January 31, 1995

10 CFR Part 50
Section 50.55a

U S Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Docket Nos. 50-282   License Nos. DPR-42
50-306   DPR-60

Steam Generator Weld Indication Evaluations

By letter dated December 30, 1994, we submitted for your review the results of analytical evaluations of flaws detected in #11 and #12 steam generators. These flaws were detected during inspections in accordance with ASME Boiler and Pressure Vessel Code Section XI. The evaluation results were submitted several months after the evaluations had been performed because we had just recently become aware of the Code requirement for submittal of the evaluations. In that submittal, we stated that we would complete a review of other inspections by January 31, 1995; if we determined that other evaluations would have required submittal, we would submit those at that time.

We have completed our review and determined that there are two additional flaws (one on steam generator #12 and the other on steam generator #22) that needed evaluation and need to be submitted. These evaluations are attached to this letter.

In addition, since the December 30, 1994 submittal, discussion with the NRR Project Manager for Prairie Island prompts us to submit two Westinghouse reports which are referenced by the flaw evaluation summaries. These attachments are handbooks on flaw evaluations for Prairie Island steam generators and pressurizers.

Please contact Jack Leveille (612-388-1121, Ext. 4662) if you have any questions related to this letter.

Roger O Anderson
Director
Licensing and Management Issues

c: (see next page)

c: Regional Administrator - Region III, NRC
   Senior Resident Inspector, NRC
   NRR Project Manager, NRC
   J E Silberg (w/o the WCAPs)

Attachments:

1. #12 Steam Generator Flaw Evaluation for ISI Report 94-0128, Prairie
   Island Unit 1, January 31, 1995 (19 pages)
2. #22 Steam Generator Flaw Evaluation for ISI Report 89-364, Prairie
   Island Unit 2, January 31, 1995 (24 pages)
3. Westinghouse WCAP 13032, Handbook on Flaw Evaluation, Prairie Island
   Units 1 and 2 Steam Generators, Upper Shell to Dome Weld Region,
   July 1991
4. Westinghouse WCAP-14166, Handbook on Flaw Evaluation for Prairie Island
   Units 1 and 2 Steam Generators and Pressurizer, January 1995

#12 Steam Generator Flaw Evaluation for ISI Report 94-0128

Prairie Island Unit 1

January 31, 1995

ISI Flaw Disposition Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number	14. Total Number of Pages
- 0128 SY4-0270 (FF)	1	0140	2

4. ISI Interval ☒ OK Reviewer _____
☐ second interval   ☒ third interval   ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer _____
☐ 80 W81   ☐ 8i no addenda   ☒ 89 no addenda   ☐ other

6. Acceptance Standard ☒ OK Reviewer _____
N/A

☐ IWB-3510	☒ IWB-3511	☐ IWB-3512	☐ IWB-3514	☐ IWB-3515	☐ IWB-3516	☐ IWB-3518
☐ IWB-3522	☐ IWB-3523					
☐ IWC-3510	☐ IWC-3511	☐ IWC-3512	☐ IWC-3513	☐ IWC-3514	☐ IWC-3515	

7. Calculations ☒ OK Reviewer _____

From Attached ISI Flaw Sizing Worksheet: $\ell = 1.125''$, $g = 0.185''$

$t_{nom} = 3.68''$, $S = 0.75''$

Refer to Attachment 1: Flaw Evaluation chart

Verify $\dfrac{2g}{t} \leq 0.25$

$\dfrac{2g}{t} = \dfrac{2 \cdot 0.185}{3.68}$

$= 0.1005$

Rounded to 0.10

$0.10 \leq 0.25$ TRUE

$\delta = S + g$
$= 0.75 + 0.185$
$= 0.9350$

$\dfrac{\delta}{t} = \dfrac{0.9350}{3.68}$
$= 0.2541$

Rounded to 0.25

$\dfrac{g}{t} = \dfrac{0.185}{3.68}$
$= 0.0503$

Rounded to 0.05

Plot $\dfrac{g}{t} = 0.05$ versus $\dfrac{\delta}{t} = 0.25$ (see attached).

Since $\dfrac{g}{t}$ vs $\dfrac{\delta}{t}$ is within Acceptable Range

__FLAW is Acceptable.__

8. Results ☒ OK Reviewer _____

a/t = _NA_

calculated a/t % = _5.0 %_

Code allowable a/t % = _NA_

laminar flaw surface area: (0.75 • l • w) = _NA_

9. Table used for analysis ☒ OK Reviewer _____
N/A

☐ IWB-3510-1	☒ IWB-3510-2	☐ IWB-3510-3	☐ IWB-3511-1	☐ IWB-3511-2	☐ IWB-3512-1
☐ IWB-3512-2	☒ IWB-3514-1	☐ IWB-3514-2	☐ IWB-3514-3	☐ IWB-3514-4	☐ IWB-3514-6
☐ IWB-3515-1	☐ IWB-3516-1	☐ IWB-3516-2	☐ IWB-3518-1	☐ IWB-3518-2	
☐ IWC-3510-1	☐ IWC-3510-2	☐ IWC-3510-3	☐ IWC-3511-1	☐ IWC-3511-2	☐ IWC-3512-2
☐ IWC-3513-1					

10. Was linear interpolation used? ☐ yes ☒ no If no, why? _Not necessary_

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer _____ If no, why?

12. The correct Code Edition and Addenda was available and used. ☐ yes Preparer _____ ☒ OK Reviewer _____ NA table

13. Statement of acceptability or rejectability with basis ☒ OK Reviewer _____

☒ Accept.   ☐ (a/t)Code allowable ≥ (a/t)calculated

☐ Reject.   ☐ (a/t)Code allowable < (a/t)calculated

☒ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date	16. Engineering review by and date	17. Approved by and date
Kevin Moe 1.5.95 Kevin W. Moe The results are correct and the methodology used it is in accordance with applicable codes, standards, specifications and procedures.	JAN 17 95 This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.	Rick 1/19/95 This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.

IVI Flaw Disposition
Rpt # 94-0218 (PI-1)
      -0128
Flaw #1   PI-2
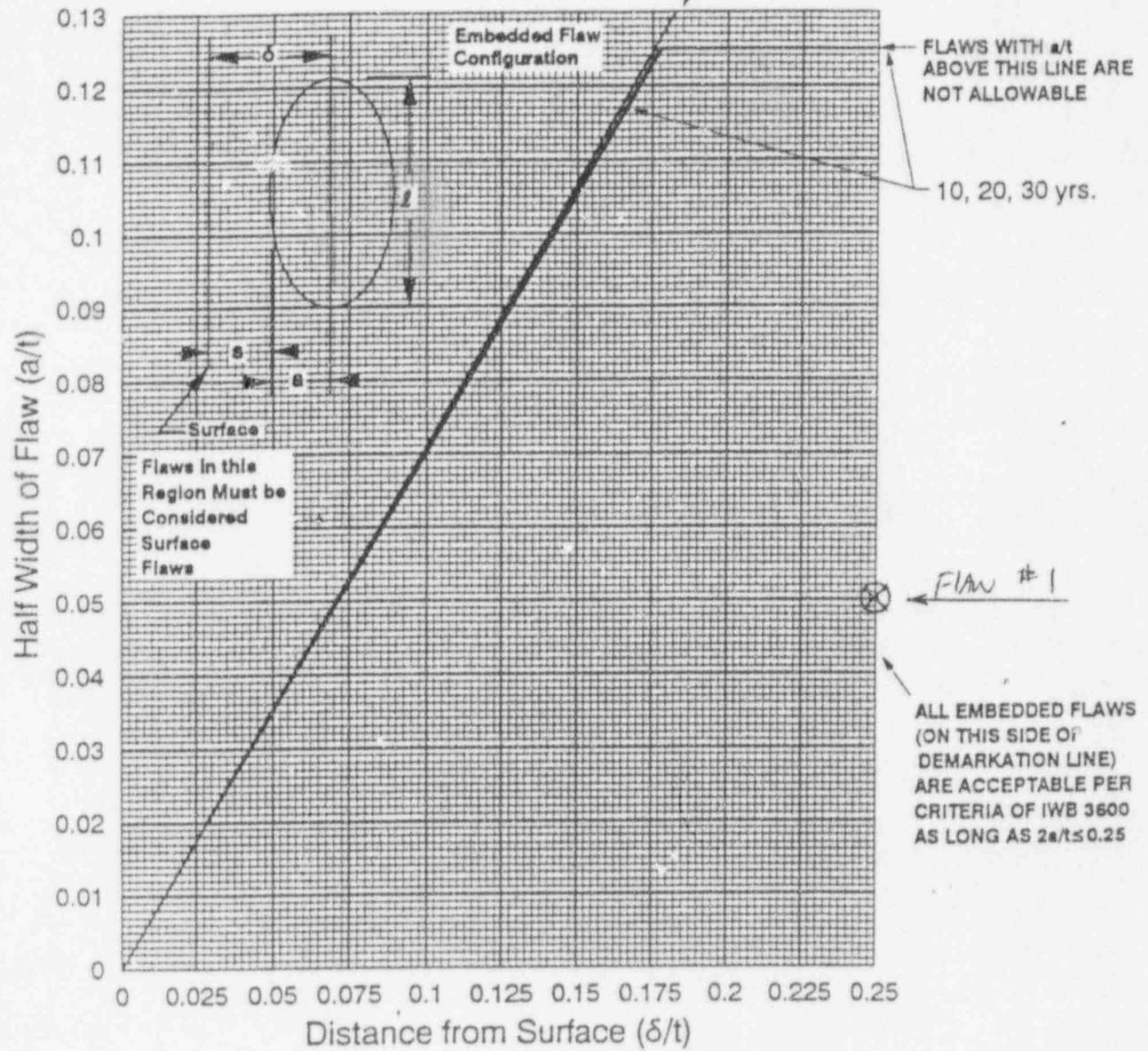   1.2675
Attachment 1 page 10f1

Figure A-6.4   Flaw Evaluation Chart for the Upper Shell-Cone Weld for
                Prairie Island Units 1 and 2

| X | Inside Surface | __ | Surface Flaw | __ | Longitudinal Flaw |
| X | Outside Surface | X | Embedded Flaw | X | Circumferential Flaw |

ISI Flaw Disposition Worksheet

1. ISI Report Number -0128	2. Flaw Number	3. Item Number	15. Total Number of Pages
PI 1 94-0218	1	C1,10	1

4. ISI Interval ☑ OK Reviewer _____
☐ second interval   ☒ third interval   ☐ preservice

5. Code Edition and Addenda ☑ OK Reviewer _____
☐ 80 W81   ☐ 86 no addenda   ☒ 89 no addenda   ☐ other _____

6. Acceptance Standard ☐ OK Reviewer _____
☐ IWB-3510   ☐ IWB-3511   ☐ IWB-3512   ☐ IWB-3514   ☐ IWB-3515   ☐ IWB-3516   ☐ IWB-3518
☐ IWB-3522   ☐ IWB-3523
☒ IWC-3510   ☐ IWC-3511   ☐ IWC-3512   ☐ IWC-3513   ☐ IWC-3514   ☐ IWC-3515

7. Calculations ☑ OK Reviewer _____

From Attached ISI Flaw Sizing worksheet : $\ell = 1.125"$, $a = 0.185"$, $t_{nom} = 3.68"$
$S = 0.75"$, Flaw Type = Subsurface flaw

$\dfrac{a}{\ell} = \dfrac{0.185}{1.125} = 0.1644$ Round to 0.16   SA-533 Gr. A Cl 1 = 50 Ksi Yield

$\dfrac{a}{t}\% = \dfrac{0.185}{3.68} \cdot 100 = 5.027$ Round to 5.0% $Y = S/a = \dfrac{0.75}{0.185} = 4.05 > 1.0$ Let $Y = 1.0$

Linear Interpolation: Round to

From Table IWC-3510-1 for Subsurface
a/t % Code Allowable

a/ℓ	$t = 2.5"$	$t = 3.68"$	$t \geq 4.0"$
0.15	4.9		2.9
0.16	5.1	3.4	3.0
0.20	5.7		3.3

$\dfrac{a/t\%}{t=2.5, \, a/\ell=0.16} = 4.9 + \dfrac{0.16-0.15}{0.20-0.15}(5.7-4.9) = 5.06 \rightarrow 5.1\%$

$\dfrac{a/t\%}{t=4.0, \, a/\ell=0.16} = 2.9 + \dfrac{0.16-0.15}{0.20-0.15}(3.3-2.9) = 2.98 \rightarrow 3.0$

$\dfrac{a/t\%}{t=3.68, \, a/\ell=0.16} = 5.1 + \dfrac{3.68-2.5}{4.0-2.5}(3.0-5.1) = 3.44 \rightarrow 3.4$

Since a/t calculated of 5.0% is greater than a/t code allowable = 3.4% for t=3.68, a/\ell =0.16
This indication is Rejectable using this method.

8. Results ☑ OK Reviewer _____

a/t = _0.16_

calculated a/t % = _5.0 %_

Code allowable a/t % = _3.4 %_

laminar flaw surface area: $(0.75 \cdot \ell \cdot w)$ = _NA_

9. Table used for analysis ☑ OK Reviewer _____
☐ IWB-3510-1   ☐ IWB-3510-2   ☐ IWB-3510-3   ☐ IWB-3511-1   ☐ IWB-3511-2   ☐ IWB-3512-1
☐ IWB-3512-2   ☐ IWB-3514-1   ☐ IWB-3514-2   ☐ IWB-3514-3   ☐ IWB-3514-4   ☐ IWB-3514-6
☐ IWB-3515-1   ☐ IWB-3516-1   ☐ IWB-3516-2   ☐ IWB-3518-1   ☐ IWB-3518-2
☒ IWC-3510-1   ☐ IWC-3510-2   ☐ IWC-3510-3   ☐ IWC-3511-1   ☐ IWC-3511-2   ☐ IWC-3512-2
☐ IWC-3513-1

10. Was linear interpolation used? ☒ yes ☐ no If no, why?

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☑ OK Reviewer _____ If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer _____ ☑ OK Reviewer _____

13. Statement of acceptability or rejectability with basis ☑ OK Reviewer _____

☐ *Accept.*   ☐ (a/t)Code allowable $\geq$ (a/t)calculated
☒ **Reject.**   ☒ (a/t)Code allowable $<$ (a/t)calculated
              ☐ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date	16. Engineering review by and date	17. Approved by and date
_____ 1.26.95	Jan 26 95	_____ 1/26/95

The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.
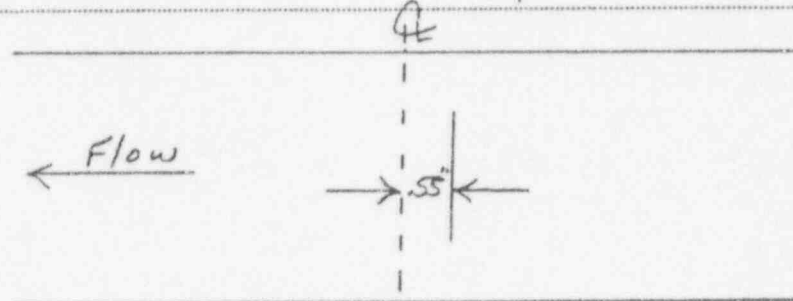
ISI Flaw Sizing Worksheet

1. ISI Report Number 94-0128	2. Flaw Number 1	3. Item Number C1.10

4. ISI Interval ☒ OK Reviewer _WT_
☐ 2nd interval ☒ 3rd interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer _WT_
☐ 80 W81 ☐ 86 no addenda ☒ 89 no addenda ☐ other _____

6. Method ☒ UT ☐ RT
☐ PT ☐ MT

7. Flaw Sketch ☒ OK Reviewer _WT_

Front View

0 ← 33' 8" →

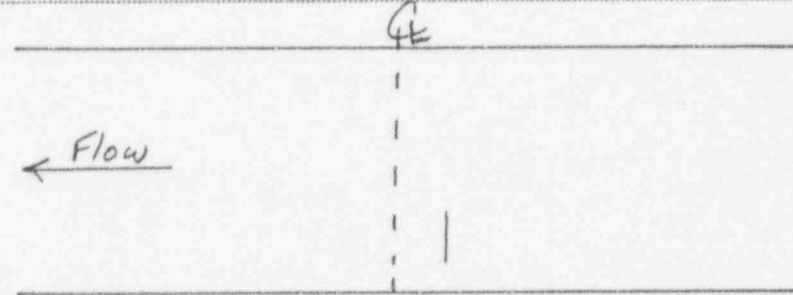← 1.125" →

0.37"

0.75"

3.68"

Top View

₡

← Flow

.55"

Side View

₡
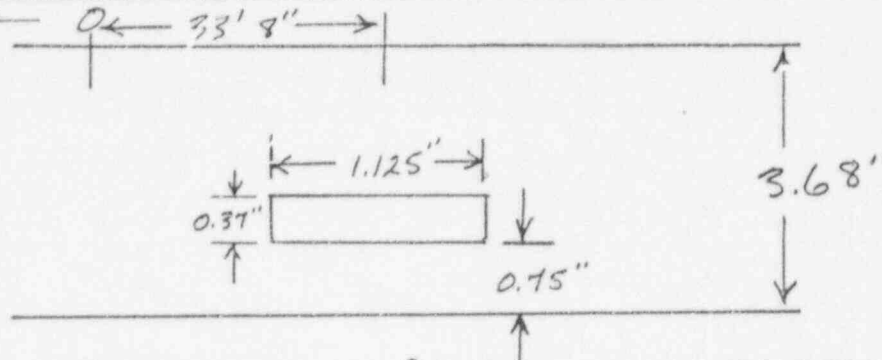
← Flow

8. Calculations ☒ OK Reviewer _WT_

Show determination of surface or subsurface

see attached

Show determination of type of "a" to use

see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used. ☒ yes Preparer _TMJ_ ☒ OK Reviewer _WT_

10. Code Flaw Dimensions ☒ OK Reviewer _WT_

"ℓ" = 1.125" "a" = 0.185" "$t_{nominal}$" = 3.68" "$t_{measured}$" = N/A "S" = 0.75" "W" = N/A

11. Flaw Type ☒ OK Reviewer _WT_
☐ Surface Planar (UT/RT) ☒ Subsurface Planar (UT/RT) ☐ Laminar (UT/RT) ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☒ OK Reviewer _WT_

☐ IWA-3310-1	☐ IWA-3330-1	☐ IWA-3350-1	☐ IWA-3380-1	☐ IWA-3400-1
☒ IWA-3320-1	☐ IWA-3340-1	☐ IWA-3360-1	☐ IWA-3390-1	

13. Flaw Characterization Figure Number

☒ Flaw 1	☐ Flaw 2	☐ Flaw 3	☐ Flaw 4	☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ yes Preparer _TMJ_ ☒ OK Reviewer _WT_

16. Prepared by and date	17. Review by and date
Tom Jones 11/22/94	_W. Thomas_ 12/12/94
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.	This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

pg 1 of 3

Flaw Sizing Calculations for ISI RPT # 94-0128

For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface

ASME SECT XI 1989 W/ NO ADDENDA _TMJ_ INITIAL TO VERIFY

ISI Report # _94-0128_   Evaluation Performed By: _Tom Budd_   Date: _11/22/94_

Indication # _1_   Reviewed By: _____ Date: _12/2/94_

                                        WL THOMAS

Length

Length of the flaw "L" is determined by finding the difference between L1 and L2.

L1 and L2 are from page _4_ of the UT report.

l= _404.375"_ (L2) - _403.25'_ (L1) = _1.125_ inches.

    33' 8.375"   33' 7.25"

Thickness

Thickness of the component from nominal wall value.

This value is from page _1_ of the UT report.

"t"= _3.68_ inches

Calibration

From the calibration report (_WLT-011_), the calibration was performed on a "T" = _3.50_ inch thick block.

Calculations

From page _4_ of the UT report the flaw exhibited 50% Peak Amplitude (indication did not reach 50% DAC) at _5.551_ and _5.94_ inches of metal path at _5.00_ and _5.75_ inches from the weld center. line respectively. A manual plot was made with this information which provided depths for these points as _0.75_ and _1.12_ inches from the inner surface.

1)   Determine S in inches.

      S = _0.75_ inches (as measured for 50% point closest to surface).

2)   Determine 2a in inches.

      2a = _1.12_ (inches depth at upper 50% pt.) - _0.75_ (inches depth at lower 50% pt.) =

      _0.37_ inches.

Determination of surface or subsurface ("a" and "d" are equivalent)

0.4a = (2a / 2) * 0.4 = _0.074_

Compare to S (from step 1).

If S is less than 0.4d, the flaw is **surface**. a = 2d + S = _N/A_ inches.

If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = _0.185_ inches.

----

l = _1.125_ (for a/t > 0.5, l = 2a)   t = _3.68_ (part "T")

a = _0.185_ (surf or (sub surf) circle one)   S = _0.75_

NOTE: These values were derived without applying beam width correction.

PI 1 Indication Review

Rpt # - 94-0128

Item # - W-F

New Iso # - ISI-43A

Method - UT 60°

Code - ASME Sect XI '89 with No Addenda

Iso # - ISI-43A

Indication # - 1

New Item # - W-F

Procedure - NSP-UT-3 Rev 5

Discussion -
This indication is being re-evaluated in response to Audit No. 94-19-OUT, Finding 94-28 on Inappropriate Flaw Analysis for ISI. This action is taken to ensure correctness of the original disposition of this indication and to provide additional OJT for the M&SP personnel in performing flaw evaluations.

The indication was reported as a linear with a length of 1 1/8" and an amplitude of 30% DAC. This weld had been previously examined and reported on report #91-0164. There were no indications noted as a result of that examination. The requirements for recording of indications have become more stringent in the edition of the code required for the third interval. Due to the transition from the cone to the shell on this weld it was decided to use a beam plot to determine the dimensions of the indication for evaluation.

Assumptions -
The evaluation that is provided does not take into account the effect of beam spread on sizing of indications. If this were factored into the calculations it would reduce the through wall dimension and also increase the "S" distance. Our approach is more conservative.

Code Requirements -
ASME Sect XI IWA-2232 refers to Appendix 1 which refers to Sect V Art 4 with supplements. Supplement 10 deals with reporting criteria and requires that "Angle beam reflectors that produce a response greater than 20% of the reference level shall be investigated. The maximum amplitude, location, and extent of these reflectors shall be recorded. The operator shall determine whether the indication originates from a flaw or is a geometric indication in accordance with Supplement 11. When the reflector is determined to be a flaw, the acceptance standards of IWA-3000 apply".

Summary -
The indication noted on this report exhibited an amplitude in excess of 20% of the reference level and requires evaluation to the code acceptance standards.

Prepared By _____ Tom Jones Lv/III

Reviewed By _____
W.L. Thomas

1 of 1 pms

Northern States Power Company Operations & Maintenance Supt Materials & Special Processes	Prairie Island Unit 1 60° ULTRASONIC EXAMINATION REPORT (3rd 10yr)	Report# 94-0128 Source Doc=C 1. 10 S/N 1071

System STEAM GENERATOR #11	ISO ISI-43A	Item W-F	Item Description TRANSITION - SHELL

(handwritten left margin: 1d. 3/258)
(handwritten: SA-533 GRACLI / SA53GRACLI)

Material ~~SA-533GAC2~~ / ~~SA-533GAC2~~	Size/Length 175"ø	Thick/Dia 3.680	Temp 90°F	Surface Condition BLENDED

Procedure ISI-UT-3 Rev 5 Field Change N/A	W R Number 9402190	ISI Contractor LMT	Exam Date 05/18/94

Calibration Report Nmbr WLT-011	Beam Angle 60° (Nominal)	Temp Gauge S/N NSP-030	Exam Start @ 0941 hours Exam End @ 1200 hours

| Evaluation Level 20% DAC	Reporting Level 20% DAC	Cal Block 26 Ref Std LMT-107	Ref Sensitivity 58 dB Scan Sensitivity 70 dB

RESULTS NAD = No Apparent Discontinuities; L = Linear; S = Spot; M = Multiple
         GEO = Geometry   Visual = Non-Section XI Visual Examination

Scan Nmbr	Results	Indication Type	Sweep Loc'n	Metal Path	Surf Dist	Circ Location	Axial Location	Indication Length	Amp %DAC
1	IND	L	6.8	5.51	4.77	33' 8"	5.0	1-1/8"	30
2	NAD								
3	NAD								
4	NAD								

LIMITATIONS: 5"x8" WELDED PADS D.S. AT 5' 8", 17' 3", 18' 10" AND 14' 2"

REMARKS: E.J. PAVLIC, LEVEL I   *Indication reviewed and found acceptable.*
Refer to attach #1.   *(signed)* 6/3/94
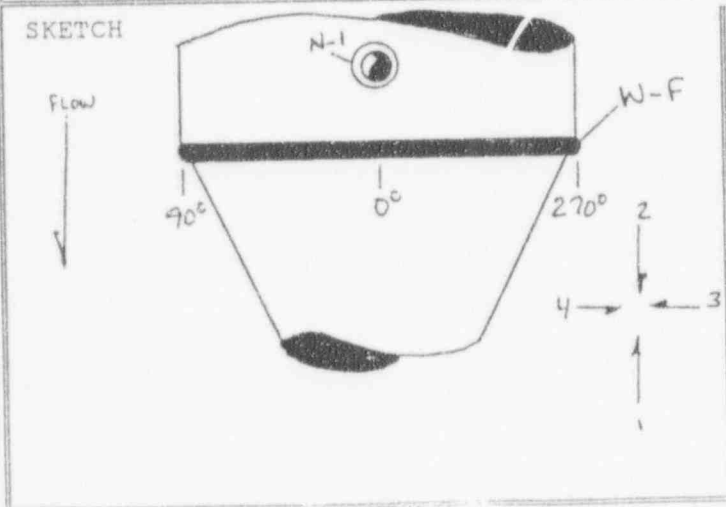
SKETCH

PERSONNEL

Examiner: W.L. THOMAS	II Level
Examiner: J.L. DWYERS	II Level

Contractor Review:	5/26/94 Date
NSP Review:	6/8/94 Date
ANII Review:	6/16/94 Date

Northern States Power Company Operations & Maintenance Supt Materials & Special Processes	Prairie Island Unit 1 60° ULTRASONIC EXAMINATION REPORT (3rd 10yr)	Report# 94-0128R1 Source Doc=C 1. 10 S/N 1071

System STEAM GENERATOR #11	ISO ISI-43A		Item W-F	Item Description TRANSITION - SHELL

Material SA-533GAC2 SA-533GAC2	Size/Length 175"ø	Thick/Dia 3.680	Temp N/A F	Surface Condition N/A

Procedure ISI-UT-3 Rev 5 Field Change N/A		W R Number 9402190	ISI Contractor LMT	Exam Date 06/08/94

Calibration Report Nmbr N/A	Beam Angle N/° (Nominal)	Temp Gauge S/N N/A	Exam Start @ N/A hours Exam End @ N/A hours

Evaluation Level N/A% DAC	Reporting Level N/A% DAC	Cal Block N/A Ref Std N/A	Ref Sensitivity N/A dB Scan Sensitivity N/A dB

RESULTS   NAD = No Apparent Discontinuities; L = Linear; S = Spot; M = Multiple
GEO = Geometry   Visual = Non-Section XI Visual Examination

Scan Nmbr	Results	Indication Type	Sweep Loc'n	Metal Path	Surf Dist	Circ Location	Axial Location	Indication Length	Amp %DAC
1	NAD								
2	NAD								
3	NAD								
4	NAD								

LIMITATIONS: NONE

REMARKS: SEE REMARKS ON ISI 3RD 10-YEAR REPORT #94-0128 FOR EVALUATION.

SKETCH

PERSONNEL

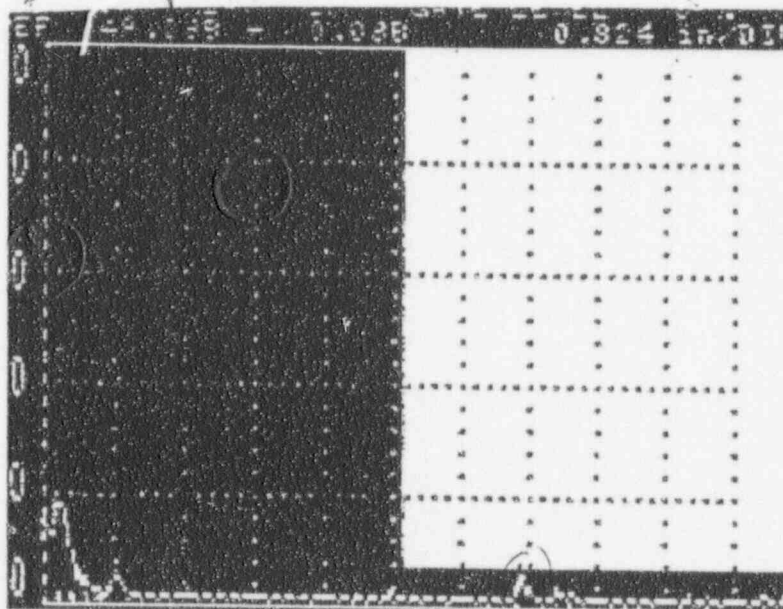Examiner: _____N/A_____ Level _____

Examiner: _____N/A_____ Level _____

Contractor Review: ___N/A,___ Date _/_/_

NSP Review: _____ Date 6 18 94

ANII Review: _____ Date 6 18 94

EXAMINATION PARAMETERS

INDICATION #1

INDICATION DATA TABULATION SHEET

NSP

Examination Report # ___94-0128___

IND #	SCAN #	% OF DAC	W MAX		FORWARD 50% DAC		BACKWARD 50% DAC		L1 50% DAC	L MAX	L2 50% DAC	REMARKS
			W	MP	W1	MP	W2	MP				
1	1	30%	5.25	5.601	5.00	5.551	6.75	5.94	33'7.25"	33'8"	33'8.375"	LINEAR

SCALED PLOT

SEE ATTACHED

Examiner ___W.L. THOMAS___   Date ___II___

Examiner _____   Date _____

SCALED PLOT

~70°

①
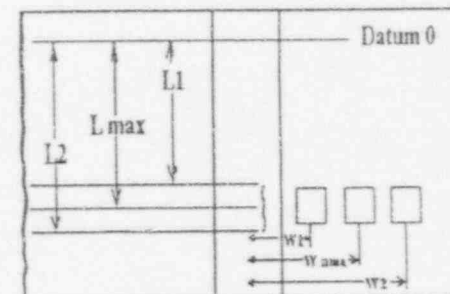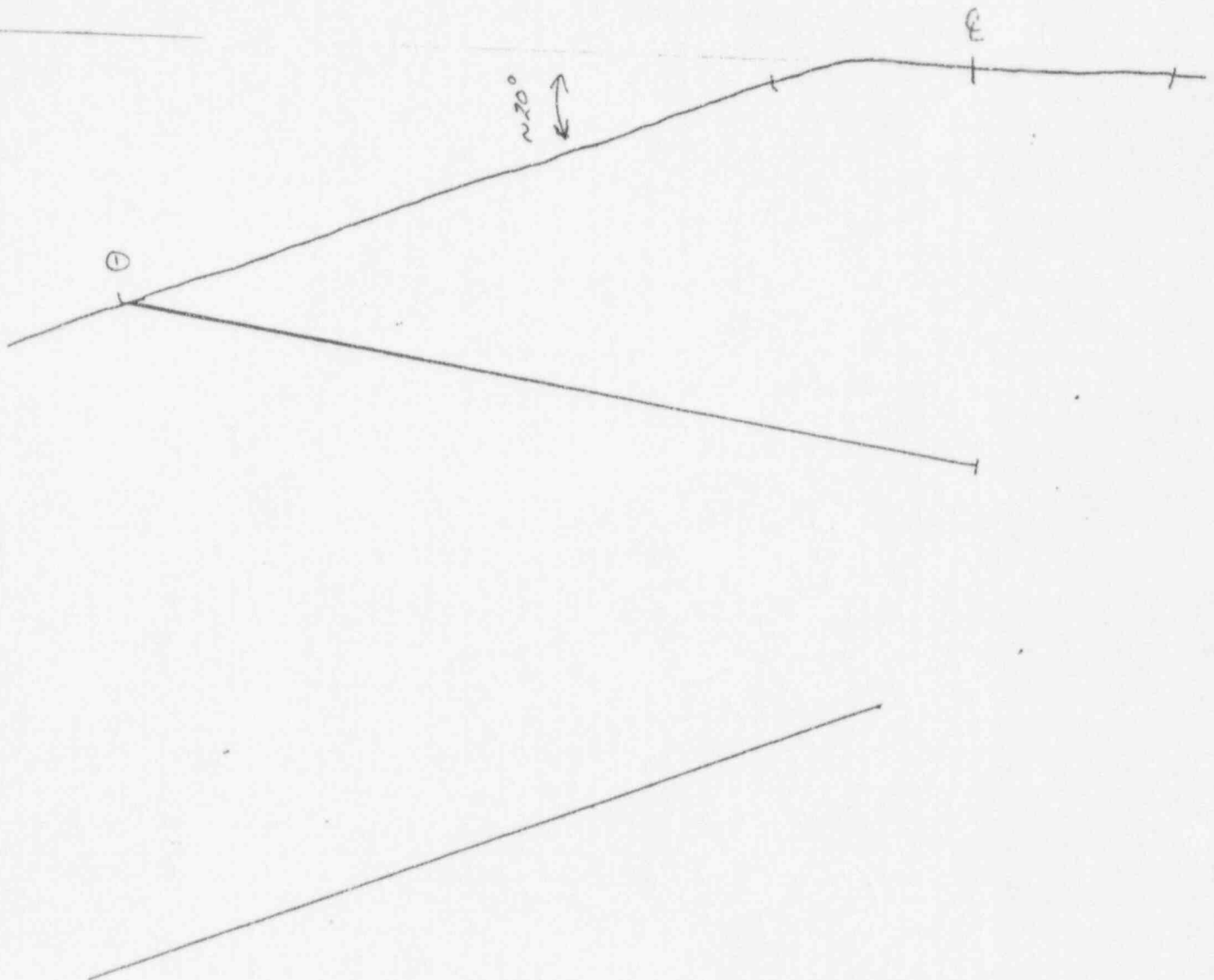
RPT #   94-0128
IND #   1   REV 1 6/28/94

PLANAR FLAWS   a/l (ASPECT) RATIO

FOR ALL FLAWS

l =   1.13 = LENGTH OF THE FLAW AS DETERMINED BY FINDING
            _____ THE DIFFERENCE BETWEEN L1 AND L2 (50% PTS FOR LENGTH)

FOR SURFACE PENETRATING FLAWS

a =   0.00 = DISTANCE BETWEEN THE ID/OD SURFACE OF THE COMPONENT AND
            _____ THE POINT OF MAX THROUGH-WALL PROPAGATION OF THE FLAW

a/l =   0.00 = THIS IS THE ASPECT RATIO FOR A SURFACE PENETRATING FLAW

FOR NON-SURFACE PENETRATING FLAWS

S =   0.90 = SEPARATION DISTANCE BETWEEN THE ID/OD SURFACE AND
            _____ THE CLOSEST APPROACH OF THE FLAW

2d =   0.21 = THROUGH WALL DIMENSION OF A NON-SURFACE
            _____ PENETRATING FLAW

DETERMINATION OF SURFACE vs SUBSURFACE

PRODUCT   0.04 = DIVIDE 2d BY 2 AND THEN MULTIPLY QUOTIENT BY 0.4

a =   N/A   = IF "S" IS LESS THAN PRODUCT ABOVE THEN FLAW IS SURFACE
            _____ - ADD 2d TO S

a =   = IF "S" IS GREATER THAN PRODUCT ABOVE THEN FLAW IS
            _____ SUB-SURFACE - (2a = 2d)   DIVIDE 2a BY 2

a/l =   0.09 = THIS IS THE ASPECT RATIO FOR A SUB-SURFACE FLAW

a/t RATIO

THE ASPECT RATIO IS APPLIED TO THE APPROPRIATE SECT XI TABLE AND THE
ALLOWABLE a/t PERCENTAGE IS DETERMINED FOR THE SUBJECT FLAW

t =   3.68 = NOMINAL (OR ACTUAL) THICKNESS OF THE COMPONENT
            _____

a =   0.10 = EFFECTIVE THROUGH-WALL DIMENSION AS DETERMINED
            _____ FOR THE TYPE OF FLAW ABOVE

a/t% =   2.72 = DIVIDE EFFECTIVE THROUGH-WALL DIMENSION (a) BY THE
                    NOMINAL (OR ACTUAL) THICKNESS OF THE COMPONENT

2.815   a/t% ALLOWED BY USE OF LINEAR INTERPOLATION

Northern States Power Company Operations & Maintenance Support Materials & Special Processes	Ultrasonic Calibration Report	Calibration Number WLT-011 Date: 05/18/94

Procedure ISI-UT-3　　Rev 5　　Field Change N/A	ISI Contractor LMT	Initial Cal @ 0801 hrs Check @ 0941 hrs
Calibration Block Serial Number 26 　Material: C/S Temperature 65°F	Type BASIC Size 6"　Thickness 3.50 Entry Surface N/A	Check @ N/A　hrs Check @ N/A　hrs Check @ N/A　hrs Final Check @ 1630 hrs

Reference Block Serial Number LMT-107　　Type ROMPAS Temperature 65°F	Couplant Batch Number 093014

Ultrasonic Instrument

Manufacturer PANAMETRICS　　　　　　　　Model EPOCH 2100
Serial Number 91042006　　　　　　　　Recalibration Due 7/13/94

Search Units

S/N	Angle	Freq	Wave Mode	Mfr	Size	Index-Nose	Wedge Mfr
R5239	60	2.25	SHEAR	HARISONIC	1"x.5"	N/A	HARISONIC
N/A	N/A	N/A	N/A	N/A	N/A	/NA	N/A

Refracted Angle in:	SU#1	SU#2	Search Unit Cable	Temperature
Calibration Block	58	N/A	Type RG-174	Gauge S/N
Reference Standard	58	N/A	Length 24' Connectors 1	NSP-030

AMPLITUDE LINEARITY (Signal 2 shall equal 50% of Signal 1, ±5% F.S.H.)

Signal 1	(Set)	100	90	80	70	60	50	40	30	20	10
Signal 2	(Read)	50	45	40	35	30	25	20	15	10	5

AMPLITUDE CONTROL ACCURACY

Amplitude Setting, % F.S.H./db Change	80 / -6	80 / -12	40 / +6	20 / +12
Acceptable Range, % F.S.H.	32 to 48	16 to 24	64 to 96	64 to 96
Actual, % F.S.H.	40	20	80	80

Status Display

Reject	0 %		
Gain/Sensitivity	49.0 dB	Sweep	.824 in/div
Delay	0.00 in	Zero	15.300 µsec
Filter	2.25 Mhz	Damping	150Ω
Gate Start	0.886 in	Energy	HIGH
Gate Width	8.085 in	FULL WAVE	(Detector)
Gate Level	20.0 %	P/E	Mode
Velocity	.1268 in/µsec	60.0 (Angle) / 3.50 in (Thick)	

Beam Spread. (UT-3, UT-3A, only) YES	Signal to Noise Ratio (UT-16 only) N/A

REMARKS: NONE

PERSONNEL

Examiner	_W.L. THOMAS_	II Level
Examiner	_E.J. PAVLIC_	I Level
Examiner	_J.L. DEVERS_	II Level
Examiner	N/A	Level

REVIEW

Contractor
Review _a. w._____　　5/26/94

NSP
Review _____　　5/26/94

ANII
Review _____　　6/2/94

SWEEP

Reflector Number	1	2	3	4	5	6	7
Identification	1/4T	1/2T	3/4T	5/4T	PLANAR	ROMPAS SDH	N/A
Amplitude (% fsh)	80	50	32	18	12	45	N/A
Sweep	2.0	4.0	6.0	10.0	8.0	1.8	N/A
Metal Path	1.688	3.297	4.985	8.338	6.594	1.483	N/A
Surface Distance	1.460	2.852	4.312	7.212	5.704	1.283	N/A

Northern States Power Company Operations & Maintenance Support Materials & Special Processes	Ultrasonic Calibration Report Beam Spread	Calibration Report Number WLT-011

Beam Spread Data
Surface Distance, Range, Metal Path, at:

Reflector	Leading Surf	(50% Maximum) Sweep	M. P.	Surf	Maximum Amplitude\ Sweep	M. P.	Trailing Surf	(50% Maximum) Sweep	M. P.
T/4	1.692	2.3	1.957	1.460	2.0	1.688	1.208	1.7	1.396
2T/4	3.249	4.4	3.757	2.852	4.0	3.297	2.553	3.7	2.952
3T/4	4.630	6.5	5.353	4.312	6.0	4.958	3.798	5.5	4.576
PLANAR	6.062	8.5	7.008	5.704	8.0	6.594	5.272	7.4	6.095
5T/4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Near / Far Surface Resolution Data

Near Surface (Rompas Block)	Amp	Sweep	M.P.
"Near" Side-Drilled-Hole (~0.3" depth)	N/A	N/A	N/A
"Far" Side-Drilled-Hole (~0.7" depth)	N/A	N/A	N/A

Straight Beam Far Surface (Calibration Block)	Amp	Sweep	M.P.
Notch	N/A	N/A	N/A
Back Reflection	N/A	N/A	N/A

Angle Beam Far Surface (Calibration Block)	Amp	Sweep	M.P.
Clad Interface Side Drilled Hole	N/A	N/A	N/A

Estimate of Near Surface Resolution: N/A inches below front (entry) surface

Estimate of Far Surface Resolution: N/A inches below front (entry) surface

CALIBRATION PARAMETERS

GENERAL COMPUTATION SHEET
Form 17-2494 (4-91)

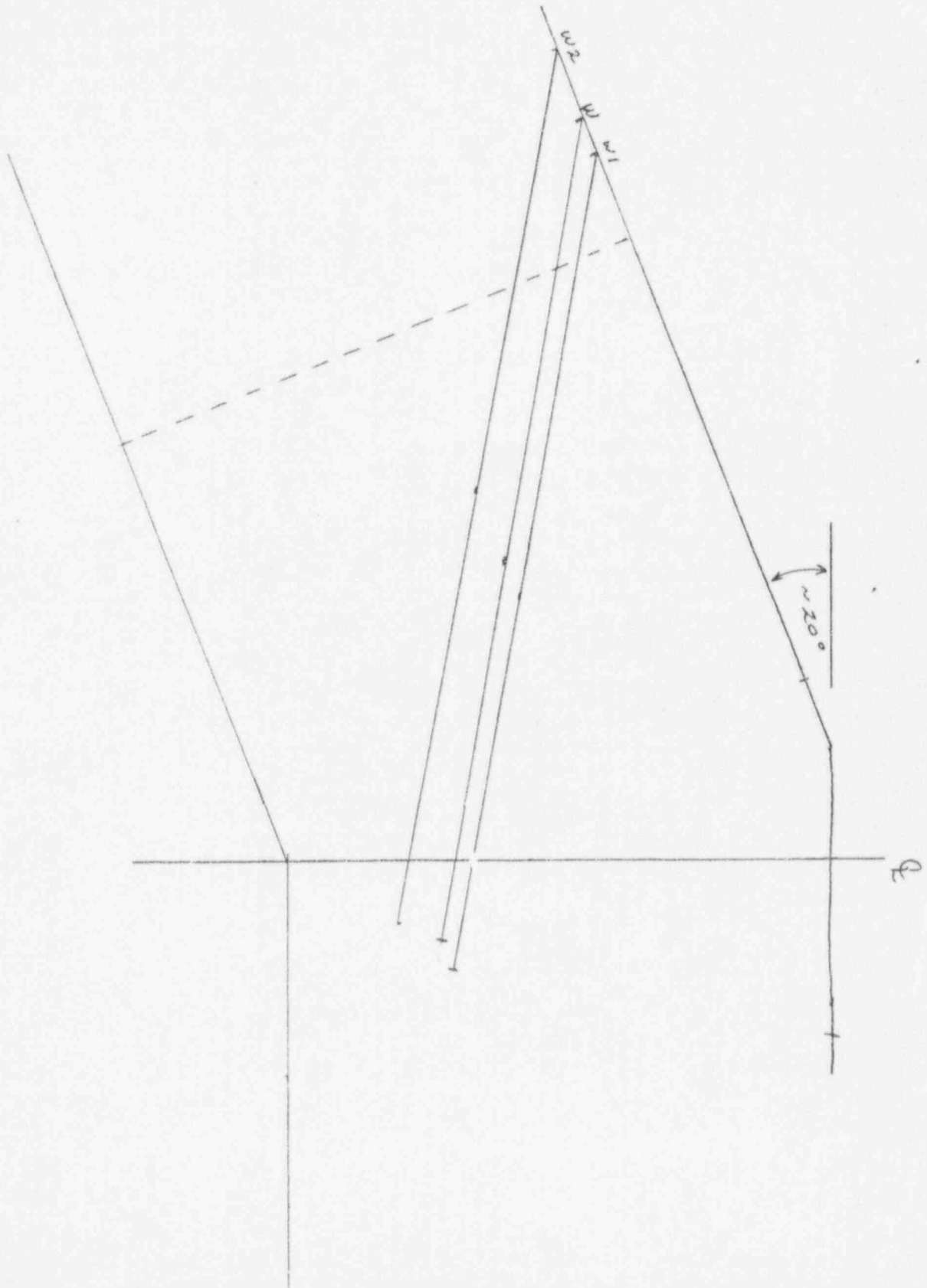**NSP** **N** Northern States Power Company

PROJECT _UT Report # 94-0128_

SUBJECT _____

E NO. _____
SHEET NO _____ OF _____
DATE _____
COMP. BY _____ C'K'D BY _____

#22 Steam Generator Flaw Evaluation for ISI Report 89-364

Prairie Island Unit 2

January 31, 1995

PI 2 Indication Review

Rpt # - 89-364

Iso # - 2-ISI-37

Item # - W-A (12' to 22' 3")

Indication # - 1 through 4

New Iso # - 2-ISI-37B

New Item # - W-A

Method - UT 60°

Procedure - NSP-UT-3 Rev 4 w/FC-1

Code - ASME Sect XI '80 through Winter '81

Discussion -
These indications are being re-evaluated in response to Audit No. 94-19-OUT, Finding 94-28 on Inappropriate Flaw Analysis for ISI. This action is taken to ensure correctness of the original disposition of this indication and to provide additional OJT for the M&SP personnel in performing flaw evaluations.

The three indications were reported as "Linear". The maximum amplitudes for these indications were 40%, 20%,45% and 40% of DAC respectively. The depth of these was approximately 28%, 31%, 43% and 28% respectively from the O. D.

Assumptions -
None

Code Requirements -
ASME Sect XI IWA-2232 (a) references ASME Sect V Article 4 for conduct of the examination. Paragraph T-441.8 (a) states "Record all reflectors that produce a response equal to or greater than 50% of the distance-amplitude correction (DAC)" and "Record surface reflectors that produce a response equal to or exceeding the calibration amplitude established per T-432.3.1 (d)". The last is a reference to the amplitude of the notch in the far surface of the calibration block.

Summary -
The indications (1 through 4) noted on report #89-364 are not surface related and therefore the requirements for recording in relation to the DAC apply. These indications are acceptable and require no further evaluation.

Calculations - From calibration report KJL-001 the ID notch is at 8.3 screen divisions and 11.33" metal path with a measured angle of 61 deg in the cal block.

Ind #1 - cos 61 deg = 0.4848   0.4848 * 3.02" MP = <u>1.4641" depth from outer surface</u>   1.4641" / 5.312" = 0.2756 or <u>27.56% depth</u>

Ind #2 - cos 61 deg = 0.4848   0.4848 * 3.36" MP = <u>1.6289" depth from outer surface</u>   1.6289" / 5.312" = 0.3066 or <u>30.66% depth</u>

Ind #3 - cos 61 deg = 0.4848   0.4848 * 4.67" MP = <u>2.2640" depth from outer surface</u>   2.2640" / 5.312" = 0.4262 or <u>42.62% depth</u>

PI 2 Indication Review

Ind #4 - cos 61 deg = 0.4848   0.4848 * 3.02" MP = __1.4641" depth from outer surface__   1.4641" / 5.312" = 0.2756 or __27.56% depth__

Prepared By _Tom Jones Lvl III_

Reviewed By _____
           12/21/94

ISI Flaw Disposition Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number	4. Total Number of Pages
P I Z / 8Y-364	5	B 7.40	2

4. ISI Interval ☑ OK Reviewer _____
☒ second interval ☐ third interval ☐ preservice

5. Code Edition and Addenda ☑ OK Reviewer _____
☐ 80 W81 ☐ 86 no addenda ☐ 89 no addenda ☒ other _N/A_

6. Acceptance Standard ☑ OK Reviewer _____

N/A

☐ IWB-3510	☐ IWB-3511	☐ IWB-3512	☐ IWB-3514	☐ IWB-3515	☐ IWB-3516	☐ IWB-3518
☐ IWB-3522	☐ IWB-3523					
☐ IWC-3510	☐ IWC-3511	☐ IWC-3512	☐ IWC-3513	☐ IWC-3514	☐ IWC-3515	

7. Calculations ☑ OK Reviewer _____

From Attached ISI Flaw Sizing worksheet: $l = 0.7402$, $a = 0.3701$

$$t_{nom} = 5.312, \quad S = 0.0027$$

Refer to Attached Flaw Evaluation chart: Flaw Type = Surface flaw

$$\frac{a}{l} = \frac{0.3701}{0.7402} = 0.5000 \quad \text{Rounded to } 0.50$$

$$\frac{a}{t}\% = \frac{0.3701}{5.312} \cdot 100 = 6.9672 \quad \text{Rounded to } 7.0\%$$

Plot of $\frac{a}{t}\%$ versus $\frac{a}{l}$ using values above (see Attached)

Plot of $\frac{a}{t} = 7.0\%$ versus $\frac{a}{l} = 0.50$ is within IWB-3600 Acceptable region.

8. Results ☑ OK Reviewer _____

$$a/t = \underline{0.50}$$
$$\text{calculated } a/t\% = \underline{7.0\%}$$
$$\text{Code allowable } a/t\% = \underline{N/A}$$
$$\text{laminar flaw surface area: } (0.75 \cdot l \cdot w) = \underline{N/A}$$

9. Table used for analysis ☑ OK Reviewer _____

N/A

☐ IWB-3510-1	☐ IWB-3510-2	☐ IWB-3510-3	☐ IWB-3511-1	☐ IWB-3511-2	☐ IWB-3512-1
☐ IWB-3512-2	☐ IWB-3514-1	☐ IWB-3514-2	☐ IWB-3514-3	☐ IWB-3514-4	☐ IWB-3514-6
☐ IWB-3515-1	☐ IWB-3516-1	☐ IWB-3516-2	☐ IWB-3518-1	☐ IWB-3518-2	
☐ IWC-3510-1	☐ IWC-3510-2	☐ IWC-3510-3	☐ IWC-3511-1	☐ IWC-3511-2	☐ IWC-3512-2
☐ IWC-3513-1					

10. Was linear interpolation used? ☐ yes ☒ no If no, why? _Not See Attach_

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☑ OK Reviewer _____ If no, why?

12. The correct Code Edition and Addenda was available and used ☒ yes Preparer _____ ☑ OK Reviewer _____ ☒ N/A _____

13. Statement of acceptability or rejectability with basis ☑ OK Reviewer _____

☒ **Accept.** ☐ (a/t)Code allowable $\geq (a/t)$calculated

☐ **Reject.** ☐ (a/t)Code allowable $< (a/t)$calculated

☒ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date	16. Engineering review by and date	17. Approved by and date
Kear S. Abe 01.09.95	JAN 17 96	_signature_ 1/19/95
Keith W. Abe		
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.	This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.	This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.

-10 yrs.
-20 yrs.
-30 yrs.

TAKEN FROM WCAP 14166 (DRAFT).

A - The 10, 20, 30 year
acceptable flaw limits.

B - Within this zone, the
surface flaw is acceptable
by ASME Code analytical
criteria in IWB-3600

C - ASME Code allowable since
1983 Winter Addendum

D - ASME Code allowable prior
to 1983 Winter Addendum

FLAW DEPTH a/t(%) — vertical axis: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20

FLAW SHAPE(a/ℓ) — horizontal axis: 0, 0.04, 0.08, 0.12, 0.16, 0.2, 0.24, 0.28, 0.32, 0.36, C.4, 0.44, 0.48

A

B

ISI FLAW Disposition, #-2
Rept # 89-364, FLAW 5
Attachment 1, Page 1 of 1

$\left(\frac{a}{t} = 7.0\%, \frac{a}{\ell} = 0.50\right)$

C

D

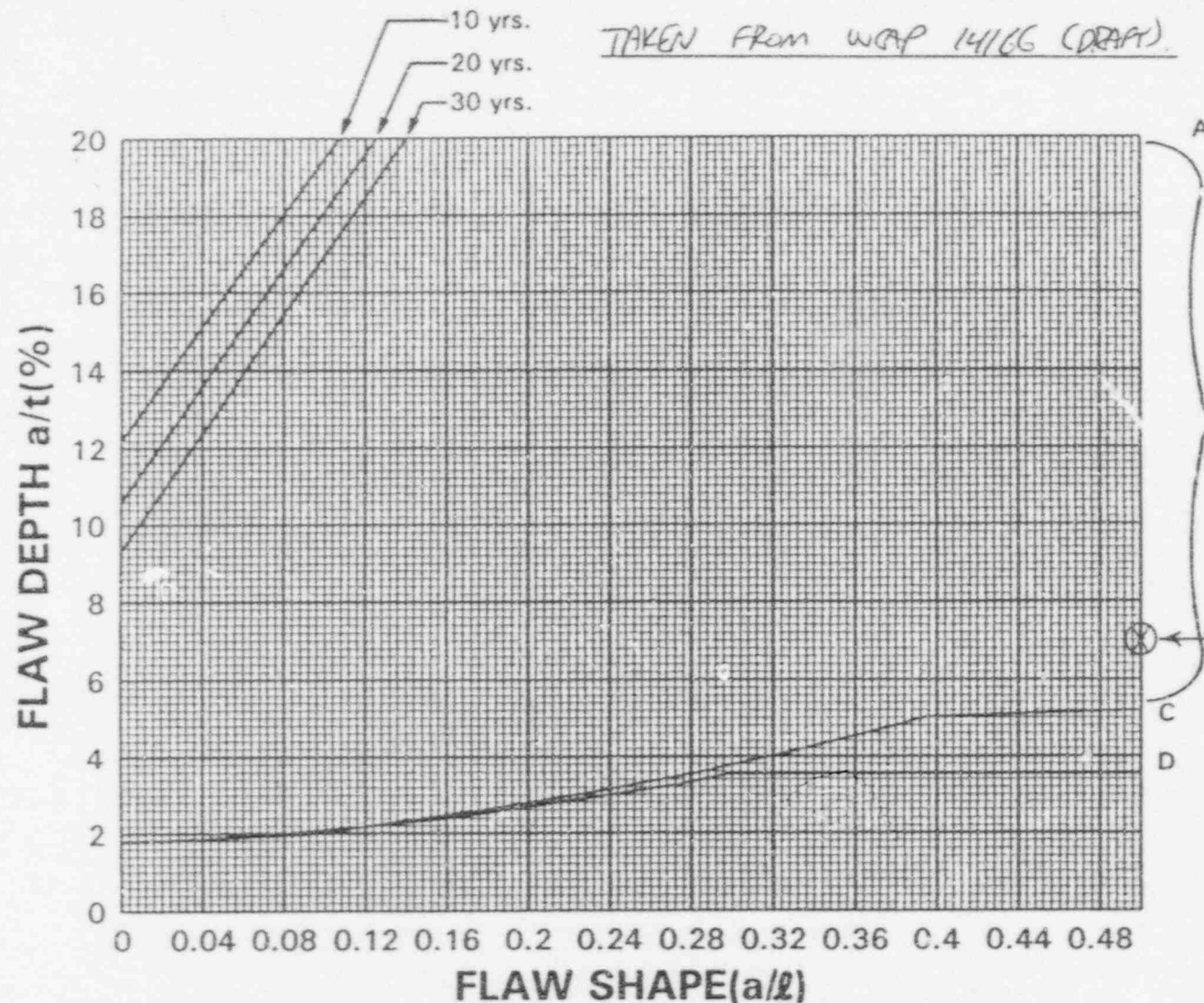Figure A-2.2   Flaw Evaluation Chart for the Tubesheet Channel Head Junction
for Prairie Island Units 1 and 2

X	Inside Surface		X	Surface Flaw	X	Longitudinal Flaw
	Outside Surface			Embedded Flaw	X	Circumferential Flaw

per teleecon with Warren Bamford
of Westinghouse on 01-17-95

ISI Flaw Disposition Worksheet

1. ISI Report Number PT 2 89-364	2. Flaw Number 5	3. Item Number B2.40	14. Total Number of Pages 1

4. ISI Interval ☒ OK Reviewer *illeg*
☒ second interval ☐ third interval ☐ preservice

5. Code Edition and Addenda ☒ OK Reviewer *illeg*
☒ 80 W81 ☐ 86 no addenda ☐ 89 no addenda ☐ other

6. Acceptance Standard ☒ OK Reviewer *illeg*
☐ IWB-3510 ☒ IWB-3511 ☐ IWB-3512 ☐ IWB-3514 ☐ IWB-3515 ☐ IWB-3516 ☐ IWB-3518
☐ IWB-3522 ☐ IWB-3523
☐ IWC-3510 ☐ IWC-3511 ☐ IWC-3512 ☐ IWC-3513 ☐ IWC-3514 ☐ IWC-3515

7. Calculations ☒ OK Reviewer *illeg*

FROM ATTACHED FSI FLAW SIZING WORKSHEET $l = 0.7402$ $a = 0.3701$

$t_{nom} = 5.312$ $S = 0.0027$

FLAW TYPE = SURFACE PLANAR

SA-216 GR WCC - 40 KSI MIN YIELD

SA-508 CL 2 - 50 KSI MIN YIELD

$$\frac{a}{l} = \frac{0.3701}{0.7402} = 0.5000 \text{ ROUND TO } 0.50$$

$$\frac{a}{t}\% = \frac{0.3701}{5.312} = 0.0697 \text{ ROUND TO } 7.0\%$$

$$-Y = \frac{S}{a} = \frac{0.0027}{0.3701} = 0.0073$$

FROM TABLE IWB-3511-1

$\frac{a}{l}$	$\frac{a}{t}\%$ code
0.5	3.7

BY OBSERVATION $\frac{a}{t}\%$ code ALLOWABLE IS LESS THAN $\frac{a}{t}\%$ CALCULATION

THEREFORE INDICATION IS REJECTABLE BY CODE ALLOWABLE

8. Results ☒ OK Reviewer *illeg*

a/t =	0.50
calculated a/t %=	7.0
Code allowable a/t %=	3.7
laminar flaw surface area: (0.75 • l • w) =	NA

9. Table used for analysis ☒ OK Reviewer *illeg*
☐ IWB-3510-1 ☐ IWB-3510-2 ☐ IWB-3510-3 ☒ IWB-3511-1 ☐ IWB-3511-2 ☐ IWB-3512-1
☐ IWB-3512-2 ☐ IWB-3514-1 ☐ IWB-3514-2 ☐ IWB-3514-3 ☐ IWB-3514-4 ☐ IWB-3514-6
☐ IWB-3515-1 ☐ IWB-3516-1 ☐ IWB-3516-2 ☐ IWB-3518-1 ☐ IWB-3518-2
☐ IWC-3510-1 ☐ IWC-3510-2 ☐ IWC-3510-3 ☐ IWC-3511-1 ☐ IWC-3511-2 ☐ IWC-3512-2
☐ IWC-3513-1

10. Was linear interpolation used? ☐ yes ☒ no If no, why? BY OBSERVATION

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer *illeg* If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer *illeg* ☒ OK Reviewer *illeg*
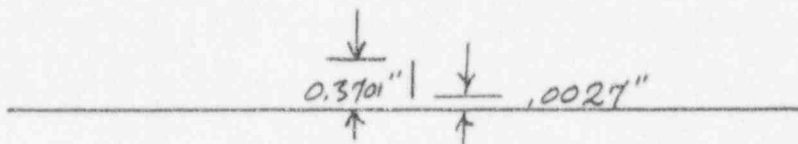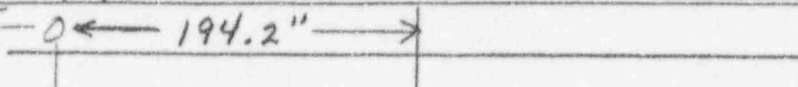
13. Statement of acceptability or rejectability with basis ☒ OK Reviewer *illeg*

☐ Accept.   ☐ (a/t)Code allowable ≥ (a/t)calculated

☒ Reject.   ☒ (a/t)Code allowable < (a/t)calculated

☐ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date	16. Engineering review by and date	17. Approved by and date
signature JAN 26 95	*signature* 1.26.95	*signature* 1/26/95
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.	This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.	This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.

ISI Flaw Sizing Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number
P12 89-364	5	B 2.40

4. ISI Interval ☒ OK Reviewer ~~~	5. Code Edition and Addenda ☒ OK Reviewer ~~~	6. Method ☒ UT ☐ RT
☒ 2nd interval ☐ 3rd interval ☐ preservice	☒ 80 W81 ☐ 86 no addenda ☐ 89 no addenda ☐ other ___	☐ PT ☐ MT

7. Flaw Sketch ☒ OK Reviewer ~~~

Front View

$0 \longleftarrow 194.2" \longrightarrow$

0.3701"   .0027"

Top View

Btm. Head

1.5"

0.7402"

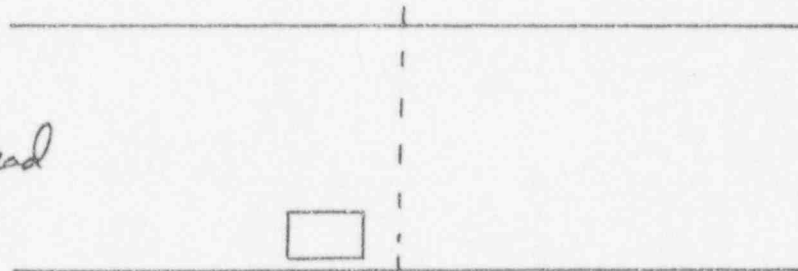**Side View**

Btm. Head

8. Calculations ☒ OK Reviewer ~~~

Show determination of surface or subsurface

see attached

Show determination of type of "a" to use

see attached

9. ISI-FE-1 Paragraph 7.0 - "Rounding-Off Method" was used. ☒ yes Preparer ~~~ ☒ OK Reviewer ~~~

10. Code Flaw Dimensions ☒ OK Reviewer ~~~

"ℓ" = 0.7402"   "a" = 0.3701"   "$t_{nominal}$" = 5.312"   "$t_{measured}$" = N/A   "S" = 0.0027"   "W" = N/A

11. Flaw Type ☒ OK Reviewer ~~~
☒ Surface Planar (UT/RT)   ☐ Subsurface Planar (UT/RT)   ☐ Laminar (UT/RT)   ☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☒ OK Reviewer ~~~

☒ IWA-3310-1	☐ IWA-3330-1	☐ IWA-3350-1	☐ IWA-3380-1	☐ IWA-3400-1
☐ IWA-3320-1	☐ IWA-3340-1	☐ IWA-3360-1	☐ IWA-3390-1	

13. Flaw Characterization Figure Number	☐ Flaw 1	☐ Flaw 2	☒ Flaw 3	☐ Flaw 4	☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ yes Preparer ~~~ ☒ OK Reviewer ~~~

16. Prepared by and date	17. Review by and date
Tom Jones (Lvl III ~~~) 12/7/94	~~~ 12/21/94 W. Flores
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.	This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.

pg 1 of 3

Flaw Sizing Calculations Using Metal Path for Fe Vessels $\geq 2"$
For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface
ASME SECT XI 1980 W/ ADDENDA THRU WINTER '81 ~TMJ~ INITIAL TO VERIFY

ISI Report # __89-364__   Evaluation Performed By: __Tom Jones__ Date: __12/2/94__
Flaw # __5__   Reviewed By: _____ Date: __12/21/94__
    12/21/94

Length
Length of the flaw "ℓ" is determined by finding the difference between L1 and L2.
L1 and L2 are from page __4__ of the UT report. (L max position is given. L1 & L2 are calculated
ℓ = __1.6875__ (L2) - __1.3125__ (L1) = __0.375__ inches.   based on Lmax being centered)

Thickness
Thickness of the component at the location of the flaw, using UT or (nom wall) (circle one).
This value is from page __1__ of the UT report.
"t" = __5.312__ inches (used in step 3 and step 6)

Calibration
From the calibration report (__KJL-001__), the calibration was performed on a "T" = __5.550__ inch thick
block.
The ID notch was set at __11.33__ inches metal path (used in step $\cancel{3}$ 2).

Calculations using metal path
From page __4__ of the UT report the flaw exhibited 50% DAC at __11.60__ and __10.85__ inches MP.
(Use of 50% DAC instead of 50% max amp for indications over 100% DAC is more conservative).

1) Determine the calibration block to part thickness ratio.
    __5.550__ (calibration block thickness) / __5.312__ (part thickness) = __1.0448__

2) Determine the thickness of the part in metal path.
    __11.33__ (ID notch metal path) / __1.0448__ (from step 1) = __10.8442__ inches MP.

3) Determine inches of metal path for equivalent inches of depth
    __10.8442__ (part "t" in MP) / __5.312__ (part "t" in inches) = __2.0415__ inches of MP per inch of
    depth

✱ 4) Determine the ~upper~ *Lower* depth of the flaw from the exam surface.   Part "T"
    __10.85__ (metal path at 50% upper) / __2.0415__ (from step 3) = __5.3147__ inches depth. − 5.312" = 0.00

✱ 5) Determine the ~lower~ *upper* depth of the flaw from the exam surface.   Part "T"
    __11.60__ (metal path at 50% lower) / __2.0415__ (from step 3) = __5.6821__ inches depth. − 5.312" = 0.370

6) Determine S by picking the smaller of the following;   *Lower*
    S = __0.0027__ (result of 4) = distance between exam surface and the ~upper~ flaw tip
    >> OR <<
    S = __5.312__ (part "t") - __0.3701__ (result of 5) = __4.9419__ distance between the side opposite
    exam surface and the ~lower~ flaw tip
        upper

7) Determine 2d in though wall thickness.
    __0.3701__ (from step 5) - __0.0027__ (from step 4) = __0.3674__ inches.

Determination of surface or sub surface
0.4d = (2d / 2) * 0.4 = __0.0735__
Compare to S (from step 6)
If S is less than 0.4d, the flaw is **surface**. a = 2d + S = __0.3701__ inches.
If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = __N/A__ inches.

t = __0.7402__ (for a/t > 0.5 (t = 2a)   t = __5.312__ (part thickness)
a = __0.3701__ (surf or sub surf, circle one)   S = __0.0027__

flaw-mp1 Rev 0   ✱ The indication is evident on the second leg of
        ~~...~~   p 1 of 3

<u>PI 2 Indication Review</u>

Rpt # - 89-364   **Iso #** - 2-ISI-37

Item # - W-A (12' to 22' 3")   **Indication #** - 5 & 6

New Iso # - 2-ISI-37B   **New Item #** - W-A

Method - UT 60°   **Procedure** - NSP-UT-3 Rev 4 w/FC-1

Code - ASME Sect XI '80 through Winter '81

Discussion -
These indications are being re-evaluated in response to Audit No. 94-19-OUT, Finding 94-28 on Inappropriate Flaw Analysis for ISI. This action is taken to ensure correctness of the original disposition of this indication and to provide additional OJT for the M&SP personnel in performing flaw evaluations.

The indications were reported as "Linear". The maximum amplitudes for these indications were 75% and 75% of DAC respectively. In performing the evaluation it was noted that for indication #5 the movement of the indication on the baseline between 50% points was less than 2/3 the movement noted for the 2% notch during the calibration. Using the notch comparison would reduce the flaw through wall dimension (which was determined by calculations based on recorded metal path for the 50% points) by a factor of more than four.

Assumptions -
None

Code Requirements -
ASME Sect XI IWA-2232 (a) references ASME Sect V Article 4 for conduct of the examination. Paragraph T-441.8 (a) states "Record all reflectors that produce a response equal to or greater than 50% of the distance-amplitude correction (DAC)" and "Record surface reflectors that produce a response equal to or exceeding the calibration amplitude established per T-432.3.1 (d)". The last is a reference to the amplitude of the notch in the far surface of the calibration block.
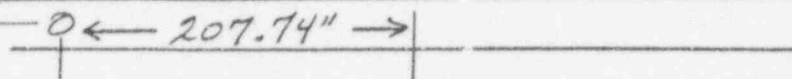
ISI Flaw Disposition Worksheet

1. ISI Report Number	2. Flaw Number	3. Item Number	14. Total Number of Pages
PI 2 89-364	6	B 2.40	

4. ISI Interval ☒OK Reviewer _Mle_
☒ second interval ☐ third interval ☐ preservice

5. Code Edition and Addenda ☒OK Reviewer _Mle_
☒ 80 W81 ☐ 86 no addenda ☐ 89 no addenda ☐ other _____

6. Acceptance Standard ☒OK Reviewer _Mle_

	☐ IWB-3510	☒ IWB-3511	☐ IWB-3512	☐ IWB-3514	☐ IWB-3515	☐ IWB-3516	☐ IWB-3518
	☐ IWB-3522	☐ IWB-3523					
	☐ IWC-3510	☐ IWC-2511	☐ IWC-3512	☐ IWC-3513	☐ IWC-3514	☐ IWC-3515	

7. Calculations ☒OK Reviewer _Mle_

FROM ATTACHED FSI FLAW SIZING WORKSHEET

$l = 0.5$ $a = 0.1518$
$t_{NOM} = 5.312$ $S = 0.5361$
FLAW TYPE = SUB SURFACE PLANAR
SA-216 GR WCC - 40 KSF MIN YIELD
SA-508 CL 2 - 50 KSF MIN YIELD

$$\frac{a}{l} = \frac{0.1518}{0.5} = 0.3036 \quad \text{ROUND TO } 0.30$$

$$\frac{a}{t}\% = \frac{0.1518}{5.312} = .0286 \quad \text{ROUND TO } 2.9\%$$

FROM TABLE IWB-3511-1

$$Y = \frac{S}{a} = \frac{0.5361}{0.1518} = 3.53 \quad \therefore Y = 1.0$$

$\frac{a}{l}$	$\frac{a}{t}Y$ CODE
0.30	4.6

BY OBSERVATION $\frac{a}{t}$ CODE ALLOWABLE IS ~~GREATER~~ THAN $\frac{a}{t}$ CALCULATED

THEREFORE INDICATION IS ACCEPTABLE BY CODE ALLOWABLE.

8. Results ☒OK Reviewer _Mle_

a/t = 0.30
calculated a/t % = 2.9
Code allowable a/t % = 4.6
laminar flaw surface area: (0.75 • l • w) = NA

9. Table used for analysis ☒OK Reviewer _Mle_

	☐ IWB-3510-1	☐ IWB-3510-2	☐ IWB-3510-3	☒ IWB-3511-1	☐ IWB-3511-2	☐ IWB-3512-1
	☐ IWB-3512-2	☐ IWB-3514-1	☐ IWB-3514-2	☐ IWB-3514-3	☐ IWB-3514-4	☐ IWB-3514-6
	☐ IWB-3515-1	☐ IWB-3516-1	☐ IWB-3516-2	☐ IWB-3518-1	☐ IWB-3518-2	
	☐ IWC-3510-1	☐ IWC-3510-2	☐ IWC-3510-3	☐ IWC-3511-1	☐ IWC-3511-2	☐ IWC-3512-2
	☐ IWC-3513-1					

10. Was linear interpolation used? ☐ yes ☒ no If no, why? BY OBSERVATION

11. Was IWA-3200 Significant Digits For Limiting Values followed? ☒ yes ☐ no ☒ OK Reviewer _Mle_ If no, why?

12. The correct Code Edition and Addenda was available and used. ☒ yes Preparer _W._ ☒ OK Reviewer _Mle_

13. Statement of acceptability or rejectability with basis ☒OK Reviewer _Mle_

☒ **Accept.** ☒ (a/t)Code allowable ≥ (a/t)calculated

☐ **Reject.** ☐ (a/t)Code allowable < (a/t)calculated

☐ OEM flaw evaluation handbook (see attached analysis)

15. Prepared by and date	16. Engineering review by and date	17. Approved by and date
JM 2695	_[signature]_ 1.26.95	_[signature]_ 1/26/95
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.	This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.	This approval assures that all involved with this flaw sizing and flaw disposition were aware of the necessity that the results and the methodology are correct and in accordance with applicable codes, standards, specifications and procedures.

ISI Flaw Sizing Worksheet

1. ISI Report Number PI 2 89-364	2. Flaw Number 6	3. Item Number B 2.40

4. ISI Interval ☒ OK Reviewer	5. Code Edition and Addenda ☒ OK Reviewer	6. Method ☒ UT ☐ RT
☒ 2nd interval ☐ 3rd interval ☐ preservice	☒ 80 W81 ☐ 86 no addenda ☐ 89 no addenda ☐ other	☐ PT ☐ MT

7. Flaw Sketch ☒ OK Reviewer

Front View

0 ←— 207.74″ —→

0.3037″

0.5361″

Top View

Btm. Head

3.0″

0.5″

Side View

Btm. Head

8. Calculations ☒ OK Reviewer

Show determination of surface or subsurface

see attached

Show determination of type of "a" to use

see attached

9. ISI-FE-1 Paragraph 7.0 "Rounding-Off Method" was used. ☒ yes Prepared ☒ OK Reviewer

10. Code Flaw Dimensions ☒ OK Reviewer

"ℓ" = 0.5″   "a" = 0.1518″   "$t_{nominal}$" = 5.312″   "$t_{measured}$" = N/A   "S" = 0.5361   "W" = N/A

11. Flaw Type ☒ OK Reviewer			
☐ Surface Planar (UT/RT)	☒ Subsurface Planar (UT/RT)	☐ Laminar (UT/RT)	☐ Linear (PT/MT/RT)

12. Flaw Characterization Figure ☒ OK Reviewer				
☐ IWA-3310-1	☐ IWA-3330-1	☐ IWA-3350-1	☐ IWA-3380-1	☐ IWA-3400-1
☒ IWA-3320-1	☐ IWA-3340-1	☐ IWA-3360-1	☐ IWA-3390-1	

13. Flaw Characterization Figure Number	☒ Flaw 1	☐ Flaw 2	☐ Flaw 3	☐ Flaw 4	☐ Flaw 5

14. Was IWA-3300 Flaw Characterization followed? ☒ yes ☐ no If no, why?

15. The correct Code Edition and Addenda was available and used. ☒ yes Prepared ☒ OK Reviewer

16. Prepared by and date	17. Review by and date
Tom Jones (Lvl III _) 12/7/94	12/4/94 W.L. Thomas
The results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures.	This review assures that the results are correct and the methodology used is in accordance with applicable codes, standards, specifications and procedures

pg 1 of 3

Flaw Sizing Calculations Using Metal Path for Fe Vessels ≥ 2"
For surface and subsurface single planar flaws oriented in plane normal to pressure retaining surface
ASME SECT XI 1980 W/ ADDENDA THRU WINTER '81 _Thm_ INITIAL TO VERIFY

ISI Report # _89-364_   Evaluation Performed By: _Tom Sass_ Date: _12/2/94_

Flaw # _10_   Reviewed By: _____ Date: _12/21/94_

W.L. THOMAS

Length
Length of the flaw "l" is determined by finding the difference between L1 and L2.

L1 and L2 are from page _5_ of the UT report. _(L max position is given. L1 & L2 position are_

l = _3.25_ (L2) - _2.75_ (L1) = _0.5_ inches.   _calculated based on L max being centered)_

Thickness
Thickness of the component at the location of the flaw, using UT or nom wall (circle one). [nom wall circled]

This value is from page _1_ of the UT report.

"t" = _5.312_ inches (used in step 3 and step 6)

Calibration
From the calibration report (_KJL-001_), the calibration was performed on a "T" = _5.550_ inch thick block.

The ID notch was set at _11.33_ inches metal path (used in step $\overset{2}{8}$)

Calculations using metal path
From page _5_ of the UT report the flaw exhibited 50% DAC at _9.75_ and _9.13_ inches MP.
(Use of 50% DAC instead of 50% max amp for indications over 100% DAC is more conservative).

1) Determine the calibration block to part thickness ratio.
   _5.550_ (calibration block thickness) / _5.312_ (part thickness) = _1.0448_

2) Determine the thickness of the part in metal path.
   _11.33_ (ID notch metal path) / _1.0448_ (from step 1) = _10.8442_ inches MP.

3) Determine inches of metal path for equivalent inches of depth
   _10.8442_ (part "t" in MP) / _5.312_ (part "t" in inches) = _2.0415_ inches of MP per inch of depth

4) Determine the upper depth of the flaw from the exam surface.
   _9.13_ (metal path at 50% upper) / _2.0415_ (from step 3) = _4.4722_ inches depth.

5) Determine the lower depth of the flaw from the exam surface.
   _9.75_ (metal path at 50% lower) / _2.0415_ (from step 3) = _4.7759_ inches depth.

6) Determine S by picking the smaller of the following;
   S = _4.4722_ (result of 4) = distance between exam surface and the upper flaw tip
   >> OR <<
   S = _5.312_ (part "t") - _4.7759_ (result of 5) = _0.536_ distance between the side opposite exam surface and the lower flaw tip

7) Determine 2d in though wall thickness.
   _4.7759_ (from step 5) - _4.4722_ (from step 4) = _0.3037_ inches.

Determination of surface or subsurface
0.4d = (2d / 2) * 0.4 = _0.0607_

Compare to S (from step 6)

If S is less than 0.4d, the flaw is **surface**. a = 2d + S = _N/A_ inches.

If S is greater than or equal to 0.4a the flaw is **sub-surface**. a = 2a / 2 = _0.1518_ inches.

t = _0.5_ (for a/t > 0.5, t = 2a)   t = _5.312_ (part thickness)

a = _0.1518_ (surf or sub surf, circle one)   S = _0.5361_

PI 2 Indication Review

Rpt # - 89-364

Item # - W-A (12' to 22' 3")

New Iso # - 2-ISI-37B

Method - UT 60°

Code - ASME Sect XI '80 through Winter '81

Iso # - 2-ISI-37

Indication # - 5 & 6

New Item # - W-A

Procedure - NSP-UT-3 Rev 4 w/FC-1

Discussion -
These indications are being re-evaluated in response to Audit No. 94-19-OUT, Finding 94-28 on Inappropriate Flaw Analysis for ISI. This action is taken to ensure correctness of the original disposition of this indication and to provide additional OJT for the M&SP personnel in performing flaw evaluations.

The indications were reported as "Linear". The maximum amplitudes for these indications were 75% and 75% of DAC respectively. In performing the evaluation it was noted that for indication #5 the movement of the indication on the baseline between 50% points was less than 2/3 the movement noted for the 2% notch during the calibration. Using the notch comparison would reduce the flaw through wall dimension (which was determined by calculations based on recorded metal path for the 50% points) by a factor of more than four.

Assumptions -
None

Code Requirements -
ASME Sect XI IWA-2232 (a) references ASME Sect V Article 4 for conduct of the examination. Paragraph T-441.8 (a) states "Record all reflectors that produce a response equal to or greater than 50% of the distance-amplitude correction (DAC)" and "Record surface reflectors that produce a response equal to or exceeding the calibration amplitude established per T-432.3.1 (d)". The last is a reference to the amplitude of the notch in the far surface of the calibration block.

GENERAL COMPUTATION SHEET
Form 17-4103 (4-91)

NSP N Northern States Power Company

PROJECT _____

SUBJECT _RPT 89-364_
IND# 5 & 6

E NO. _____
SHEET NO _____ OF _____
DATE _____
COMP. BY ____ C'K'D BY _____
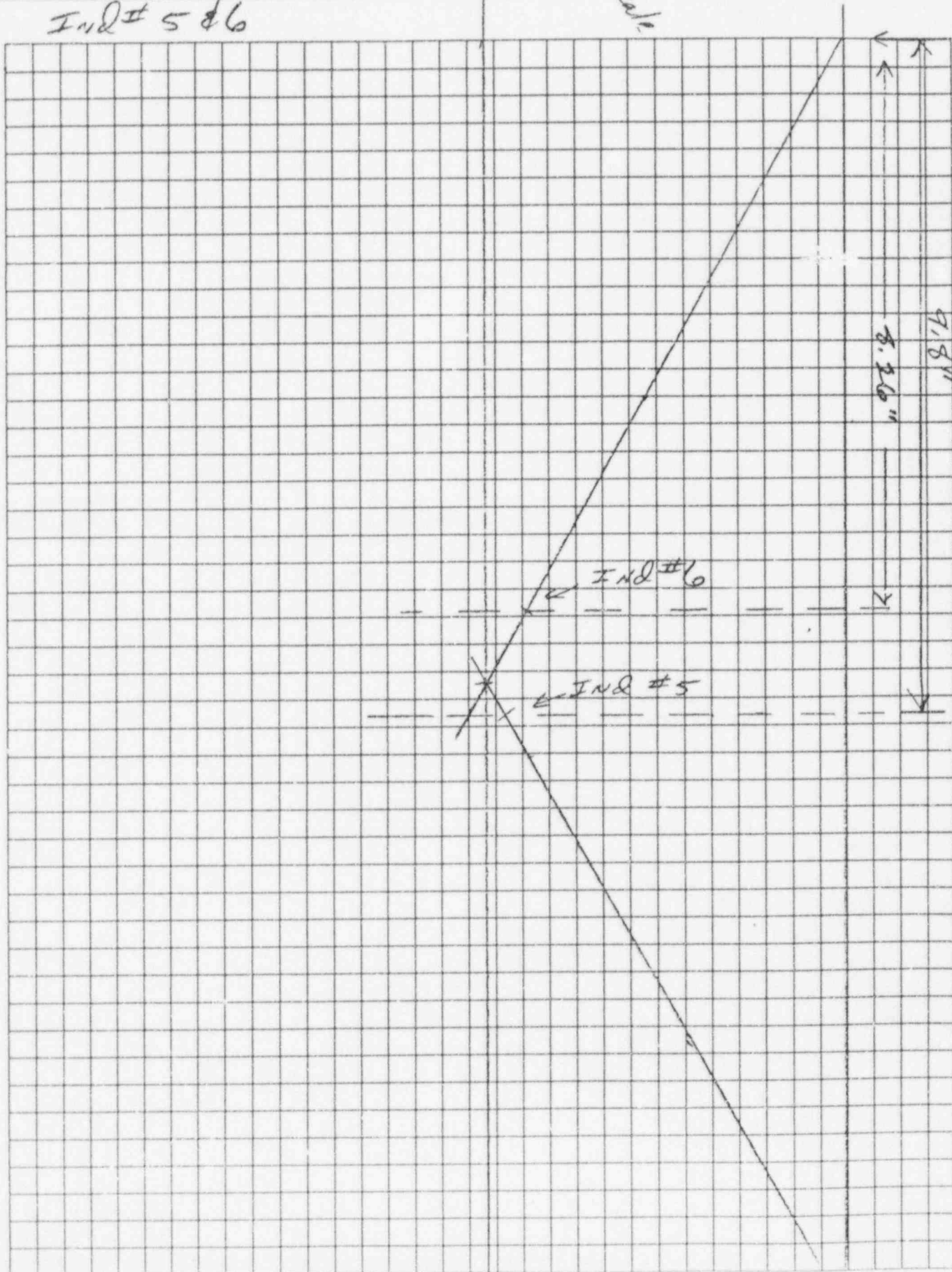
½ Scale

IND #6

IND #5

5.26"

9.8"

TUBESHEET SA-508 CL2
HEAD   SA-216 GR WCC ULTRASONIC EXAMINATION REPORT

TUDESHEET SA-508 CL2
HEAD   SA-216 GR WCC

JAN 25 96

System STEAM GENERATOR 22	ISO 2-ISI-37	Item Ident W-A 12'-22'3"	Calib'n Report Number: KJL--001
Material ~~SA-533GBC1~~	Size	Thickness 5.312	Exam From:OD	Surf Type UNCLAD	Plant: PI UNIT II

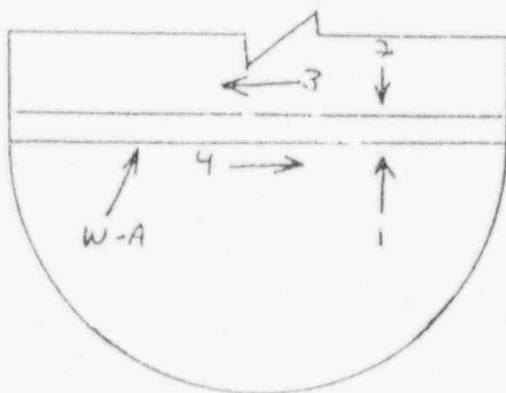| Material ~~SA-533GBC1~~	Size	Thickness 5.312	Exam From:OD	Surf Type UNCLAD	Plant: PI UNIT II
Procedure # NSP-UT-3	/ Rev 4 FC1	Beam Angle 60 deg(Nom)	Surface Temp 84 °F		Exam Company: LMT, Inc.
Evaluation Level 20 % DAC		Reporting Level 20 % DAC	Exam Start Time 1100		W R Number: N1610-RC-Q
Cal Standard 25A		Ref Standard 404	Exam Finish Time 1218		Exam Date: 04/12/89

Description of Results at Reference Level: GEO = Geometry; IND = Indication
L = Linear; M = Multiple; S = Spot; NAD = No Apparent Discontinuities.

Scan nmbr	Res-ults	Indication Type	Sweep Loc'n	Metal Path	"A" Dist	Max Amp	Location Circ.	Location Axial	Indication Length
1	NAD								
2	NAD								
3	IND	LINEAR	2.2	3.02	1.65	40	16'	-2.5"	3/8" 1
3	IND	LINEAR	2.4	3.36	3.0	20	18'	-4.5"	.55" 2
4	IND	LINEAR	3.3	4.67	2.9	45	13'	-2.9"	.5" 3
4	IND	LINEAR	2.2	3.02	10.5	40	14'	-4"	5/8" 4
4	IND	LINEAR	8.1	11.3	10	75	17'	-1.5"	.375" 5
4	IND	LINEAR	6.9	9.54	1.0	75	18'	-3"	.5" 6

Limitations: 2"x2" pads upstrm, 9" @ 21' 8", 19' 8", 12' 6", 14' 6", 16' 4,
18' 9". Pads at 14' 3" from weld centerline upstream and dnstream side
scan area due to insulation ring.

Remarks: INDICATIONS RECORDED ARE EVALUATED AS POROSITY AND INCLUSIONS
IN THE CAST MATERIAL (HEAD SIDE).

SKETCH & SCAN DIRECTIONS

PERSONNEL

Examiner: K.J. LEVESQUE   II LEVEL

Examiner: W.L. THOMAS   I LEVEL

Contractor
Review: _____ 4-18-89
Date

N S P
Review: _____ 4-18-89
Date

A N I I
Review: P.D.Fisher 4/19/89
Date

PRE-CAL. CHECK
ROMPAS @ REF.
1100

Top display:
REJ 0%   GATE START   1.304 in
REF 61.0dB + 6.0dB   1.373 in/DIV
y= 1.58 in. →= 1.37 in. ↓= 0.79 in

Bottom display:
REJ 0%   GATE START   1.510 in
REF 61.0dB + 0.0dB   1.373 in/DIV
y= 4.67 in. →= 4.04 in. ↓= 2.33 in

ROMPAS @ +6DB

#3
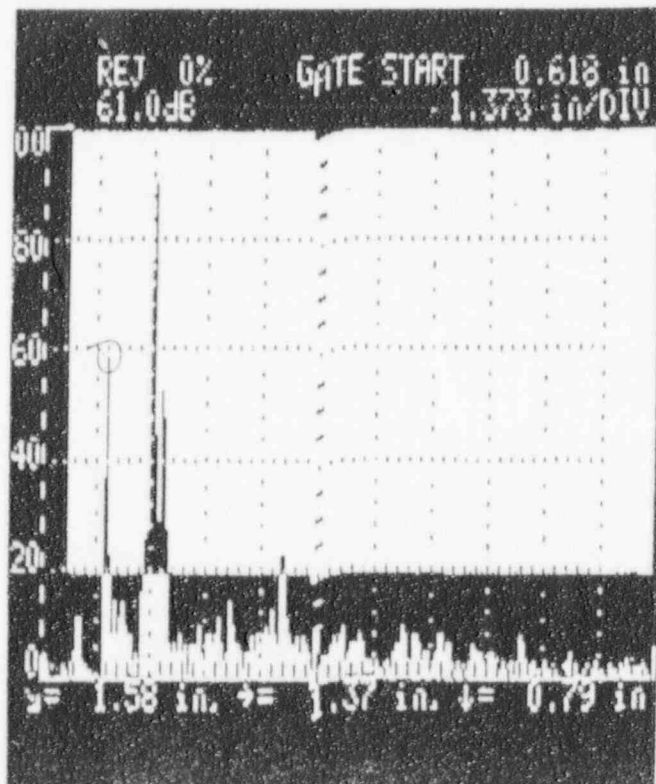
SCAN 4 INDICATION
UP STREAM

L	M	T	
3.0	2.9	3.5	W
3.7	3.3	2.9	DIV
5.15	4.67	3.98	MP

W'S TAKEN FROM 13'
L MAX 4" FROM WELD ₵
LENGTH 3.95" TO 4.45"

Report # 89-364

Page 3 of 7

REJ 0%   GATE LEVEL   8%
REF 61.0dB + 0.0dB   1.373 in/DIV

∽= 3.02 in. →= 2.62 in. ↓= 1.51 in

SCAN 4 INDICATION
UPSTREAM SIDE

#4

	L	M	T	
	9.75	10.5'	10.9	W
	2.3	2.2	2.0	DIV
	3.29	3.02	2.81	MP

W'S TAKEN FROM 14'

L MAX 4" FROM WELD ℄

LENGTH 3⅞ TO 4½"

REJ 0%   GATE LEVEL   9%
REF 61.0dB + 6.0dB   1.73 in/DIV

∽= 11.26 in. →= 9.75 in. ↓= 5.37 in
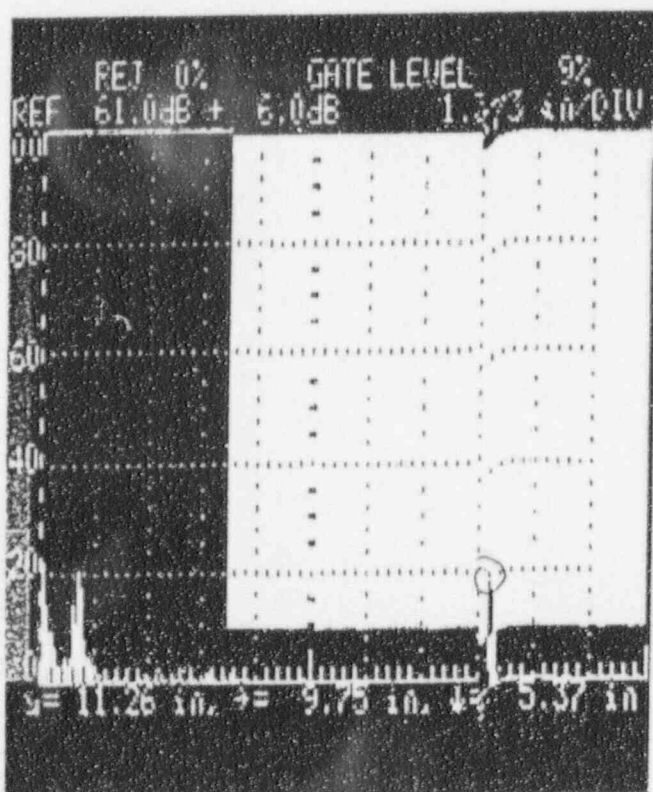
SCAN 4 INDICATION
U.S SIDE

#5

	L	M	T	Ⓦ
	9.9	10.0	10.9	
	9.4	8.1	7.8	DIV
	11.60	11.26	10.85	MP

W'S TAKEN FROM 17'

L MAX 1.5" FROM WELD ℄

LENGTH .375" LONG
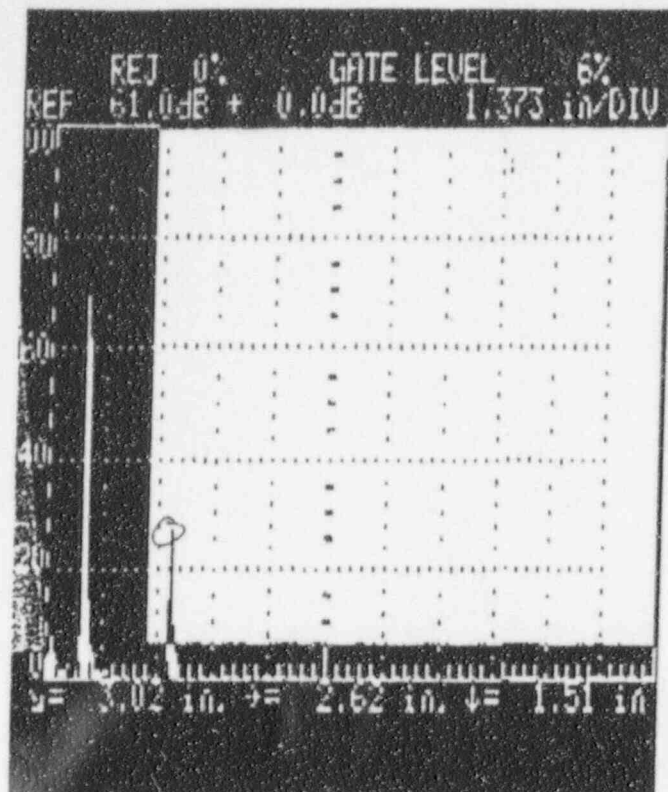
#1

INDICATION SCAN 3
U.S. SIDE

L	M	T	
2.0	1.65	1.25	W
2.4	2.2	2.0	DIV
3.36	3.02	2.81	MP

W'S TAKEN FROM 16'

L MAX 25" FROM WELD ₵

LENGTH - 3/8" LONG
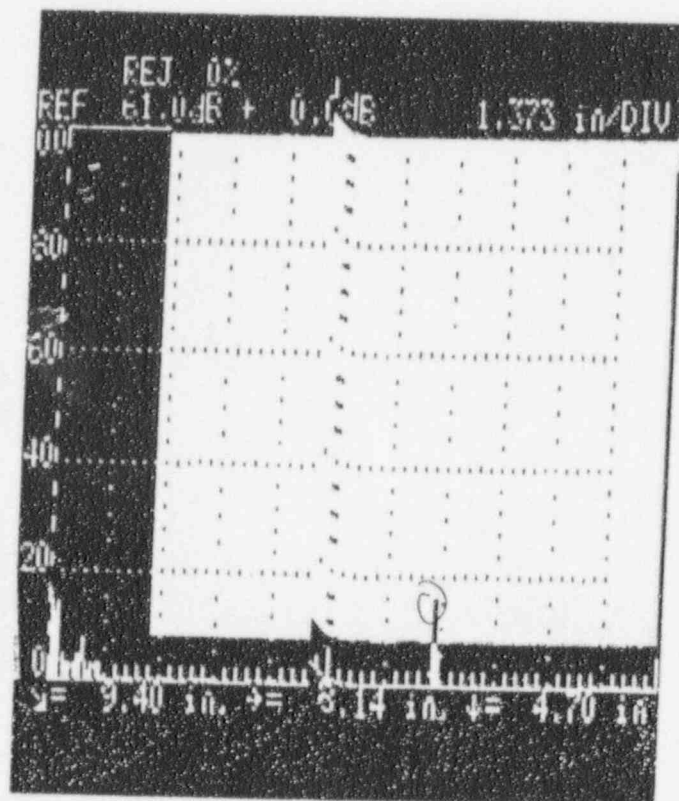
#6

INDICATION SCAN 4
UP STREAM SIDE

L	M	T	
.85	1.0	1.15	W
7.1	6.9	6.6	DIV
9.75	9.54	9.13	MP

W'S TAKEN AT 18'

L MAX 3" FROM WELD ₵

LENGTH - 1/2" LONG

Report # 89-364

Page 5 of 7

REJ 0%   GATE START   1.785± in
REF 61.0dB + 0.0dB   1.373 in/DIV

⤡= 3.36 in. ↗= 2.91 in. ↓= 1.68 in

REJ 0%   GATE START   1.304 in
REF 61.0dB + 0.0dB   1.373 in/DIV

⤡= 1.58 in. ↗= 1.37 in. ↓= 0.79 in
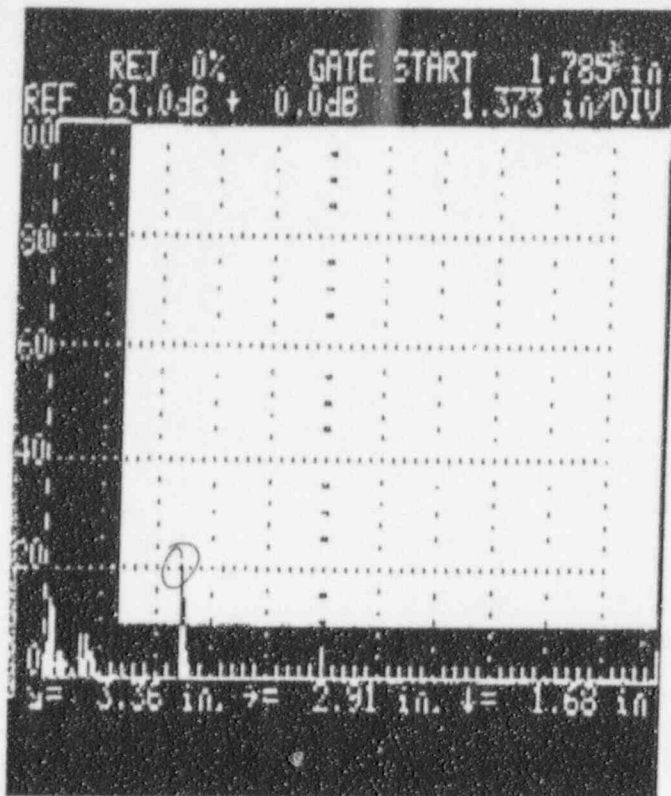
SCAN 3 INDICATION
U.S. SIDE

#2

	L	M	T	
	3.25	3.0"	2.65	W
	2.6	2.4	2.2	DIV
	3.57	3.36	3.09	MP

W'S TAKEN FROM 18'

L MAX 4.5" FROM WELD ₵

LENGTH ~ .55" LONG
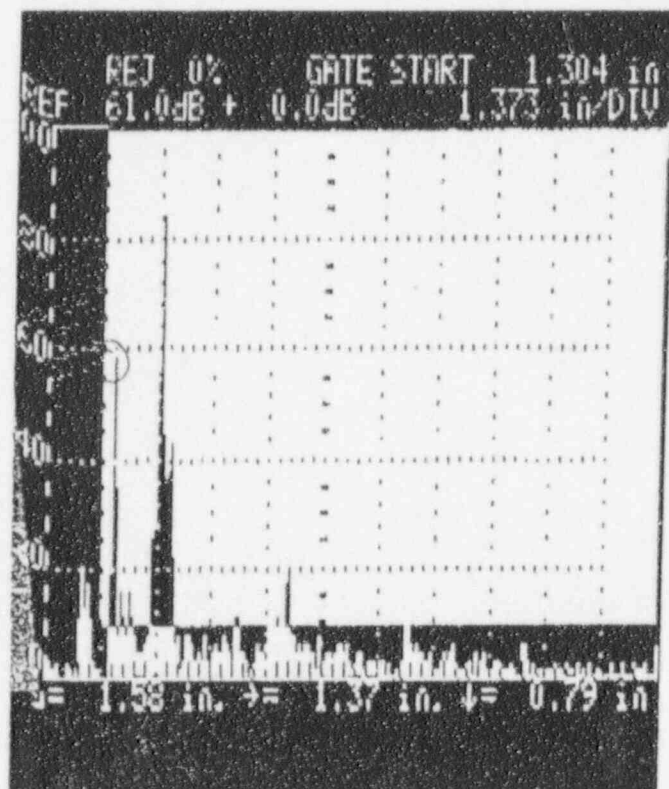
ROMPAS @ REF 1218
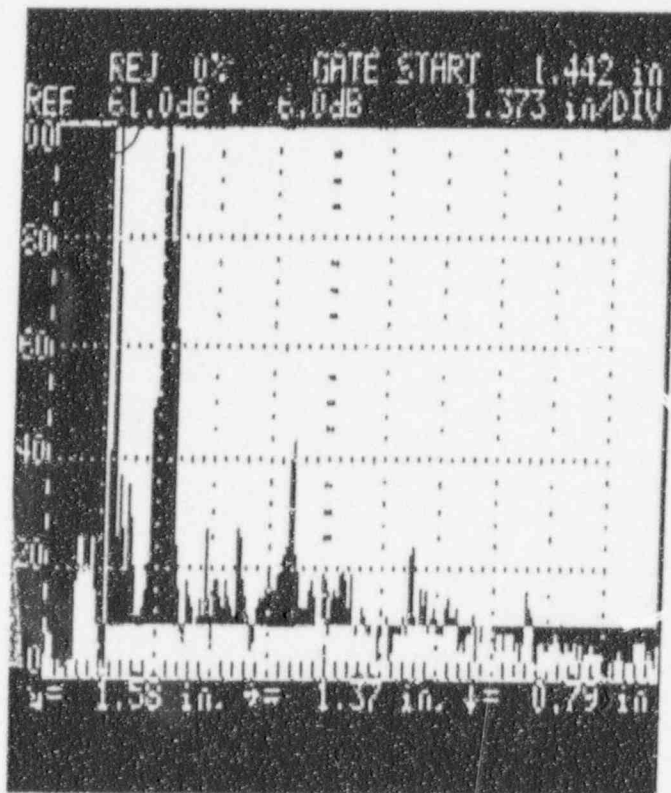
ROMPAS @ +6DB

ULTRASONIC CALIBRATION REPORT

CALIBRATION BLOCK: Type VESSEL			Procedure # / Rev
S/N 25A	Material CS	Size N/A	
Thickness 5.550	Temp 79 °F	Entry Surf OD	NSP-UT-3 / 4 FC1

REFERENCE BLOCK			Plant PI UNIT II
Type ROMPAS	S/N 404	Temp 79 °F	

ULTRASONIC INSTRUMENTS:		RECORDER:	Exam
Mfr PANAMTRICS	Mfr NOT USED	Mfr NOT USED	Company LMT, Inc.
Model 2002	Model N/A	Model N/A	
S/N 864	S/N N/A	S/N N/A	Calibration Data:
Recal 10/07/89	Recal N/A	Recal N/A	Date 04/12/89

SEARCH UNIT CABLE:		COUPLANT:	Start @ 1030
Type BNC/BNC	Length 12'	B/N 5488	Check @ N/A
			Final @ 1247

SEARCH UNITS:

S/N	Angle	Freq.	Wave Mode	Mfr	Size	Wedge Mfr.
A52	60	2.25	SW	HSC	.50 x 1.0	HARISONIC

BEAM ANGLE DATA:

Serial Number	Index Check	Refracted Angle In Reference Block	Refracted Angle In Calibration Block
A52	OK	60 deg	61 deg

AMPLITUDE LINEARITY (Signal 2 Shall Equal 50% of Signal 1, ±5% F.S.H.)

	Signal 1 (Set)	100	90	80	70	60	50	40	30	20	10
MASTER:	Signal 2 (Read)	50	45	40	36	30	25	20	15	10	5

AMPLITUDE CONTROL ACCURACY

Amplitude Setting:	80% /- 6dB	80% /-12dB	40% /+ 6dB	20% /+12dB
Acceptable Range:	32% to 48%	16% to 24%	64% to 96%	64% to 96%
MASTER, Actual:	40% F.S.H.	20% F.S.H.	80% F.S.H.	80% F.S.H.

INSTRUMENT SETTINGS AT REFERENCE SENSITIVITY

	Straight Beam	Angle Beam	FLAW GATE SETTING
Gain	N/A	61 dB	Start 1.5 div
Frequency	N/A	2.25MHz	End 10 div
Sweep	N/A	1.373	
Delay	N/A	0	Beam Spread Page 2
Damping	N/A	400	
Reject	N/A	0	Signal to Noise
Rep. Rate	N/A	N/A	Ratio N/A
Filter	N/A	2-4	

REMARKS: ID NOTCH 15% @ + 6 dB

PERSONNEL:

|					
Examiner	*K.J. Levesque* (signature)	II Level	Contractor Review	*signature*	4-18-89 Date
	K.J. LEVESQUE				
Examiner	*signature*	I Level	NSP Review	*signature*	4-18-89 Date
	W.L. THOMAS				
Examiner	NA	Level	ANII Review	*signature*	4/14/89 Date
Examiner	NA	Level			

ULTRASONIC CALIBRATION REPORT

BEAM SPREAD DATA: Surface Distance, Range, and Metal Path at:

	Leading (50% Maximum)			Maximum Amplitude			Trailing (50% Maximum)		
	Surf	Sweep	M.P.	Surf	Sweep	M.P.	Surf	Sweep	M.P.
T/4	2.73	2.3	3.10	2.37	2.0	2.75	2.12	2.7	2.48
2T/4	5.53	4.5	6.51	4.68	4.0	5.40	4.40	3.5	5.07
3T/4	8.06	6.7	9.23	7.19	6.0	8.36	6.67	5.5	7.70
5T/4	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.0	0.00
PLANAR	10.30	8.6	11.82	9.81	8.3	11.33	9.01	7.6	10.62

DISTANCE-AMPLITUDE CORRECTION (DAC) CURVE PLOT
(AT REFERENCE SENSITIVITY)
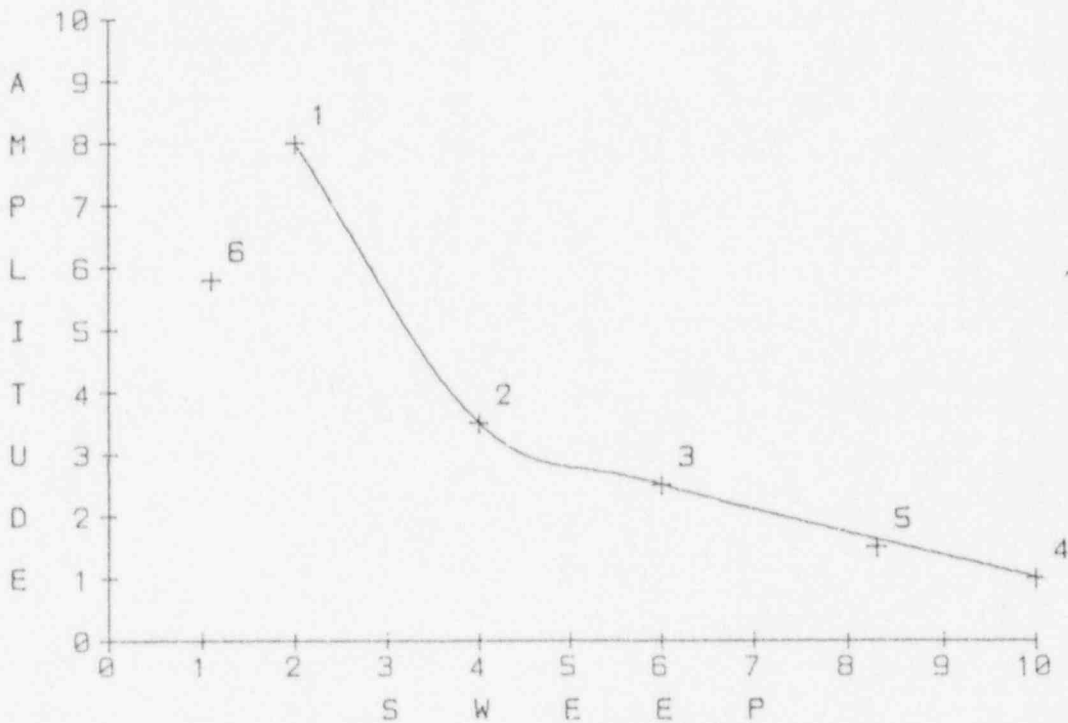
Reflector Number:	1	2	3	4	5	6	7
Ident:	T/4	2T/4	3T/4	5T/4	NOTCH	ROMP	N/A
Amplitude:	80	35	25	10	15	58	N/A
Sweep:	2	4	6	10.0	8.3	1.1	N/A
Metal Path:	2.75	5.40	8.36	N/A	11.33	1.65	N/A
Surf. Dist:	2.37	4.68	7.19	N/A	9.81	N/A	N/A

REJ 0% ** STORI,0 MEMORY #10 **
61.0dB   1.373 in/DIV

DELAY 0.000 in   ZERO 16.10 us
FILTER 2-4 MHz   DAMPING 400 OHMS
GATE START 1.304 in   ENERGY LOW
GATE WIDTH 14.37 in   FULL WAVE
GATE LEVEL 19%   T/R MODE
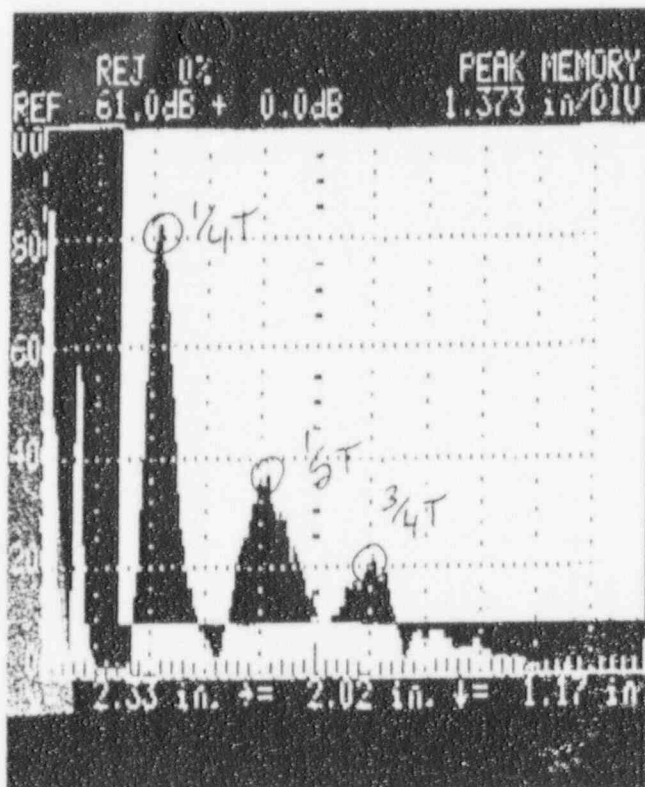VEL 0.1258 in/us   ↕ 60.0°/ 5.500in

MEMORY SELECT → ■ 1 2 3 4 5 6 7 8 9 10
x = OCCUPIED   →   X X X   X X X

REJ 0%   PEAK MEMORY
REF 61.0dB + 0.0dB   1.373 in/DIV

1/4T
1/2T
3/4T

2.33 in. →= 2.02 in. ↓= 1.17 in.

PEAK MEMORY
1/4T, 1/2T, 3/4T SDH
@ REF