Peter E. Katz
Vice President
Calvert Cliffs Nuclear Power Plant
Constellation Generation Group, LLC

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Constellation Energy Group

April 4, 2003

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Response to Request for Additional Information Regarding Interim Inspection Requirements for Reactor Pressure Vessel Head (TAC Nos. MB7752 and MB7753)

REFERENCES:

(a) Letter from Mr. P. E. Katz (CCNPP) to Document Control Desk (NRC), dated February 18, 2003, Response to Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors

(b) Letter from Mr. S. J. Collins (NRC) to Holders of Licenses for Operating Pressurized Water Reactors, dated February 11, 2003, Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors (EA-03-009)

(c) Letter from Mr. G. S. Vissing (NRC) to Mr. P. E. Katz (CCNPP), dated April 2, 2003, Calvert Cliffs Nuclear Power Plant, Unit No. 2 – Request for Additional Information Regarding the Response of March 13, 2003, to the Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) dated February 28, 2003, Regarding the Relaxation of the Order of February 11, 2003 (TAC Nos. MB7752 and MB7753)

By letter dated February 18, 2003 (Reference a), Calvert Cliffs Nuclear Power Plant, Inc. submitted a request for relaxation from the inspection requirements of Section IV.C(1)(b)(1) of Reference (b). This letter provides Calvert Cliffs Nuclear Power Plant's response to the April 2, 2003, letter (Reference c) request from the Nuclear Regulatory Commission for additional information regarding that relaxation request. The requested information and our responses are contained in Attachment (1) to this letter.

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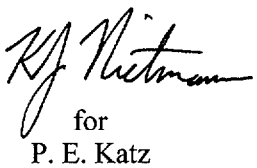
Should you have questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,



for
P. E. Katz
Vice President
Calvert Cliffs Nuclear Power Plant

PEK/JKK/bjd

Attachment: (1) Response to NRC Request for Additional Information

cc: J. Petro, Esquire
J. E. Silberg, Esquire
Director, Project Directorate I-1, NRC
G. S. Vissing, NRC
H. J. Miller, NRC
Resident Inspector, NRC
R. I. McLean, DNR

ATTACHMENT (1)

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION

Calvert Cliffs Nuclear Power Plant, Inc.
April 4, 2003

ATTACHMENT (1)

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION

NRC Request 1:

Please provide a tabular listing of the maximum operating stress (across the cross-section) from the top of the J-groove weld to 2 inches above the weld. How does the yield strength of the nozzle material used in the calculations compare to the strength of the Calvert Cliffs nozzles, and what impact does the yield strength difference have on the calculated residual stresses?

CCNPP Response:

A tabular listing is provided as Enclosure (1). This enclosure describes the axial and hoop stresses at the nodes of the finite element model used to produce the color figures that were provided in the first set of request for additional information questions. For reference in correlating the node numbers to their position in the model, please use the attached Figure 1, which shows the node-numbering scheme used in the models. In general, nodes increase from 1 to 5 through the nozzle wall from inside diameter (ID) to outside diameter (OD), nodes increase by 100's axially, and increase by 10000's circumferentially. The tabulation provides the axial and hoop stresses at the ID and OD surfaces. The stresses are reported only at nodes, so the stress at the 2-inch elevation is not provided. Instead, the stress at the node closest to the 2-inch elevation is provided.

The model used to calculate the stresses was performed for the 42 ksi yield strength material used to fabricate the control element drive mechanism penetrations in Calvert Cliffs Unit 1. According to the contractor who performed the finite element model analysis, the residual stresses at the nozzle surfaces should scale with the material yield strength, therefore, the tabulated stresses would all be proportionally slightly lower for Calvert Cliffs Unit 2 Control Element Drive Mechanism penetrations, which have yield strengths of 37.5 ksi.

NRC Request 2:

Is the primary impediment to effective examination at elevations higher than 0.75 inches above the J-groove weld due to the counterbore step in the nozzles or the expansion points in the guide sleeves?

CCNPP Response:

The primary impediment to effective examination to the full extent 2 inches above the J-groove weld root is the counterbore step on the ID of the nozzle. The expansion points in the guide sleeves are located above the elevation of the counterbore. At the counterbore, the annular gap between the guide sleeve and the penetration nozzle narrows, from approximately 0.175 to 0.123 inches.

NRC Request 3:

If the guide sleeves are removed, would there be additional geometric constraints on performing the examination required in the Order?

CCNPP Response:

If the guide sleeves were removed, the ID of the nozzle would become accessible for a rotating probe. We believe it would be possible to acquire data for the full 2 inches required, above the root of the J-groove weld, for nozzles that had their guide sleeves removed.

NRC Request 4:

Since the Order allows either ultrasonic testing (UT) examination or a surface examination and you have identified hardship only for the UT examination, what would be the implications of performing a surface examination of the nozzle areas with limited UT coverage to give 100% coverage of all nozzles?

CCNPP Response:

A surface examination of the nozzle ID surface could be accomplished with an eddy current probe if one could be delivered to the location. It is currently not possible to deliver an eddy current probe to the area 2 inches above the J-groove weld. A different inspection contractor could provide the capability to deliver an eddy current probe to the region where access is limited nearly 2 inches above the top of the high side of the J-groove welds. However, the different contractor is not available to perform inspections at Calvert Cliffs during the Spring 2003 outage.

Surface examination could also be accomplished by penetrant testing, however this would require removal of the guide sleeves.

NRC Request 5:

As stated in the response, the inspection contractor's evaluation of 260 cracks in reactor pressure vessel penetrations at other plants showed that all cracks were found located below 0.75 inch above the weld. Are the data evaluated inclusive of all data from all inspections by all vendors? Based on the data evaluated, has any analysis been performed to conclude that all 260 indications would still have been detected even if the scope of examination had been only 0.75 inch above the weld? What does industry experience with outside diameter primary water-stress-corrosion cracking (PWSCC) in vessel head penetration (VHP) nozzles indicate about the likelihood for cracking in the region of the VHP nozzle more than 0.75 inch above the top of the J-groove weld?

CCNPP Response:

The inspection contractor's evaluation of 260 cracks in VHP nozzles at other plants was performed on data available only to the contractor. No analysis was performed on data from plants inspected by other contractors. Therefore, the data evaluated were not inclusive of all data from all inspections by all vendors.

Since all 260 previously identified cracks were located below 0.75 inches above the weld, we conclude, with high confidence, that all 260 indications would have been detected with an examination scope up to 0.75 inches above the weld. However, no analysis has been performed since such an analysis would require re-evaluation of the entire inspection data sets from previously inspected plants. The re-evaluation would need to be performed in a double blind experiment with modifications to the raw data to limit coverage to 0.75 inch above the weld. It is difficult to get operating plants' permission to have third parties independently modify, then re-analyze their inspection data. Calvert Cliffs has no plans to perform this analysis.

Industry experience with outside diameter PWSCC in VHP nozzles is indicated on the attached figure "Vertical Distance from Weld Root to Lower End of Flaw" (Figure 2), which shows the approximate location of circumferential cracks identified in previous inspections by this inspection contractor.

ENCLOSURE (1)

RESPONSE TO NRC REQUEST #1:

Table of Maximum Operating Stress

Residual Plus Operating Stresses for Penetration Nozzle at 11 Degree Angle							
Nozzle ID				Nozzle OD			
Node	Inches above J-groove	Hoop Stress (psi)	Axial Stress (psi)	Node	Inches above J-groove	Hoop Stress (psi)	Axial Stress (psi)
1401	0	44967	13194	1405	0	59923	11842
1501	0.24	40275	25636	1505	0.239	38296	-5770.8
1601	0.6	32582	30660	1605	0.6	12965	-23711
1701	1.074	30205	28429	1705	1.124	-3496.1	-22493
1801	1.438	12543	17213	1805	1.697	-3401.9	-5062
11401	0	44843	13263	11405	0	59720	11531
11501	0.24	39714	25416	11505	0.241	37292	-6774.5
11601	0.596	32451	30322	11605	0.597	13117	-23486
11701	1.065	27644	27850	11705	1.087	-1697.9	-22453
11801	1.408	9914.4	15581	11805	1.685	-3441.5	-5067.8
21401	0	44217	12258	21405	0	59522	11309
21501	0.242	40437	25545	21505	0.241	35252	-8930.8
21601	0.594	36443	31588	21605	0.593	14712	-22724
21701	1.343	20651	20972	21705	0.997	-1531.3	-24011
21801	1.671	2213	9157.1	21805	1.672	-5031.1	-6247.4
31401	0	43998	11126	31405	0	58343	9450.9
31501	0.242	40789	23678	31505	0.242	33152	-10738
31601	0.59	38030	30289	31605	0.59	15521	-22645
31701	1.249	19386	19304	31705	0.868	-3039.5	-25575
31801	1.659	196.17	7302.3	31805	1.659	-5352	-7135.1
41401	0	43810	9143.4	41405	0	57819	7120.2
41501	0.243	40397	19766	41505	0.243	31362	-11171
41601	0.587	38763	28569	41605	0.718	6287.1	-25725
41701	1.14	24222	21922	41705	1.042	3374.5	-14752
51401	0	43904	6452	51405	0	58326	5099.2
51501	0.244	42564	18305	51505	0.243	27978	-17543
51601	0.583	39996	26830	51605	0.567	7212	-27629
51701	1.031	29203	22694	51705	1.033	-1446.2	-17249
51801	1.633	3551.8	6163.6	51805	1.632	-5546.9	-3016.8
61401	0	43980	3867.6	61405	0	59574	3734.7
61501	0.244	44455	17830	61505	0.245	27975	-20562
61601	0.579	41052	25828	61605	0.439	3548.8	-32138
61701	0.937	33450	21973	61705	1.026	-1505.2	-16999
61801	1.621	5137.7	5796.3	61805	1.62	-5180.7	-1538
71401	0	44440	2692.6	71405	0	61287	4021.3
71501	0.246	42857	14965	71505	0.245	25113	-23487
71601	0.577	42456	26424	71605	0.576	6438.1	-27576
71701	0.872	37899	24136	71705	1.018	-1630.4	-14836
71801	1.61	6014.9	6073.7	71805	1.609	-5716	-1567.6
81401	0	44742	2557.9	81405	0	61918	4004
81501	0.247	42700	14623	81505	0.246	25809	-23552
81601	0.574	42880	26499	81605	0.574	5517.9	-27972
81701	0.843	38527	24055	81705	1.012	-2011	-14950
81801	1.6	6078.7	6114.5	81805	1.598	-5644.4	-1410.9

ENCLOSURE (1)

Residual Plus Operating Stresses for Penetration Nozzle at 29 Degree Angle							
Nozzle ID				Nozzle OD			
Node	Inches above J-groove	Hoop Stress (psi)	Axial Stress (psi)	Node	Inches above J-groove	Hoop Stress (psi)	Axial Stress (psi)
1401	0	44112	24613	1405	0	54871	23576
1501	0.254	37098	32056	1505	0.255	35765	13626
1601	0.658	30565	33813	1605	0.661	13959	-14412
1701	1.193	23506	29806	1705	1.198	-6440.7	-22835
1801	1.899	11508	19714	1805	1.907	-10838	-8107.7
11401	0	41852	23866	11405	0	53606	23646
11501	0.253	35736	31229	11505	0.255	36054	14583
11601	0.646	29732	33750	11605	0.649	14144	-11479
11701	1.168	22092	29152	11705	1.173	-3780.5	-19745
11801	1.862	10701	19478	11805	1.87	-9177.7	-7493.2
21401	0	37680	21726	21405	0	49644	21995
21501	0.253	34156	29254	21505	0.254	35976	15441
21601	0.634	28262	32615	21605	0.636	13444	-8115.8
21701	1.144	19330	28370	21705	1.147	1335.7	-15424
31401	0	34175	17626	31405	0	45169	18152
31501	0.252	33358	25733	31505	0.252	34013	13206
31601	0.621	29370	31758	31605	0.623	11420	-8674.7
31701	1.119	19060	26447	31705	1.121	5411.6	-12669
31801	2.218	2119.2	10483	31805	1.916	1350.5	-6171.9
41401	0	33099	11804	41405	0	45281	15215
41501	0.251	34987	22473	41505	0.25	30662	5748.8
41601	0.609	32002	30147	41605	0.609	10322	-11921
41701	1.095	22215	24316	41705	1.095	7242.6	-14377
51401	0	35712	6923	51405	0	48486	11414
51501	0.25	37845	18974	51505	0.249	24365	-9199.8
51601	0.599	35266	26186	51605	0.597	12397	-16451
51701	1.073	23101	19705	51705	1.047	782.01	-20435
51801	1.588	5808.9	7262.8	51805	1.714	736.01	-7238.1
61401	0	39303	1914.6	61405	0	53234	7389.9
61501	0.248	39879	11918	61505	0.248	18441	-20707
61601	0.587	42568	22627	61605	0.678	4197.9	-23134
61701	1.317	26377	14789	61705	1.048	647.4	-13800
61801	1.683	4304.1	-47.106	61805	1.679	-4649.7	-4701.4
71401	0	40773	-1915.8	71405	0	58875	6873.5
71501	0.248	43557	11054	71505	0.247	18066	-30137
71601	0.578	40627	17821	71605	0.422	-2565.1	-34509
71701	1.127	30334	13708	71705	1.028	-5062	-15484
71801	1.653	8033.3	-125.11	71805	1.648	-5584	-1475.5
81401	0	42852	-2356.7	81405	0	60817	6802.8
81501	0.247	45583	10393	81505	0.247	11475	-36398
81601	0.569	42887	20114	81605	0.567	2393.3	-26136
81701	1.041	33074	14892	81705	1.01	-6146.9	-13873
81801	1.626	10705	803.77	81805	1.621	-6662.4	-1105.1

ENCLOSURE (1)

Residual Plus Operating Stresses for Penetration Nozzle at 43 Degree Angle							
Nozzle ID				Nozzle OD			
Node	Inches above J-groove	Hoop Stress (psi)	Axial Stress (psi)	Node	Inches above J-groove	Hoop Stress (psi)	Axial Stress (psi)
1401	0	42080	34501	1405	0	48401	27917
1501	0.26	37191	35969	1505	0.263	29296	23670
1601	0.741	32465	33711	1605	0.747	7889.5	-2198.1
1701	1.379	26591	28324	1705	1.39	-15958	-14903
1801	2.226	14699	16909	1805	2.244	-12285	711.5
11401	0	37759	32760	11405	0	45551	28512
11501	0.257	34256	34810	11505	0.26	31609	26483
11601	0.72	30732	33698	11605	0.726	11225	2992.4
11701	1.338	24795	27851	11705	1.349	-10695	-8832.3
11801	2.166	16574	19191	11805	2.182	-9690.5	1610.2
21401	0	28128	29286	21405	0	37542	26556
21501	0.255	28684	32973	21505	0.256	33326	31246
21601	0.699	26532	32179	21605	0.703	15169	9274
21701	1.297	21807	27244	21705	1.304	-1244.2	-3254.1
21801	2.104	11339	17267	21805	2.115	-3146.2	538.25
31401	0	22807	25060	31405	0	28468	19539
31501	0.251	23881	28682	31505	0.252	30775	30564
31601	0.677	24396	29871	31605	0.68	15446	7691
31701	1.255	18328	24482	31705	1.26	5053.4	-3887.4
31801	2.041	4169.6	12448	31805	2.048	3720.8	-4300.9
41401	0	22347	17993	41405	0	27967	17211
41501	0.248	25141	23224	41505	0.247	27286	22806
41601	0.657	26468	27283	41605	0.656	12627	480.58
41701	1.216	16925	21035	41705	1.216	6100.6	-8632
51401	0	25135	7642.1	51405	0	35807	18352
51501	0.243	32479	18671	51505	0.243	21286	6453.6
51601	0.636	30656	24175	51605	0.635	9222.5	-9785.7
51701	1.178	21653	20552	51705	1.499	6393.6	-12003
51801	2.098	-498.65	2614.6	51805	1.919	4076.3	-7878.5
61401	0	31487	622.91	61405	0	43760	15252
61501	0.241	38664	11971	61505	0.239	9976	-19042
61601	0.619	37729	20776	61605	0.615	11389	-16157
61701	1.143	23934	15570	61705	0.899	-4871.3	-21039
61801	1.66	6378.7	2296.6	61805	1.861	-1905.9	-5965
71401	0	36215	-4261.5	71405	0	54224	17178
71501	0.237	41508	5831.9	71505	0.236	9263.3	-30644
71601	0.603	43041	16371	71605	0.487	-8499.5	-33204
71701	1.353	31936	12950	71705	1.106	-5049.2	-10138
71801	1.823	9032.7	-4133.3	71805	1.813	-5407.6	-1099
81401	0	41891	-1095.8	81405	0	56042	17699
81501	0.235	44223	7573.3	81505	0.234	3041	-38712
81601	0.589	42463	17261	81605	0.585	-5543.4	-24629
81701	1.216	33954	13208	81705	1.079	-12184	-11826
81801	1.782	11450	-3706.8	81805	1.771	-6575.6	-598.85

ENCLOSURE (1)

Residual Plus Operating Stresses for Penetration Nozzle at Zero Degree Angle							
Nozzle ID				Nozzle OD			
Node	Distance above J-groove	Hoop Stress (psi)	Axial Stress (psi)	Node	Distance above J-groove	Hoop Stress (psi)	Axial Stress (psi)
1401	0	47136	9035.8	1405	0	60275	5944.8
1501	0.251	44106	22607	1505	0.25	33457	-15547
1601	0.74	37472	27955	1605	0.604	10395	-23477
1701	1.068	20559	18755	1705	1.068	-2662	-14958
1801	1.674	1289	5355.9	1805	1.673	-3825.2	-278.77
11401	0	47134	9034.8	11405	0	60269	5937.5
11501	0.251	44107	22607	11505	0.25	33460	-15546
11601	0.74	37476	27953	11605	0.604	10403	-23472
11701	1.068	20564	18753	11705	1.068	-2665.7	-14960
11801	1.674	1296.9	5353.1	11805	1.673	-3827.9	-282.63
21401	0	47135	9034.9	21405	0	60269	5936.7
21501	0.251	44107	22605	21505	0.25	33461	-15543
21601	0.74	37476	27952	21605	0.604	10396	-23469
21701	1.068	20567	18752	21705	1.068	-2667.9	-14956
21801	1.674	1301.8	5352.1	21805	1.673	-3822.8	-278.56
31401	0	47135	9035.3	31405	0	60269	5936.6
31501	0.251	44106	22604	31505	0.25	33459	-15545
31601	0.74	37474	27952	31605	0.604	10396	-23473
31701	1.068	20565	18754	31705	1.068	-2667.5	-14961
31801	1.674	1298.6	5355	31805	1.673	-3825	-282.02
41401	0	47134	9035.5	41405	0	60269	5936.7
41501	0.251	44106	22605	41505	0.25	33459	-15546
41601	0.74	37473	27952	41605	0.604	10398	-23472
41701	1.068	20564	18754	41705	1.068	-2665.7	-14961
41801	1.674	1297.3	5355.6	41805	1.673	-3824.8	-282.82
51401	0	47135	9035.3	51405	0	60269	5936.6
51501	0.251	44106	22604	51505	0.25	33459	-15545
51601	0.74	37474	27952	51605	0.604	10396	-23473
51701	1.068	20565	18754	51705	1.068	-2667.5	-14961
51801	1.674	1298.6	5355	51805	1.673	-3825	-282.02
61401	0	47135	9034.9	61405	0	60269	5936.7
61501	0.251	44107	22605	61505	0.25	33461	-15543
61601	0.74	37476	27952	61605	0.604	10396	-23469
61701	1.068	20567	18752	61705	1.068	-2667.9	-14956
61801	1.674	1301.8	5352.1	61805	1.673	-3822.8	-278.56
71401	0	47134	9034.8	71405	0	60269	5937.5
71501	0.251	44107	22607	71505	0.25	33460	-15546
71601	0.74	37476	27953	71605	0.604	10403	-23472
71701	1.068	20564	18753	71705	1.068	-2665.7	-14960
71801	1.674	1296.9	5353.1	71805	1.673	-3827.9	-282.63
81401	0	47136	9035.8	81405	0	60275	5944.8
81501	0.251	44106	22607	81505	0.25	33457	-15547
81601	0.74	37472	27955	81605	0.604	10395	-23477
81701	1.068	20559	18755	81705	1.068	-2662	-14958
81801	1.674	1289	5355.9	81805	1.673	-3825.2	-278.77

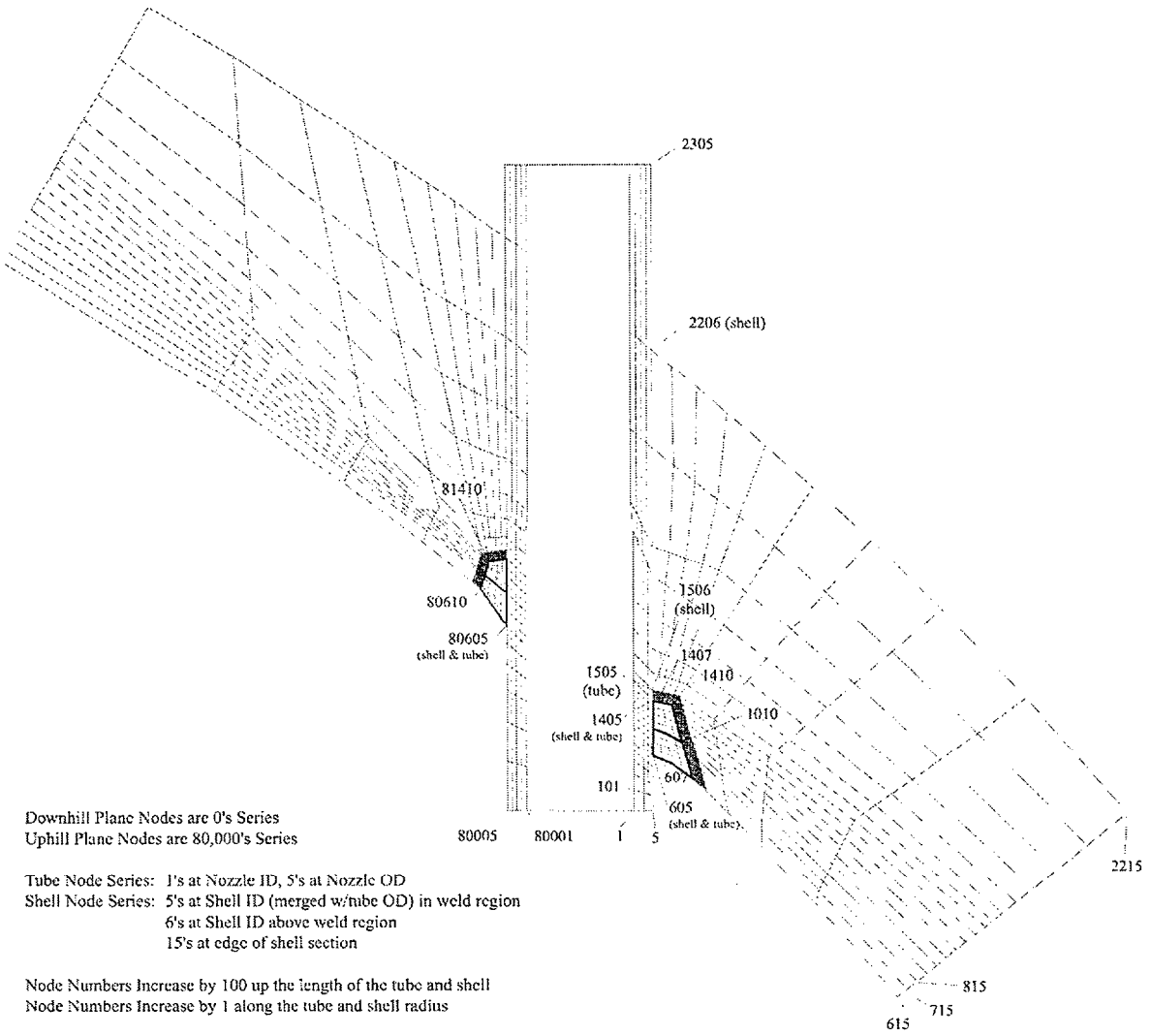


FIGURE 1
CEDM Nozzle Node Numbering Scheme

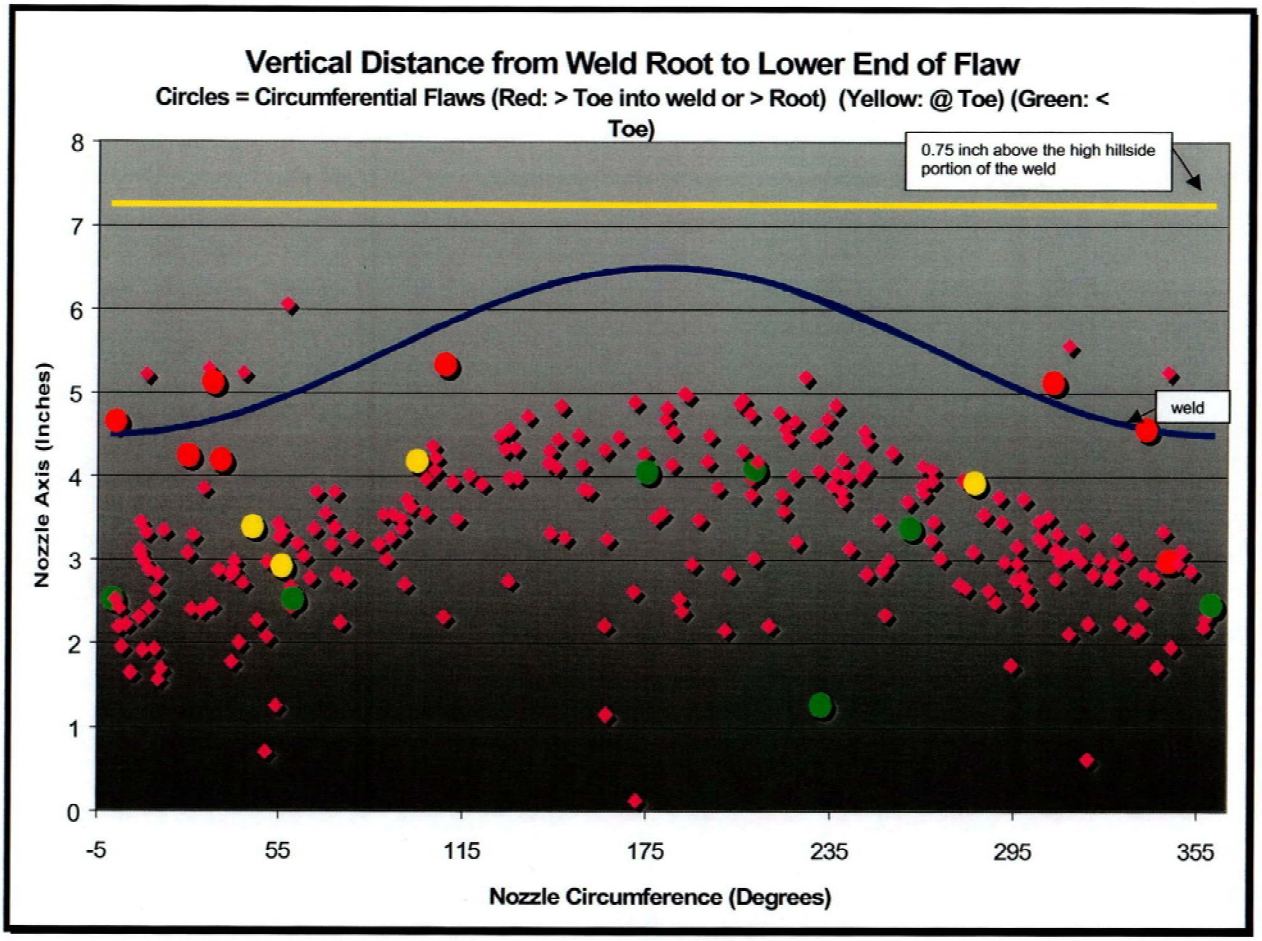

Vertical Distance from Weld Root to Lower End of Flaw
Circles = Circumferential Flaws (Red: > Toe into weld or > Root) (Yellow: @ Toe) (Green: < Toe)
0.75 inch above the high hillside portion of the weld
weld
Nozzle Axis (Inches)
0
1
2
3
4
5
6
7
8
-5
55
115
175
235
295
355
Nozzle Circumference (Degrees)

FIGURE 2

C01