ENCLOSURE TO NL-16-133

IP-CALC-16-00079 FCU 31 SW Leak

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 3
DOCKET NO. 50-286

ATTACHMENT 9.2 **ENGINEERING CALCULATION COVER PAGE**

Sheet 1 of 2

☐ ANO-1	☐ ANO-2	☐ GGNS	☐ IP-2	☒ IP-3	☐ PLP
☐ JAF	☐ PNPS	☐ RBS	☐ VY	☐ W3	
☐ NP-GGNS-3	☐ NP-RBS-3				

CALCULATION COVER PAGE	**EC #** 67913	**Page 1 of** 6 (20 Total)

Design Basis Calc. ☐ YES ☒ NO	☒ CALCULATION ☐ EC Markup

Calculation No: IP-CALC-16-00079	**Revision: 0**
Title: Evaluation of leak on weld B297 on 31 Fan Cooler Unit return line	**Editorial** ☐ YES ☒ NO

System(s): SW	**Review Org (Department): Civil/Structural**

Safety Class:	**Component/Equipment/Structure Type/Number:**
☒ **Safety / Quality Related**	**FCU-31**
☐ **Augmented Quality Program**	
☐ **Non-Safety Related**	

Document Type: CALC	

Keywords (Description/Topical Codes):	
SW	
31 FCU	

REVIEWS

Name/Signature/Date	Name/Signature/Date	Name/Signature/Date
S. Malinski 11-4-16	J. Ruch 11/4/16	R. Drake for R. Drake 11/4/16
Responsible Engineer	☒ **Design Verifier** ☒ **Reviewer** ☐ Comments Attached	**Supervisor/Approval** ☐ Comments Attached

CALCULATION REFERENCE SHEET	*CALCULATION NO: IP-CALC-16-00079* REVISION: 0

I. EC Markups Incorporated (N/A to NP calculations)
None

II. Relationships:	Sht	Rev	Input Doc	Output Doc	Impact Y/N	Tracking No.
1.			☐	☐		
2.			☐	☐		
3.			☐	☐		
4.			☐	☐		
5.			☐	☐		

III. CROSS REFERENCES:
See page 5, section 5.6

IV. SOFTWARE USED:
Title: N/A Version/Release: Disk/CD No.

V. DISK/CDS INCLUDED:
Title: N/A Version/Release Disk/CD No.

VI. OTHER CHANGES:
None

Revision	Record of Revision
0	Initial issue.

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5.0 Calculation Section

5.1 Background

CR-IP3-2016-03607 documented a potential leak near the 31 FCU, observed from the 68' elevation walkway. After removing insulation and pressurizing the service water line 12b it was discovered that there is a pinhole leak at weld B297. This weld is located on a 3.5 inch O.D. pipe on a service water return branch line which connects 10 inch line 12b to the 31 FCU internal coils.

5.2 Purpose

This calculation determines the minimum wall thickness for the 3.5 inch branch connection and evaluates the allowable flaw size (axial and circumferential) for this section of pipe.

5.3 Method of analysis

The method of analysis is based on EN-CS-S-008-MULTI, Rev. 1, utilizing an Excel spreadsheet to calculate and tabulate the appropriate required values.
Pipe stress inputs are extracted from IP3-CALC-SWS-03023 which inspected a weld on the same branch connection as part of 3R10 outage 89-13 inspections.

5.4 Assumptions

Conservatively, the plant-wide standard observed wear rate = 0.012 in/yr is used. This calculation investigates a stainless steel component where the wear rate will be slower than that of carbon steel piping.

Inaccessible areas assumed to have thickness consistent with available readings which are all at or above nominal thickness due to the relative consistency of results. Note: only actual UT readings are utilized in this calculation, including tabulation of average thicknesses.

5.5 Design Input

1. USAS B31.1 Power Piping Code, 1955 and 1973 edition
2. FCU specification MDA-RCFC-01
3. IP3-CALC-SWS-03023
4. IP3-UT-16-035
5. Flow Diagram 209762

5.6 Reference

1. Westinghouse Drawing INRN-1020-4
2. IP3 Line List, IP3-LIST-MULT-01177
3. ANSI B31.1 Power Piping Code, 1955 and 1973 edition
4. EN-CS-S-008-MULTI Rev. 1, "Pipe Wall Thinning Structural Evaluation"
5. Calculation IP3-CALC-SWS-03023 Rev. 1

5.7 Calculation

Based on the design temperature, pressure, and material condition, an allowable stress value for the piping material was obtained. Pipe stresses from normal, upset and emergency loading conditions are either determined in this calculation or are obtained from other calculations for the component system. Some of the stress values obtained from existing calculations and various reference information are in Attachment 2. The calculated wall thickness for hoop stress, axial pipe stress are then determined and compared to 30% of the nominal pipe wall thickness and the highest value of the three will be used as the minimum required wall thickness for the design condition of the pipe at that location.

5.8 Conclusion/Results

The minimum required thickness for the elbow containing weld B297 is 0.073 inches, whereas the minimum measured thickness is 0.117 inches.

The maximum allowable axial flaw size is 4.11 inches and maximum allowable circumferential flaw size is 3.65 inches. The existing flaw is characterised as approximately 0.50 in x 0.50 in, and the uninspected arc length (approximately 3 in) of the pipe circumference is less than the allowable circumferential flaw length. Therefore, if the entirety of the uninspected portion of the pipe were to be considered a flaw, the pipe would still retain its structural integrity as evaluated in this calculation. The pinhole flaw is opposite the uninspected portion and the flaw sizes of the two areas are independent and not additive.

Based on the above statements, the pipe is structurally adequate for service until a permanent repair can be made during the upcoming 3R19 outage in 2017.

Attachment 1

Calculation for Minimum Required Wall Thickness and Allowable Flaw Size

IP-CALC-16-00079

Design Parameters

Stress values ref: IP3-CALC-SWS-03023

	Line 12b
D_o: Outside Diameter, (in)	3.5
t_{nom} : Nominal Thickness, (in)	0.216
Material	904L SS
P : Design Pressure, (psi)	150
T : Design Temperature, (°F)	160
S_h : Allowable Stress at Design Temperature, (psi) (See App. A of B31.1)	17100
S_A : Thermal Expansion Allowable Stress , (psi)	25650
A : An additional thickness per Section 104.1 of B31.1, (in)	0

Prediction of Min. Thickness for 2 Years of Service, t_P

t_{meas} : Measured thickness of latest inspection, (in)	t_{meas} must be $\geq t_p$		0.117
W_r : Wear Rate (in/yr) based on IPEC experience	(1)		0.01200
Y : Service years between the latest and next inspections, (yr)			2
SF : Safety factor			1.1
Projected thermal cycles between the latest and next inspections			70
$t_P = t'_{min} + SF*W_r*Y$, (in)			0.099
$R_o/t'_{min} \leq 50$, "OK"; or > 50, "Buckling Evaluation Required"	R_o/t'_{min} :	24	OK

b = estimate width of thinned section =			21.85
Based on clamp support at 4 edges, allowable buckling stress = $8.46E(t_p/b)^2$ =	2635	psi < S_h	
Actual compressive stress = $[S_{nor} - PD/(4t_{nom})](t_{nom}/t'_p)(I'/i)$	1113	psi, o.k.	17100
Actual compressive stress = $[S_{ups} - PD/(4t_{nom})](t_{nom}/t'_p)(I'/i)$	24157	psi, o.k.< $1.2S_h$ =	20520
Actual compressive stress = $[S_{emg} - PD/(4t_{nom})](t_{nom}/t'_p)(I'/i)$	16282	psi, o.k.< $1.8S_h$ =	30780

Screening Rules for Pipe Wall Thinning

Rule 1: Acceptance Standard = $0.875*t_{nom}$	(2), (3)	0.189
Rule 2: Minimum Required Thickness		
$0.3*t_{nom}$ for Class 1		0.065
$0.2*t_{nom}$ for Class 2 or 3		0.043
Rule 3: Between the above two limits, wall thinning can be accepted by a structural evaluation		

Action required based on the above screening rules for the inspected thinned pipe

Class 1 piping	Structural Evaluation Req'd
Class 2 or 3 piping	Structural Evaluation Req'd

Structural Evaluation

a. Minimum Thickness for Hoop Stress :

$t_{min} = P*D_o/[2(S_h+.4*P)] + A$, (in) (4) 0.015

b. Minimum Thickness for Axial Stress :

Is the thermal expansion stress required to be evaluated? Yes

(No for $t_p \geq 0.75*t_{nom}$ and cycles $\leq$ 150; Yes for otherwise)

K_{Nor} : Allowable stress increase factor for Normal Condition	1.0
K_{Ups} : Allowable stress increase factor for Upset Condition	1.2
K_{Emg} : Allowable stress increase factor for Emergency Condition	1.8
γ : Allowable stress increase factor for CC-N-597	1.143

Safety Related Piping

IPEALC-16-00079

Original Piping Stresses

S_{Nor} : Normal Condition Stress, (psi)	780
S_{Ups} : Upset Condition Stress, (psi)	4350
S_{Emg} : Emergency Condition Stress, (psi)	3130
S_{The} : Thermal Expansion Stress, (psi)	unknown

Let t^a_{min} =	(5)	0.073
i = stress intensification factor at elbow = $0.9/[1.5(D)t_{nom}/(0.5(D_o-t_{nom}))^2]^{0.66}$		1.603
i' = SIF of thinned section at elbow = $0.9/[1.5(D)t^a_{min}/(0.5(D_o-t^a_{min}))^2]^{0.66}$	(6)	3.498
i' / i =		2.182
$Z/Z' = [D_o^4 - (D_o-2t_{nom})^4]/[D_o^4 - (D_o-2t^a_{min})^4]$		2.61

Allowable Stress - Axial Stress ≥ 0

Normal conditions:	$\gamma*K_{Nor}*S_h - [P*D_o/4t^a_{min} + (i'/i)*(S_{Nor} - P*D_o/4t_{nom})*(Z/Z')] \geq 0$	16765
Upset conditions:	$\gamma*K_{Ups}*S_h - [P*D_o/4t^a_{min} + (i'/i)*(S_{Ups} - P*D_o/4t_{nom})*(Z/Z')] \geq 0$	317
Emergency conditions:	$\gamma*K_{Emg}*S_h - [P*D_o/4t^a_{min} + (i'/i)*(S_{Emg} - P*D_o/4t_{nom})*(Z/Z')] \geq 0$	19001
Normal and Ther. Expansion conditions:	$\gamma*(S_h + S_A) - [P*D_o/4t^a_{min} + (i'/i)*(S_{Nor} - P*D_o/4t_{nom} + S_{The})*(Z/Z')] \geq 0$	unknown

c. Minimum Required Thickness

Class 1:	$t'_{min} = Max.[t_{min}, t^a_{min}, 0.3*t_{nom}]$, (in);	Acceptable if $t_{meas} \geq t'_{min}$	0.073	Yes
Class 2 & 3:	$t'_{min} = Max.[t_{min}, t^a_{min}, 0.2*t_{nom}]$, (in);	Acceptable if $t_{meas} \geq t'_{min}$	0.073	Yes

Remaining Service Life (RSL)

Class 1:	$RSL = [t_{meas} - t'_{min}]/(SF*W_r)$, (yr)	3.3
Class 2 & 3:	$RSL = [t_{meas} - t'_{min}]/(SF*W_r)$, (yr)	3.3

Notes:

(1) The wear rate will be obtained from Responsible FAC Engineer or based on the Attachment 7.7.

(2) The acceptance standard ($0.875t_{nom}$) can not be applied to:
1. Class 1 short radius elbows,
2. Reinforcement area of a tee or branch connection, and
3. For regions of piping designed to specific wall thickness requirements, such as counterbores or weld attachments.

(3) For the small end of reducers, the standard shall be based on the t_{nom} of the pipe size at the small end. For the large end, the large end transition and the conical portion, it shall be based on the t_{nom} of the pipe size at the larger end.

(4) The formula is applicable for straight pipes, bends, and elbows.
For reducers, t_{min} at each end shall be equal to t_{min} of straight pipe of the same nominal size as the reducer end.
For the conical portion and transition at larger end of reducers, t_{min} shall be that of the large diameter pipe end.
For branch connections and tees, the reinforcement area of the opening shall be based on the B31.1 code.

(5) t^a_{min} can be obtained by the "Trial and Error" method until the "Allowable Stress - Axial Stress" due to Normal, Upset, Emergency, and combined Normal and Thermal Expansion conditions are all positive and one of them shall be close to zero.

(6) (i) can be calculated from Appendix D of ANSI B31.1. (i') needs to be adjusted for the pipe wall thinning. It is suggested that the average thickness or 2 times of the original value be used for the i' calculation.

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ASME CODE CASE N-513 EVALUATION FOR A THROUGH-WALL FLAW				
A. Pipe Parameters				
D_o = Pipe OD (in)				3.5
t_{ave} = average wall thickness of pipe circumference based on UT report (in)			at section	0.243
t_{nom} = nominal pipe wall thickness (in)				0.216
p_d = Design Pressure (psi)				150
p_o = Operational Pressure (psi) (< 275 psig)				150
T = Metal Temperature at evaluation(°F) (< 200°F)				160
E = elastic modulus at T (ksi)				27557
v = poison ratio				0.3
J_{1c} = material toughness (lb/in)				45
S = allowable stress for pipe (ksi)				17.1
i = SIF = stress intensification factor used in the stress analysis				1.00
Service Level	A	B	C	D
$p_dD_o/(4t_{nom})$ or from stress summary: Axial stress due to design pressure (ksi)	0.61	0.61	0.61	0.61
$s = p_dD_o/(4t_{nom}) + (0.75i)\sigma_b$: Piping Axial Stress (ksi, from stress output)	0.78	4.35	3.13	3.13
SF_m : Level A = 2.7; Level B = 2.4; Level c = 1.8; Level D = 1.3 [C-2621& 2622]	2.7	2.4	1.8	1.3
SF_b : Level A = 2.3; Level B = 2.0; Level c = 1.6; Level D = 1.4 [C-2621]	2.3	2.0	1.6	1.4
R_m = pipe mean radius (in) = $(D_o - t)/2$				1.642
$E' = E/(1 - v^2)$				30282
K_{1c} = material critical stress intensity factor = $(J_{1c}*E'/1000)^{0.5}$ (ksi(in)$^{0.5}$)				36.91
$t_{min} = p_dD_o/[2(S+0.4p_d)]$ (in)				0.02
$t = t_{adj}$ = adjusted wall thickness, varied for evaluation of through-wall nonplanar flaw (in), $t_{adj} >= t_{min}$				0.189
(Start with average of the UT thickness at the grid points surrounding the leak)				
B. **(Based on LEFM C-7400 & N513-2, I-3.0)**				
Service Level	A	B	C	D
c = a/2 = Half axial flaw length (in), try "c" to make $K_{Ic} - K_I >= 0.0$	2.06	2.25	2.78	4.00
p = pressure for the service level condition	150	150	150	150
$\sigma_h = p'*D_o/(2t)/1000$ (ksi)	1.39	1.39	1.39	1.39
For through wall flaw, a = c :				
$\lambda = c/(tR_m)^{0.5}$	3.69	4.04	5.00	7.18
$F = 1 + A\lambda + B\lambda^2 + C\lambda^3 + D\lambda^4 + E\lambda^5$	3.87	4.17	4.99	5.40
Where A= 0.0724 B= 0.6486 C= -0.2327 D= 0.0382 E= -0.0023				
$K_{Ic} - K_I = K_{Ic} - K_{Im} = (SF_m)F\sigma_h(\pi c)^{0.5}$ (ksi(in)$^{0.5}$)	0.00	0.00	0.00	2.33
flaw length "2c"	4.11	4.50	5.57	8.00
Allowable Axial Flaw Length = Smaller "2c" of four service levels (in.) =		**4.11**		
C. Evaluate as a planar flaw in circumferential direction				
Service Level	A	B	C	D
(0.75i) >= 1.0	1.00	1.00	1.00	1.00
$\sigma'_b = (s - p_dD_o/(4t_{nom})/(0.75i)$ (ksi)	0.17	3.74	2.52	2.52
$\sigma_b = \sigma'_b[D_o^4 - (D_o - 2t_{nom})^4]/[D_o^4 - (D_o - 2t_{ave})^4]$ (ksi)	0.157	3.406	2.295	2.295
p = pressure at the service level	150	150	150	150
$\sigma_m = pD_o/(4t_{ave})$: Axial stress due to service pressure (ksi)	0.54	0.54	0.54	0.54
K_{Ic} =	36.9	36.9	36.9	36.9
For through wall flaw, based on a = c				
c : Half circumferential flaw length, try "c" to make $K_{Ic} - K_I > 0.0$	3.31	1.83	2.53	2.76
$\alpha = c/(\pi R_m)$	0.642	0.354	0.491	0.535
$r = R_m/t$	8.7	8.7	8.7	8.7

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ASME CODE CASE N-513 EVALUATION FOR A THROUGH-WALL FLAW										
	i=	0	1	2	3				
$A_m = A_{m0} + A_{m1}*r + A_{m2}*r^2 + A_{m3}*r^3$	A_{mi}	-2.0292	1.6776	-0.0799	0.0018	7.7	7.7	7.7	7.7
$B_m = B_{m0} + B_{m1}*r + B_{m2}*r^2 + B_{m3}*r^3$	B_{mi}	7.0999	-4.4239	0.2104	-0.0046	-18	-18	-18	-18
$C_m = C_{m0} + C_{m1}*r + C_{m2}*r^2 + C_{m3}*r^3$	C_{mi}	7.7966	5.1668	-0.2458	0.0054	37.7	37.7	37.7	37.7
$A_b = A_{b0} + A_{b1}*r + A_{b2}*r^2 + A_{b3}*r^3$	A_{bi}	-3.2654	1.5278	-0.0727	0.0016	5.6	5.6	5.6	5.6
$B_b = B_{b0} + B_{b1}*r + B_{b2}*r^2 + B_{b3}*r^3$	B_{bi}	11.363	-3.9141	0.1862	-0.0041	-11	-11	-11	-11
$C_b = C_{b0} + C_{b1}*r + C_{b2}*r^2 + C_{b3}*r^3$	C_{bi}	-3.1861	3.8476	-0.1830	0.0040	19.1	19.1	19.1	19.1
$F_m = 1 + A_m*\alpha^{1.5} + B_m*\alpha^{2.5} + C_m*\alpha^{3.5}$						6.82	2.23	3.65	4.35
$F_b = 1 + A_b*\alpha^{1.5} + B_b*\alpha^{2.5} + C_b*\alpha^{3.5}$						4.18	1.84	2.60	2.95
$K_{Ic} - K_I = K_{Ic} - [(SF_m)(\pi c)^{0.5}(\sigma_m F_m) + SF_b(\pi c)^{0.5}(\sigma_b * F_b)] \geq 0.0$						0.0	0.0	0.0	0.0
Flaw length (2c) =						6.62	3.65	5.07	5.52
Allowable Circumferential Crack Length = Smaller "2c" of 4 service levels (in.) =							**3.65**		

D. Check the hole penetration flaw length

L_{axial} = length of through wall flaw in the axial direction of the pipe (inch)		0.5	< allow flaw, OK
L_{circ} = length of through wall flaw in the circumferential direction of the pipe (inch)		0.5	< allow flaw, OK

E. Minimum remaining ligament thickness requirement

$d_{adj} = 1.5[R_m t_{adj}]0.5(t_{adj} - t_{min})/t_{min}$	(in)	9.4886		
Let d_{adj} = (in)		4.11		
Minimum remaining ligament thickness requirement = $0.353 d_{adj}(p_d/s)^{0.5}$ (in)		0.1359		
Minimum remaining ligament thickness is less than adjusted thickness used		OK		

Attachment 2

Miscellaneous Reference Information

VC-31-8

TABLE 2
Required Pipe Wall Thickness for Projected 2 Year Service

ID No.	Line No.	Node No.	t_{nom}	S_h	t_p	S_{NOR}	S_{UPS1}	S_{UPS2}	S_{UPS3}	S_{UPS}	S_{EMG}	t_a	t_{min}	t_{req}	Ref	
VC-8	10"-#11b	640/650	0.365	15	0.05	1.32	6.9	2.16	0	6.9	8.3	0.14	0.14	0.162	7	
VC-22	10"-#11c	421/425	0.365	15	0.05	1.33	4.08	4.53	0	4.53	4.03	0.092	0.11	0.135	7	
VC-23	10"-#12c	109/110	0.365	15	0.05	1.24	5.51	4.49	5.59	5.59	6.25	0.113	0.113	0.138	7	
VC-36	10"-#12c	39/41	0.365	15	0.05	2.32	7.57	6.17	6.72	7.57	9.21	0.154	0.154	0.175	7	
VC-37	10"-#12b	70/80	0.365	15	0.05	2.18	9.1	9	7.89	9.1	8.55	0.185	0.185	0.203	7	
VC-38	2"-#671		0.154	17.1	0.01	2.9				12	16.5	0.09	0.09	0.097	8	Rev 1
VC-39	10"-#12e	122/123	0.365	17.1	0.05	1.58	4.74	4.89	15.82	15.82	4.41	0.281	0.281	0.292	7	
VC-40	10"-#11b	820	0.365	17.1	0.05	2.71	7.47	6.78	0	7.47	7.96	0.133	0.133	0.156	7	
VC-41	10"-#12a	1380	0.365	15	0.05	1.21	11.01	3.13	3.13	11.01	10.69	0.223	0.223	0.239	7	
VC-42	2"-#672		0.154	17.1	0.01	2.9				12	16.5	0.09	0.09	0.097	8	Rev 1
VC-43	10"-#12b	780	0.365	17.1	0.05	1.18	1.18	1.18	1.18	1.18	1.18	0.025	0.11	0.135	7	
VC-44	10"-#12d	160	0.365	17.1	0.05	1.82	9.26	8.14	10.23	10.23	8.18	0.182	0.182	0.201	7	
VC-45	10"-#11c	138	0.365	15	0.05	2.28	8.72	5.79	0	8.72	7.95	0.177	0.177	0.196	7	
VC-46	10"-#11a	1310	0.365	15	0.05	2.01	9.11	5.91	0	9.11	8.38	0.185	0.185	0.204	7	
VC-47	10"-#12a	1280	0.365	15	0.05	2.32	6.53	5.29	9.98	9.98	6.83	0.202	0.202	0.22	7	
VC-48	10"-#12e	87/90	0.365	15	0.05	1.41	7.36	7.61	5.45	7.61	6.3	0.154	0.154	0.176	7	
VC-49	10"-#11e	90	0.365	15	0.05	1.43	7.02	5.48	0	7.02	6.63	0.142	0.142	0.165	7	
VC-50	10"-#12d	15	0.365	15	0.05	1.49	7.49	5.8	10.57	10.57	6.96	0.214	0.214	0.231	7	
VC-51	10"-#11d	15	0.365	15	0.05	1.99	10.17	7.83	0	10.17	9.84	0.206	0.206	0.223	7	
VC-52	10"-#11c	140	0.365	15	0.05	2.3	8.62	8.94	0	8.94	7.9	0.181	0.181	0.2	7	
VC-31-1	12b-A	7060	0.216	17.1	0.015	0.74	2.83	1.01	4.9	4.9	2.96	0.052	0.065	0.08	7	
VC-32-2	11d-E	290	0.216	17.1	0.015	1.19	4.04	3.78	0	4.04	4.09	0.043	0.065	0.08	7	
VC-32-3	12d-C	490	0.216	17.1	0.015	1.13	3.28	1.45	5.76	5.76	3.94	0.061	0.065	0.08	7	
VC-32-4	12d-B	390	0.216	17.1	0.015	1.32	4.72	3.59	7.53	7.53	4.35	0.079	0.079	0.093	7	
VC-32-5	12d-F	335	0.216	17.1	0.015	1.98	6.62	3.27	6.38	6.62	6.54	0.07	0.07	0.084	7	
VC-33-1	12a-A	3560	0.216	17.1	0.015	1.07	2.87	1.98	1.93	2.87	2.98	0.03	0.065	0.08	7	
VC-34-1	12c-E	545	0.216	17.1	0.015	1.02	1.4	1.71	1.56	1.71	1.47	0.018	0.065	0.08	7	
VC-35-1	12e-A	290	0.216	17.1	0.015	0.91	3.59	1.31	8.37	8.37	4.09	0.088	0.088	0.101	7	
VC-31-7	11a-F	3790	0.216	17.1	0.015	0.7	8.03	3.78	0	8.03	7.34	0.085	0.085	0.098	7	
X VC-31-8	12b-B	6050	0.216	17.1	0.015	0.78	2.96	1.25	4.35	4.35	3.13	0.046	0.065	0.08	7	
VC-32-7	11d-G	490	0.216	17.1	0.015	1.23	4.23	1.78	0	4.23	4.23	0.045	0.065	0.08	7	
VC-32-8	12d-E	245	0.216	17.1	0.015	1.93	6.06	4.44	17.42	17.42	5.99	0.183	0.183	0.188	7	
VC-33-7	11b-A	10110	0.216	17.1	0.015	1.7	5.36	3.06	0	5.36	6.6	0.056	0.065	0.08	7	
VC-33-8	12a-F	3040	0.216	17.1	0.015	0.93	7.4	2.92	2.83	7.4	7.94	0.078	0.078	0.092	7	
VC-34-7	11c-D	1120	0.216	17.1	0.015	0.91	1.65	2.12	0	2.12	1.69	0.022	0.065	0.08	7	
VC-34-8	12c-C	381	0.216	17.1	0.015	1.89	3.33	3.01	4.18	4.18	3.57	0.044	0.065	0.08	7	
VC-35-7	11e-B	350	0.216	17.1	0.015	0.8	4.21	2.5	0	4.21	5.37	0.044	0.065	0.08	7	
VC-35-8	12e-B	390	0.216	17.1	0.015	0.83	2.91	1.29	6.5	6.5	3.25	0.068	0.068	0.083	7	
VC-52	1" br line	cs/ss coup	0.133	15	0.01	0.38				13.74	20.42	0.102	0.102	0.106	9	Rev 1

New York Power Authority

Calculation No IP3-CALC-SWS-03023 Revision 1

Project IP3 Page 6 of 59

Subject Minimum Wall Thickness @ R10 Inspection Locations

Computed by MCC Date 11/23/99

Checked by KC Date 11-23-99

13/14

IP3-CALC-SWS-03023 Att. A

R10 INSP[illegible]ION LIST
NRC GENERIC LETTER 89-13 CORROSION MONITORING PROGRAM
IP3 SERVICE WATER SYSTEM

ID No.	Line No.	Section XI	Line Description	Floor El.	Pipe El.	NDE Location	Weld Type	WR Number	Drawing No.	Notes
VC-31-1	3" 904L	Class 3A	#31 FCU Return	VC El. 68'	El. 70'	Elbow weld, 2nd pipe up from floor	BW	98-04162-00	INRN-1020-22	(2), (3)
VC-32-2	3" 904L	Class 3A	#32 FCU Supply	VC El. 68'	El. 69'	Elbow weld, 2nd pipe up from floor	BW	98-04162-00	INRN-1020-22	(2), (3)
VC-32-3	3" 904L	Class 3A	#32 FCU Return	VC El. 68'	El. 76'	Elbow weld, 5th pipe up from floor	BW	98-04162-00	INRN-1020-22	(1), (2), (3)
VC-32-4	3" 904L	Class 3A	#32 FCU Return	VC El. 68'	El. 74'	Elbow weld, 3rd pipe up from floor	BW	98-04162-00	INRN-1020-[illegible]	
VC-32-5	3" 904L	Class 3A	#32 FCU Return	VC El. 68'	El. 74'	Elbow weld, 4th pipe up from floor	BW	98-04162-00	INRN-1020[illegible]	
VC-33-1	3" 904L	Class 3A	#33 FCU Return	VC El. 68'	El. 70'	Elbow weld, 2nd pipe up from floor	BW	98-04162-00	INRN-1020-22	(2), (3)
VC-34-1	3" 904L	Class 3A	#34 FCU Return	VC El. 68'	El. 70'	Elbow weld, 2nd pipe up from floor	BW	98-04162-00	INRN-1020-22	(2), (3)
VC-35-1	3" 904L	Class 3A	#35 FCU Return	VC El. 68'	El. 70'	Elbow weld, 2nd pipe up from floor	BW	98-04162-00	INRN-1020-22	(2), (3)
VC-31-7	3" 904L	Class 3A	#31 FCU Supply	VC El. 68'	El. 72'	Elbow weld, 3rd pipe up from floor	BW	98-05100-	INRN-1020-22	(2), (4)
VC-31-8	3" 904L	Class 3A	#31 FCU Return	VC El. 68'	El. 74'	Elbow weld, 3rd pipe up from floor	BW	98-05100-	INRN-1020-22	(2), (4)
VC-32-7	3" 904L	Class 3A	#32 FCU Supply	VC El. 68'	El. 76'	Elbow weld, 6th pipe up from floor	BW	98-05100-	INRN-1020-22	(1), (2), (4)
VC-32-8	3" 904L	Class 3A	#32 FCU Return	VC El. 68'	El. 72'	Elbow weld, 1st pipe up from floor	BW	98-05100-	INRN-1020-22	(2), (4)
VC-33-7	3" 904L	Class 3A	#33 FCU Supply	VC El. 68'	El. 69'	Elbow weld, 1st pipe up from floor	BW	98-05100-	INRN-1020-22	(2), (4)
VC-33-8	3" 904L	Class 3A	#33 FCU Return	VC El. 68'	El. 75'	Elbow weld, 4th pipe up from floor	BW	98-05100-	INRN-1020-22	(2), (4)
VC-34-7	3" 904L	Class 3A	#34 FCU Supply	VC El. 68'	El. 79'	Elbow weld, 8th pipe up from floor	BW	98-05100-	INRN-1020-22	(1), (2), (4)
VC-34-8	3" 904L	Class 3A	#34 FCU Return	VC El. 68'	El. 78'	Elbow weld, 6th pipe up from floor	BW	98-05100-	INRN-1020-22	(1), (2), (4)
VC-35-7	3" 904L	Class 3A	#35 FCU Supply	VC El. 68'	El. 72'	Elbow weld, 4th pipe up from floor	BW	98-05100-	INRN-1020-22	(2), (4)
VC-35-8	3" 904L	Class 3A	#35 FCU Return	VC El. 68'	El. 75'	Elbow weld, 3rd pipe up from floor	BW	98-05100-	INRN-1020-22	(2), (4)

NOTES:

(1) Need scaffolding.
(2) Need insulation removal.
(3) R09 followup inspection.
(4) New R10 inspection.

D. P. Pennino x6099
Systems Engineering

3/9/99 3:15 PM

c:\Excel Files\R10checklst.xls

4/14

UT Erosion/Corrosion Examination

Entergy

Site/Unit:	IP3 / 3	Procedure:	CEP-NDE-0505	Outage No.:	N/A
Summary No.:	31FCU	Procedure Rev.:	4	Report No.:	IP3-UT-16-035
Workscope:	BOP	Work Order No.:	00460297-04	Page:	1 of 6

Code: ANSI B31.1 '67 Edition - '69 Add. Cat./Item: N/A Location: IP3 VC 68'@ 31FCU

Drawing No.: Westinghouse INRN-1020-4 Description: UT to characterize leaking weld on 3" Line SWN #12B

System ID: VCV

Component ID: Westinghouse DWG INRN-1020-4, Line C, Weld B297 Size/Length: 3" Sch 40 Thickness/Diameter: S/S / 0.216"

Limitations: None Component File No.: LEAK CIRC / BULLSEYE Start Time: 04:33 Finish Time: 04:58

Calibration Information

Calibration Thickness (In) Actual	Calibration Thickness (In) Measured	Calibration Times / Initials		
0.040"	0.040"	Start: 04:32	VWD	
0.100"	0.100"	Verify: N/A	N/A	
0.200"	0.200"	Verify: N/A	N/A	
0.300"	0.300"	Verify: N/A	N/A	
0.500"	0.500"	Final: 04:59	VWD	

Partitioning Information

Component	Begin/Col/Row	Ending/Col/Row
M. UPST Ext.	N/A	N/A
Main UPST.	N/A	N/A
Main	A-1	J-5
Main DNST.	N/A	N/A
M. DNST Ext.	N/A	N/A
Branch	N/A	N/A
Branch Ext.	N/A	N/A

Component Information

Component Geometry: Pipe to Elbow
Outside Diameter: 3.5" Grid Size: 1/2" x 1"
Max. Thickness: 0.383" Min. Thickness: 0.117"
Nominal Thickness: 0.375" Tmin.: 0.189"
Min. Thickness Location: At leak
Max. Thickness Location: Bullseye A-4
Surface Condition: As Welded

Instrument:
Manufacturer: Olympus
Model: 38DL Plus
Serial No.: 151058303
Gain: 69 db
Range: 1.0"

Transducer:
Manufacturer: Panametrics
Serial No.: 673816
Size: 0.283" Freq.: 7.5 MHz
Model: D7908
# of Elements: Dual

Reference/Simulator Block:
Serial No.: 97-7437
Type: S/S 0.04"-.5"
Ref./Simulator Block Temp.: 81 °F
Material/Component Temp.: 86 °F

Temp. Tool:
Manufacturer: Traceable
Serial No.: QS-2

Couplant:
Type: Ultragel II
Batch No.: 12125

Comments/Obstructions: Grid point readings taken. Reading of 0.117" at leak.

Results: Accept ☐ Reject ☑ Info ☐ Tmin = 0.189" (87.5% nominal) Leak identified in CR-IP3-2016-03607

Examiner Dittrich, Victor W.	Level IIL	Signature Victor W. Dittrich	Date 11/4/2016	Reviewer N/A	Signature	Date
Examiner N/A	Level N/A	Signature	Date	Site Review Robert Allen	Signature	Date 11/4/16
Other N/A	Level N/A	Signature	Date	ANII Review N/A	Signature	Date

Entergy

Supplemental Report

Report No.: **IP3-UT-16-035**

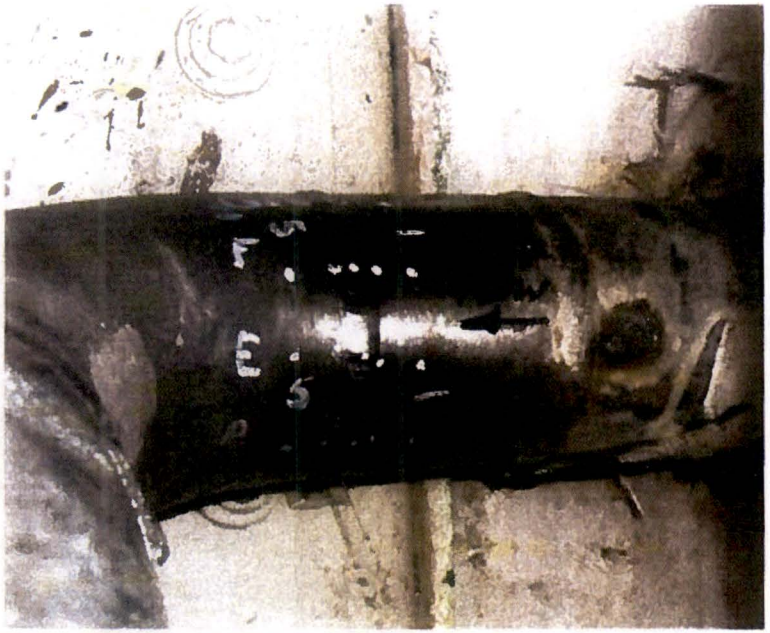
Page: **2** of **6**

Summary No.: **31FCU**

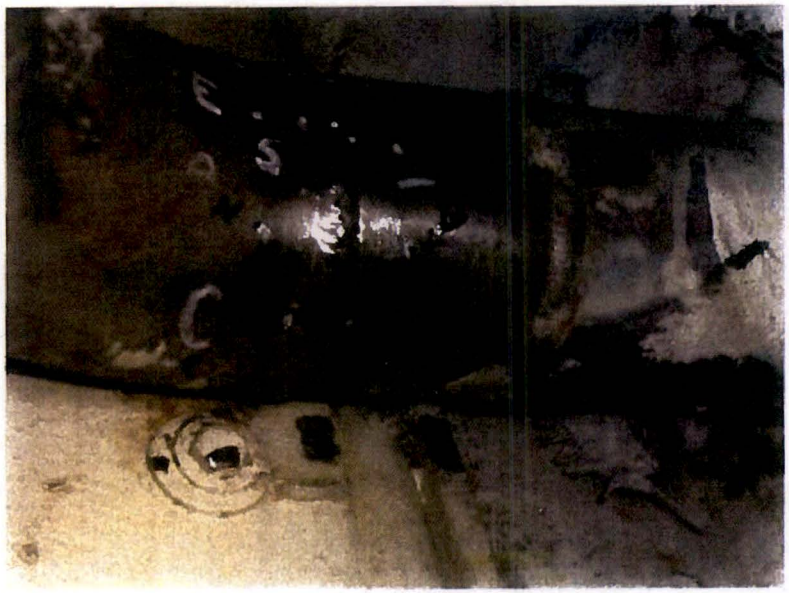
Examiner:	**Dittrich, Victor W.** Victor W. Dittrich	Level:	**IIL**	Reviewer:	N/A	Date:	
Examiner:	**N/A**	Level:	**N/A**	Site Review:	R. Allen	Date:	11/4/16
Other:	**N/A**	Level:	**N/A**	ANII Review:	N/A	Date:	

Comments: **Photo left below of the leaking weld, photo right below of the bullseye grid around the leak.**

Sketch or Photo: O:\Iddeal_Server_Ver8\Iddeal_IP3\Graphics-Pictures\31FCU\31 FCU Leak circ pic.jpg



O:\Iddeal_Server_Ver8\Iddeal_IP3\Graphics-Pictures\31FCU\31FCU Leak Bullseye pic.jpg



Entergy

Supplemental Report

Report No.: IP3-UT-16-035

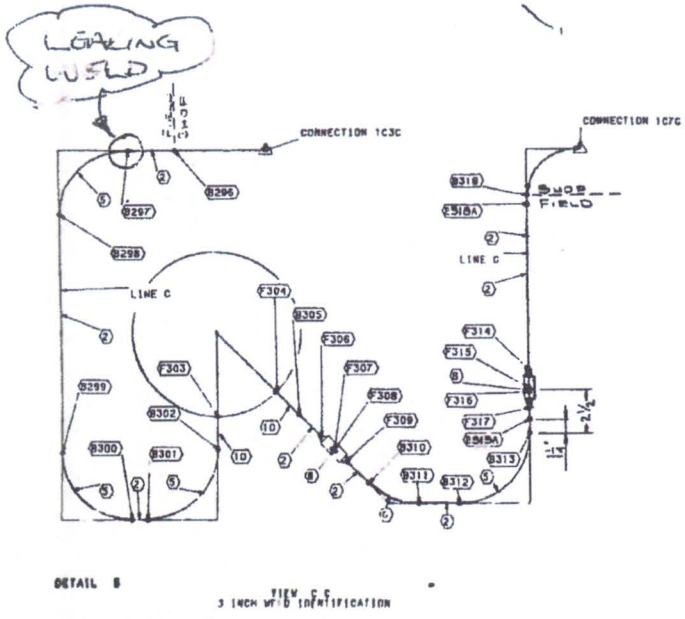
Page: 3 of 6

Summary No.: 31FCU

Examiner:	Dittrich, Victor W. Victor W. Dittrich	Level:	IIL	Reviewer:	N/A	Date:	
Examiner:	N/A	Level:	N/A	Site Review:	Robert Allen	Date:	11/4/16
Other:	N/A	Level:	N/A	ANII Review:	N/A	Date:	

Comments: **Drawing left below identifying the weld by number on Line C, drawing right below identifying the location of the weld on the 31FCU return header.**

Sketch or Photo: O:\Iddeal_Server_Ver8\Iddeal_IP3\Graphics-Pictures\Service Water\Line #12B b.jpg



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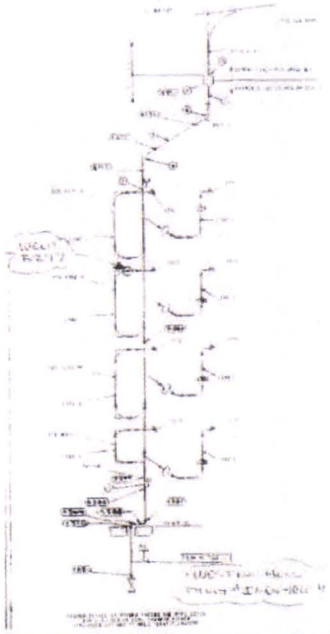


Entergy

Supplemental Report

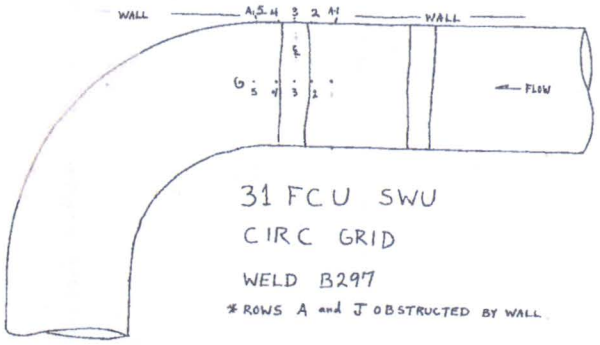
Summary No.: 31FCU

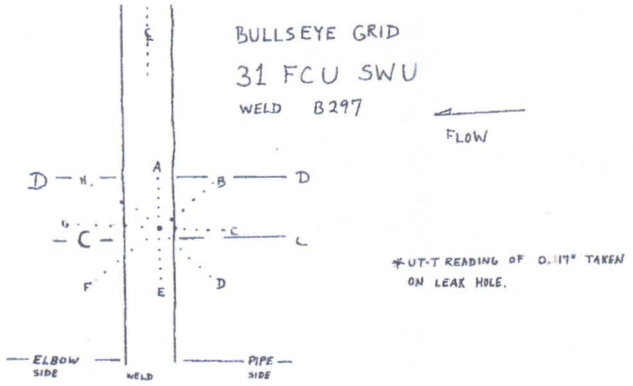
Examiner:	Dittrich, Victor W. Victor W. Dittrich	Level:	IIL	Reviewer:	N/A	Date:	
Examiner:	N/A	Level:	N/A	Site Review:	R Allen Smith II	Date:	11/4/16
Other:	N/A	Level:	N/A	ANII Review:	N/A	Date:	

Comments: **Sketch left below showing the 1/2" x 1" grid around the pipe, sketch right below showing the bullseye grid around the leak at 1/4" increments.**

Sketch or Photo: O:\Iddeal_Server_Ver8\Iddeal_IP3\Graphics-Pictures\Service Water\Line # 12B Grid.jpg

O:\Iddeal_Server_Ver8\Iddeal_IP3\Graphics-Pictures\Service Water\Line #12B Bullseye.jpg





COLOR CODED DATA GRID

The Survey Name:	31 FCU LEAK CIRC	Survey Date:	11/4/2016 4:26:00 PM
Survey Description:	CIRC GRID	Survey Mode:	THICKNESS
Survey Type:	2D GRID	Erase Protection:	OFF
Location Note:	UNIT-3	Inspector ID:	VWD
OlpmpusNDT Thickness			
		Reviewer:	R. ALLEN 11/4/16
NDE Report:	IP3-UT-16-035		
Page 5 of 6			

	A	B	C	D	E	F	G	H	I	J	Min	Max	Avg
1	0.000	0.234	0.248	0.237	0.244	0.224	0.218	0.219	0.213	0.000	0.213	0.248	0.230
2	0.000	0.237	0.244	0.230	0.249	0.218	0.221	0.216	0.219	0.000	0.216	0.249	0.229
3	0.000	0.287	0.302	0.342	0.296	0.286	0.258	0.296	0.251	0.000	0.251	0.342	0.290
4	0.000	0.240	0.244	0.217	0.240	0.238	0.229	0.228	0.216	0.000	0.216	0.244	0.232
5	0.000	0.236	0.225	0.249	0.255	0.244	0.231	0.220	0.211	0.000	0.211	0.255	0.234
Min	0.000	0.234	0.225	0.217	0.240	0.218	0.218	0.216	0.211	0.000			
Max	0.000	0.287	0.302	0.342	0.296	0.286	0.258	0.296	0.251	0.000			
Avg	0.000	0.247	0.253	0.255	0.257	0.242	0.231	0.236	0.222	0.000			

Color Legend:

Not Used	
Not Used	0.350
0.244 - 0.350	0.243
0.190 - 0.243	0.189
0.101 - 0.189	0.100
0.051 - 0.100	0.050
0.000 - 0.050	0.000
Under Range	
Row or Column Statistics	

Total Statistics:

Maximum	0.342
Minimum	0.211
Average	0.243

COLOR CODED DATA GRID

The Survey Name:	31 FCU LEAK BULLSEYE	Survey Date:	11/4/2016 4:30:00 PM
Survey Description:	BULLSEYE GRID	Survey Mode:	THICKNESS
Survey Type:	2D GRID	Erase Protection:	OFF
Location Note:	UNIT-3 VC	Inspector ID:	VWD
OlpmpusNDT Thickness			
		Reviewer:	T. Allen 11/4/16
NDE Report:	IP3-UT-16-035		
Page 6 of 6			

	A	B	C	D	E	F	G	H	Min	Max	Avg
1	0.324	0.241	0.237	0.238	0.295	0.232	0.234	0.128	0.128	0.324	0.241
2	0.304	0.241	0.241	0.236	0.248	0.230	0.239	0.234	0.230	0.304	0.247
3	0.340	0.238	0.241	0.236	0.258	0.231	0.239	0.239	0.231	0.340	0.253
4	0.383	0.235	0.239	0.238	0.309	0.229	0.239	0.241	0.229	0.383	0.264
5	0.341	0.239	0.238	0.236	0.290	0.231	0.240	0.247	0.231	0.341	0.258
Min	0.304	0.235	0.237	0.236	0.248	0.229	0.234	0.128			
Max	0.383	0.241	0.241	0.238	0.309	0.232	0.240	0.247			
Avg	0.338	0.239	0.239	0.237	0.280	0.231	0.238	0.218			

Color Legend:

Not Used	
Not Used	0.350
0.244 - 0.350	0.243
0.190 - 0.243	0.189
0.101 - 0.189	0.100
0.051 - 0.100	0.050
0.000 - 0.050	0.000
Under Range	
Row or Column Statistics	

Total Statistics:

Maximum	0.383
Minimum	0.128
Average	0.252