NRC Form 366 (9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Point Beach, Unit 1	0 5 0 0 0 2 6 6	1 OF 1 0

TITLE (4)
Reactor Vessel Outlet Nozzle-to-Shell Weld Indications

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 2	2 8	8 4	8 4	0 0 2	0 0	0 3	2 8	8 4		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
N		20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
0 0 0		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	X 50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
C. W. Fay	AREA CODE

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
B	A B	R C T	B 0 1 5	N							

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

During Unit 1 Refueling 11, an inspection of the reactor vessel outlet nozzle-to-shell welds was performed using programmed and remote mechanized ultrasonics. This examination was a part of the first period inservice inspection for the second ten-year interval. Four indications in the "A" nozzle and seven indications in the "C" nozzle were recorded, sized, and evaluated. On 02/28/84, the Licensee was notified that there was one indication in each of the outlet nozzle welds that exceeded the Code allowable size. These indications are located in the root area of the welds and are believed, by the evaluator, to be slag. The Licensee's consultant (SwRI) has performed beam spread experiments on the Point Beach calibration block and fracture analysis of the flaw indications. Final results from these studies by SwRI individually demonstrate that the indications meet the acceptance criteria of ASME Section XI, thereby confirming the continued serviceability of the reactor vessel.

An ultrasonic examination of the reactor vessel outlet nozzles was performed in accordance with ASME Boiler and Pressure Vessel Code Section XI. The second 10-year interval inspection plan for Point Beach, Unit 1, was written to conform to the 1977 Edition of ASME Section XI with addenda through the summer of 1979. Included in the inspection plan for this outage was an inspection of the nozzle-to-vessel shell weld, nozzle inside radius section, nozzle integral extension, and nozzle-to-pipe weld of both outlet nozzles. An examination of 100% of the vessel flange-to-shell weld was also done during the outage.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

Overall, the examination identified eleven indications in the nozzle-to-shell welds of both outlet nozzles. These were evaluated by an individual who is certified Level III in ultrasonic testing. The indications were recorded and sized in accordance with Regulatory Guide 1.150 and then evaluated against the Standards provided in IWB-3000 of ASME Section XI. Table 1 summarizes the identification, location, and size of each indication. These indications were also present during a previous examination in 1981 but were of lesser reflectivity. One indication in each outlet nozzle-to-shell weld exceeds the acceptable sizes listed in Table IWB-3512[A(2) and C(4)]. Figure 1 shows a plot of the flaws, indicating which ones fall outside of the acceptable range, as defined in IWB-3000. Figures 2 and 3 and 4 and 5 show the physical size and location of the major indications in the "A" and "C" outlet nozzles, respectively.

After determining that there were indications in the outlet nozzle-to-shell welds that exceed the allowable indication standards of IWB-3000, the inspection program was expanded to include the inlet nozzle-to-shell welds in accordance with IWB-2430. Both inlet nozzles were examined from the bore of the nozzle using the same method that was used for the outlet nozzles. The inlet nozzle weld inspection was looking for the same type of flaws as found in the outlet nozzle welds. No recordable indications were found in the inlet nozzle-to-shell welds.

In a March 12, 1984 letter to the NRC, Licensee advised that it was our intention to demonstrate that the indications are acceptable and that continued service of the Unit 1 reactor vessel is warranted. In the fracture analysis, normal, upset, and test and emergency and faulted transient conditions were considered. Using the end-of-life predicted flaw, the maximum applied stress intensities occurred during the cold hydro test at 3,125 psia. The alternative acceptance criterion in IWB 3612, $K_{1a}/K_1 > 10$ is satisfied for the worst case; hence, the flaws, as originally sized, are acceptable.

Flaw #A(2)

$$\frac{K_{1a}}{K_1} = \frac{149}{43.5} = 3.43 > \sqrt{10}$$

Flaw #C(4)

$$\frac{K_{1a}}{K_1} = \frac{149}{38.02} = 3.92 > \sqrt{10}$$

Three accident conditions were considered: loss of coolant accident; large steam line break (with and without off-site power); and locked rotor pressure transient (loss of load). The acceptance criterion for a flaw to withstand crack initiation under emergency and faulted conditions is given by $K_{1c}/K_1 > \sqrt{2}$. For all transients considered, it was noted that those with high pressure provided the highest stresses. Additionally, in the cooldown transient cases, the thermal stresses tended to be compressive at the crack location and, thus, lessen the contribution of the pressure stress. The cold hydro test condition stresses, therefore, bounded the stresses imposed by the accident conditions. Hence, the acceptability of the flaws is also confirmed for accident conditions.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

As can be seen in Figure 3, the flaw indication in the "A" outlet nozzle-to-shell weld which exceeds the acceptable size limits of Table IWB-3512 is in the proximity to another individually acceptable indication, A(2A), such that $(a_1 + a_2) \leq (a_e + a_e')/2$ may not be satisfied. In the fracture analysis, interaction of these two indications was considered. Using ASME, Section XI, Appendix A, fatigue growth calculations were performed on these two indications. Predicted growth was small, so interaction was not expected to occur. Additionally, stress amplification of one flaw on the other was considered in computing the maximum applied stress intensities. The effect on stress intensity at the larger crack by the small crack was determined to be insignificant.

The indication sizes presented in Table 1 are those determined by following the Code procedures. However, the Code procedures do not properly address the sizing of a reflector obtained in this particular type of nozzle examination (from inside the nozzle bore). The Code procedures tend to exaggerate the size of all reflectors so detected. Therefore, calibration block experiments were undertaken to overcome the difficulties in sizing the reflectors. Basically, the outlet nozzle weld indications were oriented normal to the incident beam and almost parallel to the examination surface. This provided a high amplitude response but an insignificant change in metal path. The Code does not outline or specify the technique for sizing this type of reflector. The calibration block experiments, in which the position and orientation of the nozzle indications was duplicated with a 3/8" flat-bottomed hole in the calibration block, permitted the performance of beam spread analyses using the same search unit assembly as was used at Point Beach to more accurately size the reflectors. Based on these studies, beam spread correction factors were determined. The beam spread corrected sizing demonstrates that the previously unacceptable indications are, in fact, within the limits specified in the Code.

Table 2 documents the refined characterization of reflectors A(2) and C(4).

It is our belief and that of our consultant (SwRI) that the reflectors are due to entrapped foreign material in the weld and/or adjacent base metal repair area, and have been there since the vessel was fabricated and are not indicative of service-induced flaws. Furthermore, it is our conclusion that the requirements of ASME Section XI have been satisfied and that continued serviceability of the Unit 1 reactor vessel is confirmed.

Table 1

INDICATION EVALUATION SUMMARY

Indication	Metal Path	Nozzle Azimuth (Degrees)	20% DAC Size 2a	/ 1	50% DAC Size 2a	/ 1	Ratio a/l	a/t% Allow.	/ Meas.
Weld No. 2-686-A									
A(1)	7.3"	45	0.9"	0.9"	0.2"	0.2"	0.5	6.5	1.1
A(2)	9.2"	104	*	*	1.24"	1.935"	0.32	4.3	6.8
A(2A)	9.2"	103.5	*	*	0.2	0.2	0.5	6.5	0.01
A(3)	7.5"	106.5	*	*	0.62"	0.86"	0.36	4.7	3.4
A(4)	8.8"	339.5	*	*	0.67"	1.1"	0.30	4.1	3.67
Weld No. 2-686-C									
C(1)	8.0"	211	*	*	0.4"	0"	0.5	6.5	4.4
C(2)	8.0"	246.5	*	*	0.55"	0.43"	0.5	6.5	3.0
C(3)	8.0"	249	*	*	0.72"	0"	0.5	6.5	3.9
C(4)	8.0"	311	*	*	1.14"	1.29"	0.44	5.8	6.2
C(5)	7.8"	316	*	*	0.5"	0.43"	0.5	6.5	2.7
C(6)	7.8"	319	*	*	0.33"	0"	0.5	6.5	1.8
C(7)	7.8"	321.5	*	*	1.13"	0"	0.5	6.5	6.19

*Indication located in outer 3/4 of wall, therefore, only size based on 50% DAC.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

Table 2

REFINED INDICATION CHARACTERIZATION*

Flaw A(2)

2a = 0.531"

l = 0.9"

a/l = 0.295

a/t%	
Allowable	Measured
4.05	2.9

Flaw C(4)

2a = 0.431"

l = 0.255"

a/l = 0.5 (Limit)

a/t%	
Allowable	Measured
6.5	2.4

where t = 9.125"

*Southwest Research Institute's experiments on the calibration block with the search unit used at Point Beach produced beam spread correction factors, applicable to the above indications only, of 1.035" in length and 0.709" in the through-wall dimension. Applying these factors to indications A(2) and C(4) yields the above refined reflector characterization.

Figure 1

SwRI 17-7222 POINT BEACH UNIT I 26 FEB 84 WJC McGaughey

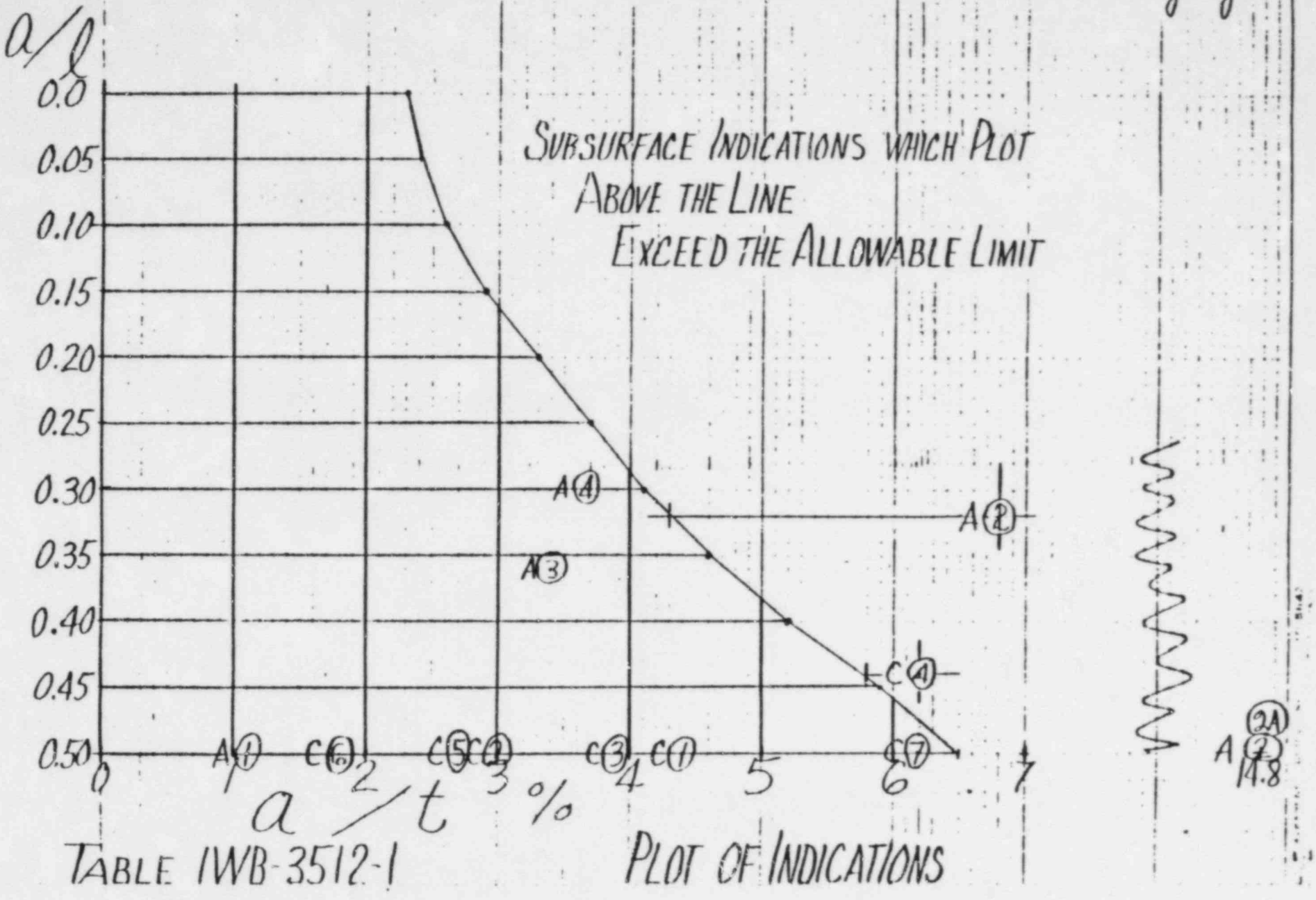
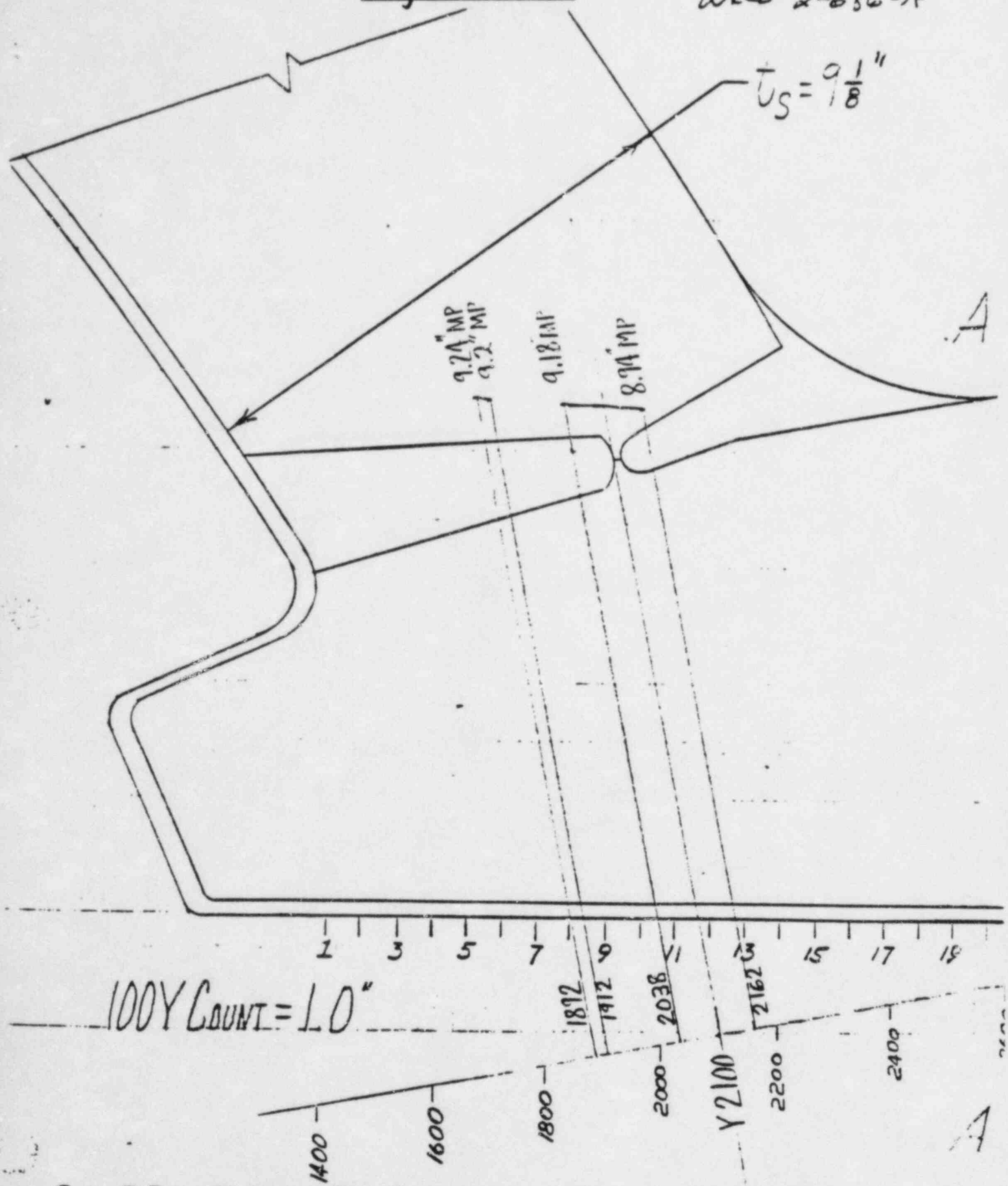


TABLE IWB-3512-1 PLOT OF INDICATIONS

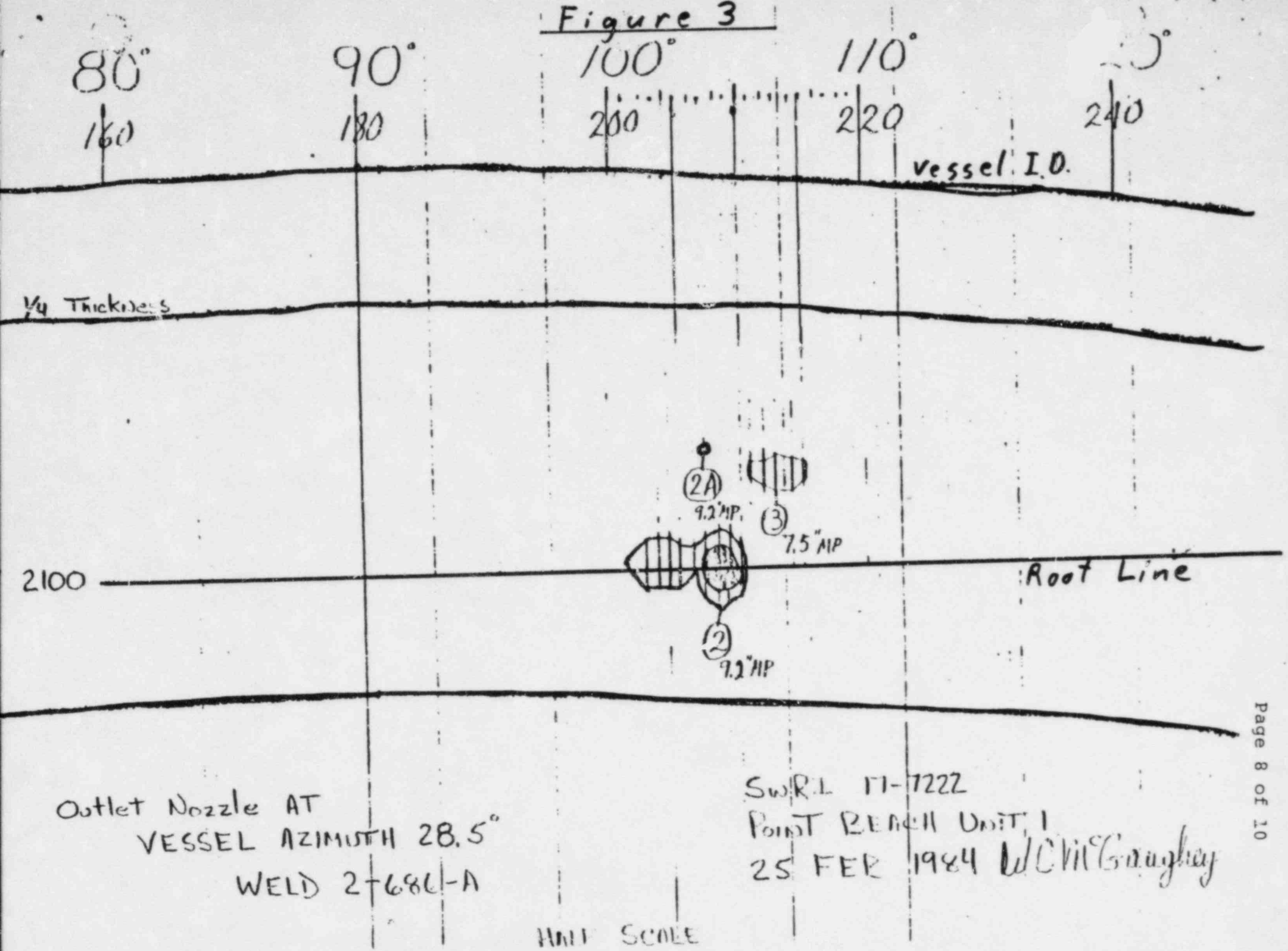
Figure 2

WELD 2-686-A



SwRI 17-7222 POINT BEACH UNIT I 27FEB84

Figure 3

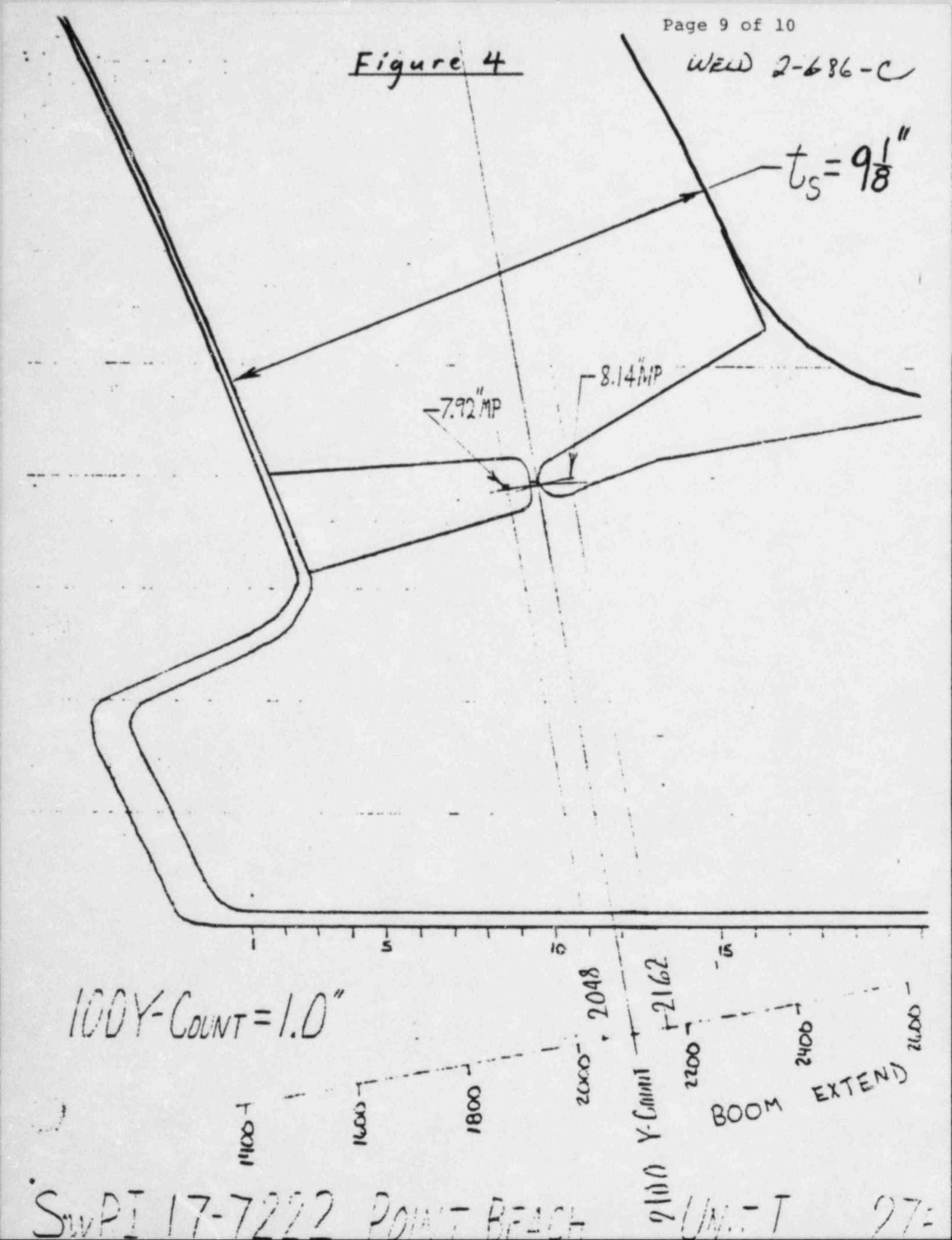


Outlet Nozzle AT
VESSEL AZIMUTH 28.5°
WELD 2-686-A

SwRI FI-7222
Point Beach Unit 1
25 FEB 1984 W C McGaughey

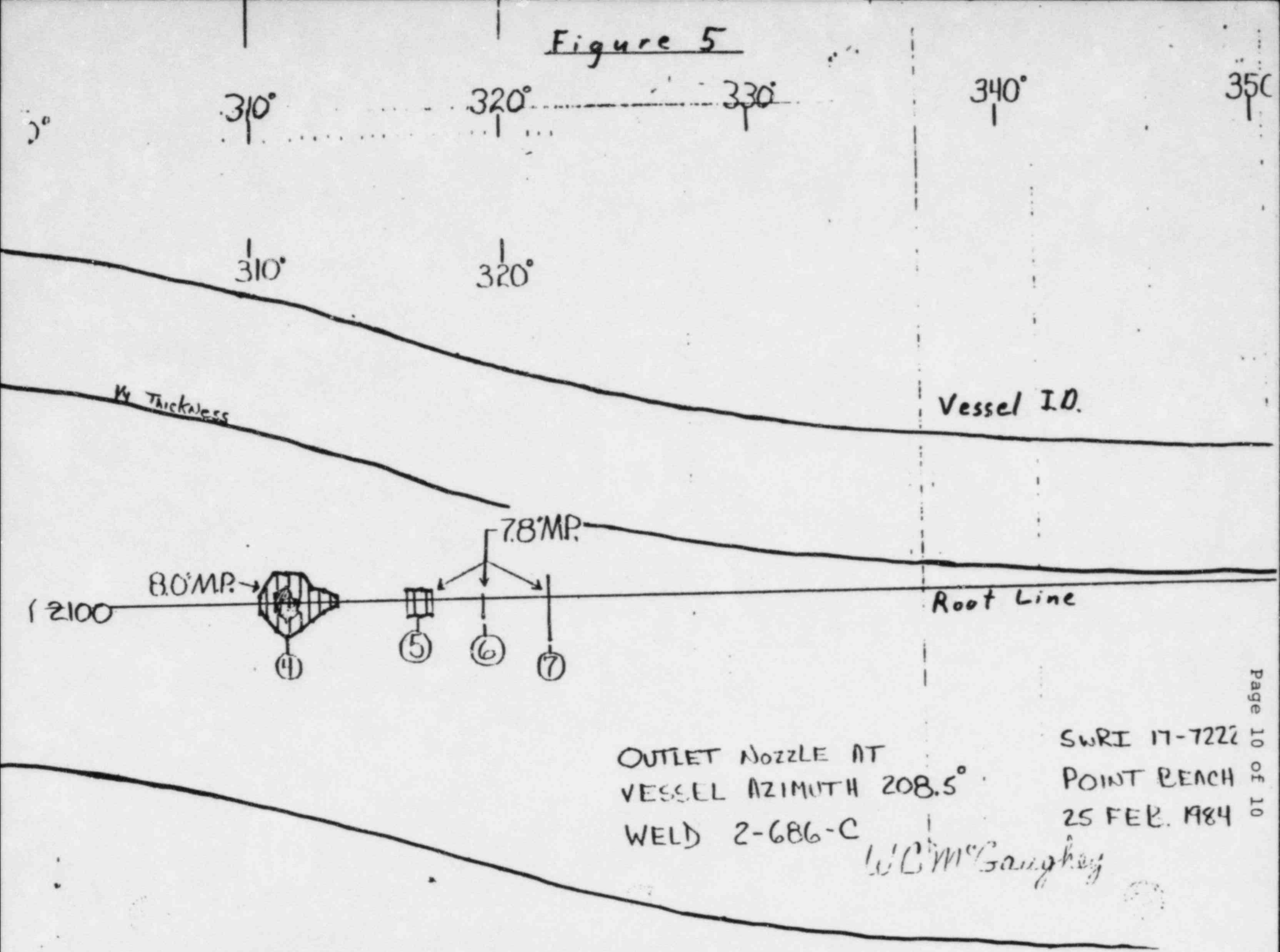
Figure 4

WELD 2-686-C



SwPI 17-7222 POINT BEACH UNIT 2

Figure 5



OUTLET NOZZLE AT
VESSEL AZIMUTH 208.5°
WELD 2-686-C

SwRI 17-7222
POINT BEACH
25 FEB. 1984

W C McGaughey

DMB

Wisconsin Electric POWER COMPANY
231 W. MICHIGAN, P.O. BOX 2046, MILWAUKEE, WI 53201

March 28, 1984

Mr. J. G. Keppler, Regional Administrator
Office of Inspection and Enforcement,
Region III
U. S. NUCLEAR REGULATORY COMMISSION
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Dear Mr. Keppler:

DOCKET NO. 50-266
LICENSEE EVENT REPORT NO. 84-002-00
REACTOR VESSEL NOZZLE WELD INDICATIONS
POINT BEACH NUCLEAR PLANT, UNIT 1

Enclosed is Licensee Event Report No. 84-002-00 which provides a description of an event initially reportable in accordance with 10 CFR 50.73(a)(2)(ii), "any event or condition that resulted in the condition of the nuclear power plant, including its principal safety barriers, being serious degraded, or that resulted in the nuclear power plant being . . .". As discussed in the Licensee Event Report narrative, based on calibration block experiments and beam spread corrections, the subject indications were determined to be within the Code-specified limits. We are, nevertheless, filing this report for informational purposes.

Very truly yours,

C W Fay

Vice President-Nuclear Power

C. W. Fay

Enclosure

Copy to NRC Resident Inspector

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