Consumers Power
POWERING MICHIGAN'S PROGRESS

EA - SP-03316-04

PALISADES NUCLEAR PLANT

ENGINEERING ANALYSIS COVER SHEET

Total Number of Sheets 32

Title SERVICE WATER SYSTEM - EVALUATION OF PIPE WALL THINNING DOWN STREAM OF VALVE MV SW 136.

INITIATION AND REVIEW

Calculation Status	Preliminary	Pending	Final	Superseded
	☐	☐	☑	☐

Rev #	Description	Initiated		Init Appd By	Review Method			Technically Reviewed		Revr Appd By	CPCo Appd
		By	Date		Alt Calc	Detail Review	Qual Test	By	Date		
0	Original Issue	P. Hoang P. HOANG	6/19/93	RBQ		✓		BRRogers BR ROGERS	6/22/93	RBQ	

Form 3619 10-91

9307060314 930701
PDR ADOCK 05000255
P PDR

1.0 Purpose:

The purpose of this caclulation is to evaluate the structural integrity of a small through wall leak found at the down stream butt weld of valve MV SW136 on line HB23-4" of Service Water system for a temperory non-Code repair permit. The scope of the calculation includes evaluations using the proposed Code Case N-513 "Fracture Mechanics Approach", the Code Case N-480 "Wall Thinning Evaluation Method" and the "Branch Reinforcement Approach" per the proposed Code Case N-513.

2.0 Design Input:

1. Nondestructive Testing Service Thickness Measurement Examination Report Sheet MFS-03, dated 6/10/93. (Attachment 1)

2. Drawing M101-SH. 2744, Rev. 2.

3. Stress Report EA*SP* 03316-01, S&L File # 9131-00

4. Palisades Plant Piping Class Summary, M-259, Sh 3HB, Rev. 9.

5. Nondestructive Testing Service Thickness Measurement Examination Report Sheet RDW-01, dated 6/2/93. (Attachment 2)

3.0 Assumptions:

1. Per the plant NDE personnels, the UT weld crown thickness measurement (Ref. 7.1) at 10:00 location is near to the pin hole leak. Weld surface irregularities and component configuration prohibited the taking of UT measurements at this location where the material thickness may be thinner than the weld crown thickness. Surface grinding to facilitate additinal UT measurements could not be accomplished to avoid further wall thinning. Therefore, the thickness mesurements used as the basis for the calculation are only an approximation of wall thickness at the toe of the weld.

2. Since the thickness measurement of 0.228" at the valve end (Ref. 7.1) is about the same as the expected thickness at the valve end counterbore, it is assumed that there is no significant erosion or corrosion in the valve body.

3. Per the conversation between CPCo Licensing and NRC staff, structural integrity of a pin hole leaked pipe can be evaluated by the "Wall Thinning Approach" or the "Branch Reinforcement Approach" for a non-code repair permit. (See Attachment 3)

4.0 Approach:

The measured weld thicknesses at several locations around the pipe circumference are ploted in Figure 1. The corroded area is concentrated near the 10:00 o'clock location where the pin hole leak was found. There is no significant thickness reduction in the adjacent pipe metal (except location E1, t=0.187" or 0.789 times pipe nominal thickness, Ref. 7.6) . Furthermore, there is no indication of erosion/corrosion on the down stream pipe wall. Therefore, the leak may be resulted from corrosion in a local weld area where the weld is not fully penetrated. Structural integrity of the leaked pipe is evaluated by the following approaches:

4.1. Fracture Mechnics Approach:

a) Flaw characterization:

The stress intensity factor K assuming pipe wall thickness of t_{min} per the USNRC GL 90-05 is judged to be too conservative for low pressure piping (very small t_{min}). Alternatively, the proposed Code Case N-513 (Ref. 7.10) suggests that the adjusted pipe wall thickness t_{adj} can be chosen such as

$$t_{min} < t_{adj} < t_{act}$$

where t_{min} is the Code minimum pressure design pipe wall thickness

$$t_{min} := \frac{P \cdot D}{2(15000 + 0.4 \cdot P)}$$

and t_{act} is the actual pipe thickness adjacent to the flaw (t_{act} = 0.19").

In this calculation t_{adj} is chosen such that the characterized flaw length 2a is the 2" (15% of the circumference) length limit. From Figure 3, with the smooth flaw profile and 2a=2", t_{adj} is approximately 0.125".

Therefore, a 2" inch circumferential through wall crack on a 4.5" OD, 0.125" thick pipe, is the postulated fracture mechanics model. The crack length is about from 9:00 to 11:00 o'clock positions.

Note that the predicted pipe wall thickness at the end of the evaluation period is not required for this approach.

b) Applied stress:

The nomimal applied stress s(ksi) for pressure, dead weight and SSE is recalculated from the intensified combined stresses at the valve end (REF. 7.3). Note that thermal load is not considered due to temperature < 150 degree and SSE stress is two times OBE stress.The applied stress is the far field stress (unintensified and no adjustment for pipe wall thickness).

c) Stress intensity factor K: Ref. 7.10

$$K := 1.4 \cdot s \cdot F \cdot \sqrt{\pi \cdot a}$$

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

$$c := \frac{a}{(\pi \cdot R)} \qquad r := \frac{R}{t_{adj}}$$

$$R := \frac{D - t_{adj}}{2}$$:Mean radius

The coeficients A,B and C are given in Section 5.2 of this calculation.

d) Acceptance criteria $K < K_I$

Where K_I is the material initiation stress intensity. For carbon steel,

$$K_I := 35000 \ psi \cdot \sqrt{in}$$ (Ref. 7.5 and 7.10)

4.2 Wall Thinning Approach:

a) Methodology: (Ref. 7.4)

- The predicted pipe wall thickness at the end of 18 month evaluation period is calculated from the current minimum measured thickness and the wear rate.

- The average wear rate of the pass 20 years of the plant operation is calculated from the difference between the maximum and the minimum measured weld thichness divided by 20 year.

- The Code minimum pipe wall thickness t_{min} is calculated as such that axial and hoop stresses meet all Code stress limits.

b) Acceptance Criteria

- The predicted pipe wall thickness to the next outage (18 month appx.) t_p shall be greater than t_{min}.

- The stress limit for pressure hoop stress is Sh (15 Ksi)

- The stress limit for equation 11 (P+WT) is Sh (15 Ksi)

- The stress limit for equation 12B (P+WT+OBE) is 1.2Sh (18 Ksi)

- The stress limit for equation 12B (P+WT+SSE) is 2.4Sh (36 Ksi)

4.3 Branch Reiforcement Approach

a) Flaw characterization:(Proposed Code Case N-513)

The Code minimum thickness is calculated as:

$$t_{min} := \frac{P \cdot D}{2(15000 + 0.4 \cdot P)}$$

Per the proposed Code Case N-513 (Ref. 7.10), the adjusted pipe wall thickness t_{adj} can be chosen such as

$$2^* t_{min} < t_{adj} < t_{act}$$

In this calculation t_{adj} is chosen such that the characterized flaw is entirely contained within a 2.25 inch diameter circular opening which is half of d=4.5", the diameter of a postulated circular opening. (Ref. 7.10, Section 3.2).

- Applied stress:

The nomimal applied stress s for pressure, dead weight and SSE is recalculated from the intensified combined stresses at the valve end (REF. 7.3). Note that thermal load is not considered due to temperature < 150 degree. SSE stress is two times OBE stress. The nominal stresses are then adjusted for the new pipe thickness before reintensified by the UFT stress intensification factor.

- The required reinforcement area for the circular opening is calculated in accordance with ND-3643.3, Ref. 7.7.

- Stress intensification factor of an equivalent unreinfored fabricated tee (UFT) is calculated using Figure ND-3673.2(b)-1, Ref 7.8.

c) Acceptance criteria

Stress at the postulated circular opening using UFT stress intensification factor shall be within the ND-3650 limits for all service levels.

5.0 Calculations

$l := \pi \cdot 4.5$

5.1 Measured pipe wall thickness:

Weld thickness plot using the measured data dated 6/10/93

Location from top (12:00)

fraction of the circumference

$D := 4.5$: OD of the pipe

$l := \pi \cdot D$: The circumference

$$x := \begin{bmatrix} 0 \\ \frac{1}{12} \\ \frac{1}{6} \\ \frac{1}{4} \\ 7 \cdot \frac{1}{24} \\ \frac{1}{3} \\ \frac{1}{2} \\ 3 \cdot \frac{1}{4} \\ 5 \cdot \frac{1}{6} \end{bmatrix}$$

Distance from the top (in)

$$x = \begin{bmatrix} 0 \\ 1.178 \\ 2.356 \\ 3.534 \\ 4.123 \\ 4.712 \\ 7.069 \\ 10.603 \\ 11.781 \end{bmatrix}$$

Weld thickness(in)

$$t := \begin{bmatrix} .3 \\ .185 \\ .094 \\ .148 \\ .184 \\ .362 \\ .38 \\ .330 \\ .33 \end{bmatrix}$$

$i := 0..8$

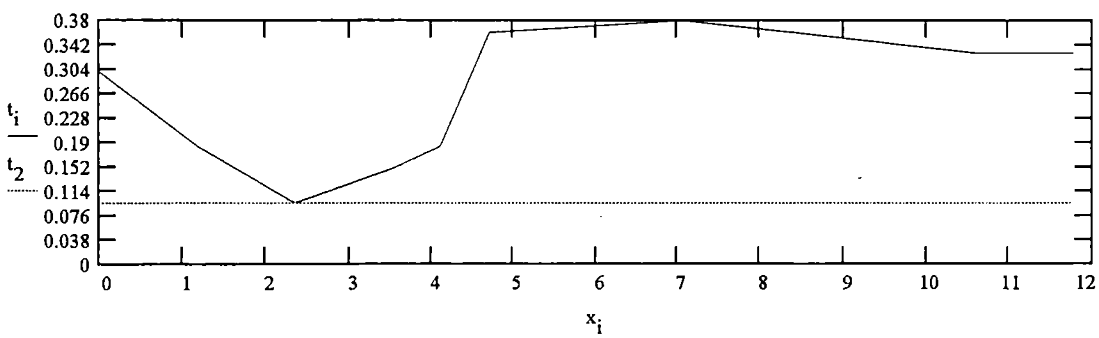


Figure 1: Measured weld thickness along the circumference.

5.2 Calculation using fracture mechanics approach.

a) Flaw characterization:

The Code min wall thickness for design pressure: $P := 100$

$D := 4.5$

$$t_{min} := \frac{P \cdot D}{2 \cdot (15000 + 0.4 \cdot P)}$$

$t_{min} = 0.015$

Envelope the pipe wall thickness to a smooth profile (curve in Fig. 2)

$$tsm := \begin{bmatrix} .3 \\ .13 \\ .094 \\ .138 \\ .184 \\ .282 \\ .38 \\ .330 \\ .33 \end{bmatrix}$$

$z := 0.1 .. 12$

$vs := pspline(x, tsm)$

$f(z) := interp(vs, x, tsm, z)$

From Figure 2, for crack length 2a= 2", the adjusted thickness is approximately 0.125"

$t_{min} = 0.015 \quad < \quad t_{adj} := 0.125 \quad < \quad t_{act} := 0.19$

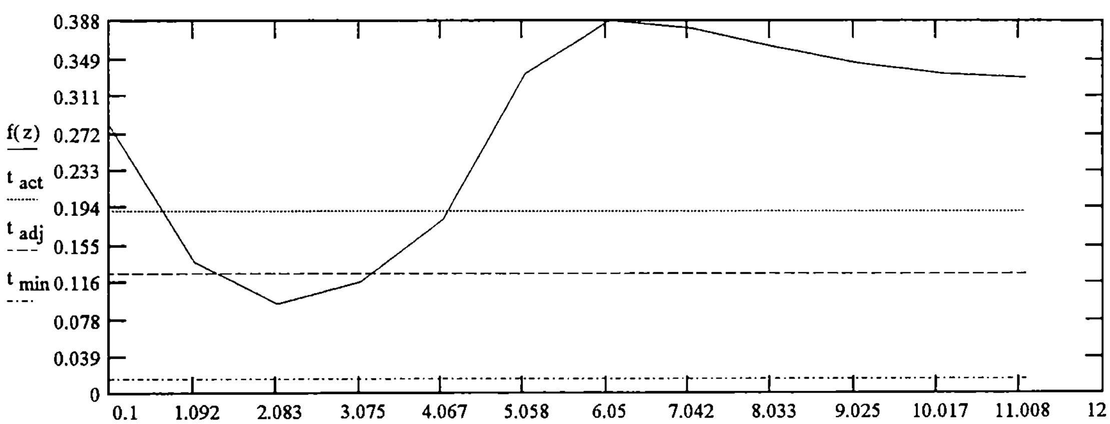


Figure 2 : Smooth weld thickness profile in cricumferential direction. t_{adj} is determined from the smooth wall profile such that the through wall crack length 2a is 2 inches.

b) <u>Applied Stress</u>

Nominal stress field s near the flaw (RUNID 03316A.INP EA-SP-03316-01 Rev 0)

At node point 66, analysed pressure P=65 psi $i := 1.425$ 0.75 factor included

$P := 65$ $D := 4.5$ $t_{nom} := 0.237$ $s_{11} := 2465$ $s_{12B} := 3457$

$s_p := \frac{P \cdot D}{4 \cdot t_{nom}}$ $s_p = 308.544$: Pressure stress

$s_{wt} := \frac{s_{11} - s_p}{i}$ $s_{wt} = 1.513 \cdot 10^3$: Weight stress

$s_{obe} := \frac{s_{12B} - s_{11}}{i}$ $s_{obe} = 696.14$: OBE stress

$s_{sse} := 2 \cdot s_{obe}$ $s_{wt} = 1.513 \cdot 10^3$: SSE stress

$s := s_p + s_{wt} + s_{sse}$ $s = 3.214 \cdot 10^3$: Applied stress

c) <u>Applied stress intensity K</u>

$R := \frac{D - t_{adj}}{2}$ The 2a flaw length is about 15% of the circumference at thickness t_{adj}

$r := \frac{R}{t_{adj}}$ $al := \frac{2}{2}$ $r = 17.5$

Coefficients A,B,C and D in matrix form

$$a := \begin{pmatrix} -3.26543 & 1.52784 & -0.072698 & 0.0016011 \\ 11.36322 & -3.91412 & 0.18619 & -0.004099 \\ -3.18609 & 3.84763 & -0.18304 & 0.00403 \end{pmatrix}$$

$$b := \begin{bmatrix} 1 \\ r \\ r^2 \\ r^3 \end{bmatrix} \qquad c := a \cdot b \qquad c = \begin{pmatrix} 9.789 \\ -22.081 \\ 29.69 \end{pmatrix}$$

$C := \frac{al}{(\pi \cdot R)}$ $C = 0.146$

$F := 1 + c_0 \cdot C^{1.5} + c_1 \cdot C^{2.5} + c_2 \cdot C^{3.5}$

$F = 1.4$

$s = 3.214 \cdot 10^3$ $s := \frac{s}{1000}$ Ksi

$K := 1.4 \cdot s \cdot F \cdot (\pi \cdot al)^{0.5}$ $K = 11.165$ $Ksi \cdot \sqrt{in}$

$K < K_I$ $K_I := 35$ $Ksi \cdot \sqrt{in}$

d) Results

The applied stress intensity K (12.662) is less then 35 ksi $\sqrt{in}$
Therefore, no Code repair or replacement is required.

5.3 Wall thinning approach:

a) Minimum measured thickness

$t_{meas} := t_2$ $t_{meas} = 0.094$

b) Predicted pipe thickness in the next 18 month period

- The average wear rate in the pass 20 years of operation based on the max and min measured weld thickness.

$$rate := \frac{0.38 - 0.094}{20}$$

$rate = 0.014$ inch per year

- The predicted pipe thickness for the next 18 month period is

$$t_p := t_{meas} - \frac{18}{12} \cdot (rate)$$

$t_p = 0.073$

t_p is greater than 0.3*t_{nom} =0.71 inch, therefore t_p meet the requirement 3410 of Code Case N-480.

c) Minimum pipe wall thickness required per the Code Case N-480

c.1) Minimum pipe wall thickness required for hoop stress

Hoop stress due to design pressure P=100 psi. was calculated in section 5.2(a) for the following condition.

$P := 100$ $D := 4.5$ $S_h := 15000$

$t_{min} = 0.015$

c.2) Minimum thickness required for axial stress to meet the Code stress limits

Section modulus for thin wall pipe:

$Z(t) := \pi \cdot \left(\frac{D - t}{2}\right)^2 \cdot t$ $t_{nom} := 0.237$ $Z_{orig} := Z(t_{nom})$

As analysed stresses based on the original section modulus (Ref. 7.3)

$s_{11} = 2.465 \cdot 10^3$

$s_{12B} = 3.457 \cdot 10^3$

$s_{12D} := s_{11} + 2 \cdot (s_{12B} - s_{11})$

- Minimum thickness required to meet Eq. 11 stress limit

Stress as a function of t calculated from the ratio of the original section modulus and the reduced thickness section modulus.

$s(t) := s_{11} \cdot \frac{Z_{orig}}{Z(t)}$ $\quad S_{all} := 15000$ $\quad t := 0.01$ Initial guess

Solve for t

$t_{min} := \text{root}(s(t) - S_{all}, t)$ $\quad t_{min} = 0.036$

- Minimum thickness required to meet Eq. 12B stress limit.

$s(t) := s_{12B} \cdot \frac{Z_{orig}}{Z(t)}$ $\quad S_{all} := 18000$

Solve for t

$t_{min} := \text{root}(s(t) - S_{all}, t)$ $\quad t_{min} = 0.042$

- Minimum thickness required to meet Eq. 12D stress limit.

$s(t) := s_{12D} \cdot \frac{Z_{orig}}{Z(t)}$ $\quad S_{all} := 36000$

Solve for t

$t_{min} := \text{root}(s(t) - S_{all}, t)$ $\quad t_{min} = 0.027$

Therefore, the Code minimum pipe thickness is $t_{min} := 0.042$

c.3) Evaluations using N- 480, 3610(a) acceptance criteria:

The t_p at the end of evaluation period is greater than the Code minimum pipe wall thickness.

$$t_p = 0.073 \qquad t_{min} = 0.042$$

$$t_p > t_{min}$$

Therefore, the flaw is acceptable per 3610(a) of N-480. tp is also greater than the required thickness per section 3420 of Code Case N-480, 0.3 times t_{nom} or 0.071".

d) Result:

The flaw wall thinning predicted for the next 18 month period is acceptable per N-480 acceptance criteria 3610 (a).Therefore, code repair is not required. Note that the minimum measured weld thichness in the subsequence inspections shall not be less than 0.3 times tnom or 0.071" per the requirement 3420 of N-480.

5.4 Branch reinforcement approach (Proposed Code Case N-513)

a) Flaw characterization

The Code min wall thickness for design pressure: $P := 100$ $D := 4.5$

$$t_{min} := \frac{P \cdot D}{2 \cdot (15000 + 0.4 \cdot P)} \qquad t_{min} = 0.015$$

$$t_{act} := 0.19 \quad > \quad t_{adj} \quad > \quad 2 \cdot t_{min} = 0.03$$

The postulated circular opening diameter $d := 4.5$

From Figure 4, for $t_{adj} := 0.135$, the flaw is within a d/2=2.25" diameter circular area.

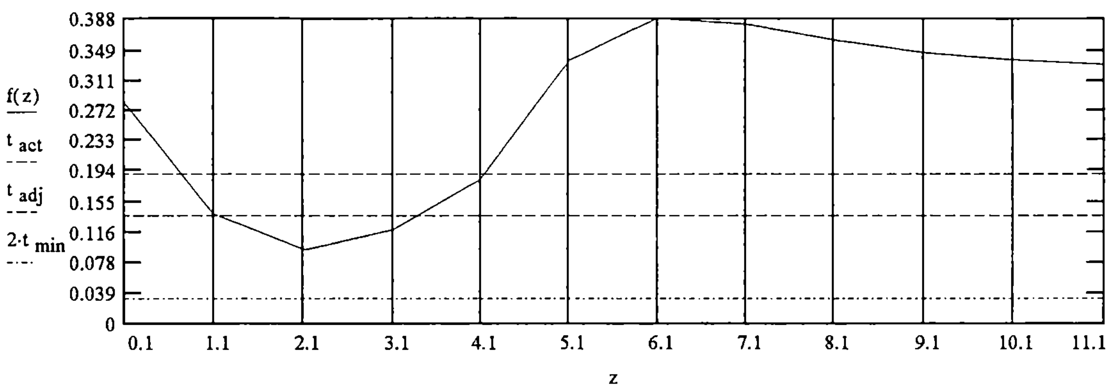


Figure 4 : Pipe Wall Thickness in cricumferential direction measured near the fillet weld toe.The smooth wall thickness profile is used to determine tadj such that t > 2*tmin and the flaw is within a 2.25 inch diameter circular opening.

b) The required reinforcement area for the circular opening is calculated in accordance with ND-3643.3, Ref. 7.7.

$d := 4.5$: the postulated circular opening

$d_2 := d$: the header reinforcement length

$A_1 := d_2 \cdot (t_{adj} - t_{min})$:available reinforcement area from header

$A_1 = 0.54$ in^2

$A_{req} := 1.07 \cdot d \cdot t_{min}$

$A_{req} = 0.072$ in^2 :required reinforcement area

Therefore, the reinforcement area meet the requirement per ND-3643.3, Ref. 7.8

c) <u>Stress using UFT stress intensification factor</u>

$t_{adj} = 0.135$ $\quad R := \frac{D - t_{adj}}{2}$ $\quad h := \frac{t_{adj}}{R}$

$i_{uft} := \frac{0.9}{h^{\frac{2}{3}}}$ $\quad i_{uft} = 5.754$

Nominal stress for the original pipe thickness (RUNID 03316A.INP EA-SP-03316-01 Rev 0)

$P := 65$ $\quad t_{nom} := 0.237$ $\quad i := 1.425$ **0.75 factor included**

$s_p := \frac{P \cdot D}{4 \cdot t_{nom}}$ $\quad s_p = 308.544$: Pressure stress

$s_{wt} := \frac{s_{11} - s_p}{i}$:WT stress

$s_{obe} := \frac{s_{12B} - s_{11}}{i}$:OBE stress

For thin wall pipe, the modified nominal stress for pipe wall thickness of t_{adj} can be approximated as follows:

$S_p := s_p \cdot \frac{t_{nom}}{t_{adj}}$ $\quad S_{wt} := s_{wt} \cdot \frac{t_{nom}}{t_{adj}}$ $\quad S_{obe} := s_{obe} \cdot \frac{t_{nom}}{t_{adj}}$

Reintensified stress using UFT stress intensification factor

Eq 11 $\quad S_{11} := S_p + 0.75 \cdot i_{uft} \cdot S_{wt}$ $\quad S_{11} = 1.201 \cdot 10^4$ **< 15,000 psi**

Eq 12B $\quad S_{12B} := S_p + 0.75 \cdot i_{uft} \cdot S_{wt} + 0.75 \cdot i_{uft} \cdot S_{obe}$ $\quad S_{12B} = 1.728 \cdot 10^4$ **< 18,000 psi**

Eq 12D $\quad S_{12D} := S_p + 0.75 \cdot i_{uft} \cdot S_{wt} + 0.75 \cdot i_{uft} \cdot S_{obe} \cdot 2$ $\quad S_{12D} = 2.256 \cdot 10^4$ **< 36,0000 psi**

d) <u>Results</u>: The leaked pipe meet the N-513 UFT evaluation citeria 3.2 (c).

6.0 Summary and Conclusion:

Three different approaches were used to evaluate the structural integrity of the pin hole leak on line HB23-4". The results of the evaluations are as the follows:

- Linear Elastic Fracture Mechanics Approach: (N-513)

$K = 11.165$ Ksi $\sqrt{in}$: Applied stress intensity

is less than

$K_I = 35$ Ksi $\sqrt{in}$: Allowable stress intensity

- Wall Thinning Approach: (Code Case N-480)

$t_p = 0.073$ in : Predicted pipe wall

is greater than

$t_{min} := 0.071$ in : Required minimum pipe wall thickness 0.3 * nominal thickness.

- Branch reinforcement Approach: (Proposed Code Case N-513)

$A_1 = 0.54$ in^2 :total available reinforcement area

is greater than

$A_{req} = 0.072$ in^2 :required reinforcement area

$S_{11} = 1.201 \cdot 10^4$ < 15,000 psi : Pass

$S_{12B} = 1.728 \cdot 10^4$ < 18,000 psi : Pass

$S_{12D} = 2.256 \cdot 10^4$ < 36,0000 psi : Pass

The structural integrity of the pipe leak was found to be assured by the fracture mechanics approach, the wall thinning approach and the branch reinforcement approach.

On the basis of the above evaluations and discusion we conclude that the structural integrity of the pipe leak on line HB23-4" is assured and due to design pressure less than 275 psig and temperature less than 200 ^oF, the leaked pipe is acceptable for a non-weld repair. (Ref. 7.5).

7.0 References

7.1. Nondestructive Testing Service Thickness Measurement Examination Report MFS-03, dated 6/10/93. (Attachment 1)

7.2. Drawing M101 SH. 2744, Rev. 2

7.3. Stress Report EA*SP* 03316-01, S&L File # 9131-00

7.4. Code Case N-480, "Examination Requirements for Pipe Wall Thinning Due to Single Phase Erosion and Corrosion", Section XI, Division 1, 05/10/90.

7.5. USNRC Generic Letter 90-05, "Guidance for Performing Non-Code Repair of ASME Code Class 1,2, and 3 Piping", 6/15/90.

7.6 Nondestructive Testing Service Thickness Measurement Examination Report Sheet No. RDW-01, dated 6/2/93. (Attachment 2)

7.7 Palisades Plant Piping Class Summary, M-259, Sh 3HB, Rev. 9.

7.8 ASME B&PV Code, Section III, Subsection ND, 1992

7.9 ANSI/ASME B31.1, 1973

7.10 Proposed Code Case N-513, "Evaluation Criteria for Temporary Acceptance of Flaws in Class 3 Piping", Section XI, Division 1, 08/13/92. (Presented in February 1993 Committee Meeting).

CONSUMERS POWER COMPANY
NONDESTRUCTIVE TESTING SERVICES
THICKNESS MEASUREMENT EXAMINATION REPORT

Examiner M.F. SHERWIN Level III Date 6/10/93 Sheet No. MFS-03

Examiner N/A Level N/A NDT Company CPCo / (MQS)

Project No. 239315-228051 Requesting Dept MECH. MAINT.

Job Location PALISADES Total Hours Worked

NDT Procedure NDT-UT-02 Rev 5

Ultrasonic Equipment PAN 26DL+ Serial No. 000355 Cal Due 9/10/93

Search Unit Size/Frequency 0.2 / 5 MHz Serial Number 19209

Reference Documents N/A

INFORMATION ONLY

Ultrasonic Couplant SONOTRACE 40 Batch Number 091014

Mechanical Equipment N/A Serial No. N/A Cal Due N/A

Material Type CS Joint Design

Nominal Diameter 4" Nominal Thickness 0.237

Item ID Number A7 System Name SWS Sub Project Number .3

Item Type 4" SERVICE WATER

Line Number ISO/Drawing No. M-208 SHT 1A

Item Location	SUPPLEMENTARY SKETCH
	SEE ATTACHMENT SHEET. WELD CROWN IS ESSENTIALLY FLAT, BUT IN THE "AS WELDED" CONDITION. POWER WIRE BRUSH WAS USED TO CLEAN THE SURFACES PRIOR TO ULTRASONIC EXAMINATION. NOTE: READINGS VERIFIED 6/11/93 MFS

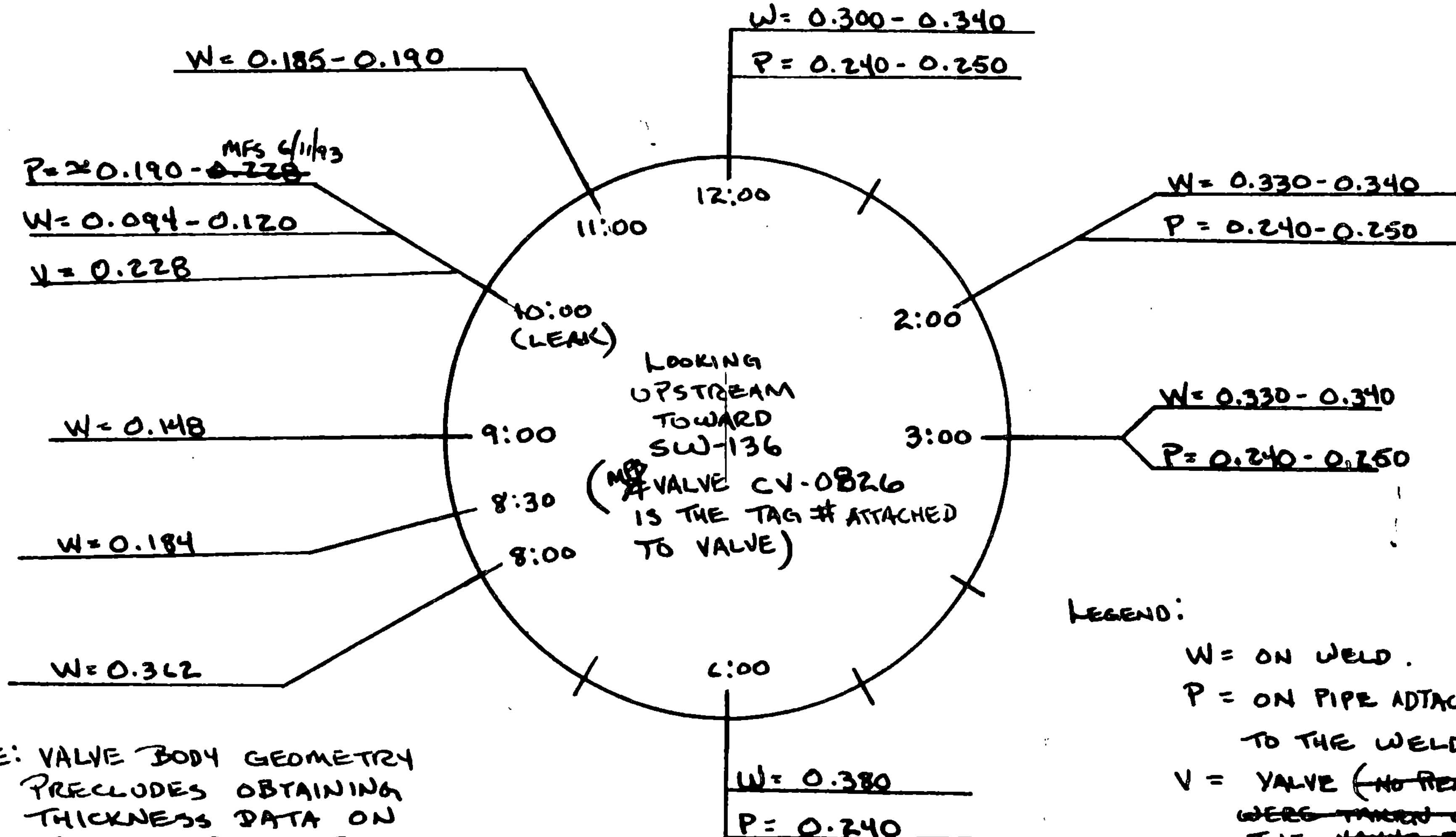
EA-SP-03316-04 ATTACHMENT 1 PAGE 1 OF 2

Examiner [signature] Page 1 of 1 Reviewed by:

CONSUMERS POWER COMPANY
NONDESTRUCTIVE TESTING SERVICES
SUPPLEMENTARY SKETCH

Examiner: M.F. SHERWIN Level: III Date: 6/10/93 Attachment Sheet No: MFS-03
Project No.: 239315-228051 Examination Report Sheet No: MFS-03
Job Location: PALISADES WO/MO No: N/A
Line No.: Item Type/No: 4" SERVICE WATER

ALL DIMENSIONS IN INCHES



NOTE: VALVE BODY GEOMETRY PRECLUDES OBTAINING THICKNESS DATA ON THE COMPONENT AT OTHER CLOCK POSITIONS

LEGEND:
W = ON WELD.
P = ON PIPE ADJACENT TO THE WELD.
V = VALVE ~~(NO READINGS WERE TAKEN ON THE VALVE BODY)~~
MFS 6/11/93

EA-SP-03316-04 ATTACHMENT 1 PAGE 2 OF 2

Rev 5/92

CONSUMERS POWER COMPANY
NONDESTRUCTIVE TESTING SERVICES THICKNESS MEASUREMENT EXAMINATION REPORT

Examiner RANDELL WELLS   Level II   Date 6-2-93   Sheet No. RDW-01

Examiner DAVID HECKSEL   Level II   NDT Company C.P. CO.

Project No. 24931522 5056   Requesting Dept SYSTEM ENGR.

Job Location PALISADES NUCLEAR PLANT   Total Hours Worked N/A

NDT Procedure NDT-UT-02   Rev 5

N/A

Reference Documents N/A

N/A

Material Type C/S   Joint Design N/A

Nominal Diameter 4"   Nominal Thickness .237"

Item Type 4" PIPING

Ultrasonic Equipment PANAMETRICS 26DLP   Serial No. ~~374~~ RDW -00355   Cal Due 9-10-93

Search Unit Size/Frequency .2" 15MHZ   Serial Number 19209

Ultrasonic Couplant SONOTRACE 40   Batch Number 091014

Mechanical Equipment N/A   Serial No. N/A   Cal Due N/A

N/A   N/A

Item ID Number PIPING DOWNSTREAM OF VALVE ~~[illegible]~~ MVSW136 MZ 6/16/93   System Name SWS   Sub Project Number N/A

Line Number N/A   ISO/Drawing No. N/A

Item Location	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
A	.245	.250	.249	.246	.247	.239	.244	.244	.247	.249	.256										
B	.250	.247	.254	.275	.270	.240	.246	.243	.238	.242	.249										
C	.257	.254	.258	.247	.252	.255	.253	.252	.238	.248	.246										
D	.256	.254	.272	.252	.254	.246	.247	.246	.245	.249	.232										
E	.187	.240	.252	.257	.242	.258	.249	.246	.253	.247	.243										
F	.220	.247	.247	.248	.246	.248	.253	.246	.247	.244	.251										
G	.244	.245	.249	.245	.246	.246	.241	.242	N/A	N/A	.243										
H	.237	.241	.248	.252	.253	.253	.245	.251	.251	.252	.260										
I	.243	.247	.248	.247	.254	.251	.244	.249	.258	.257	N/A										
J	.232	.238	.241	.242	N/A	.234	.240	.246	.259	.255	.265										
K	.241	.232	.227	N/A	.238	.239	.234	.243	.234	.259	.272										
L	.242	.242	.245	.240	.254	.256	N/A	.233	.247	.250	N/A										

Examiner Randell D. Wells   Page 1 of 2 (SEE ATTACHED SKETCH)   Reviewed by: MZ

Rev 9/92

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THICKNESS MEASUREMENT EXAMINATION REPORT
CONTINUATION SHEET

Project No. 249315225056 | Examination Report Sheet No. RDW-01 | Date 6-2-93 | Page 2 of 2

Item	Thickness Measurements																				
Location	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
M	.254	.248	.259	.252	.260	.253	.255	.247	.248	.259	.255										
N	.239	.235	.244	.236	.240	.254	.239	.235	.238	.236	.240										

NOTE: SPACES MARKED "N/A" ARE AREA WHERE SURFACE CONDITION PREVENTS READINGS.

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CONSUMERS POWER COMPANY
NONDESTRUCTIVE TESTING SERVICES
SUPPLEMENTARY SKETCH

Examiner: D. Heckel / R. Wells | Level: II | Date: 6.2.93 | Attachment Sheet No: DLH 1

Project No.: 2493152250 56 | Examination Report Sheet No: RDW.01

Job Location: Palisades | WO/MO No: N/A

Line No.: N/A | Item Type/No: Piping Downstream of Valve ~~CV-0826~~ MV-SW-136 MZ 6/16/93

Wall Thickness measurements Taken on 1" Grid.
Leak Located in Weld between Rows C & D

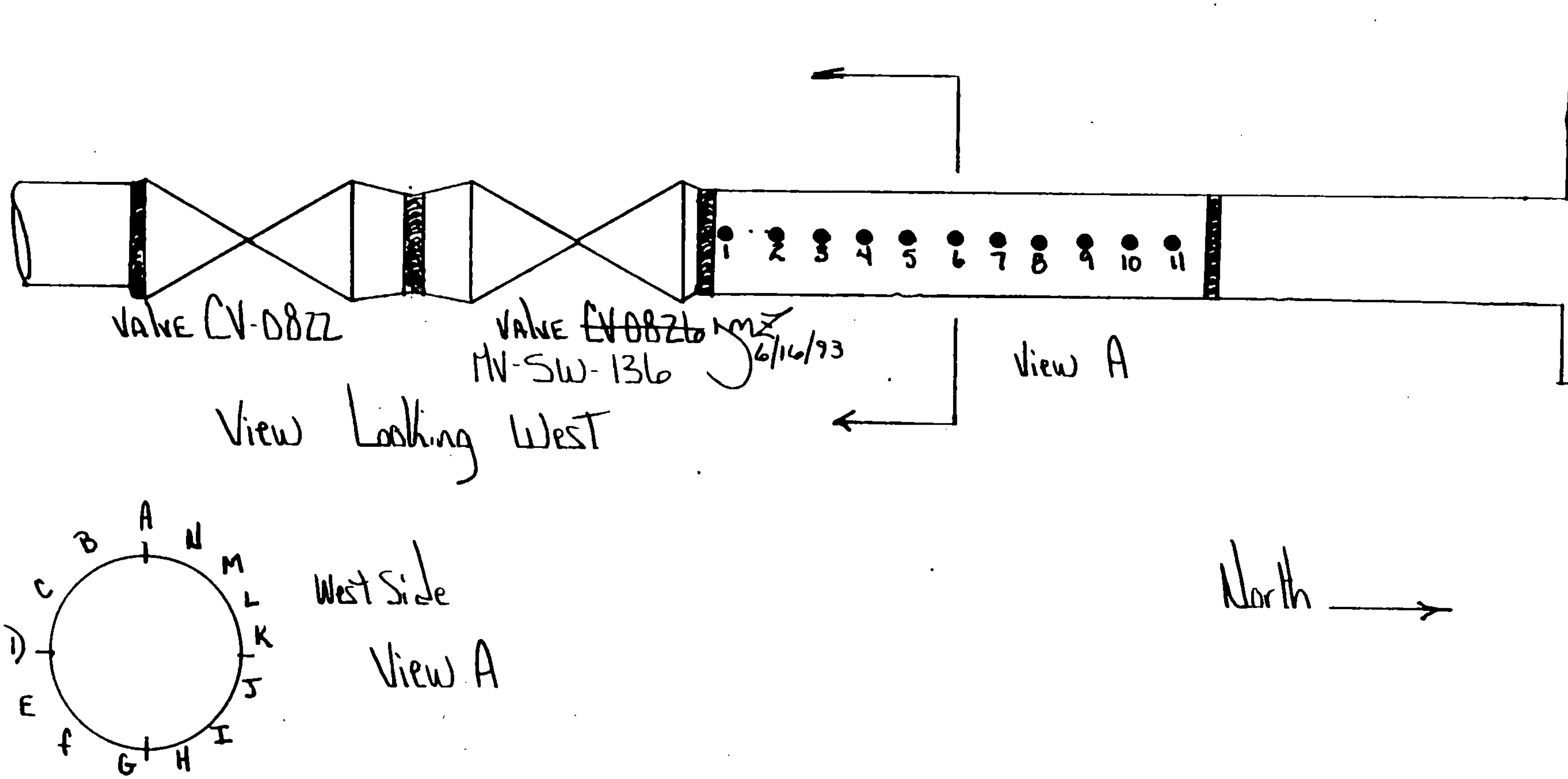

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FIGURE 1

Consumers Power Company
Palisades Plant
Docket 50-255

P&ID Drawing M-208, Sheet 1A

July 1, 1993

1 Page

System Description: Service Water Line HB-23-16"

Service water line HB-23-16" taps into the "A" Critical Service Water Header (HB-23-24"). Service water from the "A" Critical Header flows through HB-23-16" to the Component Cooling Water Heat Exchanger, E-54B. The service water flows through the tubes in E-54B and exits the heat exchanger back into service water line HB-23-16". The service water goes through CV-0826, E-54B Service Water Outlet Valve and then HB-23-16" taps into the main service water return header pipe, HB-23-24" and discharges to Lake Michigan.

A 4" bypass line around CV-0826, contains a temperature control valve, CV-0822 and a manual isolation valve, MV-SW136. Normally most of the service water going through E-54B goes through the bypass line, HB-23-4". As the lake temperature warms during summer, CV-0826 will be manually throttled open to help keep the temperature control valve, CV-0822 in a mid-point position. Estimated service water flow rates are 1000 gpm/heat exchanger in the winter to 1500 gpm/heat exchanger in the summer.

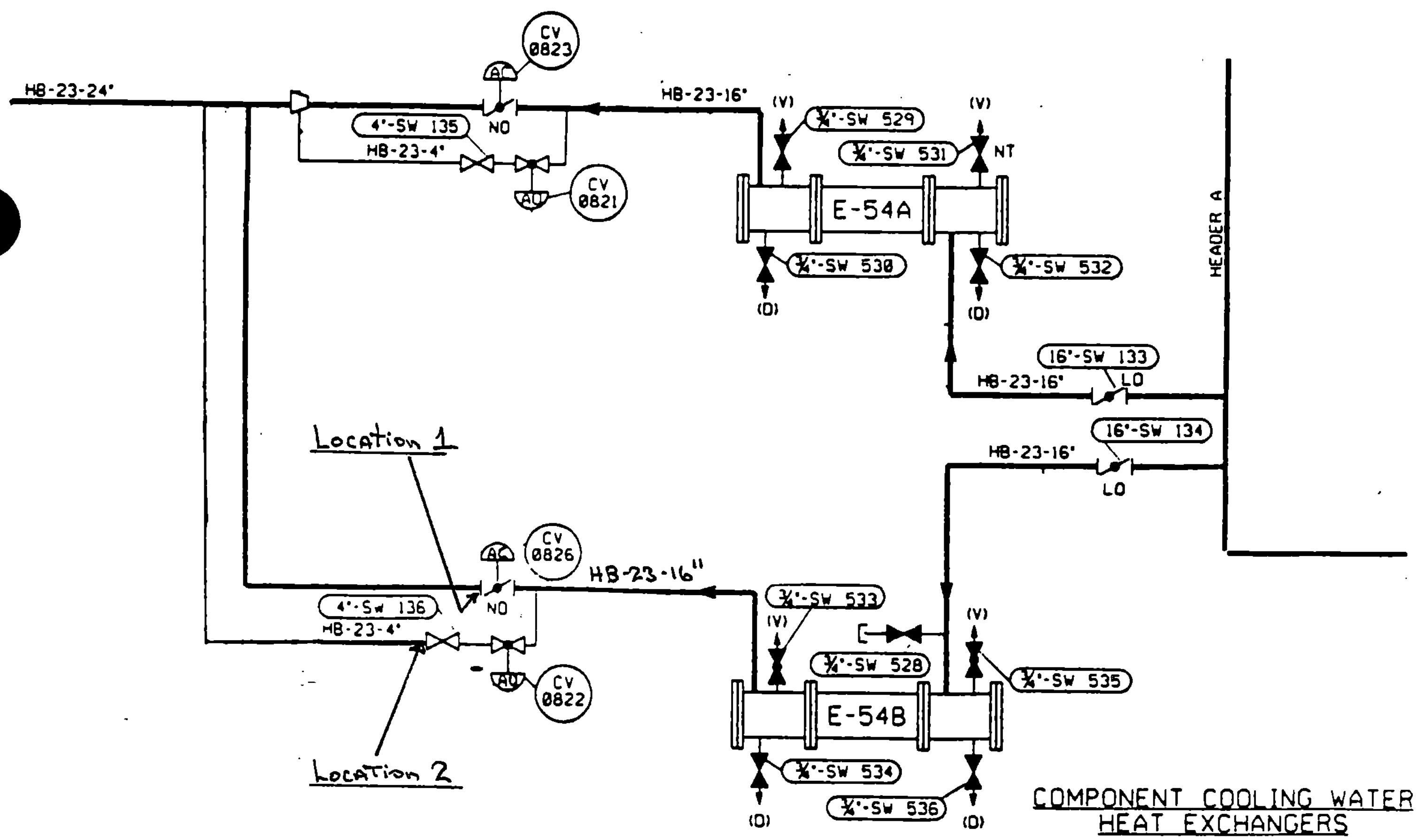

FIGURE 1
P&ID Drawing M-208, Sheet 1A