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SOUTHERN COMPANY

July 20, 2010

Docket Nos.: 50-321

NL-10-1419

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555-0001

Edwin I. Hatch Nuclear Plant – Unit 1
HNP-ISI-ALT-10, Version 1, Temporary Non-Code Repair Service Water System
Response to Request for Additional Information

Ladies and Gentlemen:

On July 16, 2010, Southern Nuclear Operating Company, Inc. (SNC) submitted letter NL-10-1377, HNP-ISI-ALT-10, Version 1, Temporary Non-Code Repair Service Water System, to the Nuclear Regulatory Commission (NRC). During a telephone conversation on July 19, 2010, the NRC staff requested SNC to submit the enclosed flaw evaluation, SMSH-10-007, Version 2.0, 30" Plant Service Water Header Pinhole Leak Evaluation. The requested flaw evaluation is included as an enclosure to this letter.

This letter contains no NRC commitments. If you have any questions, please contact Jack Stringfellow at (205)992-7037.

Respectfully submitted,

Mark J Ajluni

M. J. Ajluni
Nuclear Licensing Director

MJA/EGA/lac

Enclosure: Flaw Evaluation SMSH-10-007, Version 2.0

cc: Southern Nuclear Operating Company
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Enclosure

Edwin I. Hatch Nuclear Plant – Unit 1
SMSH-10-007, Version 2.0
30" Plant Service Water Header Pinhole Leak Evaluation

SOUTHERN COMPANY
Energy to Serve Your World

Southern Nuclear Design Calculation

Calculation Number: SMSH-10-007

Plant: Hatch	**Unit:** ☒ 1 ☐2 ☐ 1 & 2	**Discipline:** Stress
Title: 30" Plant Service Water Header Pinhole Leak Evaluation		**Subject:** Pipe Stress Analysis SW Pipe
Purpose / Objective: Pipe Stress Analysis		
System or Equipment Tag Numbers: P41		

Contents

Topic	**Page**	**Attachments** (Computer Printouts, Technical Papers, Sketches, Correspondence)	**# of Pages**
Purpose of Calculation	See pg. 1	A. Minimum Pipe Thickness calculation	1
Design inputs		B. Field Inspection Data	2
References		C. Evaluation per GL 90-05	4
Assumptions			
Evaluation			
Conclusion			
Total # of Pages including cover sheet & Attachments :	13		

Nuclear Quality Level

☒ **Safety-Related**	☐ **Safety Significant**	☐ **Non- Safety -Significant**

Version Record

Version No.	Description	Originator Printed Name Initial / Date	Reviewer Printed Name Initial / Date	Approval 1 Printed Name Initial / Date	Approval 2 Printed Name Initial / Date
1.0	Pipe Stress Evaluation of Pinhole Leak on Service Water Piping Header	Scott Pellet 07/07/2010	An Nguyen 07/07/2010	Mike Burgess 07/07/2010	Mike Burgess 07/07/2010
2.0	Added assessment of additional mass of proposed mod and eval per GL 90-05	Scott Pellet 07/14/2010	An Nguyen 07/14/2010	Mike Burgess 07/14/2010	Mike Burgess 07/14/2010
3.0	Revised sht. 1 & 3.	Scott Pellet 07/20/2010 SHP	VR Patel/VRPatel 07/20/2010	Mike Burgess 07/20/2010 MTB	Mike Burgess 07/20/2010 MTB

Notes:

Southern Nuclear Design Calculations

Plant: Hatch	Unit: ☒ 1 ☐ 2 ☐ 1 & 2	Calculation Number: SMSH-10-007	
Title: 30" Plant Service Water Header Pinhole Leak Evaluation			Sheet: i

Revision Log.

Ver. No.	Description	By:	Date	Chk:	Date
1	Pipe Stress Evaluation of Pinhole Leak on Service Water Piping Header	Scott Pellet	07/07/10	An Ngyuen	07/07/10
2	Added assessment for impact of additional mass of proposed modification and eval per GL 90-05	Scott Pellet	07/14/10	An Ngyuen	07/14/10
3	Made editorial corrections (sht. 1 & 3)	Scott Pellet	07/20/10	VR Patel	07/20/10

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Plant:	Unit:	Calculation Number:
Hatch	☒ 1 ☐ 2 ☐ 1 & 2	SMSH-10-007
Title: 30" Plant Service Water Header Pinhole Leak Evaluation		**Sheet:** 1

Purpose:
This calculation performs a piping stress analysis for a pipe flaw and checks compliance with the applicable code requirements. The initial version of this calculation was prepared to support the determination of operability.

Subsequent to version 1 of this calculation, it was decided to perform a non-Code repair on the pipe in order to stop the leakage as a housekeeping measure. Version 2 provides supplemental assessment of the flaw using Generic Letter 90-05 techniques. Version 2 also added analysis to evaluate the affect on pipe stress represented by the weight of the modification proposed by Temporary Modification TM 1-10-023.

Background

CR 2010108598 identifies a pin-hole leak in the Plant Hatch, Unit 1, Service Water Header Pipe located in the Service Water Pump/Intake Structure. The pipe flaw is located near node point 215 on piping isometric Drawing S-00779.

Subsequent to version 1 of this calculation, the applicability of Code Case N-513-2 for this condition was drawn into question. Particularly, section 1(c) states that, "The flaw evaluation criteria are permitted for adjoining fittings and flanges to a distance of $(R_o\, t\,)^{1/2}$ from the weld centerline." However, the flaw in this case is on an elbow fitting and is not within the specified distance from the weld. Therefore, it is not clear whether the intent of Code Case N-513-2 is met. Therefore, it was decided to re-evaluate the flaw condition using GL 90-05.

The repair being considered by TM 1-10-023 will encapsulate the area of the flaw and associated leak by welding a stub pipe with an isolation valve. This would be considered to be a "Code repair" except for the fact that the flaw is not being removed. The repair is considered to be a non-Code repair, as defined in GL 90-05. The reason for this designation and the requirement to seek NRC exemption is necessitated by the fact that leaving the flaw in place produces the possibility that the flaw will grow and cause catastrophic damage. Usually flaws are characterized as crack and propogation of cracks along pipe walls subject to pressure and vibration is a common concern. However, in this case the flaw is suspected to be caused from microbiological (MIC) damage. Therefore, flaw enlargement through crack growth is not an expected occurrence.

Design Inputs:

See discussion below and attached spreadsheets.

Plant:	Unit:	Calculation Number:	
Hatch	☒ 1 ☐ 2 ☐ 1 & 2	SMSH-10-007	
Title:			Sheet:
30" Plant Service Water Header Pinhole Leak Evaluation			2

References:

1. Piping Isometric S-00779, v3
2. CR 2010108598
3. Pipe Stress Calculation BH1-PD-5119, v4
4. Code Case N-513-2, Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping...
5. Pipe Specification A-11000
6. Generic Letter GL 90-05, "Guidance for Performing Temporary non-Code Repair of ASME Code Class 1, 2, and 3 Piping", dated June 15, 1990.
7. Temporary Modification TM 1-10-023.
8. NCIG-05, "EPRI Guideline for Piping Reconciliation", Rev 1

Assumptions:

1. For the Code Case N513-2 evaluation, the operating pressure is 180 psi. This is conservative, since this is the design pressure. The 90-05 evaluation is based on a conservative operating pressure of 140 psi. This lower pressure was extracted from the piping specification A-11000 for this section of piping with HEE designation.
2. Calculation BH1-PD-5119 reports a worst case Occassional Load condition (ANSI B31.1, Equation 12) stress of 14,464 psi. This stress does not occur at node point 215, which is expected to have much lower computed stress due to the adjacent support H-30 located directly below this pipe elbow, as shown on Drawing S-00779. Therefore, using this stress value to evaluate this piping node point is considered conservative.

Evaluation:

Code case N-513-2

Code case N-513-2 is used as the basis for this evaluation in Attachment A. The specific paragraph is 3(e), which allows the branch reinforcement approach. Minimum pipe wall thickness is determined by using equation 4 of the code case, which is shown in attachment A. The minimum thickness is determined to be 0.179". The maximum operating pressure is conservatively assumed to be the same as design pressure at 180 psi. The allowable stress for A-155 KC55 is listed in the pipe stress calc (BH1-PD-5119) as 12.4 ksi based on a weld joint efficiency of 0.9. In this case, we can use an allowable of 15.7 ksi based on a safety factor of 3.5 on the ultimate strength. An allowable of only 15,000 psi is conservatively used.

Based on this approach, a t_{adj} of 2 times the minimum thickness would be required to meet the requirement of paragraph 3(e). This thickness will conservatively be taken to be 0.360".

The inspection data shows that the actual measured thickness of the pipe exceeds 0.360" in all areas surrounding the pipe circumference, except for areas directly adjacent to the pinhole flaw. The area that falls below the 0.360" criteria is approximately circular and about 5" in diameter. The total area is then given by (PI*D^2)/4 = 19.6 in^2. This area is smaller than the acceptance criterion of 20 in^2 given in Code Case N-513-2, paragraph 3(e). Therefore, the acceptance criteria of the Code Case are met.

GL 90-05

Guideline 90-05 is used as the basis for the evaluation in Attachment C. Based on a conservatively characterized flaw length of 3", the evaluation shows that the flaw satisfies the criteria for temporary non-Code repair.

The affect of the additional mass represented by the modification proposed by Temporary Modification TM 1-10-023 on the pipe stress model and pipe stresses must be addressed. The repair plan drawing indicates that the additional weight of the components being added is approximately 66 lbs. The weight of the 30" short radius elbow, including contained water is about 440 lbs. Therefore, the weight of the added pipe stub, flange and valve represents about 15% of the mass of the elbow. The elbow has a pipe support (H-30) located almost directly beneath it. Based on the small percentage of additional weight and the proximity of the adjacent support, the modification will not have significant affect on the piping stress.

Attachment A shows that the branch connection created by the temporary modification met the requirements of 104.3 of the B31.1 Code, since the thickness in the reinforcement area is greater than 2 x 0.179 or 0.36 inches.

Conclusion:

The piping has been evaluated to consider the flaw, as measured and reported by field personnel, and it has been determined to meet the Code Case requirements. Therefore, the pipe configuration and associated stresses meet the evaluation criteria of Code Case N-513-2. Augmented examination per this Section 5 of the Code Case is required. Based on a conservatively characterized flaw length of 3", the GL 90-05 evaluation shows that the flaw satisfies the criteria for temporary non-Code repair.

DESIGN ...DITIONS ..... psi ..... F .....

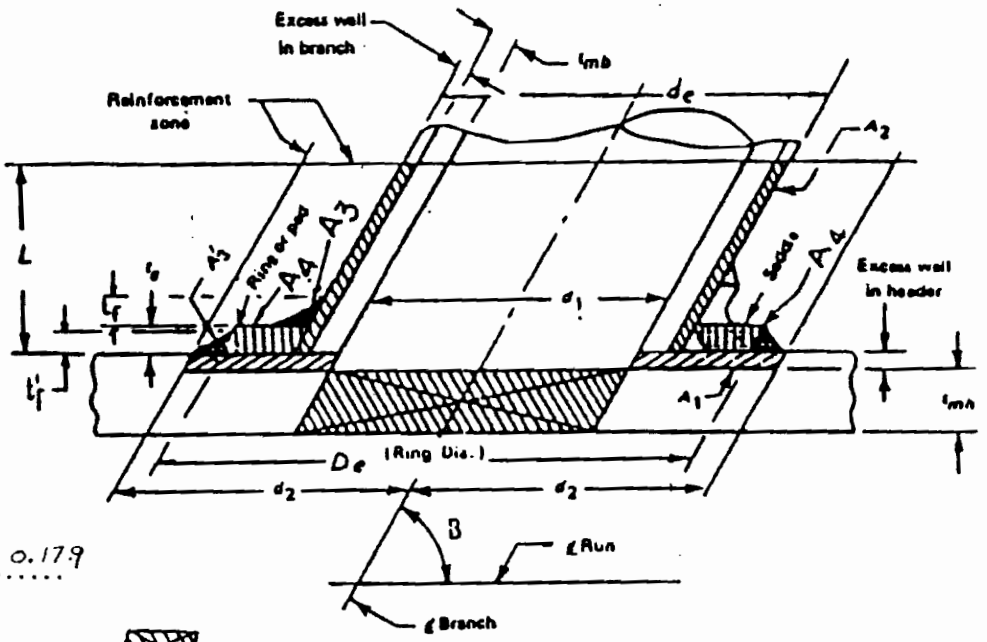
	HEADER		BRANCH	
NOMINAL SIZE				
OUTSIDE DIAMETER	D_h		D_b	
NOMINAL WALL				
ACTUAL OR MIN. WALL	T_h		T_b	
MATERIAL SPEC.				
ALLOWABLE STRESS	S_h		S_b	
JOINT EFFICIENCY	E_h		E_b	
Y FACTOR	Y_h		Y_b	
ADDITIONAL THICKNESS	A_h		A_b	
*INTERSECTION ANGLE	B			

* Angle to be 45° to 90° inclusive (see B31.1 Para. 104.3.1(A))

REQUIRED MINIMUM THICKNESS:

$$t_h = \frac{PD_{oh}}{2S_hE_h + 2Y_hP} + A_h = \frac{180 \times 30}{2x.15000x1.+2x.0.4..x.180} + \ldots = 0.179$$

$$t_b = \frac{PD_{ob}}{2S_bE_b + 2Y_bP} + A_b = \frac{\ldots X \ldots}{2x\ldots X..+2x\ldots X\ldots} + \ldots = \ldots$$



- Required reinforcement area
- Area A_1 - Excess wall in header
- Area A_2 - Excess wall in branch
- Area A_3 & A'_3 - fillet weld metal
- Area A_4 - metal in ring, pad or integral reinforcement

LIMITS OF REINFORCEMENT:

$$d_1 = \frac{D_{ob} - 2T_b}{\sin B} = \frac{\ldots\ldots - 2 \times \ldots\ldots}{\ldots\ldots\ldots} = \ldots\ldots$$

$d_2 = d_1$ or $= T_b + T_h + 0.5\,d_1 = \ldots\ldots + \ldots\ldots + 0.5x\ldots\ldots = \ldots\ldots$

Select larger of the values, but not to exceed D_h $\quad d_2 = \ldots\ldots$

$L = 2.5\,T_b + t_e = 2.5x\ldots\ldots + \ldots\ldots = \ldots\ldots$ or $2.5\,T_h$ — SELECT SMALLER OF THE VALUES

REQUIRED AND AVAILABLE REINFORCEMENT AREA:

Area = $t_{mh}\,d_1\,(2 - \sin B) = \ldots\ldots X \ldots\ldots X (2 - \ldots\ldots) = \ldots\ldots$ SQ. IN. REQUIRED

$A_1 = (2d_2 - d_1)(T_h - t_{mh}) = (2x\ldots\ldots - \ldots\ldots)(\ldots\ldots - \ldots\ldots) = \ldots\ldots$

$$A_2 = \frac{2L(T_b - t_{mb})}{\sin B} = \frac{2x\ldots\ldots(\ldots\ldots - \ldots\ldots)}{\ldots\ldots\ldots} = \ldots\ldots$$

$A_3 = (t_f)^2 = (\ldots\ldots)^2 = \ldots\ldots$

$A_1 + A_2 + A_3 = \ldots\ldots + \ldots\ldots + \ldots\ldots = \ldots\ldots$ sq. in. available. Additional Required. Yes ☐ No ☐

ADDITIONAL REINFORCEMENT:

$A'_3 = (t'_f)^2 = (\ldots\ldots)^2 = \ldots\ldots$

$d_e = \frac{D_b}{\sin B} = \frac{\ldots\ldots}{\ldots\ldots} = \ldots\ldots$

$A_4 = (D_e - d_e)\,t_e = (\ldots\ldots - \ldots\ldots) \times \ldots\ldots = \ldots\ldots$

$(A_1 + A_2 + A_3) + A'_3 + A_4 =$

$= \ldots\ldots + \ldots\ldots + \ldots\ldots = \ldots\ldots$

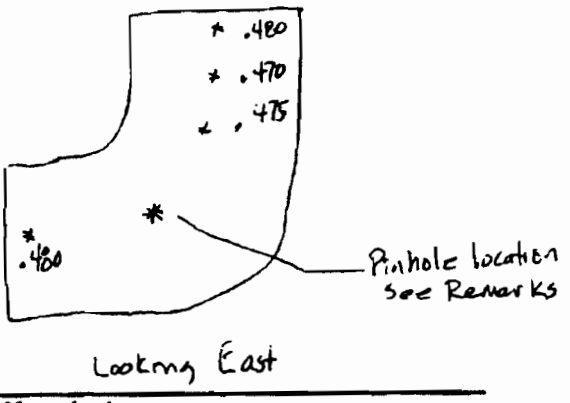
Additional reinforcement adequate: Yes ☐ No ☐

CALC
SMSH-10-007
ATTACHMENT A
SHEET 1 OF 1

CALC. BY _____ DATE _____	ORDER # _____ FOR _____ LOCATION _____ SYSTEM _____
CH. BY _____ DATE _____	Nozzle Reinforcement Worksheet W S1-B ASME B 31.1 Revised 1995
APP. BY _____ DATE _____	

Ultrasonic Thickness Report — **Southern Nuclear Operating Company**

Plant / Unit: Hatch / One		**Date:** 7/7/10	**Sheet Number:** N/A
Component: 1P41-F1437B	**ISO / Drawing No.:**		
System 1P41			
Examination Area and Location: 30" Dilution Line			
Description of Item Examined: OD of 90° Elbow West side at thru wall pinhole			
Material Type: ☒ C/S ☐ S/S Other: ____			
Calibration Standard Serial Number: QC112		**Instrument Manufacturer:** Panametric	
		Model Number: 36DL	**Serial Number:** QC212
Sound Path Screen Distance: 1.00"		**Transducer Manufacturer:** Panametric	**Type:** Dual / **Size:** .250
Smallest Screen Division: N/A		**Serial Number** 20024	**Frequency:** MHz 7.5
Procedure: NMP-MA-025-511 Ver 1.0		☐ A-Scan	☐ Metered (Digital)
Remarks:		☒ Spot	☐ Continuous
		Couplant: Sonotech	
		Cable Type / Length: 4'	
		EXAMINATION RESULTS Thru wall Localized leak	
Examiner: Dan Pittman	**Level:** II L	**Examiner:**	**Level:**
Reviewed By:		**Level**	**Date:**



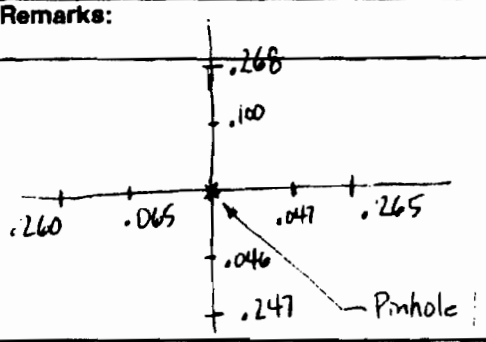
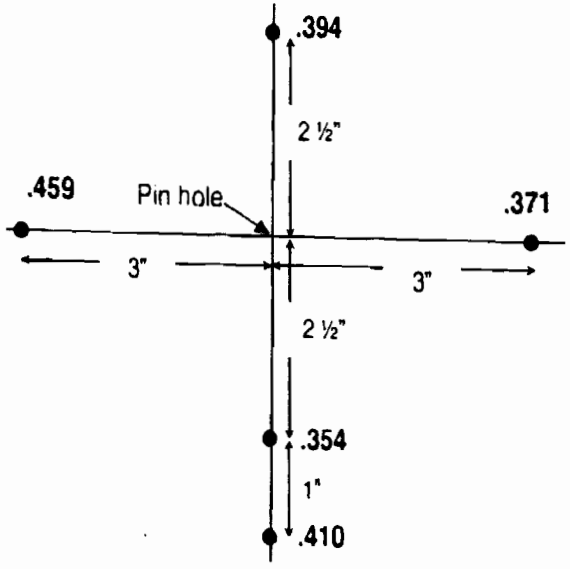


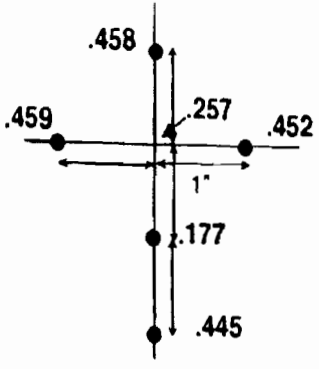
Figure 1 – Ultrasonic Thickness Report

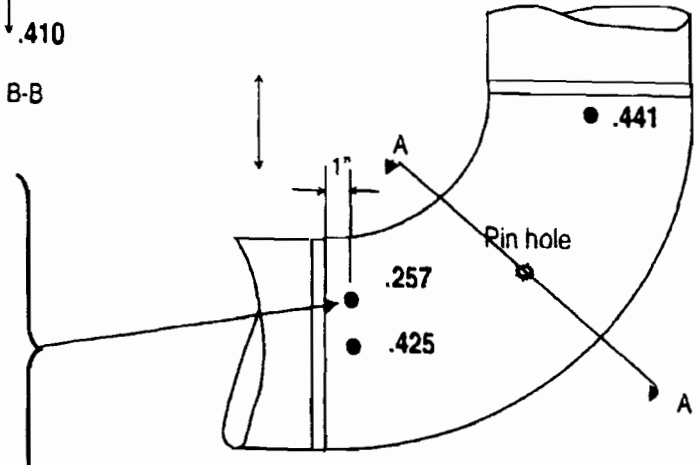
CALC SMSH-10-007
ATTACHMENT B
SHEET 1 OF 2

CALC SMSH-10-007
ATTACHMENT B
SHEET 2 of 2



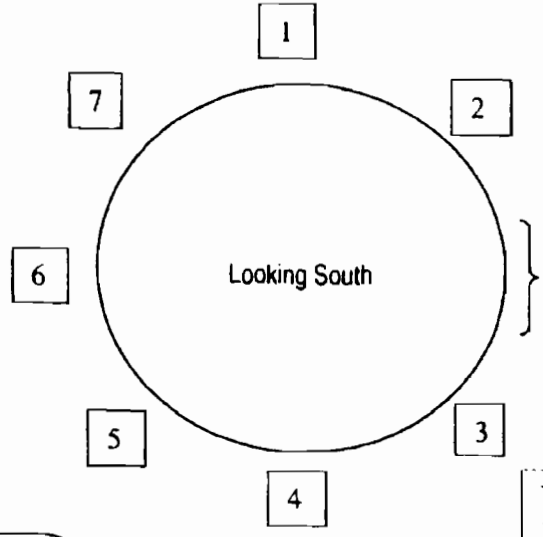
Section B-B





Elbow Looking East

Section A-A



Thickness		
1	=	.449
2	=	.433
3	=	.380
4	=	.357
5	=	.416
6	=	.469
7	=	.406

Hatch / Unit One
1P41F1437B

Thickness measurements for thru wall leakage

Calculation SMSH-10-007, Attachment C

Flaw Evaluation per Guideline GL 90-05.

First, we must determine the stress (s) at this section of piping, as defined in GL 90-05, section 2(a). The stress at this node point is conservatively taken to be 14.5 ksi, as discussed in the Assumptions section. The equation 12 combination that produces this value is given by:

$$\frac{(P \times D)}{4 \times t_{nom}} + 0.7 \times i \times \frac{M}{Z}$$

The pipe design pressure is $P := 180 \times psi$

Pipe wall nominal thickness: $t_{nom} := 0.375 \times in$

Pipe Bend Radius: $R := 30 \times in$

One Half Pipe Diameter: $r := 15 \times in$

For a short radius elbow the stress intensification factor (i) is given by:

$$i := 0.9 \times h^{-.667}$$

where h is given by $h := \frac{t_{nom} \times R}{r^2}$ $h = 0.05$

plugging this into the equation for the SIF gives

$$i := 0.9 \times h^{-.667}$$

$i = 6.638$

Plugging in the SIF, design pressure, and nominal wall thickness values produces the following:

$$\frac{(180 \times 30)}{4 \times 0.375} + 0.75 \times i \times \frac{M}{Z} \quad \text{or} \quad 3.6 \times ksi + 5\frac{M}{Z}$$

Setting this equation equal to the worst case computed stress (14.5 ksi) for the entire piping model and solving for M/Z gives:

$$\frac{M}{Z} = 12.18 \times ksi$$

The computed stress "s" at the flaw location does not include SIF terms and is given by:

$s := 3.6 \times ksi + 2.18 \times ksi$

$s = 5.78\ ksi$

This is the stress term discussed in GL 90-05, section 2(a).

This stress (s) is considered as a longitudinal stress. The circumferential stress is given by the hoop stress and may be determined as follows.

$P_{oper} := 140 \times psi$ Pipe Operating Pressure

$D_o := 30 \times in$ Pipe Outside Diameter

$$s_{circum} := \frac{P_{oper} \times D_o}{2t_{nom}} \qquad s_{circum} = 5.6 \times 10^3\ psi$$

Therefore, the longitudinal stress controls and the stress will be conservatively taken to b equal to 6,000 psi.

Generic Letter 90-05 calculations based on the "Through-Wall" Approach

Determine the minimum code-required wall thickness

$P := 140psi$ Design Pressure

$S := 15ksi$ Allowable stress A106B/A155GrC55

$D := 30in$ $tnom := .375in$

$$tm := \frac{P \times D}{2 \times (S + .4 \times P)}$$

$tm = 0.139 \times in$

Determine the flaw length "2a"

The leak in the pipe side wall is surrounded by wall thickness that is below the minimum determined above. Ultrasonic testing (UT) of the area surrounding the leak has shown tha the leak is surrounded by a depression in the wall thickness with thickness at a minimum adjacent to the leak and increasing approximately radially from the location of the leak. It is apparent from the UT data that the average wall thickness away from the leak is on the order of 0.4 inches thick, which is as expected to bound the nominal thickness of 0.375.

The flaw length may conservatively be taken as the projected length of a straight line draw through the leak that runs along portions of the pipe where thickness falls below the minimum. In other words, it is the diameter of a circle that may be drawn around the leak which encompasses all of the pipe wall locations that fall below the minimum thickness. The guideline states that the maximum length cannot exceed 3 inches. Based on the UT results, a 3" length through the leak will bring the thickness up to about 0.26, which is thicker than tmin. Therefore, the flaw length "2a" will be considered to be 3" and the minimum thickness beyond the projected flaw length will conservatively be taken to be 0.26". This is conservative, because the actual thickness has been determined to increase to about 0.4" in most areas.

$t_p := 0.26 \times in$

$a := 1.5in$ $Stress := 6ksi$

$$R := \frac{D - tnom}{2} \qquad r := \frac{R}{t_p}$$

$$A := -3.26543 + 1.52784 \times r - .072698 \times r^2 + .0016011 \times r^3$$

$$B := 11.36322 - 3.91412 \times r + .18619 \times r^2 - .004099 \times r^3$$

$$C := -3.18609 + 3.84763 \times r - .18304 \times r^2 + .00403 \times r^3$$

$$c := \frac{a}{\pi \times R}$$

$$F := 1 + A \times c^{1.5} + B \times c^{2.5} + C \times c^{3.5}$$

$$K := 1.4 \times Stress \times F \times (\pi \times a)^{.5}$$

$$K = 32.216 \times ksi \times in^{0.5}$$

$$K_{limit} := 35ksi \times in^{0.5}$$

Since the computed K value is less than that required for ferritic steel (35 ksi), as required GL 90-05, the flaw satisfies the criteria for temporary non-Code repair.