Attachment 2 to

1CAN041004

EPFM Evaluation of Potential Remnant Crack in Pressurizer Level Sensing/Sampling Nozzle (No Existing Pad) Repair

Structural Integrity Associates, Inc.	**CALCULATION PACKAGE**	**File No.:** ANO-43Q-301 **Project No.:** ANO-43Q

PROJECT NAME: **EPFM Analysis for ANO-1 Small Bore Nozzles**

Contract No.: **39293**

CLIENT: **Welding Services Inc.**

PLANT: Arkansas Nuclear One, Unit 1

CALCULATION TITLE: **EPFM Evaluation of Potential Remnant Crack in Pressurizer Level Sensing/Sampling Nozzle (No Existing Pad) Repair**

Document Revision	Affected Pages	Revision Description	Project Mgr. Approval Signature & Date	Preparer(s) & Checker(s) Signatures & Date
0	1-22 Project Computer Files	Original Issue	GSM 3/09/07	C.J. Fourcade CJF 3/09/07 G.A. Miessi GAM 3/09/07
1	1, 4, and 22	Updated Code edition of References 1 to 4. Added references to Code Appendices and minor editorial changes on Page 4. Changed project name on Page 1.	GSM 3/21/07	C.J. Fourcade CJF 3/21/07 G.A. Miessi GAM 3/21/07
2	All	Client comments incorporated.	GSM 6/29/07	C.J. Fourcade CJF 6/27/07 G.A. Miessi GAM 6/27/07

Table of Contents

List of Tables

List of Figures

1 INTRODUCTION

The analyses performed in Reference 7 include the linear elastic fracture mechanics evaluation for the pressurizer level sensing/sampling nozzle repairs at Arkansas Nuclear One, Unit 1 (ANO-1). This calculation is applicable to the following nozzle repairs:

- Two upper level sensing nozzles (no existing pad)
- Two lower level sensing nozzles
- One sampling nozzle
- One modified level sensing nozzle with thermowell replacement

In the design evaluation of such repairs, it is conservatively assumed that the original J-groove weld is cracked completely. Three flaw configurations were analyzed in the Reference 7 analysis, where "Flaw 1" is the initial flaw, which encompasses the J-groove weld and cladding. "Flaw 2" is an intermediate flaw size, and "Flaw 3" is the largest postulated flaw. "Flaw 2" and "Flaw 3" extend past the J-groove weld into the carbon steel pressurizer wall, as described in Reference 7. This postulated crack is evaluated in accordance with ASME Section XI flaw evaluation rules for acceptability.

Evaluation of such an assumed crack has been performed in the past using the flaw evaluation procedure of ASME Section XI, IWB-3610 plus Appendix A [1]. The original J-groove weld may continue to exhibit the high welding residual stresses that originally led to the need for the repair. Thus, in accordance with the requirements of Appendix A, residual stresses are included in the evaluation, along with operating pressure and thermal loads, and the full safety factors for normal operating conditions are applied. This approach has led to difficulty in demonstrating acceptability of the postulated J-groove weld cracking.

The ASME Section XI flaw evaluation rules for vessels (IWB-3610 plus Appendix A) are based on Linear Elastic Fracture Mechanics (LEFM) techniques, and were developed primarily for the irradiated RPV beltline region and other low temperature carbon and low-alloy steel applications in which the material exhibits little or no ductility. The pressurizer shell remnant crack analysis problem occurs at operating temperature, however, where considerable ductility exists. The objective of this calculation is to perform Elastic-Plastic Fracture Mechanics (EPFM) analysis of the ANO-1 pressurizer vessel to demonstrate acceptability of the postulated remnant crack in the various nozzles listed above, taking credit for the ductility that exists in the vessel material at normal operating temperature.

2 METHODOLOGY

EPFM is a more appropriate fracture mechanics technology than LEFM for flaws in non-beltline pressurizer materials at higher temperatures, such as the level sensing/sampling nozzle penetration remnant cracking concern. The LEFM methodology of [1] treats all loadings on the vessel equivalently, applying equal safety factors (~3 for normal and upset loads) to both primary stresses due to internal pressure and mechanical loads as well as to secondary and peak stresses such as those caused by differential thermal expansion and residual stresses. These loadings are equivalent in their potential to produce fracture only in the most brittle of materials, such as glass, RPV beltline and pressurizer materials at low temperatures after significant irradiation embrittlement, and thick, ferritic materials at very low temperatures.

Ample precedent exists in ASME Section XI for the use of EPFM in materials that exhibit some ductility. Such precedent may be seen in Appendix C for Evaluation of Flaws in Austenitic Piping [2], Appendix H for Evaluation of Flaws in Ferritic Piping [3], and Appendix K for Assessment of Reactor Vessels with Low Upper Shelf Charpy Impact Energy Levels [4]. Appendix H [3] includes a screening criteria to determine which regime a ferritic piping flaw evaluation falls into (LEFM, EPFM or Limit Load), and for problems that fall into the EPFM regime, specifies different safety factors, SF, for primary stresses (SF = 2.77) than for secondary loadings (SF = 1.0). An even more appropriate approach for the level sensing/sampling nozzle penetrations is presented in Appendix K [4]. In addition to different safety factors for primary versus secondary loadings, this appendix also provides an approximate procedure for performing flaw instability analysis of RPV materials on the upper shelf.

This analysis will apply the technical approach and approximate methodology of Appendix K [4] to the ANO-1 pressurizer level sensing/sampling nozzle remnant crack problem. Included in the calculation will be the application of safety factors of 3 for primary loads and 1 for secondary loads (including residual stresses). Note that these are more conservative than the safety factors actually specified for primary and secondary loads in Appendix K [4] of 1.25 for primary loads and 1 for secondary loads. However, it must be recognized that Appendix K [4] is not dealing with flaw evaluation but rather with demonstrating adequate levels of toughness, and in so doing, it postulates very large hypothetical flaw sizes. The present analysis deals with realistic flaw sizes that might actually be expected to occur, since the J-groove welds have been found to be susceptible to PWSCC. Therefore, a more conservative safety factor of 3 on primary loads, reflecting the safety factors in Appendices C and H [2, 3], is used for this evaluation.

Appendix K [4] specifies three methods for selection of the material J-integral resistance curve. A J-R curve may be generated by actual testing of the material following accepted test procedures, it may be generated from a J-integral database obtained from the same class of material with the same orientation, or an indirect method of estimating the J-R curve may be used, provided the method is justified for the material. For this calculation, an indirect method is used, based on Charpy V-notch correlations contained in Reference 5.

3 MATERIAL PROPERTIES

The ANO-1 pressurizer vessel shell is fabricated from SA-516, Grade 70 material [10]. The following material properties are required for the EPFM analysis:

Young's Modulus,	$E =$	28100	ksi	$E' = E/(1-\mu^2) =$	30879.1 ksi
Poisson's Ratio,	$\mu =$	0.3			
Yield Strength,	$YS =$	33.6	ksi		
Ultimate Tensile Strength,	$S_u =$	70	ksi		
Design Stress,	$S_m =$	22.5	ksi		
Reference Flow Stress,	$\sigma_f =$	85	ksi	(Appendix K [4])	
Fracture Toughness,	$K_{Ic} =$	200.0	ksi√in	(Appendix A [1])	
J Critical,	$J_{Ic} =$	1.295	in-kips/in^2	$= K_{Ic}{}^2/E'$	

All material properties are taken at the approximate mean temperature of 300°F (the operating temperature is 650°F [7]) from the ASME Code, Section II, Part D [9]. Figure 1, obtained from

Reference 5, presents J-T materials curves for irradiated and unirradiated nuclear vessel steels at various upper shelf Charpy V-notch energy levels (in joules). The results show a rough correlation, in that higher J-T curves are generally exhibited for higher Charpy V-notch energy levels. An actual correlation curve has been developed (Figure 2 and Figure 3) between Charpy V-notch energy and the parameters of a J-R curve power law fit of the following form:

$$J = C\,(\Delta a)^{m}$$

$$T = E'/\sigma_o^{2} Cm(\Delta a)^{(m-1)}$$

In general, a power law fit of this type is only valid for small crack extensions (Δa). However, Loss and coworkers [6] have observed good fit for the power law for larger Δa for materials with high upper shelf Charpy energy levels such as the materials we are concerned with here.

Charpy V-notch energy (CVN) tests of the ANO-1 pressurizer vessel material were conducted and documented in various source documents. That data is summarized in Reference 8, which shows a lower bound upper shelf Charpy V-notch energy (USE) value of 46 ft-lbs [8]. Based on this CVN of 46 ft-lbs and the flow stress of 85 ksi [4], Figure 2 and Figure 3 are used to determine values of the coefficient C and the exponent m for the power law J-R curve fit of 1.10 and 0.231, respectively. These are converted to a J-T diagram and illustrated by the "46 ft-lb" J-T curve in Figures 7 through 10.

4 APPLIED J AND T CALCULATIONS

4.1 Bounding Loading Conditions

Analyses for J-T applied are performed in accordance with the approximate technique of ASME Section XI, Appendix K. This allows EPFM J-Integral estimates to be developed from LEFM K calculations, which are taken from Reference 7. Comparison of the K results for each thermal transient analyzed in Reference 7 shows that the Cooldown with High Pressure Injection (HPI) transient K's are bounding for all flaw configurations at the bore location, and the Insurge Cooldown transient is bounding at the clad/vessel interface location. Therefore, these transient K values are chosen for the EPFM analysis. Since different safety factors are applied to the primary and secondary load K values (SF = 3 on pressure, and SF = 1 on thermal and residual), the stress intensity factor is plotted as a function of crack depth, separately for thermal + residual, and pressure stress. A comparison of the "K" vs. "a" behavior for the bore penetration and clad/vessel interface locations is shown in Figure 5 and Figure 6. Since it is not readily apparent which location is bounding, both locations are chosen for analysis. Furthermore, both the initial ("Flaw 1") and final ("Flaw 3") as-modeled flaws are analyzed to ensure that the EPFM margins are achieved for all flaws considered. Since the final ("Flaw 3") as-modeled flaw size was not exceeded in the crack growth analysis [11], the results for the initial and final flaw sizes will bound all intermediary flaws.

4.2 Stress Intensity Factor Distributions

The linear elastic fracture mechanics (LEFM) analyses in Reference 7 include stress intensity factors (K) due to thermal, operating pressure, and weld residual stresses, calculated for three separate flaw sizes (configurations). The stress intensity factors (K) occurring along the three crack fronts, and the corresponding crack depths (a), are extracted from the "Flaw 1", "Flaw 2", and "Flaw 3" flaw configurations, for internal pressure, residual stress, and the bounding thermal transient. The crack depth (a) is obtained from the Reference 7 analysis at the approximate location of maximum K. The maximum

K occurs at both the penetration bore and clad/vessel interface, as shown in References 7 and 11. The K's due to primary stress (K_{Ip}) include operating pressure alone, whereas the K's due to secondary stress (K_{It}) include thermal and weld residual stress. The resulting stress intensity factors are shown in Table 1.

Based on the stress intensity factor distributions listed in Table 1, the four data points are used to determine the equation for the relationship of K_I with increasing crack size. The data is plotted and curve-fitted, as shown in Figure 5 and Figure 6 for the penetration bore and clad/vessel interface locations, respectively. As seen in the figures, the relationship at both locations is simplified by a linear equation. Therefore, the following curve-fitted approximations are used, along with the appropriate safety factors, to determine K's for the plastic zone corrected crack sizes:

Penetration Bore Location:

$K'_{Ip} = SF_p*(0.312 * a_e + 1.620)$ (ksi-√in) (Pressure term)

$K'_{It} = SF_t*(-77.310 * a_e + 214.110)$ (ksi-√in) (Thermal + Residual term)

Clad/Vessel Interface Location:

$K'_{Ip} = SF_p*(0.256 * a_e + 1.137)$ (ksi-√in) (Pressure term)

$K'_{It} = SF_t*(8.394 * a_e + 102.212)$ (ksi-√in) (Thermal + Residual term)

where, SF_p and SF_t are the safety factors for the primary and secondary stresses, respectively, as shown in the second column of Table 2.

4.3 J-T Calculations

The Appendix K [4] approximate procedure for J-integral involves the calculation of a plastic zone corrected crack size for small scale yielding from elastically calculated K-values, in accordance with the following:

$$a_e = a + r_p$$

where,

$$r_p = [1/(6\pi)] [(K_{Ip} + K_{It})/YS]^2$$

The applied J integral is then calculated (see Excel spreadsheet ANO-1_EPFM_LVL-NOZ.xls) from revised stress intensity factors (K'_{Ip} and K'_{It}) computed at the plastic zone corrected crack size as follows:

$$J'total = (K'_{total})^2/E'$$

where, $K'_{total} = K'_{Ip} + K'_{It}$

The applied tearing modulus, T, is then calculated as follows:

$$T' = \left(\frac{K'total}{\sigma_f} \right)^2 \times \left(\frac{1-\mu^2}{a_i} \right)$$, where $\mu = 0.3$, and a_i = initial flaw depth (Flaw size given in Table 1).

J at instability is defined as J at the intersection of the applied J-T line (J'total vs. T') and the J-T material curve (J vs. T).

5 RESULTS AND DISCUSSION

A list of plastic zone size adjusted K and J integral values, computed in accordance with the method described in Section 4.0, is provided in Table 2, for the representative level sensing/sampling nozzle penetration bore and clad/vessel interface locations, respectively. Results are reported for two combinations of safety factors, as indicated in the first column of the table, and are plotted as the J-T Applied line in Figures 7 and 8 for the modeled initial and final flaws at the penetration bore location. Likewise, the J-T Applied line is plotted in Figures 9 and 10 for the initial and final flaws at the clad/vessel interface location. For each plot, data points are indicated on the J-T Applied line with the corresponding values of safety factors denoted.

Using the standard J-T instability analysis approach described in Reference 4, and depicted in Figure 4, crack instability is predicted when the applied J-T line intersects the appropriate J-T material curve. This value is listed in the last column of Table 2.

As shown in Table 2 for the penetration bore flaw location, the applied J at the applied safety factors of 3 on primary loads (pressure) and 1.0 on secondary loads (thermal + residual) is 0.125 in-kips/in^2 at the initial flaw and 0.101 in-kips/in^2 at the final flaw, which are well below the J-T material curve intersection points of 0.78 in-kips/in^2 and 0.89 in-kips/in^2, respectively. Likewise, the applied J is 0.458 in-kips/in^2 and 0.516 in-kips/in^2 for the initial and final clad/vessel interface flaws, which are well below the limits of 0.77 in-kips/in^2 and 0.88 in-kips/in^2, respectively.

The results of the EPFM analysis are summarized in Table 3. The ANO-1 pressurizer base material in the various level sensing/sampling nozzle regions thus shows ample margin to instability, for both the penetration bore and clad/vessel interface flaw locations.

6 CONCLUSIONS

Based on the EPFM analyses presented herein, it is concluded that potential remnant cracks in the J-groove welds after repairs of the various ANO-1 pressurizer level sensing/sampling nozzles listed in Section 1, with a portion of the existing nozzles in place, are acceptable by a large margin. The analyses assume worst case flaws encompassing the entire remaining weld. EPFM material properties are determined from correlations on similar materials, and the EPFM analyses are performed using appropriate safety factors for ductile materials (SF=3 on primary loadings and 1.0 on secondary loadings). The results indicate that J-T applied, including safety factors, is below the applicable material toughness for crack instability by a comfortable margin. Therefore, the potential remnant cracking is acceptable in accordance with the flaw evaluation principles of ASME Section XI.

Table 1: Stress Intensity Factor Summary

Location	Flaw	Crack Depth, $a^{(1)}$ (inch)	$K_{Ip}^{(2)}$ (ksi-in$^{1/2}$)	$K_{It}^{(3)}$ (ksi-in$^{1/2}$)	K_{total} (ksi-in$^{1/2}$)
Penetration Bore	Flaw 1	0.938	1.94	148.33	150.27
	Flaw 2	1.313	1.98	99.12	101.10
	Interp.	1.474	2.07	97.95	100.02
	Flaw 3	1.634	2.17	96.77	98.94
Clad/Vessel Interface	Flaw 1	0.842	1.36	109.73	111.09
	Flaw 2	1.230	1.44	111.64	113.08
	Interp.	1.397	1.49	113.78	115.28
	Flaw 3	1.563	1.55	115.93	117.48

Notes:

(1) The crack depth dimensions are given in References 7 and 11.

(2) The K value due to pressure (operating pressure and crack face pressure) [11, Tables 1 and 2], is multiplied by 0.100, using the pressure of 100 psi (at the time of maximum K, from Reference 7) from the Cooldown with HPI transient.

(3) At the penetration bore location, the K values due to the Cooldown with HPI transient thermal stress are added to the K values due to weld residual stress [11, Tables 1 and 2], and at the clad/vessel interface location, the K values due to Cooldown with insurge are added to the K values due to weld residual stress.

Table 2: J-T Computations for EPFM Analysis

Flaw	Safety Factors (SF = SF_p , SF_t)	K_{Ip}	K_{It}	K_{total}	r_p	a_e	K'_{Ip}	K'_{It}	K'_{total}	J'total	T'	J @ Instability
		(ksi-in$^{1/2}$)			(in)		(ksi-in$^{1/2}$)			(in-kips/in^2)		(in-kips/in^2)
Penetration Bore Location												
Initial (Flaw 1)	SF=1.0, 1.0	1.9	148.3	150.3	1.061	1.999	2.2	59.6	61.8	0.124	0.513	0.78
	SF=3.0, 1.0	5.8	148.3	154.1	1.117	2.055	6.8	55.3	62.1	0.125	0.517	0.78
Final (Flaw 3)	SF=1.0, 1.0	2.2	96.8	98.9	0.460	2.094	2.3	52.2	54.5	0.096	0.229	0.89
	SF=3.0, 1.0	6.5	96.8	103.3	0.501	2.135	6.9	49.0	55.9	0.101	0.241	0.89
Clad/Vessel Interface Location												
Initial (Flaw 1)	SF=1.0, 1.0	1.4	109.7	111.1	0.580	1.422	1.5	114.1	115.6	0.433	2.001	0.77
	SF=3.0, 1.0	4.1	109.7	113.8	0.609	1.451	4.5	114.4	118.9	0.458	2.115	0.77
Final (Flaw 3)	SF=1.0, 1.0	1.5	115.9	117.5	0.649	2.212	1.7	120.8	122.5	0.486	1.209	0.88
	SF=3.0, 1.0	4.6	115.9	120.6	0.683	2.246	5.1	121.1	126.2	0.516	1.283	0.88

Table 3: Summary of EPFM Results

Location	Flaw	J'total (in-kips/in^2)	J @ Instability (in-kips/in^2)	Pass?
Penetration Bore	Initial (Flaw 1)	0.125	0.78	Yes
	Final (Flaw 3)	0.101	0.89	Yes
Clad/Vessel Interface	Initial (Flaw 1)	0.458	0.77	Yes
	Final (Flaw 3)	0.516	0.88	Yes

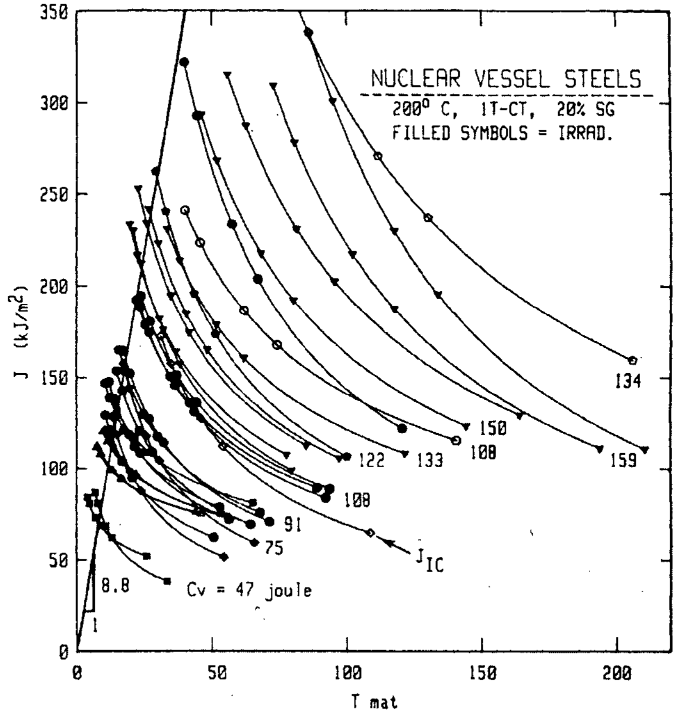


Figure 1: J-T Diagram for Several Reactor Vessel Steels and Welds Showing Rough Correlation with Charpy V-notch Upper Shelf Energy [5]

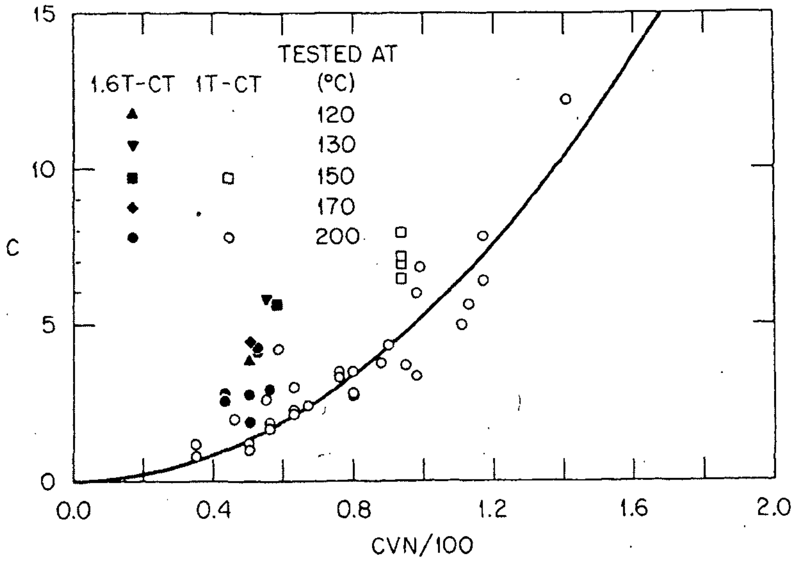


Figure 2: Correlation of Coefficient C of Power Law J R-curve Representation with Charpy V-notch Upper Shelf Energy [5]

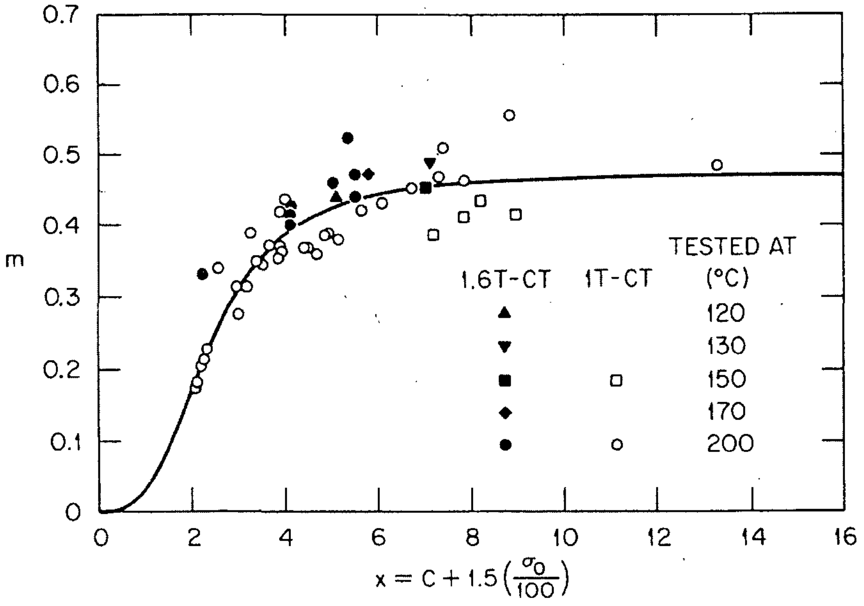
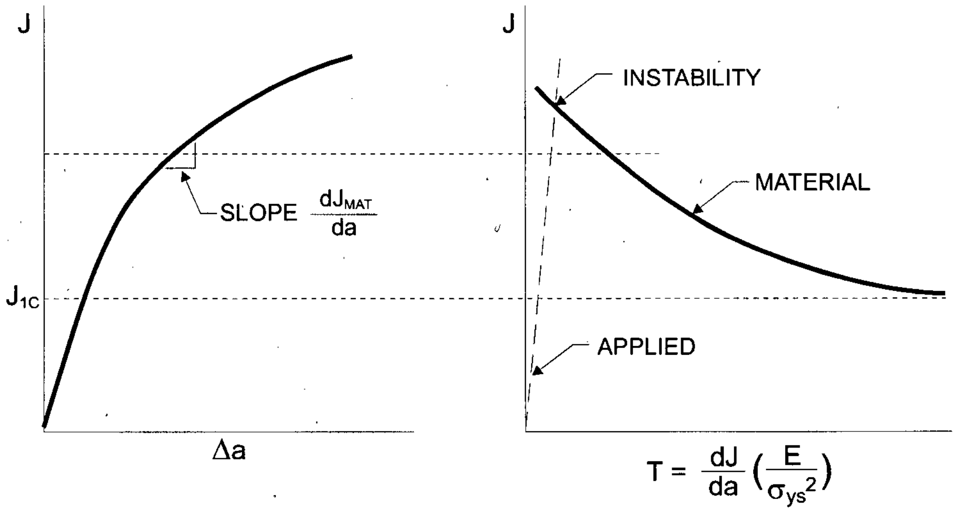


Figure 3: Correlation of Exponent m of Power Law J R-curve Representation with Coefficient C and Flow Stress σ_o [5]



93220r0

Figure 4: Schematic of EPFM Stability Analysis from ASME Section XI, Appendix K [4]

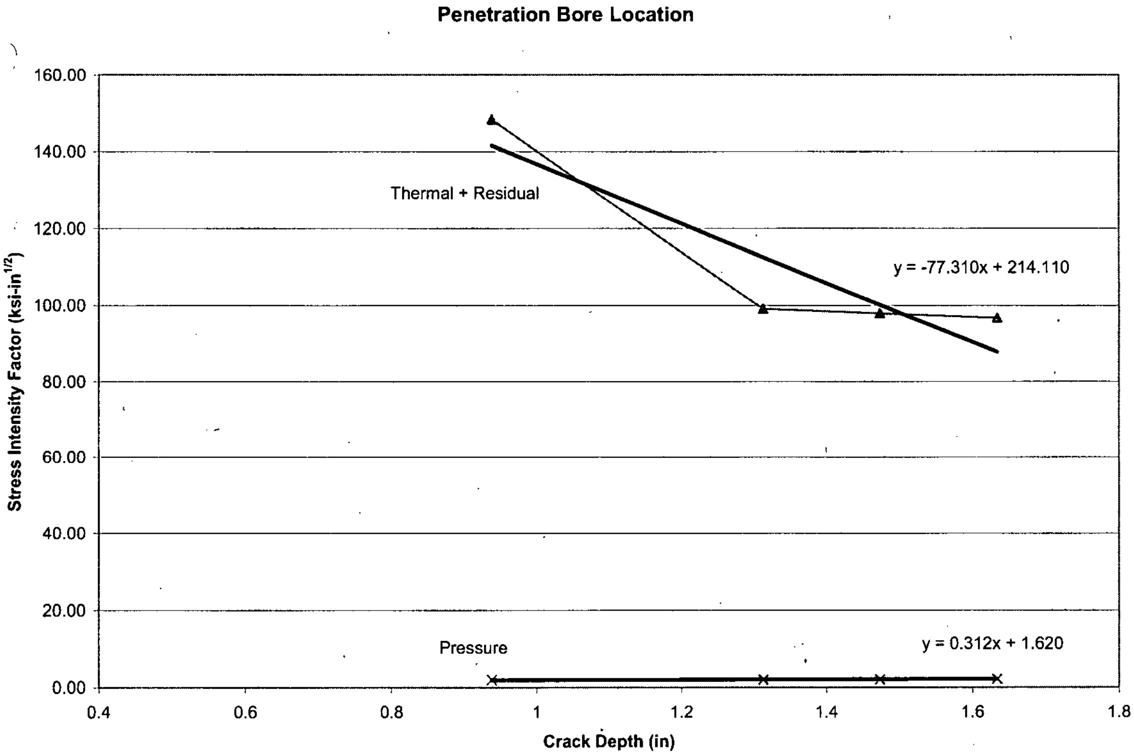


Figure 5: Stress Intensity Factor Trend at Penetration Bore Location

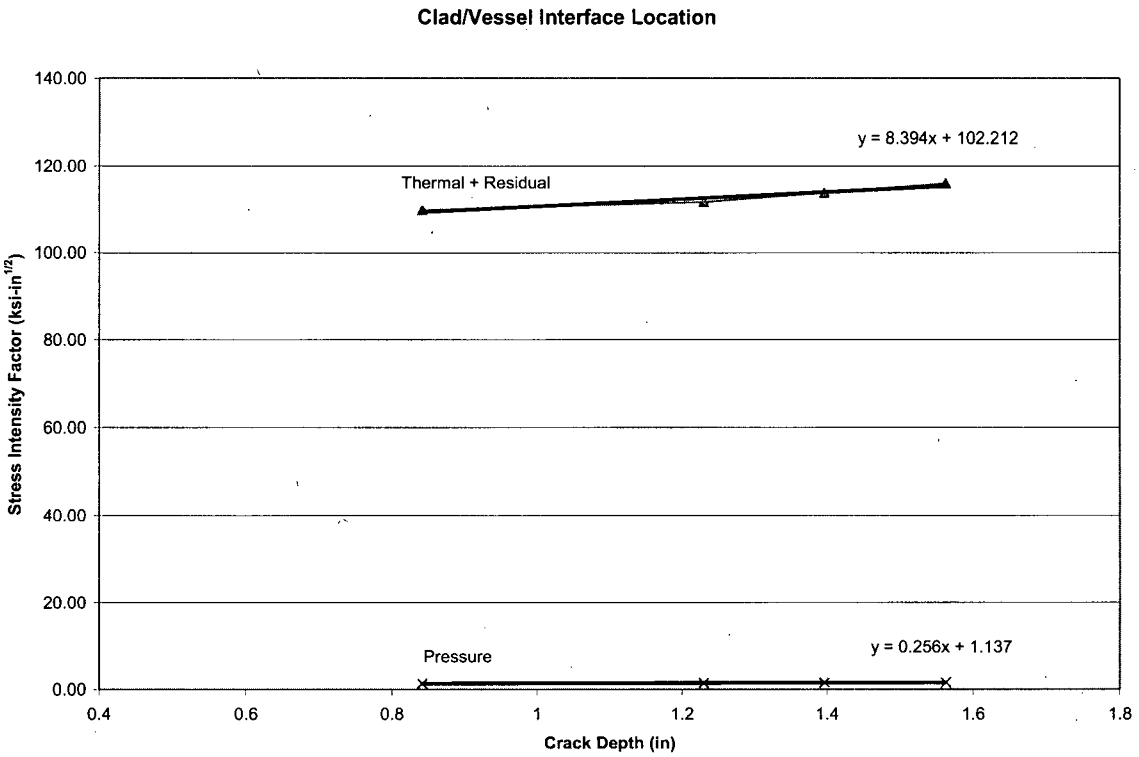


Figure 6: Stress Intensity Factor Trend at Clad/Vessel Interface Location

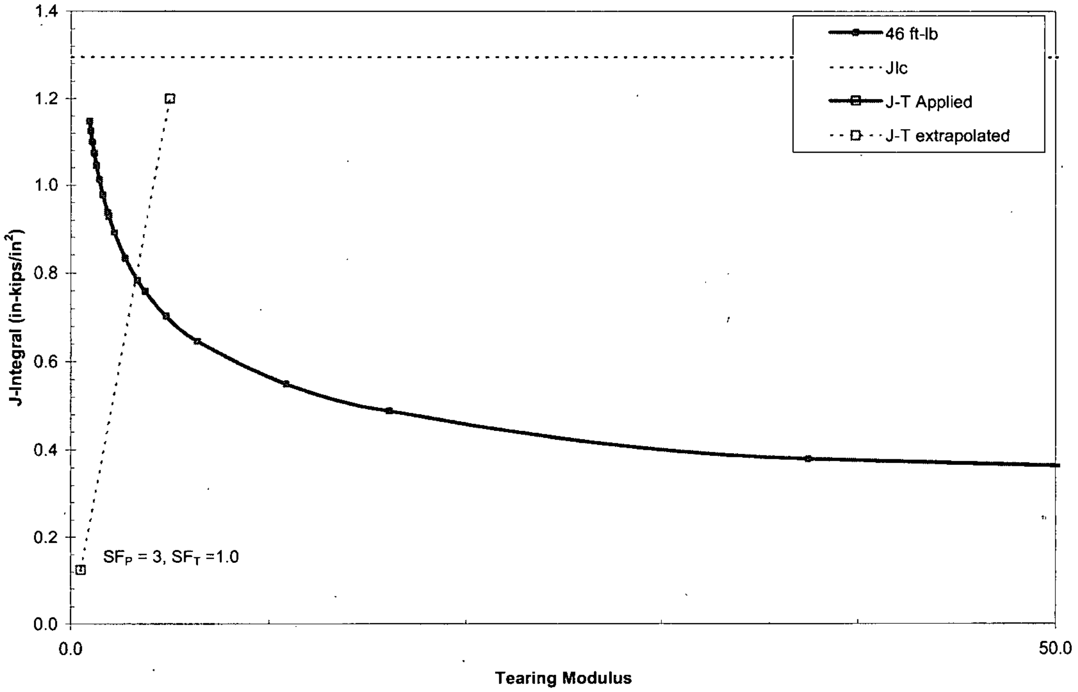

Penetration Bore Location (Initial Flaw)

Figure 7: Results of EPFM Stability Analysis, Penetration Bore Location (Initial Flaw)

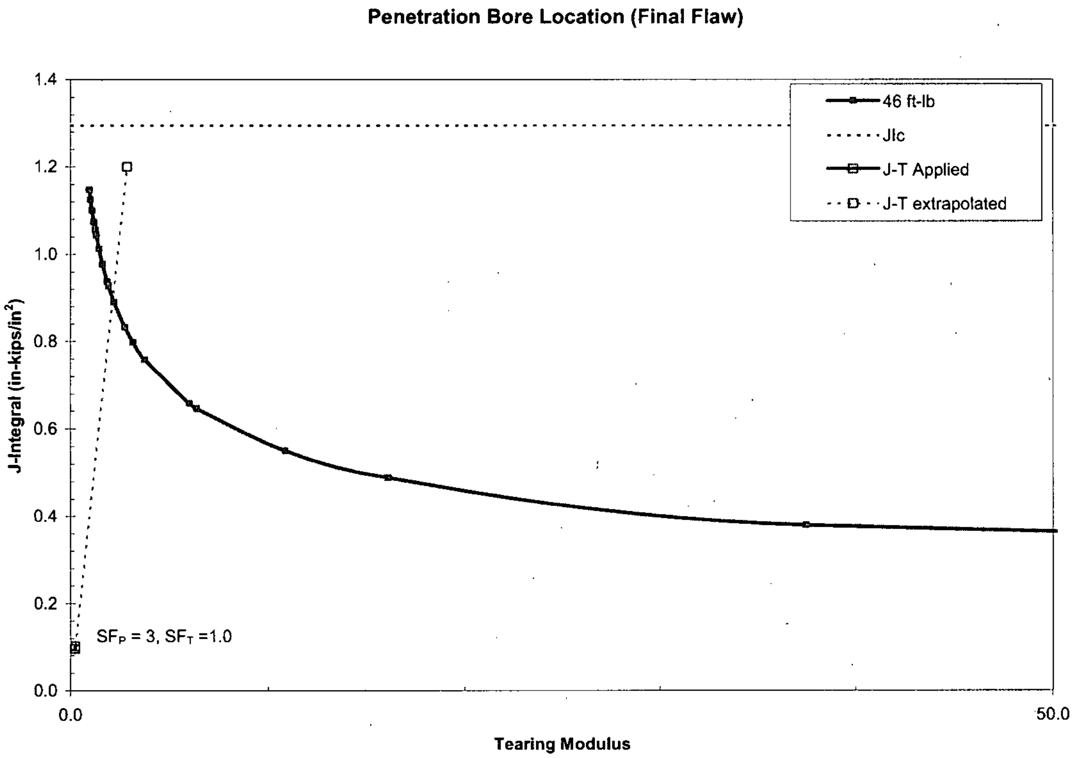


Figure 8: Results of EPFM Stability Analysis, Penetration Bore Location (Final Flaw)

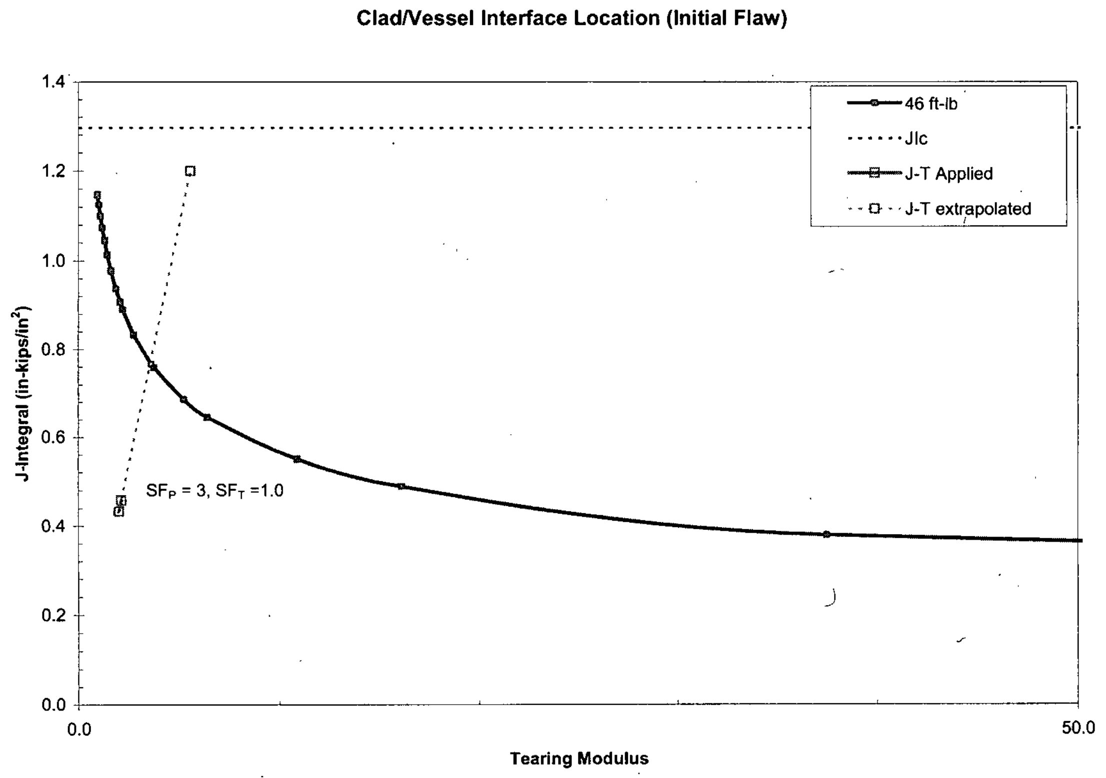


Figure 9: Results of EPFM Stability Analysis, Clad/Vessel Interface Location (Initial Flaw)

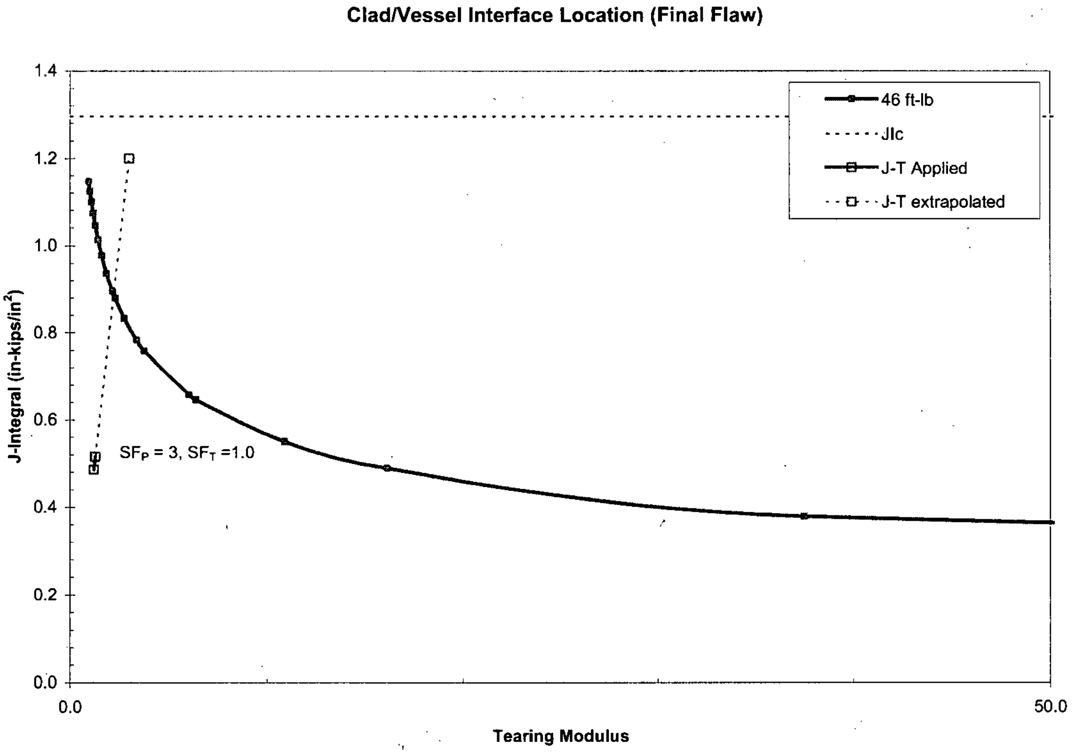


Figure 10: Results of EPFM Stability Analysis, Clad/Vessel Interface Location (Final Flaw)

7 REFERENCES

1. ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 1998 Edition with Addenda through 2000, Appendix A, Analysis of Flaws.
2. ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 1998 Edition with Addenda through 2000, Appendix C, Evaluation of Flaws in Austenitic Piping.
3. ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 1998 Edition with Addenda through 2000, Appendix H, Evaluation of Flaws in Ferritic Piping.
4. ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 1998 Edition with Addenda through 2000, Appendix K, Assessment of Reactor Vessels with Low Upper Shelf Charpy Impact Energy Levels.
5. NUREG-0744, Vol. 2, Rev. 1, Resolution of the Task A-11 Reactor Vessel Materials Toughness Safety Issue, Appendices C-K, Division of Safety Technology, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, October, 1982.
6. F. Loss, "Structural Integrity of Water Reactor Pressure Boundary Components", USNRC Report NUREG/CR-1128, 1979.
7. Structural Integrity Associates Calculation, "Pressurizer Level Sensing/Sampling Nozzle (no existing pad) Repair Fracture Mechanics Analysis," SI File No. ANO-34Q-326, Rev. 1.
8. Email from Jamie Gobell (Entergy) to Angah Miessi (SI), dated December 21, 2006, "ANO-1 Pressurizer Test Certificates," with attached file "ANO-1 Pressurizer Test Certificates.PDF," SI File No. ANO-43Q-201.
9. ASME Boiler and Pressure Vessel Code, Section II, Part D—Properties, 1998 Edition with Addenda through 2000.
10. Structural Integrity Associates Calculation, "Pressurizer One-inch Level/Sampling Nozzle Repair Finite Element Model," SI File No. ANO-34Q-303, Rev. 0.
11. Structural Integrity Associates Calculation, "Pressurizer Level Sensing/Sampling Nozzle (No Existing Pad) Repair Fatigue Crack Growth Analysis," SI File No. ANO-34Q-330, Rev. 0.

Attachment 5 to

1CAN041004

Affidavit to Withhold Analyses from Public Disclosure

Structural Integrity

Structural Integrity Associates, Inc.

5215 Hellyer Ave.
Suite 210
San Jose, CA 95138-1025
Phone: 408-978-8200
Fax: 408-978-8964
www.structint.com

April 9, 2010

AFFIDAVIT

I, Moses Taylor, Jr., state as follows:

(1) I am a Senior Associate of Structural Integrity Associates, Inc. (SI) and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in SI Calculations ANO-34Q-326, Rev. 1 "Pressurizer Level Sensing/Sampling Nozzle (no existing pad) Repair Fracture Mechanics Analysis" and ANO-34Q-330, Rev. 0, "Fatigue Crack Growth Analysis of Pressurizer Level Sensing/Sampling Nozzle (No Existing Pad) Repair." These calculations are to be treated as SI proprietary information, because they contain significant information that is deemed proprietary and confidential to AREVA NP. AREVA NP design input information was provided to SI in strictest confidence so that we could generate the aforementioned calculation on behalf of SI's client, Entergy Operations, Inc.

Paragraph 3 of this Affidavit provides the basis for the proprietary determination.

(3) SI is making this application for withholding of proprietary information on the basis that such information was provided to SI under the protection of a Proprietary/Confidentiality and Nondisclosure Agreement between SI and AREVA NP. In a separate Affidavit requesting withholding of such proprietary information prepared by AREVA NP, AREVA NP relies upon the exemption of disclosure set forth in NRC Regulation 10 CFR 2.390(a)(4) pertaining to "trade secrets and commercial or financial information". As delineated in AREVA NP's Affidavit, the material for which exemption from disclosure is herein sought is considered proprietary for the following reasons (taken directly from Items 6(b) and 6(c) of AREVA NP's Affidavit):

a) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service; and

b) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for AREVA NP.

Public disclosure of the information sought to be withheld is likely to cause substantial harm to AREVA NP with which SI has established a Proprietary/Confidentiality and Nondisclosure Agreement.

I declare under penalty of perjury that the above information and request are true, correct, and complete to the best of my knowledge, information, and belief.

Executed at San Jose, California on this 9th day of April, 2010.

Moses Taylor, Jr.
Moses Taylor, Jr., P.E.
Senior Associate
Nuclear Plant Services

State of California

County of Santa Clara

Subscribed and sworn to (or affirmed) before me

on this 9 (Date) day of April (Month), 2010 (Year),
by

(1) Moses Taylor Jr (Name of Signer)

proved to me on the basis of satisfactory evidence to be the person who appeared before me (.) [✓ (,)]
(and

(2) ________________ (Name of Signer)

proved to me on the basis of satisfactory evidence to be the person who appeared before me.)

Signature ________________ (Signature of Notary Public)

C. METZGER
Commission # 1866327
Notary Public - California
Santa Clara County
My Comm. Expires Sep 27, 2013

Place Notary Seal and/or Stamp Above

Attachment 6 to

1CAN041004

Affidavit to Withhold Analyses from Public Disclosure

AREVA

AFFIDAVIT

COMMONWEALTH OF VIRGINIA)
) ss.
CITY OF LYNCHBURG)

1. My name is Gayle F. Elliott. I am Manager, Product Licensing, for AREVA NP Inc. and as such I am authorized to execute this Affidavit.

2. I am familiar with the criteria applied by AREVA NP to determine whether certain AREVA NP information is proprietary. I am familiar with the policies established by AREVA NP to ensure the proper application of these criteria.

3. I am familiar with the AREVA NP information contained in the Structural Integrity Associates, Inc. Calculation Packages, File No. ANO-34Q-326 entitled "Pressurizer Small Bore Nozzle Repairs," and File No. ANO-34Q-330 entitled "Pressurizer Small Bore Nozzle Repairs," and referred to herein as "Documents." Information contained in these Documents has been classified by AREVA NP as proprietary in accordance with the policies established by AREVA NP for the control and protection of proprietary and confidential information.

4. These Documents contain information of a proprietary and confidential nature and is of the type customarily held in confidence by AREVA NP and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in these Documents as proprietary and confidential.

5. These Documents have been made available to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained in these Documents be withheld from public disclosure. The request for withholding of proprietary information is

made in accordance with 10 CFR 2.390. The information for which withholding from disclosure is requested qualifies under 10 CFR 2.390(a)(4) "Trade secrets and commercial or financial information."

6. The following criteria are customarily applied by AREVA NP to determine whether information should be classified as proprietary:

(a) The information reveals details of AREVA NP's research and development plans and programs or their results.

(b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for AREVA NP.

(d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for AREVA NP in product optimization or marketability.

(e) The information is vital to a competitive advantage held by AREVA NP, would be helpful to competitors to AREVA NP, and would likely cause substantial harm to the competitive position of AREVA NP.

The information in these Documents is considered proprietary for the reasons set forth in paragraphs 6(b) and 6(c) above.

7. In accordance with AREVA NP's policies governing the protection and control of information, proprietary information contained in these Documents have been made available, on a limited basis, to others outside AREVA NP only as required and under suitable agreement providing for nondisclosure and limited use of the information.

8. AREVA NP policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

9. The foregoing statements are true and correct to the best of my knowledge, information, and belief.

SUBSCRIBED before me this 9th
day of April, 2010.

Sherry L. McFaden
NOTARY PUBLIC, COMMONWEALTH OF VIRGINIA
MY COMMISSION EXPIRES: 10/31/10
Reg. # 7079129

SHERRY L. MCFADEN
Notary Public
Commonwealth of Virginia
7079129
My Commission Expires Oct 31, 2010