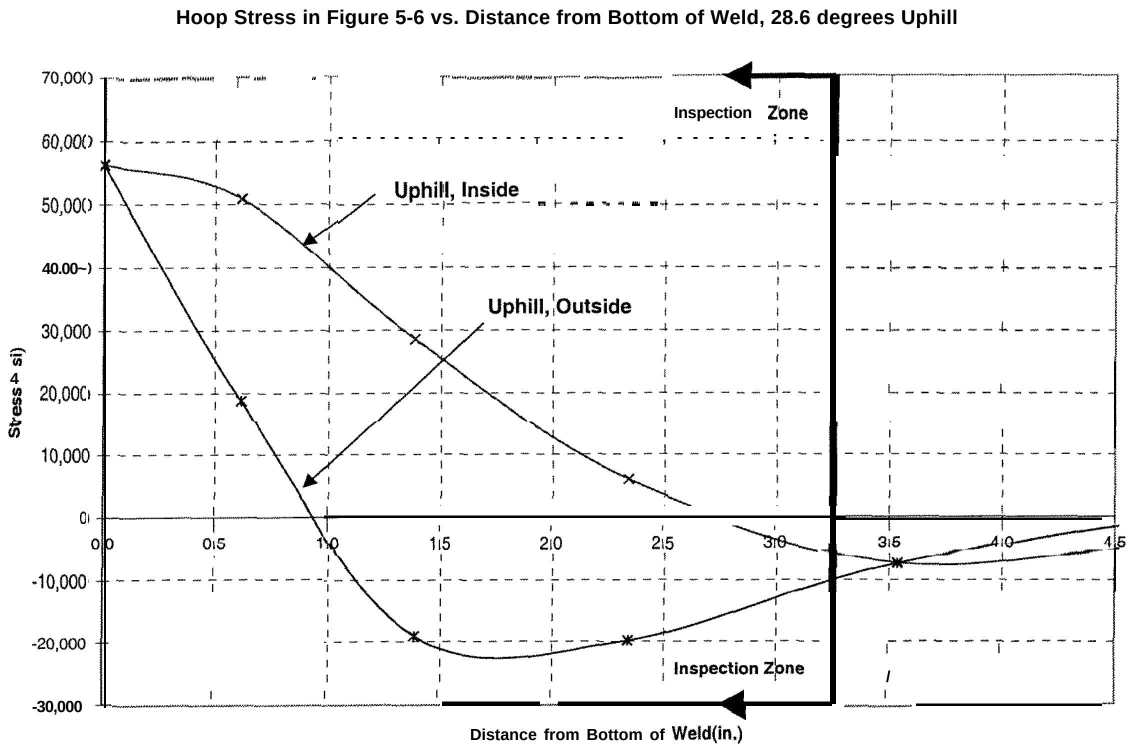

Hoop Stress in Figure 5-6 vs. Distance from Bottom of Weld, 28.6 degrees Uphill
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
-10,000
-20,000
-30,000
Stress (psi)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Distance from Bottom of Weld(in.)
Uphill, Inside
Uphill, Outside
Inspection Zone
Inspection Zone

Figure 4

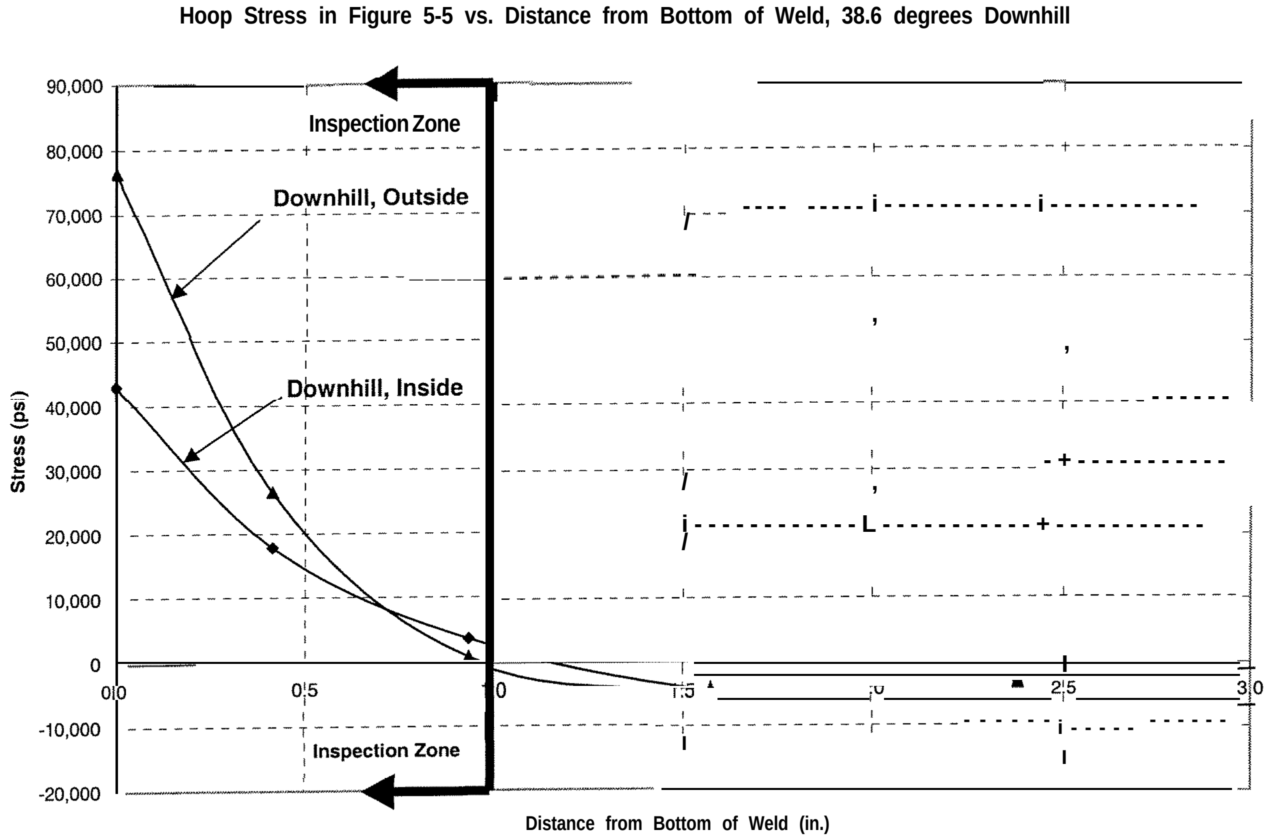

Hoop Stress in Figure 5-5 vs. Distance from Bottom of Weld, 38.6 degrees Downhill
Inspection Zone
Downhill, Outside
Downhill, Inside
Inspection Zone
Stress (psi)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
-10,000
-20,000
0.0
0.5
1.0
1.5
2.5
3.0
Distance from Bottom of Weld (in.)

Figure 5

Hoop Stress in Figure 5-5 vs. Distance from Bottom of Weld, 38.6 degrees Uphill

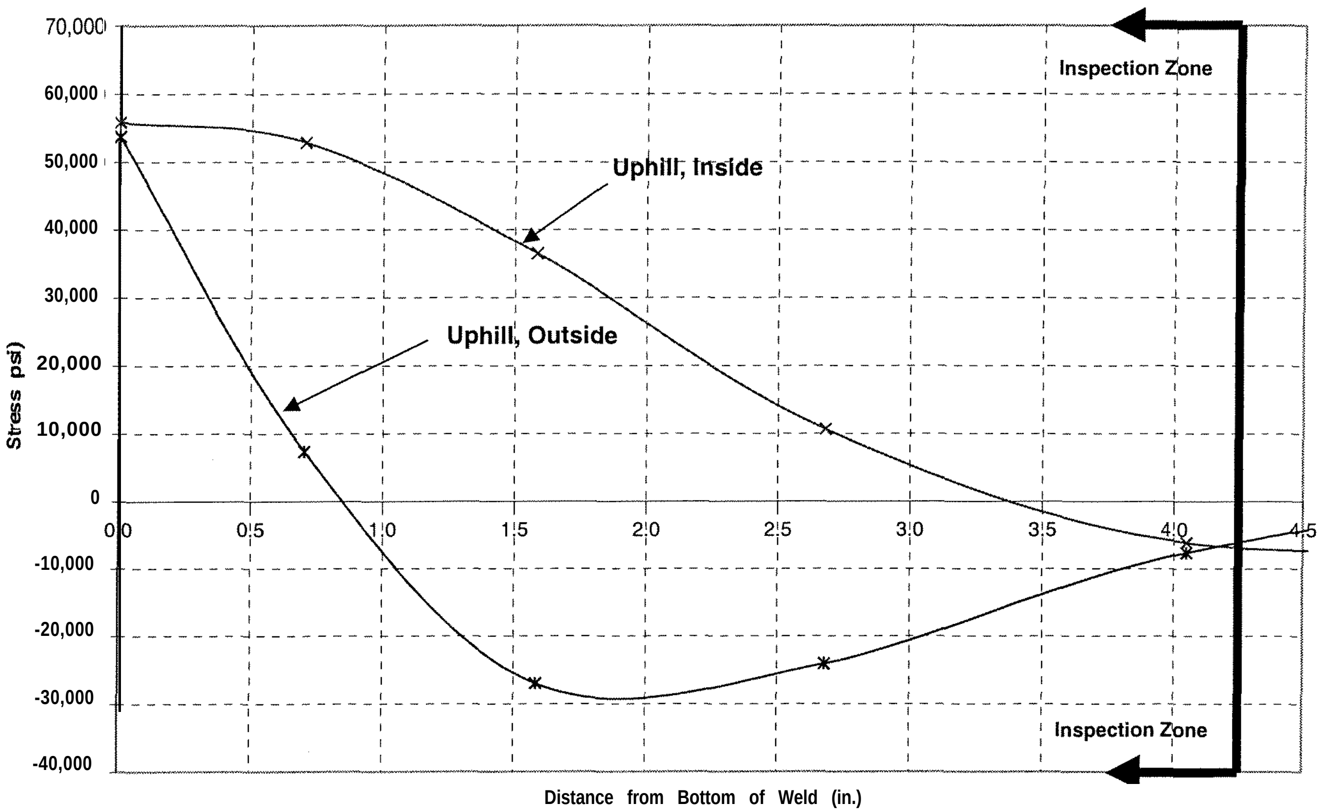


Figure 6

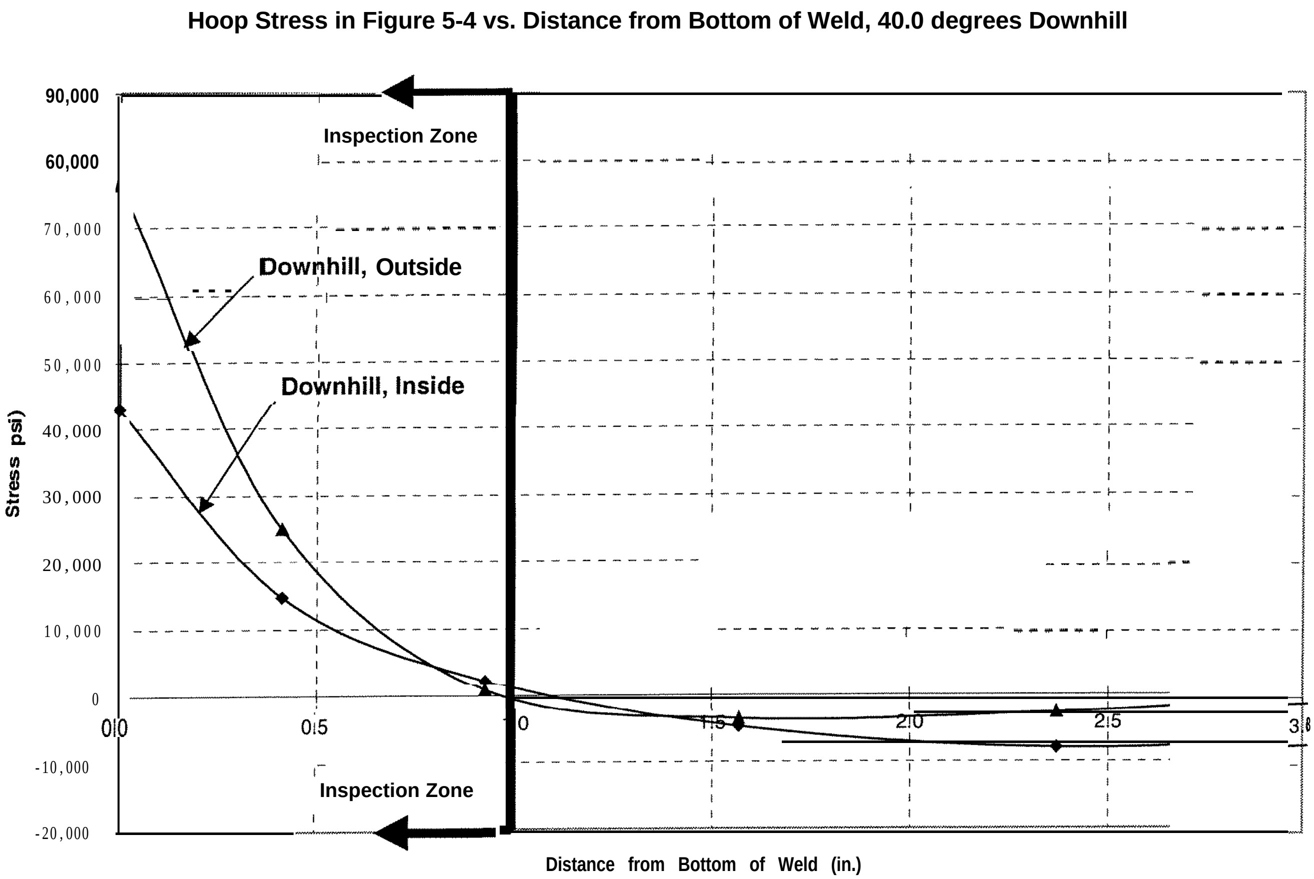

Hoop Stress in Figure 5-4 vs. Distance from Bottom of Weld, 40.0 degrees Downhill
90,000
60,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
-10,000
-20,000
Stress psi)
Inspection Zone
Downhill, Outside
Downhill, Inside
Inspection Zone
0.0
0.5
1.5
2.0
2.5
Distance from Bottom of Weld (in.)

Figure 7

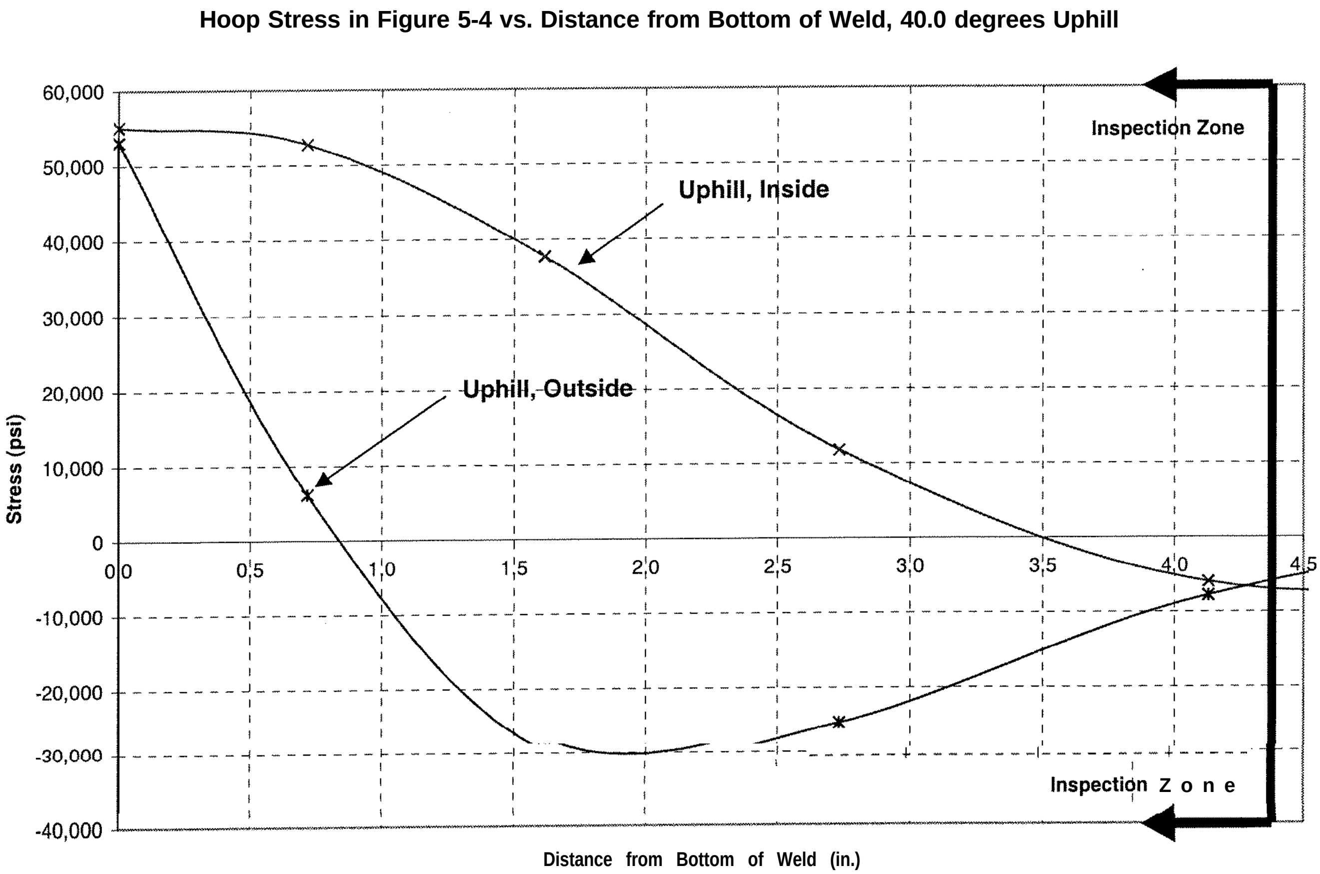

Hoop Stress in Figure 5-4 vs. Distance from Bottom of Weld, 40.0 degrees Uphill
Inspection Zone
Uphill, Inside
Uphill, Outside
Inspection Zone
Stress (psi)
60,000
50,000
40,000
30,000
20,000
10,000
0
-10,000
-20,000
-30,000
-40,000
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Distance from Bottom of Weld (in.)

Figure 8

Hoop Stress in Figure 5-3 vs. Distance from Bottom of Weld, 42.6 degrees Downhill

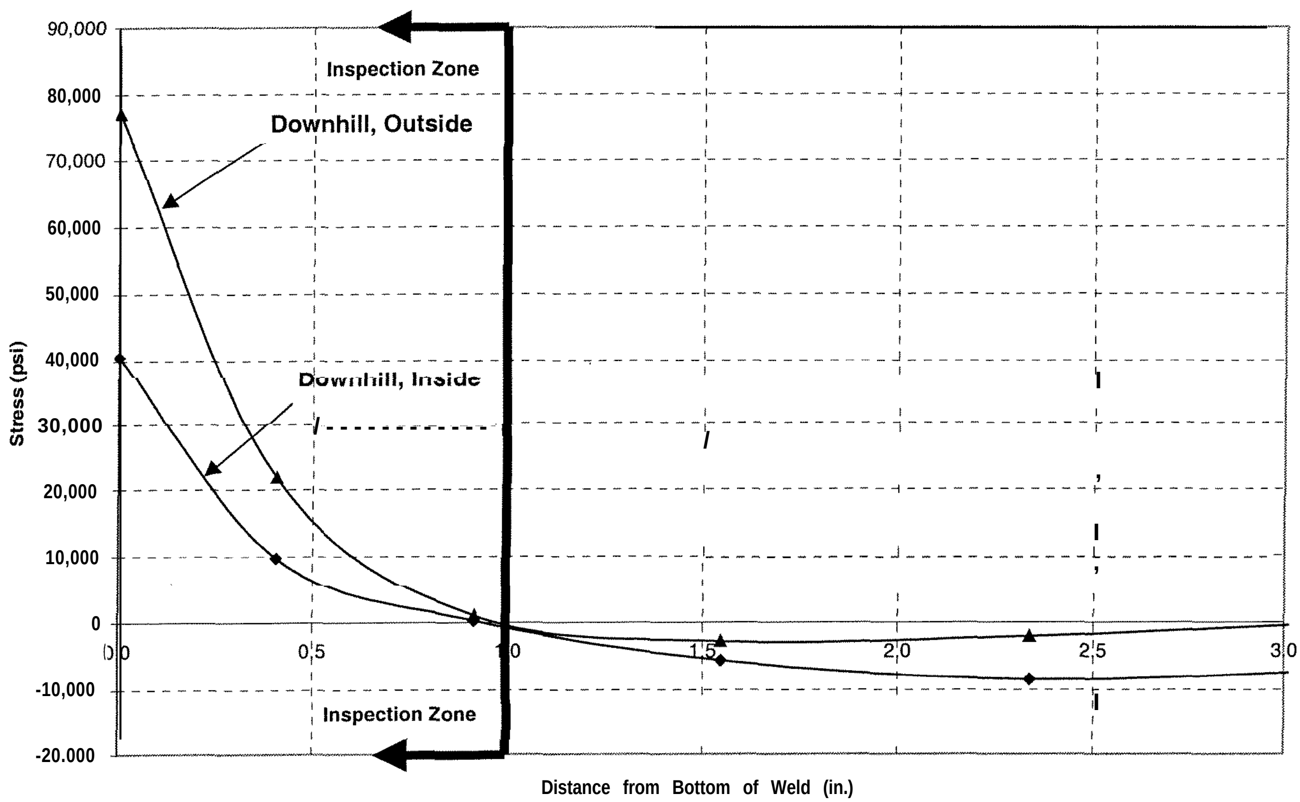


Figure 9

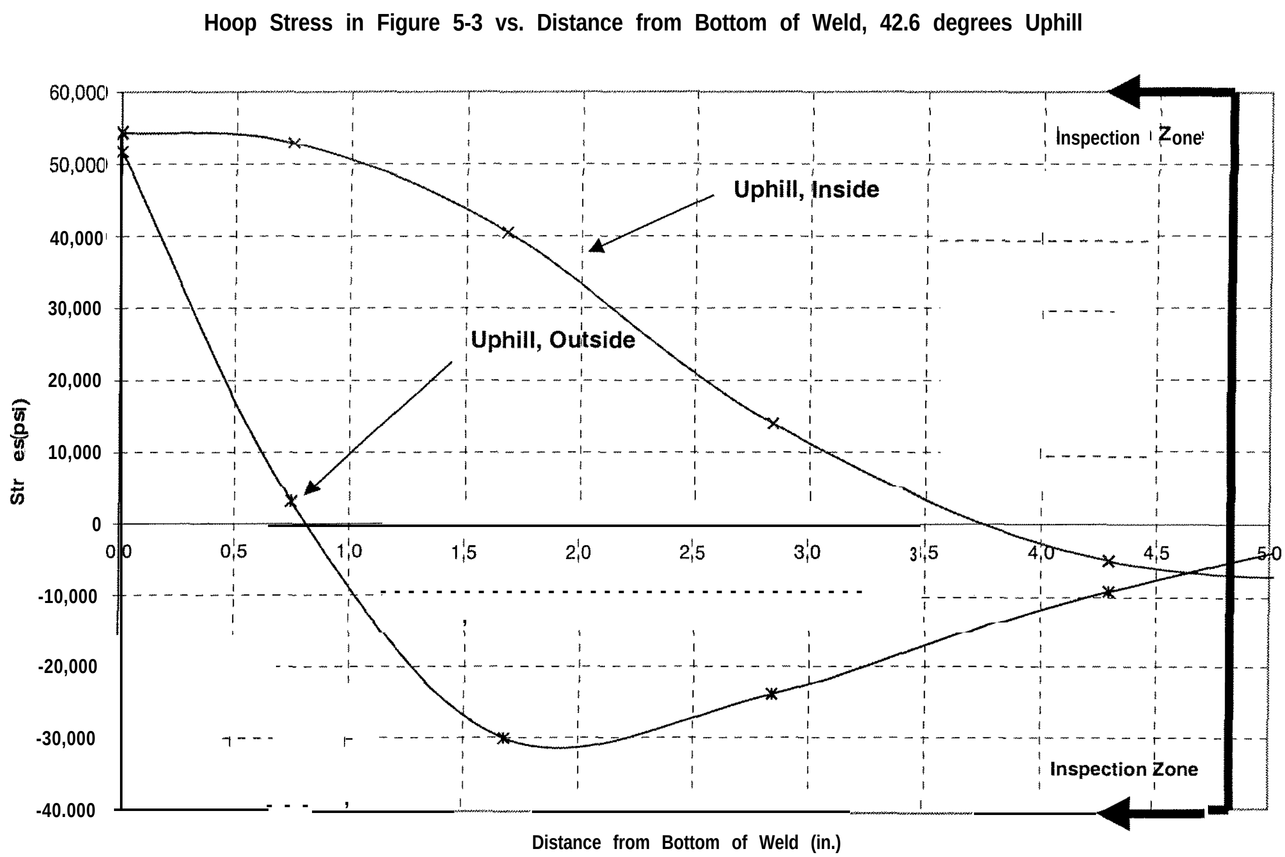

Hoop Stress in Figure 5-3 vs. Distance from Bottom of Weld, 42.6 degrees Uphill
Inspection Zone
Uphill, Inside
Uphill, Outside
Inspection Zone
60,000
50,000
40,000
30,000
20,000
10,000
0
-10,000
-20,000
-30,000
-40,000
0,0
0,5
1,0
1,5
2,0
2,5
3,0
3,5
4,0
4,5
5,0
Stress (psi)
Distance from Bottom of Weld (in.)

Figure 10 (Note : Results are for a typical plant, not Turkey Point specific)

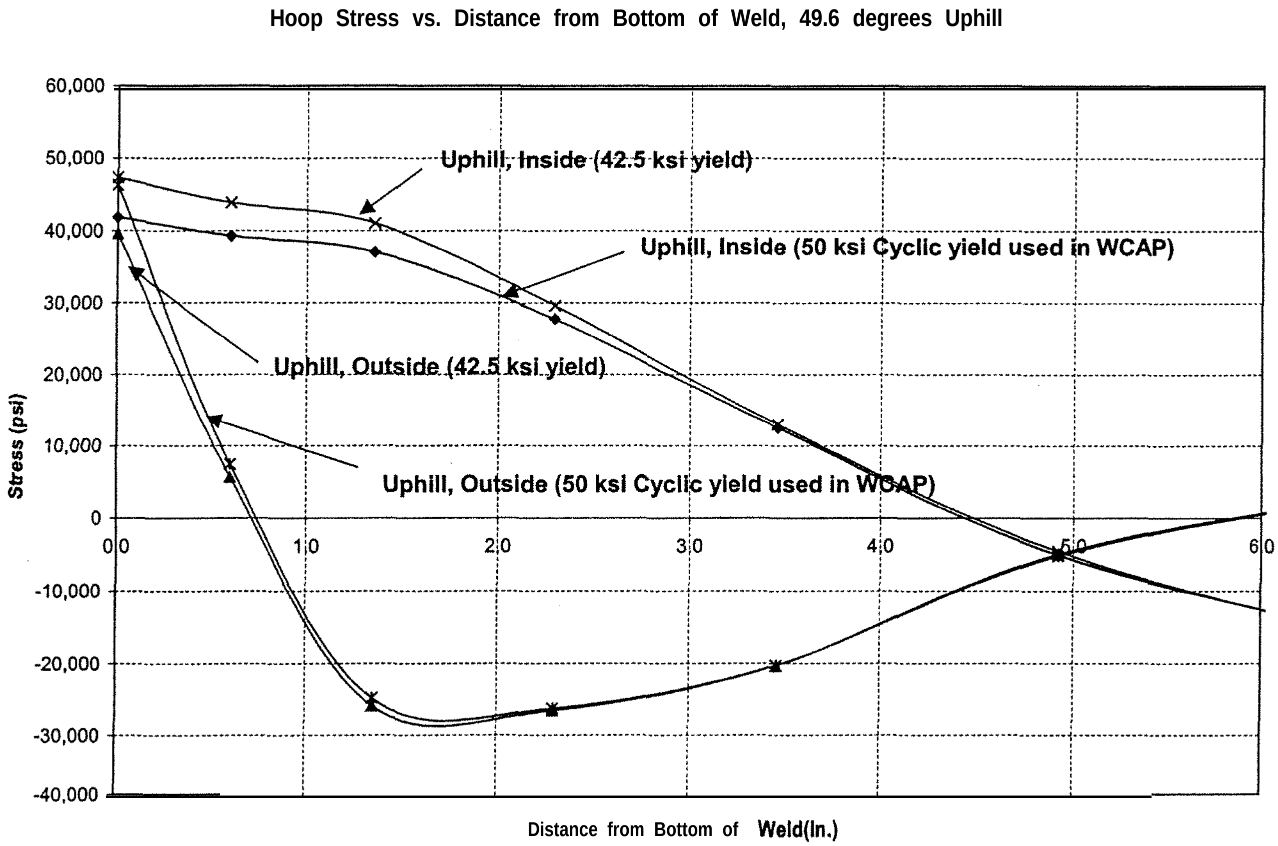
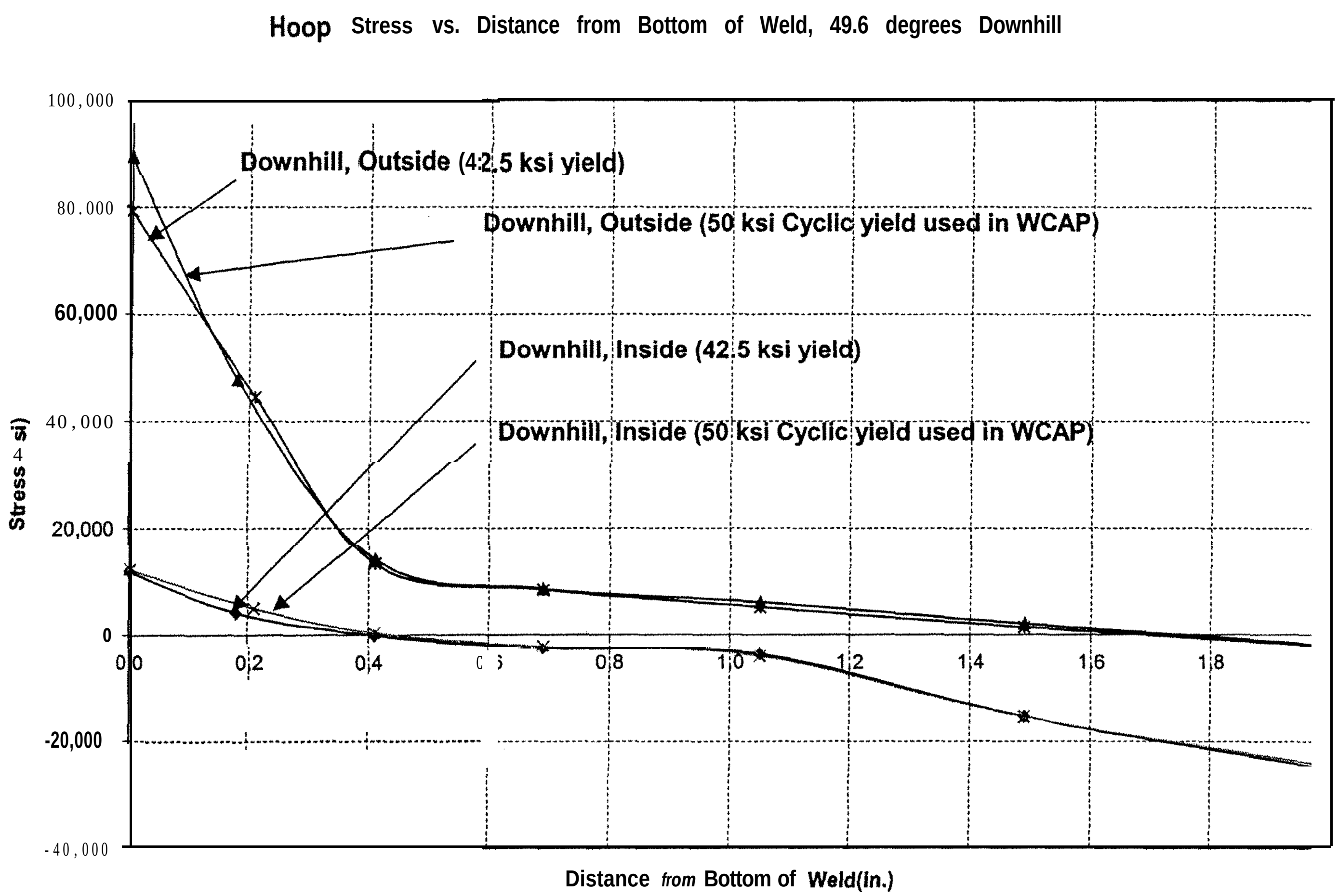


Figure 11 (Note : Results are for a typical plant, not Turkey Point specific)



Question 2. Withdrawn

Question 3. In Figure 1 of the submittal, the degrees of missed coverage for control rod drive mechanism (CRDM) 67 are listed as 60.27 and 175.79 for a total of 236.06 degrees. In Table 2 of the submittal, a comment for CRDM 67 states "coverage below weld from 343 degrees - 170 degrees." What is the area of missed coverage for this nozzle, how is it determined and how does one reconcile the information provided in the C-scans with the table?

Response:

Previously, Figure 1 was included to depict a "typical" example for nozzle #67. The figure 1 that is included in the supplemented request is the actual C-scan for nozzle #67 that illustrates the circumferential extent of missed coverage. The extent of missed coverage at the bottom of the nozzle is determined by, in this case, adding the two numbers. Additionally, the total circumferential extent of missed coverage, in degrees, is now shown in Table 2 for every nozzle where coverage was less than 100%.

Question 4. Has the crack growth data in Figure 4-4 of WCAP-16027-P (in particular the data marked "Huntington") been normalized to a common temperature (325 ° C?) or does this figure represent as-measured data?

Response:

The data have been normalized to a temperature of 325°C. The actual test temperatures are listed in parenthesis after the caption. For example, the Huntington data were obtained at temperatures ranging from 315°C to 331 °C.

Question 5. The Order provides for ultrasonic testing (UT) and assessment of leakage, OR surface examination to assess the condition of the vessel head penetration nozzles and J-groove welds. Have you considered supplementing the limited UT examination data for some nozzles (as described in your relaxation request) with surface examinations to provide 100% coverage for each nozzle?

Response:

Our inspection vendor does not currently have eddy current capability. This is the only method available for inspecting the inside surface of the affected penetrations, due to the accessibility restraint provided by the installed thermal sleeves. The available method for performing outside surface inspections is manual PT. Preparation and inspection of the subject outside surfaces would increase exposure, without obtaining information leading to a corresponding increase in safety, due to the low stresses in the affected zones. As shown in Figures 1-9, these stresses range from small tensile stresses to mostly compressive stresses.