Structural Integrity Associates, Inc.

CALCULATION PACKAGE

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Perry Plant Flaw Evaluation

CONTRACT NO.:
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CLIENT:	**PLANT:**
FirstEnergy Nuclear Operating Co.	**Perry Nuclear Power Plant**

CALCULATION TITLE:
Flaw Evaluation for N6A and C Nozzle to Safe End Welds

Document Revision	Affected Pages	Revision Description	Project Manager Approval Signature & Date	Preparer(s) & Checker(s) Signatures & Date
0	1 - 9 A-1 - A-3 B-1 – B-8	Initial Issue	H. L. Gustin HLG 4/25/09	T. J. Herrmann TJH 4/25/09 H. L. Gustin HLG 4/25/09

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1.0 INTRODUCTION/STATEMENT OF PROBLEM/ OBJECTIVE

The N6 A, and C nozzle to safe end welds at Perry are dissimilar metal welds connecting the low alloy steel nozzle forgings to the Alloy 600 safe ends. The welds are Alloy 82/182 weld metal [1, 2]. These welds were previously ultrasonically inspected in 2001, and all results were acceptable per IWB-3500 criteria, requiring no further evaluation. The welds were re-examined during the current refueling outage (RO12). This re-examination identified two flaw indications (on each in the N6-A weld and in the N6-C weld) in the Alloy 182 material which were determined to slightly exceed the flaw acceptance standards of IWB-3514-2 [3, 4]. Both of these flaw indications were determined to be subsurface indications with no connection to the inside surface of the welds. They were classified as fabrication-related defects which had not grown in the intervening period, but were re-sized due to enhancements in data acquisition and evaluation.

The purpose of this calculation is to evaluate the identified flaw indications per the requirements of IWB-3600, to demonstrate that these indications do not affect the structural adequacy of the nozzle to safe end welds.

2.0 TECHNICAL APPROACH OR METHODOLOGY

A fracture mechanics-based evaluation of the flaws is performed per the requirements of IWB-3600 considering weld residual stresses present in the welds following the application of a mechanical stress improvement process (MSIP). The observed flaws are assumed to be growing due to a fatigue crack growth mechanism. The resulting flaws after projected growth during the next 10 year inspection period are evaluated to demonstrate that all structural criteria are maintained.

3.0 ASSUMPTIONS / DESIGN INPUTS

1. A composite flaw was assumed, combining the greatest through-wall dimension and greatest eccentricity of the two reported flaws and assuming a full 360 degree circumferential crack length. This hypothetical flaw conservatively bounds the evaluation of all of the reported flaws.

2. In a previous calculation performed by SI [1], finite element analysis of the nozzle-safe end welds was performed to determine the weld residual stresses present in the welds following the application of a mechanical stress improvement process (MSIP) in 1992. The bounding residual stress distribution is shown in Figure 1, taken from [1]. Note that in that distribution, which is shown from the inside surface towards the outside (from left to right), the residual stress following MSIP varies from compressive to tensile (perpendicular to the plane of the crack) through the thickness of the weld. In the present calculation, the weld residual stress is conservatively taken to be the maximum tensile from that distribution, and is considered to be a constant membrane stress across the weld

thickness. Weld residual stress is a steady state secondary stress which is not limited by the ASME Code. In a fatigue crack growth calculation such as that which follows, residual stress acts only as a mean stress. Weld residual stresses have no effect on cumulative usage calculations. Therefore, no update to the calculated cumulative usage factor (CUF) is needed to demonstrate ASME Section III code compliance.

3. The N6 nozzles are assumed to experience stress cycles due to plant start-ups and shut downs, and due to system operation in the RHR mode. RHR cycles are assumed to occur twice as frequently as start-up/shut down cycles, and to have the same magnitude. Over the ten year period from the current refueling outage until the next scheduled inspection in 2019, the estimated number of such combined cycles is assumed to be less than 100 (49 cycles reported from 2001 through April 2008 [5]). For additional conservatism in the event that the number of cycles increases significantly from that assumed, calculations are carried out to 200 cycles.

4. Crack growth is calculated from the current refueling outage until the next time the N6 nozzles with reported flaw indications are scheduled to be re-examined (10 year inspection interval).

5. In the following, all applied stresses are modeled as membrane stresses (i.e., constant magnitude across the wall thickness). This is very conservative since the stress combination PL+PB+Q includes significant bending stresses in the PB and Q terms, and treating bending stresses as membrane is conservative.

6. Since all reported flaws are subsurface with no connection to the weld inside surface or to the coolant chemistry, the intergranular stress corrosion crack (IGSCC) growth mechanism is not active. This mechanism requires reactor water chemistry to be present in the crack.

7. The fatigue crack growth law for Austenitic Material in Air was taken from ASME Section XI, Appendix C [3]. Since the flaws are subsurface and not wetted, the air law is appropriate.

8. The value of Sm used in the calculations is for the Alloy 182 material.

4.0 FLAW CHARACTERIZATION

A total of 8 flaws were identified in the Reference [4] inspection reports.

N6A – Flaw Indication 1:
Length: 1.5", Through wall dimension: 0.35", Separation from outside surface: 0.3"

N6A – Flaw Indication 2:
Length: 1.2", Through wall dimension: 0.2", Separation from outside surface: 0.3"

N6A – Flaw Indication 3:
Length: 2.0", Through wall dimension: 0.15", Separation from outside surface: 0.4"

N6A – Flaw Indication 4:
Length: 0.85", Through wall dimension: 0.15", Separation from outside surface: 0.35"

N6C – Flaw Indication 1:
Length: 1.9", Through wall dimension: 0.1", Separation from outside surface: 0.5"

N6C – Flaw Indication 2:
Length: 3.7", Through wall dimension: 0.25", Separation from outside surface: 0.3"

N6C – Flaw Indication 3:
Length: 16.6", Through wall dimension: 0.3", Separation from outside surface: 0.35"

N6C – Flaw Indication 4:
Length: 1.9", Through wall dimension: 0.2", Separation from outside surface: 0.35"

From the review of all of the above indications, there are two subsurface flaws requiring further evaluation [4], which will be identified furthermore as Flaw 1 and Flaw 2. One of these is located in the N6A weld, and one is located in the N6C weld. These flaws are characterized as follows:

Flaw 1 (N6A):
Length: 1.5", Through wall dimension: 0.35", Separation from outside surface: 0.3"

Flaw 2 (N6C):
Length: 16.6", Through wall dimension: 0.3", Separation from outside surface: 0.35"

From the 8 identified indications, a single worst case flaw was determined that bounds all of the flaw indications for future inspections. This was done in consideration of future UT technology improvements which could result in identifying additional connected flaws (such as occurred from the 2001 data to current dimensions).

The inspection summary sheets for these flaws [4] are attached as Appendix A.

5.0 CALCULATIONS

The SI fracture mechanics program pc-CRACK [6] was used to perform the crack growth calculations. The bounding flaw from the flaw characterizations above (see assumption 1) was taken as: Length: 16.6", through wall dimension: 0.35", Separation from outside surface: 0.3".

This flaw was used as the starting point for the fatigue crack growth calculation. The center-cracked plate model was used to represent the flaw geometry for the crack growth calculation. This is illustrated in Figure 2. This model treats the modeled flaw as infinitely long in the depth direction (into the page in Figure 2). This model effectively represents the assumed full circumferential flaw.

Reference [2 page 2] gives the maximum stresses experienced at the weld as PL+PB+Q=55.03 ksi for the Inconel material. This is conservatively used to bound the stress magnitude associated with the startup-shutdown and RHR cycles.

For the purposes of the fatigue crack growth calculation, the K_{max} is taken as {PL+PB+Q+RESIDUAL} and the K_{min} is taken as RESIDUAL. The value of residual stress chosen is consistent with assumption 5; all stresses are conservatively treated as membrane stresses. Referring to Figure 1, the applicable residual stress used was for the post MSIP normal operating cases(MSIP OFF, NOP2), where the assumed valued in this analysis is tensile, and axially oriented, i. e., normal to the crack face.

The pc-CRACK crack growth results are shown in Figure 3, and the output is included in Appendix B. For the anticipated number of bounding cycles expected to occur from 2009 to 2019, only a minimal amount of growth is predicted to occur, even under the very conservative set of assumptions contained herein. The resulting throughwall dimension of the bounding flaw after 100 cycles is 0.366", corresponding to less than 0.02" growth. This meets the acceptance criteria of IWB-3641 [3].

6.0 STRUCTURAL EVALUATION

The presence of flaws will reduce the amount of wall thickness in the weld that is available to carry load. The existing flaw in nozzle N6A has an area of: [Flaw 1]: Length (1.5) x Throughwall dimension (0.35) = 0.53 in^2. The existing flaw in nozzle N6C has an area of [Flaw 2]: Length (16.6) x Throughwall dimension (0.3) = 4.98 in^2.

The cross sectional area of the weld without flaws is $A=\pi(OR^2-IR^2)=\pi(49.87-33.78)=50.55$ in^2 [7]. So the reported flaws in N6A represent approximately 1% of the total area of the weld. The flaw in N6C represents 9.9% of the total area. Removing that amount of material in either weld would increase the stress in the remaining material by the same %. All ASME Allowable stress limits as reported in [2] continue to be met after projected flaw growth up to an increase of more than 25%. Even if the conservatively evaluated full circumferential flaw of $0.366 \times 2\pi(5.8125 + 0.55) = 14.63$ in^2 were used, this would be 29 % of the area section, with a projected growth of less than 0.02", significant margin is provided to primary stress limits.

The primary membrane stress intensities at the Alloy 82/182 safe end to nozzle weld are reported in [8], sheet 13 of 18 to be 11158 psi for normal and upset conditions. The same page notes that any bending stress intensities are very small. The allowable stress intensity for the Inconel material is reported on the same page as 23300 psi. The primary stress intensity ratio (Pm+Pb)/Sm is then equal to 0.48. The largest observed flaw has a length of approximately 16 inches, and the circumference of the component at the flaw location is approximately 44 inches, so the ratio of flaw length to circumference is 0.36, which will be rounded to 0.4. Referring to ASME Section XI, 1989 Edition, Table IWB-3641-5, it may be seen that for a stress ratio of 0.48 (i.e., less than 0.6) and a flaw length/circumference of 0.4, the allowable end of interval flaw depth (2a for a subsurface flaw) is 0.6 a/t. This value is much greater than that of the limiting flaw of 0.366/1.2=0.305. Therefore, the limiting flaw is acceptable by the methods of IWB-3641.

The evaluation methods contained in Sections 5.0 and 6.0 are consistent with the methods and requirements of ASME Section XI, IWB-3600 and Appendix C.

7.0 CONCLUSIONS AND DISCUSSIONS

The presence of the two reported subsurface fabrication defects and their projected growth due to fatigue does not reduce the capacity of the welds in N6A and C below Code [3] allowable. The limiting flaw shows no significant growth in the through wall direction, as compared to the 2001 results as re-evaluated last October [5]. This supports the conclusion that the observed indications are in fact fabrication defects. The evaluation is projected out for more than 10 years, allowing the station to maintain the current 10 year inspection interval. All Code margins are maintained.

8.0 REFERENCES

1. SI Calculation 0800439.306R0, Residual Heat Removal/Low Pressure Core Injection (RHR/LPCI) Nozzle, N6, ID Repair Weld Residual + MSIP Analysis.
2. CB&I Stress Report "238" BWR Vessel" Section S-13 sheet 2. SI File Number 0800439.216
3. ASME Section XI, 1989 Edition and 2001 Edition with Addenda through 2003
4. GE Flaw Inspection Reports APR-09-209-7 (weld 1B13-N6A-KB) and ARP-09-209-9 (weld 1B13-N6C-KB). SI File 0900354.208
5. SI Calculation 0800439.307R1, Evaluation of fabrication defects in N6A and C Nozzle to Safe End Welds.
6. SI Program "**pc-CRACK for Windows**", version 3.1-98348
7. CB&I Drawing N6 Nozzle Forging (RHR-LPCI MODE)," CBI VPF No. 3521-257, Rev. 1, June 1973 SI File 0800439.208
8. CB&I Stress Report "238" BWR Vessel" Section D-13 sheet 13.

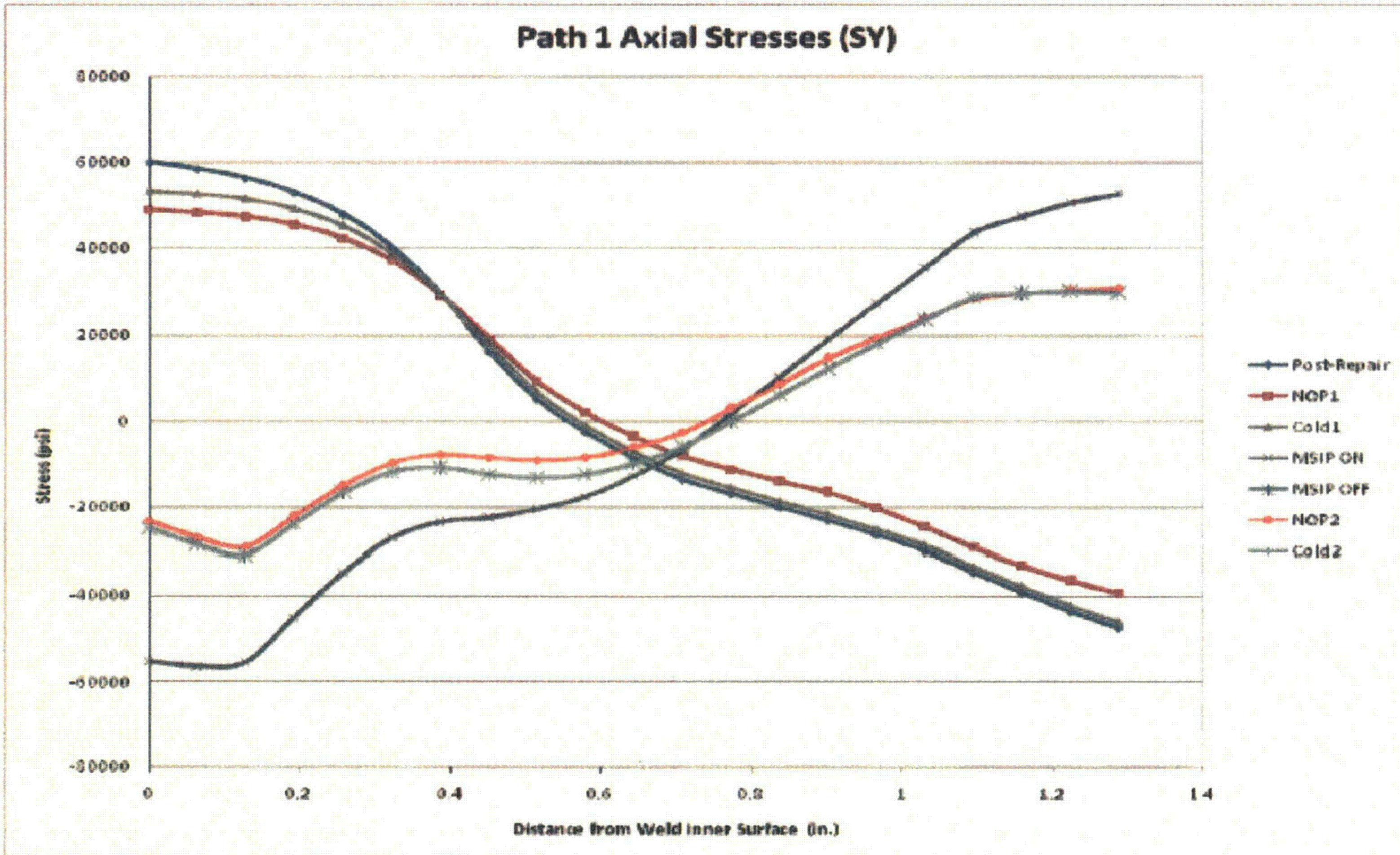
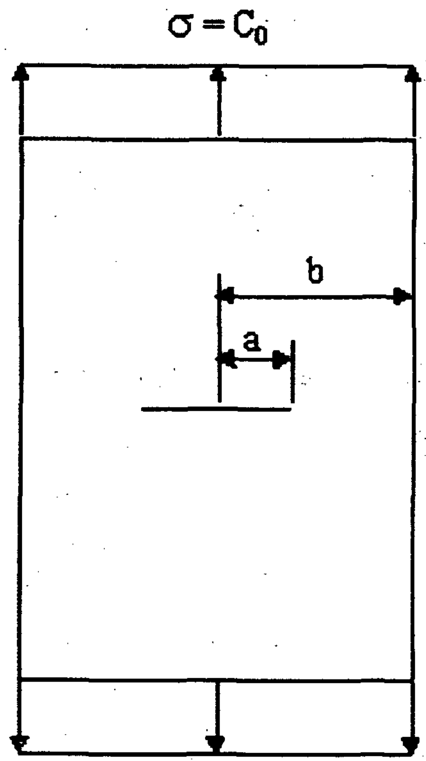


Figure 1. Path 1 Through-Wall Axial Stress (psi)



REQUIRED INPUTS:
b: plate half width
a: maximum crack depth ($a_{max} \leq 0.9b$)

Figure 2. Center-Cracked Plate Fracture Mechanics Model

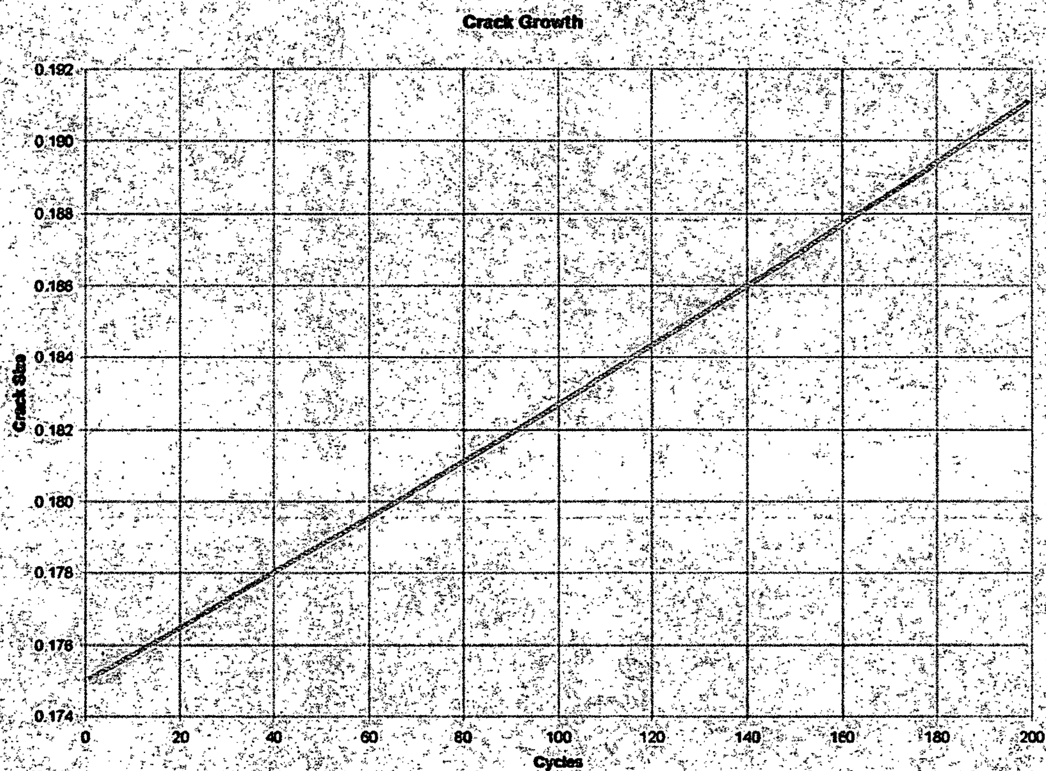


Figure 3. Crack Growth Through 200 Cycles

APPENDIX A

INSPECTION SUMMARY SHEETS FROM [4]

HITACHI

Austenitic Piping Flaw Evaluation Sheet

Project: Perry Unit 1
Weld ID: 1B13-N6A-KB
Indication: 1
Exam Data Sheet: APR-09-209-07
Sizing Data Sheet: N/A

	Measured	Rounded
Flaw Through Wall =	0.346	0.35
Flaw Length "l" =	1.53	1.5
Surface Separation "S" =	0.333	0.3

	Measured	Rounded
"T" nominal =	1.12	1.1
"T" measured =	1.20	1.2

ASME Section XI, 2001 Edition, 2003 Addenda
TABLE IWB-3514-2 Austenitic Steels, 1.10 Inch Nominal Thickness - Inservice

a/l	Surface %	Subsurface %	Surface %	Subsurface %
0.00	10.48	10.48	-	-
0.05	10.60	10.60	-	-
0.10	10.88	10.88	10.91	10.91 Y
0.15	10.98	10.98	-	-
0.20	11.26	11.26	-	-
0.25	11.38	11.38	-	-
0.30	11.58	11.58	-	-
0.35	11.76	11.76	-	-
0.40	11.96	11.96	-	-
0.45	12.08	12.08	-	-
0.50	12.34	12.34	-	-
			Allowed	Allowed
			10.91	10.91

a = 0.175
a/l value = 0.117
Y = 1.000

Flaw is Subsurface

Allowed a/t = 10.9%
a/t = 14.6%

Flaw is unacceptable by Table IWB-3514-2.

Revised: 1/27/08

Comments: ASME Section XI rounding performed in accordance with IWA-3200 and ASTM E29.
Indication is circumferential in orientation.

Subsurface Planar flaw per IWA-3320, IWA-3320-1

Evaluated By: Andre' Rochal [signature] Reviewed By: Earnest Catron [signature]

Level: II Date: 3/29/2009 Level: III Date: 3/29/2009

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[signature] FENOC 3/30/09
T. Lopez ANII 3/30/09

HITACHI

Austenitic Piping Flaw Evaluation Sheet

Project: Perry Unit 1
Weld ID: 1B13-N6C-KB
Indication: 3

Exam Data Sheet: APR-09-209-09
Sizing Data Sheet: N/A

	Measured	Rounded
Flaw Through Wall =	0.31	0.3
Flaw Length "l" =	16.55	16.6
Surface Separation "S" =	0.34	0.35

	Measured	Rounded
"T" nominal =	1.12	1.1
"T" measured =	1.20	1.2

ASME Section XI, 2001 Edition, 2003 Addenda
TABLE IWB-3514-2 Austenitic Steels, 1.10 Inch Nominal Thickness - Inservice

a/l	Surface %	Subsurface %	Surface %	Subsurface %
0.00	10.48	10.48	10.50	10.50 Y
0.05	10.60	10.60	-	-
0.10	10.88	10.88	-	-
0.15	10.98	10.98	-	-
0.20	11.26	11.26	-	-
0.25	11.38	11.38	-	-
0.30	11.58	11.58	-	-
0.35	11.76	11.76	-	-
0.40	11.96	11.96	-	-
0.45	12.08	12.08	-	-
0.50	12.34	12.34	-	-
			Allowed 10.50	Allowed 10.50

a = 0.150
a/l value = 0.009
Y = 1.000

Flaw is Subsurface

Allowed a/t = 10.5%
a/t = 12.5%

Flaw is unacceptable by Table IWB-3514-2.

Revised: 1/27/06

Comments: ASME Section XI rounding performed in accordance with IWA-3200 and ASTM E29.
Indication is circumferential in orientation.

Subsurface Planar flaw per IWA-3320, IWA-3320-1

Evaluated By: Andre' Rachal [signature] Reviewed By: Earnest Catron [signature]

Level: II Date: 3/28/2009 Level: III Date: 3/28/2009

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[signature] FENOC 3/29/09
T. [signature] ANII 3/29/09

APPENDIX B

PC-CRACK OUTPUT

Linear Elastic Fracture Mechanics

Date: Mon Apr 06 17:22:13 2009
Input Data and Results File: FY_PLFBQ.LFM

Title: 0900354: Perry N6A and N6C Flaw Evaluation

Load Cases:

Case ID	Stress Coefficients C0	C1	C2	C3	Type
Unit Membrane	10	0	0	0	Coeff
Residual Const	20	0	0	0	Coeff

------Through Wall Stresses for Load Cases With Stress Coeff-------

Wall Depth	Case Unit Membr	Case Residual C
0.0000	10	20
0.0300	10	20
0.0600	10	20
0.0900	10	20
0.1200	10	20
0.1500	10	20
0.1800	10	20
0.2100	10	20
0.2400	10	20
0.2700	10	20
0.3000	10	20

Crack Model: Center Cracked Plate Under Remote Tension Stress

Crack Parameters:
Plate Half Width: 0.6000
Crack depth: 0.3000
Co = Remote Tension Stress
All other stress coefficients are neglected.

--------------------Stress Intensity Factor--------------------

Crack Size	Case Unit Membr	Case Residual C
0.0060	1.37302	2.74604

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0.0120	1.94209	3.88417
0.0180	2.37926	4.75853
0.0240	2.74848	5.49695
0.0300	3.07453	6.14906
0.0360	3.37018	6.74036
0.0420	3.64303	7.28605
0.0480	3.89804	7.79608
0.0540	4.13869	8.27738
0.0600	4.36752	8.73503
0.0660	4.58645	9.17291
0.0720	4.79701	9.59403
0.0780	5.00041	10.0008
0.0840	5.19763	10.3953
0.0900	5.38951	10.779
0.0960	5.57675	11.1535
0.1020	5.75995	11.5199
0.1080	5.93964	11.8793
0.1140	6.11628	12.2326
0.1200	6.29028	12.5806
0.1260	6.462	12.924
0.1320	6.63178	13.2636
0.1380	6.79992	13.5998
0.1440	6.96671	13.9334
0.1500	7.1324	14.2648
0.1560	7.29724	14.5945
0.1620	7.46146	14.9229
0.1680	7.62527	15.2505
0.1740	7.78889	15.5778
0.1800	7.95251	15.905
0.1860	8.11632	16.2326
0.1920	8.28053	16.5611
0.1980	8.44531	16.8906
0.2040	8.61084	17.2217
0.2100	8.77732	17.5546
0.2160	8.9449	17.8898
0.2220	9.11379	18.2276
0.2280	9.28416	18.5683
0.2340	9.4562	18.9124
0.2400	9.63009	19.2602
0.2460	9.80602	19.612
0.2520	9.9842	19.9684
0.2580	10.1648	20.3296
0.2640	10.3481	20.6962
0.2700	10.5342	21.0684
0.2760	10.7235	21.4469
0.2820	10.916	21.832
0.2880	11.1121	22.2242
0.2940	11.3121	22.6241
0.3000	11.5161	23.0322

Crack Growth Laws:

Law ID: Sect XI Aus Air
Model: ASME Section XI - austenitic stainless steel in air environment

```
      da/dN = C * 10^F * S * dK^3.3
where
   S = 1.0                  for R < 0
     = 1.0 + 1.8 * R        for 0 < R < 0.79
     = -43.5 + 57.97 * R    for 0.79 < R < 1
   F = code specified function of temperature
```

dK = Kmax - Kmin
R = Kmin / Kmax
where:
C * 10^F = 1.8403e-010
is for the currently selected units of:
force: kip
length: inch
temperature: 550.0000 Fahrenheit

Material Fracture Toughness KIc:

Material ID: Alloy 182

Depth	KIc
0.0000	200.0000
0.5000	200.0000
1.0000	200.0000
1.5000	200.0000

Initial crack size= 0.1750
Max. crack size= 0.3000

Number of blocks= 1
Print increment of block= 1

Subblock	Cycles /Time	Calc. incre.	Print incre.	Crk. Grw. Law	Mat. KIc
Perryl	200	1	1	Sect XI Aus Air	Alloy 182

Subblock	Kmax Case ID	Kmax Scale Factor	Kmin Case ID	Kmin Scale Factor
Perryl	Residual Const	1.5000	Residual Const	1.5000
	Unit Membrane	5.5000		

Crack growth results:

Total Cycles /Time	Subblock Cycles /Time	Kmax	Kmin	DeltaK	R	DaDn /DaDt	Da	a	a/thk
Block: 1									
1	1	6.64e+001	2.34e+001	4.30e+001	0.35	7.39e-005	7.39e-005	0.1751	0.29
2	2	6.65e+001	2.35e+001	4.30e+001	0.35	7.39e-005	7.39e-005	0.1751	0.29
3	3	6.65e+001	2.35e+001	4.30e+001	0.35	7.40e-005	7.40e-005	0.1752	0.29
4	4	6.65e+001	2.35e+001	4.30e+001	0.35	7.41e-005	7.41e-005	0.1753	0.29
5	5	6.65e+001	2.25e+001	4.30e+001	0.35	7.41e-005	7.41e-005	0.1754	0.29
6	6	6.65e+001	2.35e+001	4.30e+001	0.35	7.42e-005	7.42e-005	0.1754	0.29
7	7	6.65e+001	2.35e+001	4.31e+001	0.35	7.42e-005	7.42e-005	0.1755	0.29
8	8	6.66e+001	2.35e+001	4.31e+001	0.35	7.43e-005	7.43e-005	0.1756	0.29
9	9	6.66e+001	2.35e+001	4.31e+001	0.35	7.44e-005	7.44e-005	0.1757	0.29
10	10	6.66e+001	2.35e+001	4.21e+001	0.35	7.45e-005	7.45e-005	0.1757	0.29
11	11	6.66e+001	2.35e+001	4.31e+001	0.35	7.45e-005	7.45e-005	0.1758	0.29

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12	12	6.66e+001	2.35e+001	4.31e+001	0.35	7.46e-005	7.46e-005	0.1759	0.29
13	13	6.66e+001	2.35e+001	4.31e+001	0.35	7.46e-005	7.46e-005	0.176	0.29
14	14	6.67e+001	2.35e+001	4.31e+001	0.35	7.47e-005	7.47e-005	0.176	0.29
15	15	6.67e+001	2.35e+001	4.31e+001	0.35	7.48e-005	7.48e-005	0.1761	0.29
16	16	6.67e+001	2.35e+001	4.32e+001	0.35	7.48e-005	7.48e-005	0.1762	0.29
17	17	6.67e+001	2.35e+001	4.32e+001	0.35	7.49e-005	7.49e-005	0.1763	0.29
18	18	6.67e+001	2.36e+001	4.32e+001	0.35	7.50e-005	7.50e-005	0.1763	0.29
19	19	6.67e+001	2.36e+001	4.32e+001	0.35	7.50e-005	7.50e-005	0.1764	0.29
20	20	6.68e+001	2.36e+001	4.32e+001	0.35	7.51e-005	7.51e-005	0.1765	0.29
21	21	6.68e+001	2.36e+001	4.32e+001	0.35	7.52e-005	7.52e-005	0.1766	0.29
22	22	6.68e+001	2.36e+001	4.32e+001	0.35	7.52e-005	7.52e-005	0.1766	0.29
23	23	6.68e+001	2.36e+001	4.32e+001	0.35	7.53e-005	7.53e-005	0.1767	0.29
24	24	6.68e+001	2.36e+001	4.32e+001	0.35	7.54e-005	7.54e-005	0.1768	0.29
25	25	6.69e+001	2.36e+001	4.33e+001	0.35	7.54e-005	7.54e-005	0.1769	0.29
26	26	6.69e+001	2.36e+001	4.33e+001	0.35	7.55e-005	7.55e-005	0.1769	0.29
27	27	6.69e+001	2.36e+001	4.33e+001	0.35	7.56e-005	7.56e-005	0.177	0.30
28	28	6.69e+001	2.36e+001	4.33e+001	0.35	7.56e-005	7.56e-005	0.1771	0.30
29	29	6.69e+001	2.36e+001	4.33e+001	0.35	7.57e-005	7.57e-005	0.1772	0.30
30	30	6.69e+001	2.36e+001	4.33e+001	0.35	7.57e-005	7.57e-005	0.1772	0.30
31	31	6.70e+001	2.36e+001	4.33e+001	0.35	7.58e-005	7.58e-005	0.1773	0.30
32	32	6.70e+001	2.36e+001	4.33e+001	0.35	7.59e-005	7.59e-005	0.1774	0.30
33	33	6.70e+001	2.36e+001	4.33e+001	0.35	7.59e-005	7.59e-005	0.1775	0.30
34	34	6.70e+001	2.37e+001	4.34e+001	0.35	7.60e-005	7.60e-005	0.1775	0.30
35	35	6.70e+001	2.37e+001	4.34e+001	0.35	7.61e-005	7.61e-005	0.1776	0.30
36	36	6.70e+001	2.37e+001	4.34e+001	0.35	7.61e-005	7.61e-005	0.1777	0.30
37	37	6.71e+001	2.37e+001	4.34e+001	0.35	7.62e-005	7.62e-005	0.1778	0.30
38	38	6.71e+001	2.37e+001	4.34e+001	0.35	7.63e-005	7.63e-005	0.1779	0.30
39	39	6.71e+001	2.37e+001	4.34e+001	0.35	7.63e-005	7.63e-005	0.1779	0.30
40	40	6.71e+001	2.37e+001	4.34e+001	0.35	7.64e-005	7.64e-005	0.178	0.30
41	41	6.71e+001	2.37e+001	4.34e+001	0.35	7.65e-005	7.65e-005	0.1781	0.30
42	42	6.72e+001	2.37e+001	4.35e+001	0.35	7.65e-005	7.65e-005	0.1782	0.30
43	43	6.72e+001	2.37e+001	4.35e+001	0.35	7.66e-005	7.66e-005	0.1782	0.30
44	44	6.72e+001	2.37e+001	4.35e+001	0.35	7.67e-005	7.67e-005	0.1783	0.30
45	45	6.72e+001	2.37e+001	4.35e+001	0.35	7.67e-005	7.67e-005	0.1784	0.30
46	46	6.72e+001	2.37e+001	4.35e+001	0.35	7.68e-005	7.68e-005	0.1785	0.30
47	47	6.72e+001	2.37e+001	4.35e+001	0.35	7.69e-005	7.69e-005	0.1785	0.30
48	48	6.73e+001	2.37e+001	4.35e+001	0.35	7.69e-005	7.69e-005	0.1786	0.30
49	49	6.73e+001	2.37e+001	4.35e+001	0.35	7.70e-005	7.70e-005	0.1787	0.30
50	50	6.73e+001	2.38e+001	4.35e+001	0.35	7.71e-005	7.71e-005	0.1788	0.30
51	51	6.73e+001	2.38e+001	4.36e+001	0.35	7.71e-005	7.71e-005	0.1789	0.30
52	52	6.73e+001	2.38e+001	4.36e+001	0.35	7.72e-005	7.72e-005	0.1789	0.30
53	53	6.73e+001	2.38e+001	4.36e+001	0.35	7.73e-005	7.73e-005	0.179	0.30
54	54	6.74e+001	2.38e+001	4.36e+001	0.35	7.73e-005	7.73e-005	0.1791	0.30
55	55	6.74e+001	2.38e+001	4.36e+001	0.35	7.74e-005	7.74e-005	0.1792	0.30
56	56	6.74e+001	2.38e+001	4.36e+001	0.35	7.75e-005	7.75e-005	0.1792	0.30
57	57	6.74e+001	2.38e+001	4.36e+001	0.35	7.76e-005	7.76e-005	0.1793	0.30
58	58	6.74e+001	2.38e+001	4.36e+001	0.35	7.76e-005	7.76e-005	0.1794	0.30
59	59	6.75e+001	2.38e+001	4.36e+001	0.35	7.77e-005	7.77e-005	0.1795	0.30
60	60	6.75e+001	2.38e+001	4.37e+001	0.35	7.78e-005	7.78e-005	0.1795	0.30
61	61	6.75e+001	2.38e+001	4.37e+001	0.35	7.78e-005	7.78e-005	0.1796	0.30
62	62	6.75e+001	2.38e+001	4.37e+001	0.35	7.79e-005	7.79e-005	0.1797	0.30
63	63	6.75e+001	2.38e+001	4.37e+001	0.35	7.80e-005	7.80e-005	0.1798	0.30
64	64	6.75e+001	2.38e+001	4.37e+001	0.35	7.80e-005	7.80e-005	0.1799	0.30
65	65	6.76e+001	2.38e+001	4.37e+001	0.35	7.81e-005	7.81e-005	0.1799	0.30
66	66	6.76e+001	2.39e+001	4.37e+001	0.35	7.82e-005	7.82e-005	0.18	0.30
67	67	6.76e+001	2.39e+001	4.37e+001	0.35	7.82e-005	7.82e-005	0.1801	0.30
68	68	6.76e+001	2.39e+001	4.38e+001	0.35	7.83e-005	7.83e-005	0.1802	0.30
69	69	6.76e+001	2.39e+001	4.38e+001	0.35	7.84e-005	7.84e-005	0.1803	0.30
70	70	6.77e+001	2.39e+001	4.38e+001	0.35	7.84e-005	7.84e-005	0.1803	0.30
71	71	6.77e+001	2.39e+001	4.38e+001	0.35	7.85e-005	7.85e-005	0.1804	0.30
72	72	6.77e+001	2.39e+001	4.38e+001	0.35	7.86e-005	7.86e-005	0.1805	0.30
73	73	6.77e+001	2.39e+001	4.38e+001	0.35	7.87e-005	7.87e-005	0.1806	0.30

74	74	6.77e+001	2.39e+001	4.38e+001	0.35	7.87e-005	7.87e-005	0.1806	0.30
75	75	6.77e+001	2.39e+001	4.38e+001	0.35	7.88e-005	7.88e-005	0.1807	0.30
76	76	6.78e+001	2.39e+001	4.38e+001	0.35	7.89e-005	7.89e-005	0.1808	0.30
77	77	6.78e+001	2.39e+001	4.39e+001	0.35	7.89e-005	7.89e-005	0.1809	0.30
78	78	6.78e+001	2.39e+001	4.39e+001	0.35	7.90e-005	7.90e-005	0.181	0.30
79	79	6.78e+001	2.39e+001	4.39e+001	0.35	7.91e-005	7.91e-005	0.181	0.30
80	80	6.78e+001	2.39e+001	4.39e+001	0.35	7.91e-005	7.91e-005	0.1811	0.30
81	81	6.79e+001	2.39e+001	4.39e+001	0.35	7.92e-005	7.92e-005	0.1812	0.30
82	82	6.79e+001	2.40e+001	4.39e+001	0.35	7.93e-005	7.93e-005	0.1813	0.30
83	83	6.79e+001	2.40e+001	4.39e+001	0.35	7.94e-005	7.94e-005	0.1814	0.30
84	84	6.79e+001	2.40e+001	4.39e+001	0.35	7.94e-005	7.94e-005	0.1814	0.30
85	85	6.79e+001	2.40e+001	4.40e+001	0.35	7.95e-005	7.95e-005	0.1815	0.30
86	86	6.79e+001	2.40e+001	4.40e+001	0.35	7.96e-005	7.96e-005	0.1816	0.30
87	87	6.80e+001	2.40e+001	4.40e+001	0.35	7.96e-005	7.96e-005	0.1817	0.30
88	88	6.80e+001	2.40e+001	4.40e+001	0.35	7.97e-005	7.97e-005	0.1818	0.30
89	89	6.80e+001	2.40e+001	4.40e+001	0.35	7.98e-005	7.98e-005	0.1818	0.30
90	90	6.80e+001	2.40e+001	4.40e+001	0.35	7.99e-005	7.99e-005	0.1819	0.30
91	91	6.80e+001	2.40e+001	4.40e+001	0.35	7.99e-005	7.99e-005	0.182	0.30
92	92	6.81e+001	2.40e+001	4.40e+001	0.35	8.00e-005	8.00e-005	0.1821	0.30
93	93	6.81e+001	2.40e+001	4.41e+001	0.35	8.01e-005	8.01e-005	0.1822	0.30
94	94	6.81e+001	2.40e+001	4.41e+001	0.35	8.02e-005	8.02e-005	0.1822	0.30
95	95	6.81e+001	2.40e+001	4.41e+001	0.35	8.02e-005	8.02e-005	0.1823	0.30
96	96	6.81e+001	2.40e+001	4.41e+001	0.35	8.03e-005	8.03e-005	0.1824	0.30
97	97	6.82e+001	2.41e+001	4.41e+001	0.35	8.04e-005	8.04e-005	0.1825	0.30
98	98	6.82e+001	2.41e+001	4.41e+001	0.35	8.04e-005	8.04e-005	0.1826	0.30
99	99	6.82e+001	2.41e+001	4.41e+001	0.35	8.05e-005	8.05e-005	0.1826	0.30
100	100	6.82e+001	2.41e+001	4.41e+001	0.35	8.06e-005	8.06e-005	0.1827	0.30
101	101	6.82e+001	2.41e+001	4.41e+001	0.35	8.07e-005	8.07e-005	0.1828	0.30
102	102	6.82e+001	2.41e+001	4.42e+001	0.35	8.07e-005	8.07e-005	0.1829	0.30
103	103	6.83e+001	2.41e+001	4.42e+001	0.35	8.08e-005	8.08e-005	0.183	0.30
104	104	6.83e+001	2.41e+001	4.42e+001	0.35	8.09e-005	8.09e-005	0.183	0.31
105	105	6.83e+001	2.41e+001	4.42e+001	0.35	8.10e-005	8.10e-005	0.1831	0.31
106	106	6.83e+001	2.41e+001	4.42e+001	0.35	8.10e-005	8.10e-005	0.1832	0.31
107	107	6.83e+001	2.41e+001	4.42e+001	0.35	8.11e-005	8.11e-005	0.1833	0.31
108	108	6.84e+001	2.41e+001	4.42e+001	0.35	8.12e-005	8.12e-005	0.1834	0.31
109	109	6.84e+001	2.41e+001	4.42e+001	0.35	8.12e-005	8.12e-005	0.1834	0.31
110	110	6.84e+001	2.41e+001	4.43e+001	0.35	8.13e-005	8.13e-005	0.1835	0.31
111	111	6.84e+001	2.41e+001	4.43e+001	0.35	8.14e-005	8.14e-005	0.1836	0.31
112	112	6.84e+001	2.42e+001	4.43e+001	0.35	8.15e-005	8.15e-005	0.1837	0.31
113	113	6.85e+001	2.42e+001	4.43e+001	0.35	8.15e-005	8.15e-005	0.1838	0.31
114	114	6.85e+001	2.42e+001	4.43e+001	0.35	8.16e-005	8.16e-005	0.1839	0.31
115	115	6.85e+001	2.42e+001	4.43e+001	0.35	8.17e-005	8.17e-005	0.1839	0.31
116	116	6.85e+001	2.42e+001	4.43e+001	0.35	8.18e-005	8.18e-005	0.184	0.31
117	117	6.85e+001	2.42e+001	4.43e+001	0.35	8.18e-005	8.18e-005	0.1841	0.31
118	118	6.85e+001	2.42e+001	4.44e+001	0.35	8.19e-005	8.19e-005	0.1842	0.31
119	119	6.86e+001	2.42e+001	4.44e+001	0.35	8.20e-005	8.20e-005	0.1843	0.31
120	120	6.86e+001	2.42e+001	4.44e+001	0.35	8.21e-005	8.21e-005	0.1843	0.31
121	121	6.86e+001	2.42e+001	4.44e+001	0.35	8.21e-005	8.21e-005	0.1844	0.31
122	122	6.86e+001	2.42e+001	4.44e+001	0.35	8.22e-005	8.22e-005	0.1845	0.31
123	123	6.86e+001	2.42e+001	4.44e+001	0.35	8.23e-005	8.23e-005	0.1846	0.31
124	124	6.87e+001	2.42e+001	4.44e+001	0.35	8.24e-005	8.24e-005	0.1847	0.31
125	125	6.87e+001	2.42e+001	4.44e+001	0.35	8.24e-005	8.24e-005	0.1848	0.31
126	126	6.87e+001	2.42e+001	4.45e+001	0.35	8.25e-005	8.25e-005	0.1848	0.31
127	127	6.87e+001	2.43e+001	4.45e+001	0.35	8.26e-005	8.26e-005	0.1849	0.31
128	128	6.87e+001	2.43e+001	4.45e+001	0.35	8.27e-005	8.27e-005	0.185	0.31
129	129	6.88e+001	2.43e+001	4.45e+001	0.35	8.27e-005	8.27e-005	0.1851	0.31
130	130	6.88e+001	2.43e+001	4.45e+001	0.35	8.28e-005	8.28e-005	0.1852	0.31
131	131	6.88e+001	2.43e+001	4.45e+001	0.35	8.29e-005	8.29e-005	0.1853	0.31
132	132	6.88e+001	2.43e+001	4.45e+001	0.35	8.30e-005	8.30e-005	0.1853	0.31
133	133	6.88e+001	2.43e+001	4.45e+001	0.35	8.31e-005	8.31e-005	0.1854	0.31
134	134	6.89e+001	2.43e+001	4.46e+001	0.35	8.31e-005	8.31e-005	0.1855	0.31
135	135	6.89e+001	2.43e+001	4.46e+001	0.35	8.32e-005	8.32e-005	0.1856	0.31

136	136	6.89e+001	2.43e+001	4.46e+001	0.35	8.33e-005	8.33e-005	0.1857	0.31
137	137	6.89e+001	2.43e+001	4.46e+001	0.35	8.34e-005	8.34e-005	0.1857	0.31
138	138	6.89e+001	2.43e+001	4.46e+001	0.35	8.34e-005	8.34e-005	0.1858	0.31
139	139	6.89e+001	2.43e+001	4.46e+001	0.35	8.35e-005	8.35e-005	0.1859	0.31
140	140	6.90e+001	2.43e+001	4.46e+001	0.35	8.36e-005	8.36e-005	0.186	0.31
141	141	6.90e+001	2.43e+001	4.46e+001	0.35	8.37e-005	8.37e-005	0.1861	0.31
142	142	6.90e+001	2.44e+001	4.47e+001	0.35	8.37e-005	8.37e-005	0.1862	0.31
143	143	6.90e+001	2.44e+001	4.47e+001	0.35	8.38e-005	8.38e-005	0.1863	0.31
144	144	6.90e+001	2.44e+001	4.47e+001	0.35	8.39e-005	8.39e-005	0.1863	0.31
145	145	6.91e+001	2.44e+001	4.47e+001	0.35	8.40e-005	8.40e-005	0.1864	0.31
146	146	6.91e+001	2.44e+001	4.47e+001	0.35	8.41e-005	8.41e-005	0.1865	0.31
147	147	6.91e+001	2.44e+001	4.47e+001	0.35	8.41e-005	8.41e-005	0.1866	0.31
148	148	6.91e+001	2.44e+001	4.47e+001	0.35	8.42e-005	8.42e-005	0.1867	0.31
149	149	6.91e+001	2.44e+001	4.47e+001	0.35	8.43e-005	8.43e-005	0.1868	0.31
150	150	6.92e+001	2.44e+001	4.48e+001	0.35	8.44e-005	8.44e-005	0.1868	0.31
151	151	6.92e+001	2.44e+001	4.48e+001	0.35	8.45e-005	8.45e-005	0.1869	0.31
152	152	6.92e+001	2.44e+001	4.48e+001	0.35	8.45e-005	8.45e-005	0.187	0.31
153	153	6.92e+001	2.44e+001	4.48e+001	0.35	8.46e-005	8.46e-005	0.1871	0.31
154	154	6.92e+001	2.44e+001	4.48e+001	0.35	8.47e-005	8.47e-005	0.1872	0.31
155	155	6.93e+001	2.44e+001	4.48e+001	0.35	8.48e-005	8.48e-005	0.1873	0.31
156	156	6.93e+001	2.45e+001	4.48e+001	0.35	8.49e-005	8.49e-005	0.1873	0.31
157	157	6.93e+001	2.45e+001	4.48e+001	0.35	8.49e-005	8.49e-005	0.1874	0.31
158	158	6.93e+001	2.45e+001	4.49e+001	0.35	8.50e-005	8.50e-005	0.1875	0.31
159	159	6.93e+001	2.45e+001	4.49e+001	0.35	8.51e-005	8.51e-005	0.1876	0.31
160	160	6.94e+001	2.45e+001	4.49e+001	0.35	8.52e-005	8.52e-005	0.1877	0.31
161	161	6.94e+001	2.45e+001	4.49e+001	0.35	8.53e-005	8.53e-005	0.1878	0.31
162	162	6.94e+001	2.45e+001	4.49e+001	0.35	8.53e-005	8.53e-005	0.1879	0.31
163	163	6.94e+001	2.45e+001	4.49e+001	0.35	8.54e-005	8.54e-005	0.1879	0.31
164	164	6.94e+001	2.45e+001	4.49e+001	0.35	8.55e-005	8.55e-005	0.188	0.31
165	165	6.95e+001	2.45e+001	4.49e+001	0.35	8.56e-005	8.56e-005	0.1881	0.31
166	166	6.95e+001	2.45e+001	4.50e+001	0.35	8.57e-005	8.57e-005	0.1882	0.31
167	167	6.95e+001	2.45e+001	4.50e+001	0.35	8.57e-005	8.57e-005	0.1883	0.31
168	168	6.95e+001	2.45e+001	4.50e+001	0.35	8.58e-005	8.58e-005	0.1884	0.31
169	169	6.95e+001	2.45e+001	4.50e+001	0.35	8.59e-005	8.59e-005	0.1885	0.31
170	170	6.96e+001	2.46e+001	4.50e+001	0.35	8.60e-005	8.60e-005	0.1885	0.31
171	171	6.96e+001	2.46e+001	4.50e+001	0.35	8.61e-005	8.61e-005	0.1886	0.31
172	172	6.96e+001	2.46e+001	4.50e+001	0.35	8.61e-005	8.61e-005	0.1887	0.31
173	173	6.96e+001	2.46e+001	4.50e+001	0.35	8.62e-005	8.62e-005	0.1888	0.31
174	174	6.96e+001	2.46e+001	4.51e+001	0.35	8.63e-005	8.63e-005	0.1889	0.31
175	175	6.97e+001	2.46e+001	4.51e+001	0.35	8.64e-005	8.64e-005	0.189	0.31
176	176	6.97e+001	2.46e+001	4.51e+001	0.35	8.65e-005	8.65e-005	0.1891	0.32
177	177	6.97e+001	2.46e+001	4.51e+001	0.35	8.66e-005	8.66e-005	0.1891	0.32
178	178	6.97e+001	2.46e+001	4.51e+001	0.35	8.66e-005	8.66e-005	0.1892	0.32
179	179	6.97e+001	2.46e+001	4.51e+001	0.35	8.67e-005	8.67e-005	0.1893	0.32
180	180	6.98e+001	2.46e+001	4.51e+001	0.35	8.68e-005	8.68e-005	0.1894	0.32
181	181	6.98e+001	2.46e+001	4.52e+001	0.35	8.69e-005	8.69e-005	0.1895	0.32
182	182	6.98e+001	2.46e+001	4.52e+001	0.35	8.70e-005	8.70e-005	0.1896	0.32
183	183	6.98e+001	2.46e+001	4.52e+001	0.35	8.71e-005	8.71e-005	0.1897	0.32
184	184	6.98e+001	2.47e+001	4.52e+001	0.35	8.71e-005	8.71e-005	0.1898	0.32
185	185	6.99e+001	2.47e+001	4.52e+001	0.35	8.72e-005	8.72e-005	0.1898	0.32
186	186	6.99e+001	2.47e+001	4.52e+001	0.35	8.73e-005	8.73e-005	0.1899	0.32
187	187	6.99e+001	2.47e+001	4.52e+001	0.35	8.74e-005	8.74e-005	0.19	0.32
188	188	6.99e+001	2.47e+001	4.52e+001	0.35	8.75e-005	8.75e-005	0.1901	0.32
189	189	6.99e+001	2.47e+001	4.53e+001	0.35	8.76e-005	8.76e-005	0.1902	0.32
190	190	7.00e+001	2.47e+001	4.53e+001	0.35	8.76e-005	8.76e-005	0.1903	0.32
191	191	7.00e+001	2.47e+001	4.53e+001	0.35	8.77e-005	8.77e-005	0.1904	0.32
192	192	7.00e+001	2.47e+001	4.53e+001	0.35	8.78e-005	8.78e-005	0.1905	0.32
193	193	7.00e+001	2.47e+001	4.53e+001	0.35	8.79e-005	8.79e-005	0.1905	0.32
194	194	7.00e+001	2.47e+001	4.53e+001	0.35	8.80e-005	8.80e-005	0.1906	0.32
195	195	7.01e+001	2.47e+001	4.53e+001	0.35	8.81e-005	8.81e-005	0.1907	0.32
196	196	7.01e+001	2.47e+001	4.54e+001	0.35	8.81e-005	8.81e-005	0.1908	0.32
197	197	7.01e+001	2.47e+001	4.54e+001	0.35	8.82e-005	8.82e-005	0.1909	0.32

198	198	7.01e+001	2.48e+001	4.54e+001	0.35	8.83e-005	8.83e-005	0.191	0.32
199	199	7.01e+001	2.48e+001	4.54e+001	0.35	8.84e-005	8.84e-005	0.1911	0.32
200	200	7.02e+001	2.48e+001	4.54e+001	0.35	8.85e-005	8.85e-005	0.1912	0.32

End of pc-CRACK Output