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KOBER,R.W. Rochester Gas & Electric Corp.
RECIP.NAME RECIPIENT AFFILIATION
ZWOLINSKI,J.A. Operating Reactors Branch 5

SUBJECT: Submits supplemental info to 850222 ltr re technique for detecting tubesheet crevice corrosion & sleeves,per 850313 telcon w/NRC.NRC concurrence to proceed w/installation of up to 65 tubesheet sleeves in facility inlets requested.

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ROGER W. KOBER
VICE PRESIDENT
ELECTRIC & STEAM PRODUCTION

TELEPHONE
AREA CODE 716 546-2700

March 18, 1985

Director of Nuclear Reactor Regulation
Attention: Mr. John A. Zwolinski, Chief
Operating Reactors Branch No. 5
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Steam Generator Tubesheet Crevice Corrosion and Sleeves
R.E. Ginna Nuclear Power Plant
Docket No. 50-244

Dear Mr. Zwolinski:

This letter is a supplement to our letter dated February 22, 1985 on tubesheet sleeves and in response to questions from NRC staff during a conference call on Wednesday, March 13, 1985. The Staff asked that we describe our technique for detecting tubesheet crevice corrosion and provide them with a list of crevice indications which would be sleeved during the present refueling and maintenance outage. In order to provide Staff with Ginna's procedure for detecting crevice corrosion, an historical summary of Ginna's crevice corrosion experience is helpful to see how and when the present procedure was established.

During the March 1979 refueling and maintenance outage, two crevice corrosion indications were analyzed from the 400 KHz differential channel of the multi-frequency eddy current data. These two indications were identified by both the ZETEC and Intercontrol analyst teams from their respective instruments and data. This examination's results alerted Rochester Gas and Electric (RG&E) to be sensitive to the tube sheet crevice area of the steam generator during future inspections. Another cause for concern was the experience of similar Westinghouse plants where crevice corrosion, specifically intergranular attack, was causing plant shutdowns due to primary to secondary leakage.

In December 1979, during an unscheduled outage, a large number of tubes were inspected across the center of the B-Steam Generator inlet (hot leg) where the original crevice indications had been seen in March. This examination was performed utilizing a single frequency eddy current instrument operating at 400 KHz with differential coils. Results from a significant number of tubes showed eleven more crevice indications in the same general area of the tube sheet. Therefore, a multifrequency eddy current

A001
1/1

procedure was developed for use in the upcoming Spring 1980 outage with both absolute and differential coil techniques specified.

In April 1980, during the scheduled refueling and maintenance outage, while analyzing the multifrequency eddy current data from the B-Steam Generator a relationship between the differential frequency indications and the absolute frequency indications was noticed. This relationship was based upon the fact that when there was a differential frequency indication the absolute frequencies were showing a vertical drift through the same area of the tube sheet crevice. It was further noticed that other tubes in close proximity to these indications had only absolute frequency indications. The technical evaluation of these indications was that differential frequency indications were caused by stress corrosion cracks within an area of intergranular attack. It was suspected that the intergranular attack was being detected by the absolute frequencies over some axial length. The postulated reason that the absolute frequencies were detecting the intergranular attack area and the differential frequencies were not, was that the depth of intergranular attack penetration gradually became deeper, maximized, and then gradually lessened to no penetration. Thus, geometry of corrosion would balance out on the differential coils, and not be detected. Therefore, tubesheet crevices with only absolute frequency indications were under intergranular attack and did not contain a stress corrosion crack.

To confirm this theory, two hot leg tubes were removed in April 1980 from the B-Steam Generator, one with differential and absolute frequency indications, and one with only an absolute frequency indication. The metallurgical analysis of these tubes showed that both tubes were degraded by intergranular attack. The tube with a differential frequency indication also had a stress corrosion crack penetration in front of the intergranular attack. Therefore, the tube pull results confirmed that absolute frequency indications, with no differential indication, were indicative of intergranular attack alone. The results of the examination of these tubes can be found in EPRI Report NP-2534-LD dated August 1982.

Confirmation of the absolute technique detecting the minor conductivity loss associated with intergranular attack provided the basis for developing the absolute frequency mix of 200 KHz and 100 KHz. This mix allows for the elimination of tubesheet and support plate interference signals as well as copper and other deposit signals for confirmation of true crevice indications. This, coupled with the 400 KHz and 200 KHz differential mix, has been used since that time as the standard procedure for detecting crevice corrosion in the tube sheets of Ginna Station's steam generators.

Further verification of this procedure has been demonstrated by the removal of three tubes from the B-Steam Generator in 1981 and one more in 1983. The results of the metallurgical analysis of these four tubes provided a very good correlation between the field eddy current analysis and the actual metallurgical condition. The results of the examination of these tubes can be found in EPRI Reports NP-3070-LD dated May 1983 and NP-3731-LD dated September 1984. Also, Ginna Station's steam generators have never experienced any primary to secondary leakage from crevice corrosion defects since the first two were called during the April 1979 Refueling and Maintenance Outage.

The following table provides an historical summary of Ginna's inspection results utilizing the above described multifrequency procedure.

GINNA'S STEAM GENERATORS
CREVICE CORROSION INDICATION HISTORY
B-Steam Generator (A-Steam Generator)

	Not Sizeable	0-25%	26-50%	51-75%	76-100%	A-S/G TOTAL	B-S/G TOTAL
March 1979	0	0	0	2	0	(0)	2
December 1979	0	0	6	5	0	(0)	11
April 1980	19	1	2	7	2	(0)	31
November 1980	2	0	0	1	0	(0)	3
April 1981	0	5	4	5	0	(0)	14
February 1982	1	0	1	6	5	(0)	13
October 1982	27	4	5	7(1)	16	(1)	59
April 1983	11(3)	3(1)	15	7	15	(4)	51
March 1984	5	0	0(1)	1	2	(1)	8
March 1985	23	4	6	9(1)	27(1)	(2)	69
	88(3)	17(1)	39(1)	50(2)	67(1)	(8)	261

On Friday, March 15, 1985 and Saturday March 16, 1985 the steam generator inlet (hot leg) inspection data was fully analyzed and given a complete second level review for the B- and A-Steam Generators, respectively. These analyses resulted in 2 crevice corrosion indications in the A-Steam Generator and 69 crevice corrosion indications in the B-Steam Generator as tabulated above. A listing of crevice indications and tubesheet maps

showing their locations are included as Attachments I and II to this letter. Attachment III is a description of the nomenclature used on the lists.

Presently the outlet (cold leg) inspections are proceeding with examination of all tubes to at least the first support plate and approximately 30 percent of the tubes inspected full length in both steam generators. ZETEC data analysts have interpreted approximately 70 percent of the A-Steam Generator data and 40 percent of the B-Steam Generator data. RG&E's second level review of the data is ongoing with approximately 25 percent of the data from both steam generators complete. The results to date, require one tube in each steam generator to be plugged. There is a defect in the U-bend area of the A-Steam Generator and a support plate wastage indication in the B-Steam Generator.

As was mentioned in our February 22 letter, and discussed with NRC Staff on March 15, corrective action for crevice corrosion indications would be brazed sleeves where there was accessibility for a 36 or 28 inch sleeve, and tubesheet sleeves in areas where accessibility of brazed sleeves is limited or where they would be beneficial from an ALARA standpoint. At the time of our discussion with NRC Staff, we were planning on installing no more than 35 tubesheet sleeves as part of our corrective action plan for the B-Steam Generator. However, based upon technical problems that have developed while installing ten brazed sleeves in the B-Steam Generator, and the radiation exposure associated with this installation work, we have elected not to proceed with the installation of further brazed sleeves, at this time.

As an alternative, tubesheet sleeves would allow for the repair, and maintaining inservice, of 56 tubes in the B-Steam Generator and 2 tubes in the A-Steam Generator with crevice indications. Three other tubes in the B-Steam Generator would require plugging because there is minor intergranular attack indications near the location of the tube sheet sleeve upper explosive weld. Attachment IV illustrates the position of the explosive weld relative to the secondary face of the tube sheet and provides the basis for the acceptability for the upper explosive weld to be made in that area of the tube sheet.

Although only 58 tubes have presently been identified for repair with tubesheet sleeves, RG&E is requesting NRC concurrence to proceed with installation of up to 65 tubesheet sleeves in Ginna Station's steam generator inlets. We believe this is acceptable based upon the discussion in our letter of February 22 and previous submittals on this subject.

Very truly yours,

Roger W. Kober

Roger W. Kober

Attachments

ATTACHMENT I

PLANT	UNIT#	S/G	LEG	REEL	TO	REEL	DATE
GINNA STATION	1	A	INLET	9		10	03/12/85

SG	ROW	COL	VOLTS	DEG	%	CH#	LOCATION	REPAIR	INDEX
LIST OF CREVICE INDICATIONS A S/G INLET 03-16-85									
11	021	072	01.33	042	099	1	HTS -0017.3	TS	00077-11
11	021	040	00.78	094	072	1	HTS -0017.3	TS	00201-05

Timothy F. Snell 3-16-85
TIMOTHY F. SNELL DATE
RG&E LEVEL II

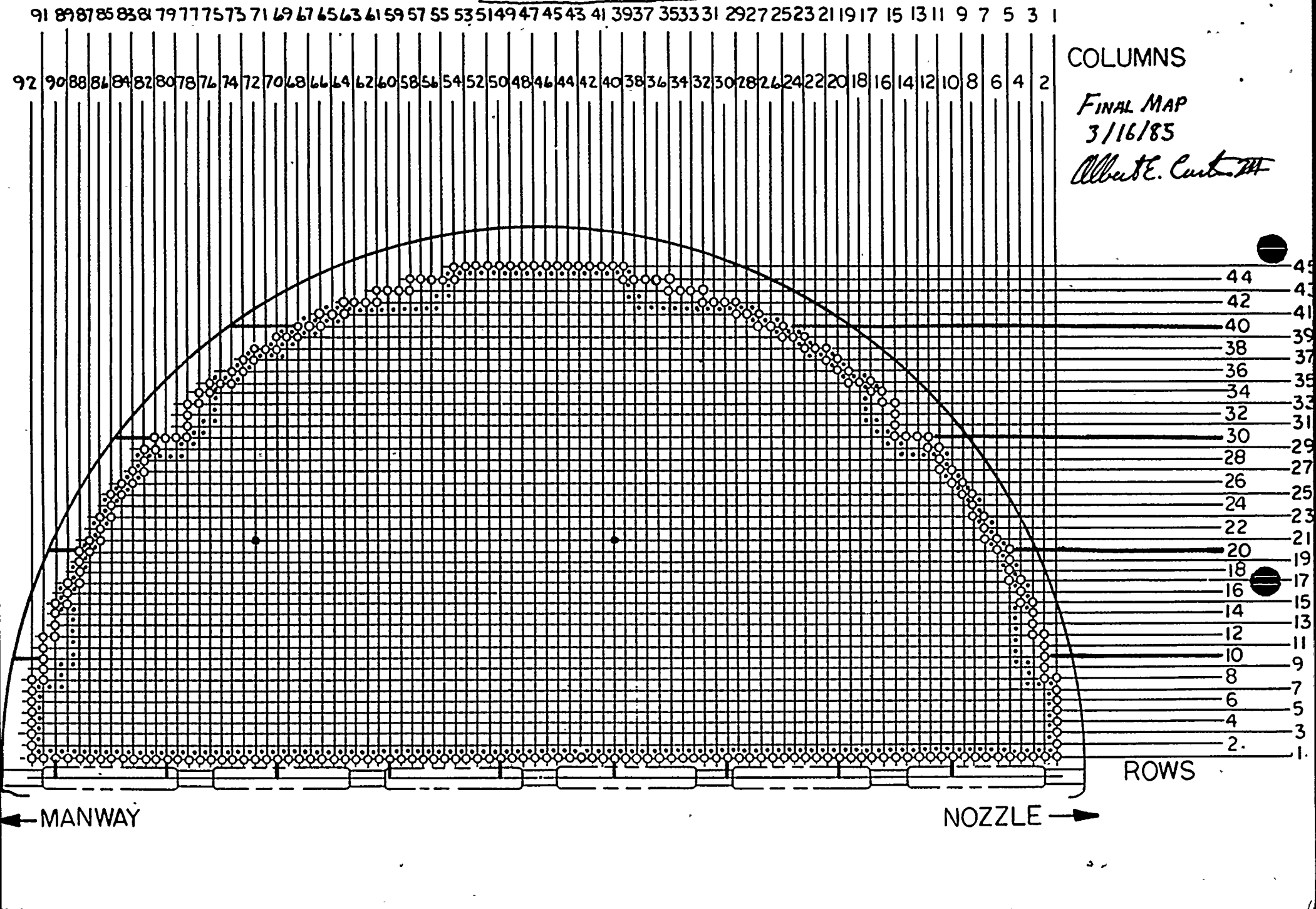
Gary L Henry 3/16/85
GARY L. HENRY DATE
BABCOCK & WILCOX LEVEL II

Albert E. Curtis III 3/16/85
ALBERT E. CURTIS III DATE
MANAGER, MATERIALS ENGINEERING
LEVEL III EXAMINER

LIST OF DATA STORED ON DISK

RG&E Steam Generator "A" Inlet

Crevice Indications



Final Map
3/16/85
Albert E. Curtis III

ATTACHMENT II

PLANT	UNIT#	S/G	LEG	REEL	TO	REEL	DATE
GINNA STATION	1	B	HOT				03/15/85

FINAL LIST OF ZETEC AND RG&E CREVICE INDICATIONS

SG	ROW	COL	VOLTS	DEG	%	CH#	LOCATION			REPAIR	INDEX
1	9	5	3.27	69	85	1	HTS	-	18.3	TS	16-15
2	9	6	1.91	73	83	1	HTS	-	17.8	TS	44-12
3	4	9	1.57	169	<20	1	HTS	-	17.4	TS	
4	8	12	1.37	139	33	1	HTS	-	17.9	TS	77-20
5	15	16	2.12	77	83	1	HTS	-	18.5	TS	149-10
6	29	19	2.30	95	68	1	HTS	-	15.4	TS	177-17
7	2	28	12.20	56	>40	M 2	HTS	-	17.6	TS	
8	38	29	2.65	70	83	1	HTS	-	18.4	TS	520-14
9	30	32	2.05	82	76	1	HTS	-	17.8	BZ	542- 7
10	18	33	1.50	155	<20	1	HTS	-	13.1	BZ	569- 6
11	19	34	1.61	98	66	1	HTS	-	7.8	PLUG	585- 9
12	13	34	1.52	85	75	1	HTS	-	6.1	TS	609-14
13	2	34			SQR		HTS	-	16.5	TS	
14	30	35	1.98	45	97	1	HTS	-	18.3	TS	634-10
15	20	36	0.89	139	33	1	HTS	-	9.1	BZ	654- 9
16	34	36			SQR		HTS	-	18.7	TS	
17	41	38	4.76	62	88	1	HTS	-	18.8	TS	677-13
18	20	39	19.82	46	>40	M 2	HTS	-	11.1	TS	751-60
19	38	39	2.70	49	95	1	HTS	-	18.4	TS	830-18
20	42	40	1.34	134	40	1	HTS	-	18.3	TS	857- 8
21	16	41	1.74	57	92	1	HTS	-	5.8	BZ	874- 8
			2.29	49	96	1	HTS	-	9.9	TS	891- 8
22	38	42	2.46	55	93	1	HTS	-	18.0	TS	1027- 9
23	21	42	10.57	54	>40	M 2	HTS	-	8.7	PLUG	1071-34
24	34	43			SQR		HTS	-	18.3	TS	
25	39	44	1.34	96	68	1	HTS	-	17.4	TS	1118-12
26	37	44	0.93	120	52	1	HTS	-	17.2	TS	1138- 7
			1.41	130	44	1	HTS	-	17.6	TS	1153- 7
			1.45	44	98	1	HTS	-	18.4	TS	1169- 8
27	16	45	0.91	116	55	1	HTS	-	5.2	BZ	1192-14
28	9	47	1.47	77	80	1	HTS	-	17.8	TS	1221-14
29	29	48	6.47	50	>40	M 2	HTS	-	7.1	TS	1284-48
30	31	48			SQR		HTS	-	17.3	TS	
31	13	49	7.40	51	>40	M 2	HTS	-	9.2	TS	1387-54
32	24	49	2.05	70	84	1	HTS	-	17.8	BZ	1457-15
33	27	49			SQR		HTS	-	18.1	BZ	
34	19	51	1.11	148	29	1	HTS	-	15.2	BZ	1482- 9
35	30	53	1.20	112	58	1	HTS	-	17.4	TS	1509-17
36	30	54	0.74	127	47	1	HTS	-	17.8	TS	1536- 9
37	1	54	1.63	88	74	1	HTS	-	18.5	TS	1553- 7
38	21	55			SQR		HTS	-	4.9	PLUG	1587-26
39	23	55			SQR		HTS	-	12.0	BZ	1640-26
40	34	55			SQR		HTS	-	17.6	TS	1693-26
41	23	56	1.56	69	85	1	HTS	-	13.4	TS	1728- 8
42	34	59	0.74	79	79	1	HTS	-	17.9	TS	1749-12

LIST OF DATA STORED ON DISK

(RG&E)

PLANT	UNIT#	S/G	LEG	REEL	TO	REEL	DATE
GINNA STATION	1	B	HOT				03/15/85

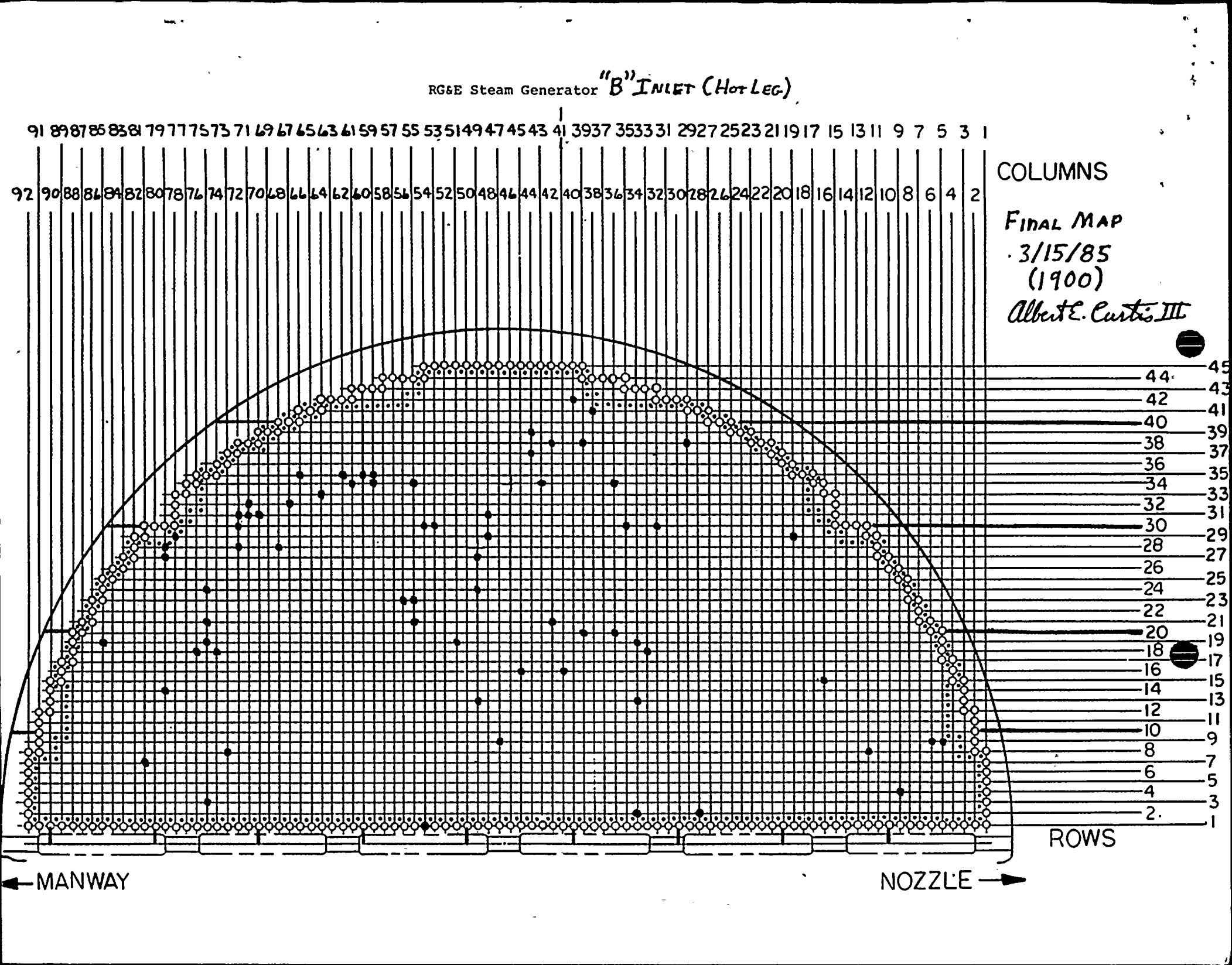
SG	ROW	COL	VOLTS	DEG	%	CH#	LOCATION	REPAIR	INDEX
43	35	59	1.28	107	61	1	HTS - 17.9	TS	1769- 7
44	35	60			SQR		HTS - 18.2	TS	1790-13
45	34	61	1.80	133	41	1	HTS - 17.6	TS	1817-13
46	35	62	7.80	84	>40	M 2	HTS - 16.9	TS	1875-44
47	33	64	2.26	72	83	1	HTS - 14.2	TS	1948-28
48	35	66			DS	1	HTS - 18.1	TS	2006-29
49	32	67			DS		HTS - 17.9	TS	2065-29
50	28	68			SQR		HTS - 8.8	TS	2140-45
51	31	70	1.81	75	81	1	HTS - 16.9	TS	2201-15
52	31	71	2.32	81	78	1	HTS - 16.8	TS	2228-11
53	32	71	3.51	81	78	1	HTS - 18.1	TS	2252-12
54	31	72	3.05	78	79	1	HTS - 17.6	TS	2282-17
55	30	72	0.84	87	74	1	HTS - 17.6	TS	2312-12
56	28	72	1.96	50	95	1	HTS - 17.7	TS	2337-12
57	8	73	10.91	45	>40	M 2	HTS - 14.3	TS	2374-24
58	18	74	7.75	52	>40	M 2	HTS - 17.5	BZ	2415-16
59	3	75	5.50	67	>40	M 2	HTS - 17.8	TS	2448-16
60	19	75	6.30	71	>40	M 2	HTS - 16.3	TS	2516-51
61	21	75			SQR		HTS - 17.8	TS	2591-23
62	24	75	2.91	48	95	1	HTS - 17.8	TS	2631-16
63	18	76	1.36	46	96	1	HTS - 15.6	TS	2673-25
64	29	78	4.61	63	88	1	HTS - 18.1	TS	2716-17
65	14	79	4.42	78	80	1	HTS - 16.6	TS	2754-20
66	27	79	1.94	46	96	1	HTS - 18.4	TS	2787-12
67	28	79	6.48	42	>40	M 2	HTS - 17.8	TS	2812-12
68	7	81			SQR		HTS - 17.1	TS	2845-20
69	19	85	2.84	43	98	1	HTS - 18.2	TS	2886-20

Todd A. Richards 3/15/85
TODD A. RICHARDS
BABCOCK & WILCOX LEVEL III

Timothy F. Snell 3-15-85
TIMOTHY F. SNELL
RG&E LEVEL II

Albert E. Curtis III 3/15/85
ALBERT E. CURTIS III
MANAGER, MATERIALS ENGINEERING
LEVEL III EXAMINER

LIST OF DATA STORED ON DISK


RG&E Steam Generator "B" Inlet (Hot Leg)
91 89 87 85 83 81 79 77 75 73 71 69 67 65 63 61 59 57 55 53 51 49 47 45 43 41 39 37 35 33 31 29 27 25 23 21 19 17 15 13 11 9 7 5 3 1
92 90 88 86 84 82 80 78 76 74 72 70 68 66 64 62 60 58 56 54 52 50 48 46 44 42 40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2
COLUMNS
Final Map
· 3/15/85
(1900)
Albert E. Curtis III
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ROWS
MANWAY
NOZZLE

Attachment III

Final List of ZETEC and RG&E Crevice Indication Nomenclature

Top of List Information

SG - Number of the defect.

ROW - Row number from the tube identification.

COL - Column number from the tube identification.

VOLTS - Amplitude of measured indication signal.

% - Perecent through wall from O.D. based on measured signal.

CH# - Channel from which indication was determined.

LOCATION - Location of crevice indication within the tubesheet.

REPAIR - TS - Tubesheet sleeve; BZ-36" Brazed sleeve, Plug - B&W or CE plug

INDEX - Location of tube data on magnetic tape.

Information under %

<20 - Measurable indication less than 20% through wall (IGA-SCC).

>40 - Absolute indication measured from absolute mix where depth determination cannot be performed because there is not a calibration curve (IGA only).

SQR - Multiple indications interferring with a depth determination (IGA-SCC).

DS - Distorted roll transition indication that cannot be confirmed or measured.

XX - The measured percent through wall of the deepest penetration (SCC) within an IGA patch or area.

Information Under CH#

1 - Indication determined and measured with 400 KHz differential for final interpretation.

M2 - Indication determined with absolute mix, depth cannot be accurately determined, but based upon amplitude is felt to be above 40% IGA.

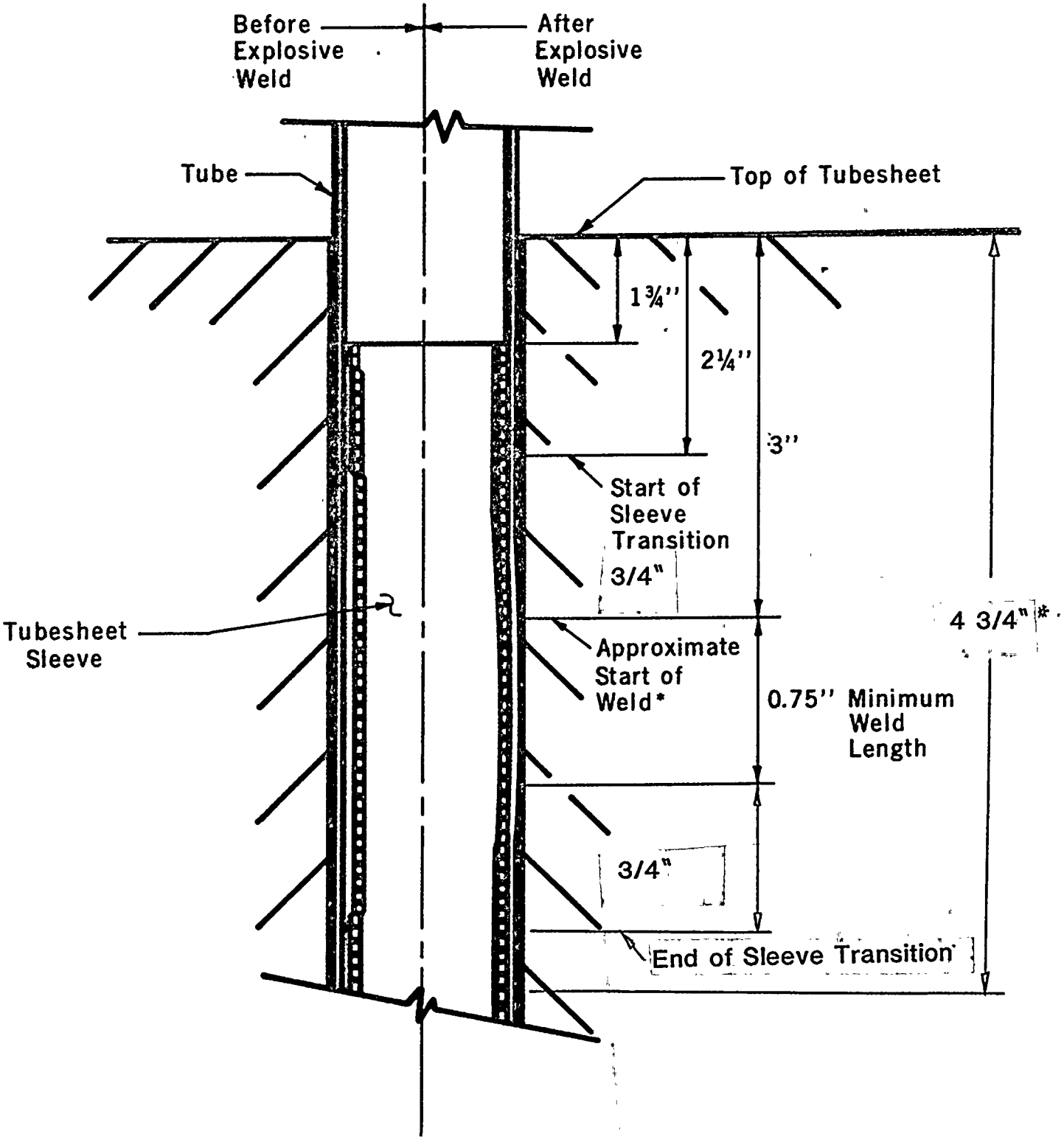
Information Under LOCATION

HTS - Secondary face of tubesheet.

-XX.X - Depth below the secondary face of the tubesheet where the indication is located.

ATTACHMENT IV

TUBESHEET SLEEVE
UPPER END



* Minimum Depth of Defect for Installation of Tubesheet Sleeves