Omaha Public Power District

1623 HARNEY ■ OMAHA, NEBRASKA 68102 ■ TELEPHONE 536-4000 AREA CODE 402

July 18, 1979

Director of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Reference: (1) Docket No. 50-285
(2) Letter, K. R. Goller to PWR Facility Licensees, dated December 9, 1977

Dear Sir:

In response to reference (2) above, please find enclosed the completed Steam Generator Operating History Questionnaire for Omaha Public Power District's Fort Calhoun Station. The questionnaire provides updated information relative to steam generator tube inspections performed during the 1978 refueling outage.

Sincerely,

for T. E. Short
Assistant General Manager

TES/KJM/BJH:cb

Enclosure

cc: LeBoeuf, Lamb, Leiby & MacRae
1333 New Hampshire Avenue, N. W.
Washington, D. C. 20036

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ENCLOSURE 1

STEAM GENERATOR OPERATING

HISTORY QUESTIONNAIRE

NOTE: All percentages should be reported to four significant figures.

I. BASIC PLANT INFORMATION

Plant: Fort Calhoun Unit No. 1

Startup Date: 8/5/73 - critical; 9/26/73 - commercial

Utility: Omaha Public Power District

Plant Location: Fort Calhoun, Nebraska 68023

Thermal Power Level: 1420 Mwth

Nuclear Steam Supply System (NSSS) Supplier: Combustion Engineering

Number of Loops: Two (2)

Steam Generator Supplier, Model No. and Type: C.E., 71266, inverted U-tube

Number of Tubes Per Generator: 5005

Tube Size and Material: 3/4" OD, .048 wall thickness, Ni-Cr-Fe alloy

II. STEAM GENERATOR OPERATING CONDITIONS

Normal Operation

Temperature: 513.8°F for sat. steam

Flow Rate: 3.112×10^6 #s/hr - secondary side

Allowable Leakage Rate: ~0.1 gpm

Primary Pressure: 2100 psia

Secondary Pressure: 770 psia at 100% power

Accidents

Design Base LOCA Max. Delta-P: 1280 psi

Main Steam Line Break (MSLB) Max. Delta-P: 2-loop - no load 1610 psi
2-loop - full load 1670 psi
1-loop - no load 1740 psi

III. STEAM GENERATOR SUPPORT PLATE INFORMATION

Material: SA-36 or equal

Design Type: Partial drilled

Design Code: 65 edition of ASME Pressure Vessel Design Section III

Dimensions: See attached Figure 1.

Flow Rate: Not available

Tube Hole Dimensions: 0.765" + 0.015" or 0.765" - 0.0"

Flow Hole Dimensions: Two 1/4" hole for each tube hole

IV. STEAM GENERATOR BLOWDOWN INFORMATION

Frequency of Blowdown: Continuous ~ 10,0[illegible] S.G.

Normal Blowdown Rate: 10,000 lbs/hr/S.G.

Blowdown Rate w/Condenser Leakage: 150 gpm/S.G. maximum

Chemical Analysis Results See attached Table 1

Resul[illegible]	Parameter Control Limits

V. WATER CHEMISTRY INFORMATION

Secondary Water

Type of Treatment and Effective Full Power (EFP) Months of Operation: AVT, 1384 EFPD as of 6-17-79

Typical Chemistry or Impurity Limits: See attached specs., Table 2.

Feedwater

Typical Chemistry or Impurity Limits: See attached specs., Table 2

Condenser Cooling Water Once-through Missouri River water

Typical Chemistry or Impurity Limits: See attached Table 3.

Demineralizers - Type: None

Cooling Tower (open cycle, closed cycle or none): None

VI. TURBINE STOP VALVE TESTING (applicable to Babcock & Wilcox (B&W) S.G. only)

Frequency of Testing

Actual: N/A

Manufacturer Recommendation: N/A

Power Level At Which Testing Is Conducted

Actual: N/A

Manufacturer Recommendation: N/A

Testing Procedures (Stroke length, stroke rate, etc.)

Actual: N/A

Manufacturer Recommendation: N/A

VII. STEAM GENERATOR TUBE DEGRADATION HISTORY

(The following is to be repeated for each scheduled ISI) See Attach. I for previous ISI

Inservice Inspection (ISI) Date: October, 1978

Number of EFP Days of Operation Since Last Inspection: 274 EFPD (October, 1977 - October, 1978)

(The following is to be repeated for each steam generator)

Steam Generator Number: A

Percentage of Tubes Inspected At This ISI: 493/5005 = 9.850%

Percentage of Tubes Inspected At This ISI That Had Been Inspected At The Previous Scheduled ISI: 74.23%

Percentage of Tubes Plugged Prior to This ISI: Zero

Percentage of Tubes Plugged At This ISI: 3 Tubes - 0.0599%

Percentage of Tubes Plugged That Did Not Exceed Degradation Limits: 0.0599%

Percentage of Tubes Plugged As A Result of Exceedance of Degradation Limits: Zero

Sludge Layer Material Chemical Analysis Results: See Attachment III

Sludge Lancing (date): None

Ave. Height of Sludge Before Lancing: N/A

Ave. Height of Sludge After Lancing: N/A

Replacement, Retubing or Other Remedial Action Considered: (Briefly Specify Details) N/A

Support Plate Hourglassing: N/A

Support Plate Islanding: N/A

Tube Metalurgical Exam Results: N/A

Fretting or Vibration in U-Bend Area (not applicable to B&W S.G.) AS OF (4)

Percentage of Tubes Plugged	Other Preventive Measures
Zero	None

Wastage/Cavitation Erosion AS OF (4)

Hot Leg: (Repeat this information for the cold leg on Combustion Engineering (C.E.) and Westinghouse (W) S.G.)

Area of Tube Bundle (1)	a	b	c	d	e
% of Tubes Affected by Wastage/Cavitation Erosion					
% of Tubes Plugged Due to Exceedance of Allowable Limit (2)					
% of Tubes Plugged That Did not Exceed Degradation Limit					
Location Above Tube Sheet (3)					
Max. Wastage/Cavitation Erosion Rate for Any Single Tube (Tube Circum. Ave) (Mills/Month)					
Max. Wastage/Cavitation Erosion in Any Single Unplugged Tube (Tube Circum. Ave) (Mills)					

None detected to date for cold leg or hot leg.

Cracking AS OF (4)

Caustic Stress Corrosion Induced in C.E. and W S.G.

Flow Induced Vibration Caused in B&W S.G. None

Cracking (Con't)

Hot Leg: (Repeat this information for the cold leg on C.E. and W S.G.)

Area of Tube Bundle (1)	a	b	c	d	e
% of Tubes Affected By Cracking					
% of Tubes Plugged Due to Cracking					
% of Tubes Plugged That Did Not Exceed Degradation Limit					
Location Above Tube Sheet (3)					
Rate of Leakage From Leaking Cracks (gpm)					

None detected to date for cold leg or hot leg.

Denting (Not applicable to B&W S.G.) AS OF (4)

Hot Leg: (Repeat this information for the cold leg on C.E. and W S.G.)

Area of Tube Bundle (1)	a	b	c	d	e
% of Tubes Affected by Denting	*				
% of Tubes Plugged Due to Exceedance of Allowable Limit (2)	0	0	0	0	0
% of Tubes Plugged That Did Not Exceed Degradation Limit	2 Tubes	0	0	0	1 Tube
Rate of Leakage From Leaking Dents (gpm)	0	0	0	0	0
Max. Denting Rate for Any Single Tube (Tube Circum. Ave) (Mills/Month)	*				
Max. Denting in Any Single Unplugged Tube (Tube Circum. Ave) (Mills)	*				

Same analysis for cold leg

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*Eddy current inspection showed anomalies in tube wall flaws, dent-like indications and distorted support plate signals. The results are given in Attachment II.

Denting (Con't)

Support Plate Levels	Max. Denting in Any Single Tube in Bundle Area (Tube Ave) (Mills) (1)					% of Tubes Affected By Denting in Bundle Area				
	a	b	c	d	e	a	b	c	d	e
1	*					*				
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										

*Eddy current inspection showed anomalies in tube wall flaws, dent-like indications and distorted support plate signals. The results are given in Attachment II.

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TABLE KEY

NOTE: All percentages refer to the percent of the tubes within a given area of the tube bundle.

(1)

Area of the Tube Bundle	No. of Tubes Within the Area
a. Periphery of Bundle (wi/20rows for B&W; wi/10 rows for C.E. and W)	
b. Patch Plate (wi/4 rows)	
c. Missing Tube Lane (B&W only) (wi/5 rows)	
c. Flow Slot Areas (C.E. and W only) wi/10 rows)	
d. Wedge Regions (C.E. and W only) (wi/8 rows)	
e. Interior of Bundle (remainder of tubes)	

(2)

Allowable Limit for Wastage/Cavitation Erosion: As per Regulatory Guide 1.83, in-service inspection of pressurized water reactor steam generator tubes (Rev. 1, 7/75)
Allowable Limit For Denting: As per Regulatory Guide 1.83, in-service inspection of pressurized water reactor steam generator tubes (Rev. 1, 7/75)

(3)

1. Specifies area between the tube sheet and the first support plate

2. Specifies in the following locations: (list the additional locations)

   Wastage/Cavitation Erosion:

   Cracking:

(4)

Specify the date of the inspection for which results have been tabulated.

October 23 through October 25, 1978

VIII. SIGNIFICANT STEAM GENERATOR ABNORMAL OPERATIONAL EVENTS

DATE	SUMMARY
	(Include event description; unscheduled ISI results, if performed; and subsequent remedial actions)
9/73	The secondary side chemistry control was changed from phosphate treatment to AVT specifications.
11-22-78	Three (3) tubes plugged in "A" Steam generator. Location and analysis are given in Attachment II.

IX. CONDENSER INFORMATION

Condenser Material	Tube Leakage Date	Tube Leakage Rate (gpm)	Detectable Limit	Detection Method
Tubes 304 S.S.	11/74	app. 100 cc/min	10 cc/min	Calculated from UV lamp and fluorecein dye.
	10/78	Unknown		High silica in feedwater

X. RADIATION EXPOSURE HISTORY WITH RESPECT TO STEAM GENERATORS

Date	Exam Dosage (Man-Rem)	Repair Dosage (Man-Rem)	Comments
	4-eddy current testing after startup and 4-visual examinations (1)	5 man-rem for S.G. handle modifications	None

(1) Eddy current 1978 - 9.51 man-rem
Eddy current 1977 - 15.19 man-rem
Eddy current 1976 - 10.51 man-rem
Eddy current 1975 - 15.39 man-rem
Inspection secondary side 1978 - 2.49 man-rem
Inspection secondary side 1977 - 2.21 man-rem
Inspection secondary side 1976 - 2.29 man-rem
Inspection secondary side 1975 - 1.04 man-rem

XI. DEGRADATION HISTORY FOR EACH TYPE OF DEGRADATION EXPERIENCED FOR TEN REPRESENTATIVE, UNPLUGGED TUBES FOR WHICH THE RESULTS OF TWO OR MORE ISI'S ARE AVAILABLE

If the results for ten tubes are not available, specify this information for all those tubes for which results are available.

(repeat the following information for each tube and degradation type)

Steam Generator No: A
Tube Identification: See Attachment II
Type of Degradation: (specify denting, wastage, cavitation erosion, caustic stress corrosion cracking, or flow induced vibration cracking) Denting and tube wall flaw.

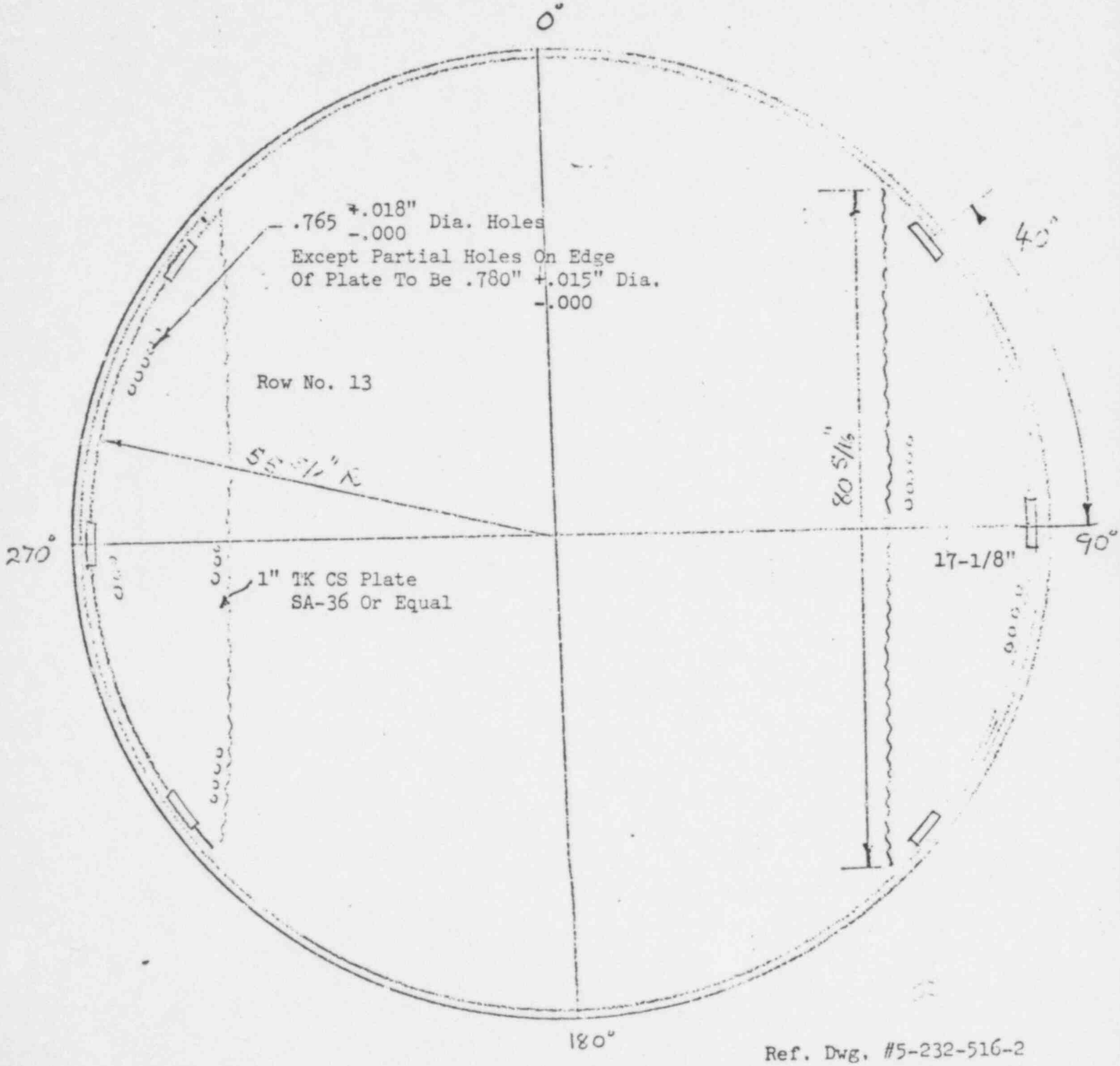
(repeat the following information chronologically for each ISI for which results are available)

ISI Date: October 23, 1978
Amount of Degradation: (specify amount and units) Random - See Attach. II
EFP Months of Operation Since Last ISI for Which Results are Given:

9.1 EFPM - See Attachment II

DRILLED PLATE (ELEV. 8)

No. of Tubes - 209
% of Total Surface - 18.2%



Ref. Dwg. #5-232-516-2

OPPD

Figure 1

TABLE 1
Fort Calhoun Station Unit No. 1
Secondary System Chemistry Summary
for Steam Generator "A" Water
(Typical Data for 1978 at Full Power)

Analysis \ Date	8/14	8/16	8/18	8/21	8/23	8/25	8/28	8/30	9/1	9/4	9/6	9/8
pH @ 25°C	8.60	8.9	9.05	9.1	8.90	8.7	8.95	8.70	8.85	8.80	8.70	8.80
Conductivity (μmhos)	2.20	1.5	2.75	3.7	4.90	3.3	6.0	3.40	3.55	3.50	3.20	3.45
Silica (ppm)	0.096	0.065	0.065	0.[illegible]	0.084	0.077	0.046	0.084	0.069	0.073	0.008	0.08
Chloride (ppm)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<1.0
Dissolved Oxygen (ppm)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Dissolved Solids (ppm)	1.54	1.05	1.92	2.59	3.43	2.37	4.2	2.38	2.49	2.5	2.24	2.42
Boron (ppm)	<0.1	<1.0	<1.0	<1.0	0.0	<1.0	<1.0	0.0	0.0	0.0	<0.1	<0.1
Hydrazine (ppm)	0.020	0.012	0.035	0.045	0.050	0.045	0.045	0.040	0.043	.043	0.035	0.03
Free Hydroxide (ppm)	<0.1	<0.1	<1.0	<1.0	0.0	<1.0	<1.0	0.0	0.0	0.0	<0.1	<0.1
Total Alkalinity (ppm)	3.0	3.0	3.0	3.0	0.3	3.0	2.0	0.3	0.2	0.2	3.0	0.2
Blowdown Rate (lbs/hr)	9500	9900	10300	11400	12000	14400	10000	10200	10100	11500	11800	11700
Suspended Solids (ppm)	0.050	-	0.100	0.050	0.025	0.100	0.100	0.025	0.050	0.050	0.025	0.025
I^{131} (μCi/mℓ)	-	-	≤2.72E-08	-	-	≤1.92E-08	-	-	≤3.52E-08	-	-	≤4.74E-

TABLE 1 (Continued)
Fort Calhoun Station Unit No. 1
Secondary System Chemistry Summary
for Steam Generator "B" Water
(Typical Data for 1978 at Full Power)

Analysis \ Date	8/14	8/16	8/18	8/21	8/23	8/25	8/28	8/30	9/1	9/4	9/6	9/8
pH @ 25°C	8.60	8.85	9.0	9.05	8.70	8.9	9.0	8.90	8.85	8.75	8.70	8.75
Conductivity (μmhos)	2.10	1.7	2.75	4.4	3.55	3.9	4.2	3.55	3.40	3.60	2.90	3.30
Silica (ppm)	0.073	0.065	0.065	0.046	0.069	0.069	0.046	0.077	0.058	0.077	0.008	0.08
Chloride (ppm)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<1.0
Dissolved Oxygen (ppm)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Dissolved Solids (ppm)	1.47	1.19	1.92	3.08	2.49	2.73	2.94	2.49	2.38	2.52	2.03	2.31
Boron (ppm)	<0.1	<1.0	<1.0	<1.0	0.0	<1.0	<1.0	0.0	0.0	0.0	<0.1	<0.1
Hydrazine (ppm)	0.020	0.012	0.030	0.045	0.050	0.050	0.045	0.038	0.042	0.043	0.035	0.035
Free Hydroxide (ppm)	<0.1	<0.1	<1.0	<1.0	0.0	<1.0	<1.0	0.0	0.0	0.0	<0.1	<0.1
Total Alkalinity (ppm)	3.0	3.0	3.0	3.0	0.3	2.0	2.5	0.2	0.2	0.3	3.0	0.2
Blowdown Rate (lbs/hr)	12500	13200	12200	12500	12000	13200	9200	9400	8700	7500	12500	10900
Suspended Solids (ppm)	0.025	-	0.150	0.050	0.025	0.150	0.150	0.075	0.050	0.075	0.01	0.050
I^{131} (μCi/mℓ)	-	-	≤1.16E-07	-	-	≤1.81E-08	-	-	≤1.19E-08	-	-	≤3.94E-0

Steam Generator Eddy Current Testing

Year	1973	1974	1975	1976	1977	1978
ISI Inspection	March* April*	None	Febr. March	Oct. Nov.	Oct. Nov.	Oct. Nov.
No. of tubes examined (by eddy current testing)						
S.G. "A"	200	0	225	0	150	493
S.G. "B"	200	0	226	308+100	0	0

*Pre-Startup Test

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Attach. I
Page 1 of 1

Table 3

Surface water quality for the Metropolitan Utilities District intake on the Missouri River at Omaha, Nebraska.

PARAMETER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
pH (units)	8.24	8.18	8.13	8.23	8.29	8.23	8.30	8.33	8.35	8.37	8.33	8.32
Dissolved Oxygen	12.40	12.40	11.30	10.40	8.30	7.20	6.60	7.00	7.50	8.60	10.30	12.40
BOD (5 day)	1.70	2.40	3.70	1.40	2.10	1.80	2.50	1.40	1.40	1.20	1.40	1.40
Hardness ($CaCO_3$)	260.00	233.00	231.00	261.00	246.00	242.00	241.00	239.00	238.00	241.00	245.00	262.00
Specific Conductance (micromhos/cm at 25 degrees C)	708.00	680.00	633.00	663.00	673.00	657.00	675.00	675.00	683.00	695.00	693.00	705.00
Suspended Solids	141.00	159.00	437.00	501.00	641.00	569.00	695.00	245.00	534.00	138.00	207.00	96.00
Total Dissolved Solids	93.00	563.00	531.00	579.60	558.00	556.00	545.00	567.00	568.00	565.00	578.00	604.00
Sodium	61.00	58.00	50.00	53.00	53.00	60.00	61.00	63.00	62.00	65.00	64.00	67.00
Magnesium	24.00	22.00	21.00	24.00	23.00	22.00	22.00	23.00	21.00	24.00	24.00	25.00
Calcium	65.00	60.00	59.00	65.00	61.00	61.00	60.00	58.00	57.00	58.00	59.00	64.00
Bicarbonate	215.00	207.00	198.00	213.00	198.00	193.00	185.00	187.00	191.00	201.00	234.00	219.00
Chloride	13.00	12.00	13.00	13.00	13.00	13.00	13.00	12.00	12.00	12.00	12.00	12.00
Fluoride	0.62	0.58	0.55	0.60	0.60	0.59	0.59	0.64	0.63	0.62	0.61	0.61
Sulfate	204.00	183.00	163.00	192.00	193.00	189.00	207.00	213.00	211.00	201.00	252.00	204.00
Nitrate	2.47	2.96	4.83	4.69	3.70	3.92	2.08	1.35	0.97	1.69	1.81	2.53
Phosphate	0.13	0.12	0.15	0.15	0.12	0.14	0.09	0.06	0.09	0.07	0.08	0.07

NOTES: All units are milligrams/liter (mg/l) unless otherwise specified.
Data are averages of monthly random samples.
No replicates were taken.
Time span: 1971 to 1975
Number of measurements: 4 to 5 per month on Wednesdays.
Location of Sampling: Florence Plant intake, at river mile 626, 10 to 35 feet below surface in winter.
Methods of Sampling: grab sample from continuous flow hose taken from raw water line which comes from plant intake.
Methods of Analysis: Ref. 2.4-16c.

Fort Calhoun Steam Generator "A"
Eddy Current Testing - October, 1978

RESULTS

A total of 493 tubes (9.8% of the bundle) were inspected at 400kHz. Of this total, 396 tubes pass through the uppermost drilled hole support plate (#8 elevation). The inspection results showed the following anomalies.

1) Dent-like indications.

2) Tube wall flaws.

3) Distorted support plate signals.

The number of dent-like indications at the various elevations were:

Structure	8 Hot Leg	7 Hot Leg	8 Cold Leg	7 Cold Leg	Other Elevations	Batwing	No Indication
No. of Indications	89	15	19	0	14	16	371

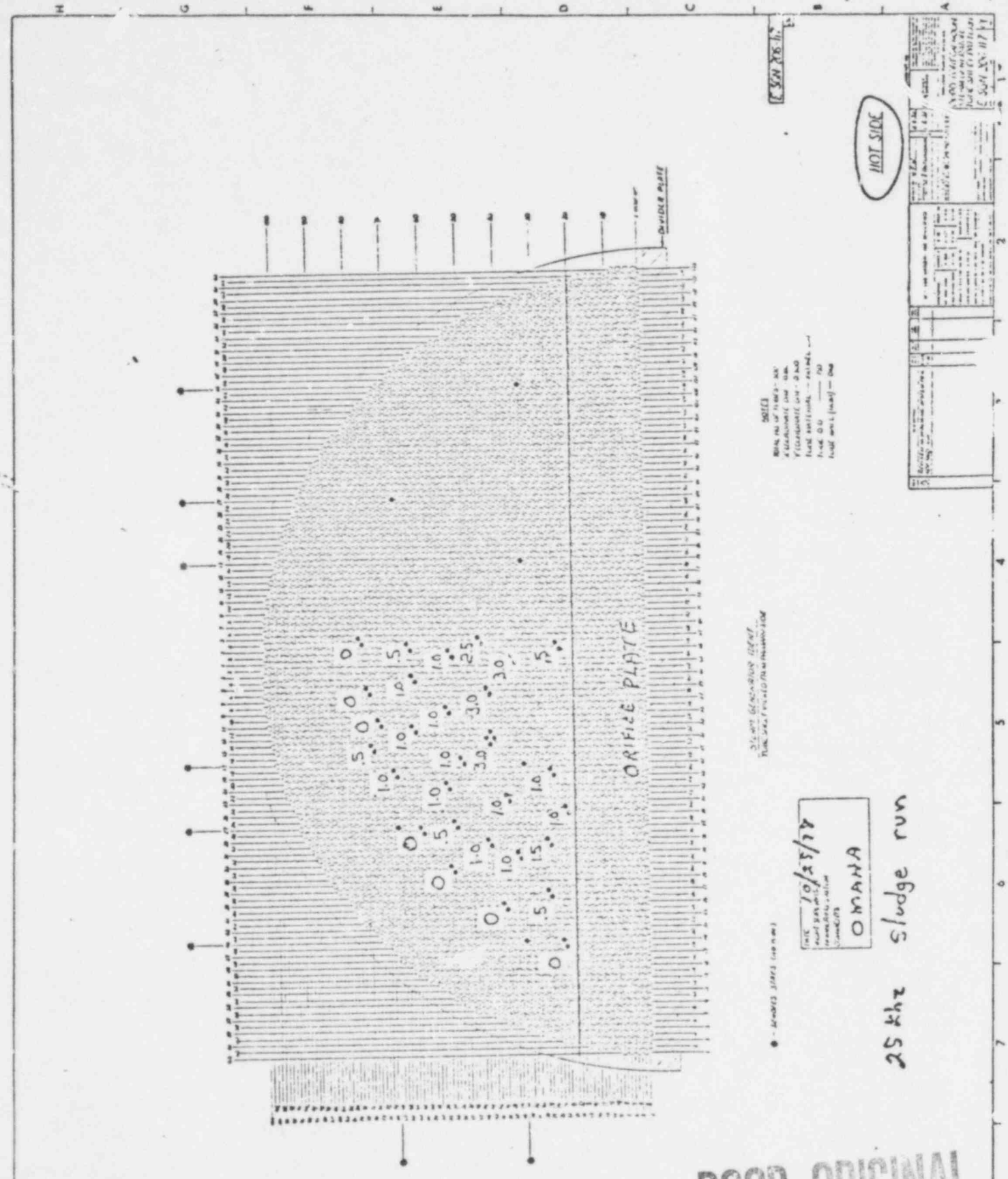
The occurrence of the signals is generally random except in the #8 hot leg support plate. In this plate, there is a cluster of tubes in the periphery in which the highest amplitude signals occurred. This situation was observed in the 1977 inspection and comparison of the data shows no change. The increased number of reported indications compared to 1977 is due to an enlarged inspection pattern and a lowering of the reporting threshold. A direct comparison of strip charts for the two inspections showed no new dent indications and no increase of existing signals. These signals correspond to minor deformation of the tube. No exact size estimate can be made because the geometry of this deformation is unknown. It is significant that none of these signals occurred in the center or mid plane of the support plates. Center dents are typical of small magnetite growth induced denting.

Six tubes had anomalies reported based on the 400kHz testing. To further evaluate these indications, additional testing at 100, 200 and 600kHz was performed. The six tubes and the final evaluation are listed below:

Tube Line	Tube Row	Indication Location	Evaluation Result
64	85	Just below #7 hot leg support plate	38% tube wall flaw.
80	97	#7 support plate hot leg	Distorted support signal possible < 20% flaw.
79	98	#7 support plate hot leg	Distorted support signal possible < 20% flaw.
64	87	#6 support plate hot leg	Distorted support signal, no tube wall flaw.
81	96	#8 support plate hot leg	Distorted support signal, no tube wall flaw.
45	98	#5 support plate hot leg	Distorted support signal, no tube wall flaw.

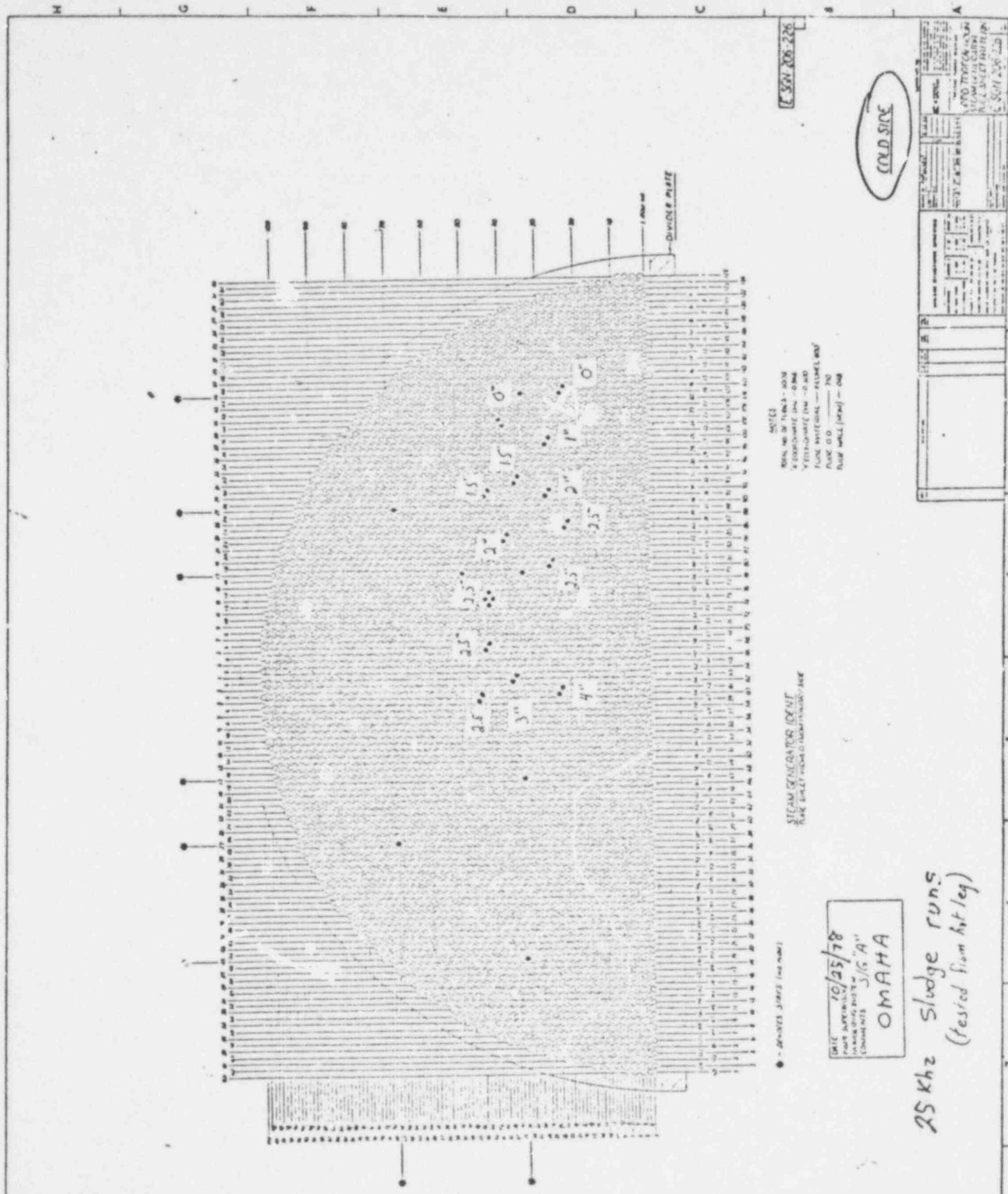
The 1977 inspection results for Line 64, Row 85 was compared to the recent data. The prior signal appeared only as a slight distortion of the support plate signal. It is probable that this flaw grew, but the results are not definitive.

The sludge height measurement results are plotted on the tube sheet maps in Figures 1 and 2 for the hot and cold side. Compared to the 1977 data, the sludge height increased by approximately 1 inch. The hot side observed maximum is 3 inches. The region on the cold side with the maximum sludge height in 1977 (6 inches) was not accessible in 1978 because of the hot side orifice plate.



Sludge Height Measurement Results

Figure 1



Sludge Height Measurement Results

Figure 2

TABLE 1

FORT CALHOUN SG SLUDGE SAMPLES
X-RAY DIFFRACTION ANALYSES
FALL 1978 INSPECTION

SAMPLE IDENTIFICATION	COMPONENTS MAJOR	MINOR	TRACE
1. SG "A" Inside Handhole Cover--90°	αFe_2O_3 Fe_3O_4		
2. SG "A" Inside Handhole Port--90°	αFe_2O_3 Fe_3O_4 Cu SiO_2		
3. SG "A" Off Top of Can Deck	Cu Fe_3O_4 αFe_2O_3		CuO
4. SG "A" Off Top of Steam Separator Can-Blister Like Sample Appearance	Fe_3O_4 αFe_2O_3	Cu	
5. SG "B" Blowdown Lane Handhole Port	αFe_2O_3 Cu Fe_3O_4		
6. SG "B" Off Top of Feedwater Header	Cu Fe_3O_4 αFe_2O_3		CuO
7. SG "B" Off Top of Can Deck	Fe_3O_4 αFe_2O_3	Cu	CuO
8. SG "B" Off Top of I-Beam Below Can Deck	Fe_3O_4 αFe_2O_3 Cu		
9. SG "B" Off Top Of Tube Bundle	Cu Fe_3O_4 αFe_2O_3		

TABLE 2

FORT CALHOUN SG SLUDGE SAMPLES

SEMI-QUANTATIVE X-RAY FLUORESCENCE
VALUES REPORTED AS PERCENT FOUND
FALL 1978 INSPECTION

Element	1. SG "A" Inside Handhole Cover--90°	2. SG "A" Inside Handhole Port--90°	3. SG "A" Off Top Of Can Deck	4. SG "A" Off Top Of Steam Separator Can-Blister Like Sample Appearance
Aluminum	0.13	0.098	0.098	0.064
Silicon	0.073	5.4	0.028	--
Phosphorus	0.061	0.026	0.023	0.032
Sulfur	0.094	0.024	--	0.0051
Chloride	--	--	--	--
Potassium	0.0070	0.0088	0.0035	0.0018
Calcium	0.040	0.056	0.011	0.0048
Titanium	0.64	0.47	0.36	0.46
Chromium	1.2	0.73	0.77	0.42
Manganese	0.68	0.47	0.37	0.68
Iron	64.3	48.5	37.5	65.0
Nickel	0.34	0.33	0.25	0.11
Copper	0.086	15.2	44.3	6.0
Zinc	0.073	0.20	0.038	0.032
Lead	0.0087	0.0079	0.011	--
Cobalt	0.099	0.061	0.049	--
Zirconium	--	0.031	0.0091	--
Molybdenum	0.69	--	0.0083	--
Sodium (Flame Phot.)	<0.1	<0.1	<0.1	0.074
Magnesium (A.A.)	0.30	<0.1	<0.1	<0.1

TABLE 2
(cont.)

FORT CALHOUN SG SLUDGE SAMPLES

SEMI-QUANTATIVE X-RAY FLUORESCENCE
VALUES REPORTED AS PERCENT FOUND
FALL 1978 INSPECTION

Element	5. SG "B" Blowdown Lane Handhole Port	6. SG "B" Off Top Of Feedwater Header	7. SG "B" Off Top Of Can Deck
Aluminum	0.10	--	0.093
Silicon	0.033	--	0.033
Phosphorus	0.019	0.032	0.035
Sulfur	--	0.0078	0.005
Chloride	--	--	0.03
Potassium	0.0060	--	0.01
Calcium	0.33	0.0098	0.021
Titanium	0.47	0.30	0.57
Chromium	0.95	0.86	0.50
Manganese	0.54	0.31	0.69
Iron	55.0	38.1	62.9
Nickel	0.28	0.23	0.31
Copper	17.4	43.6	7.8
Zinc	0.044	0.025	0.056
Lead	--	0.011	0.0094
Cobalt	--	0.065	0.068
Zirconium	0.012	0.0091	--
Molybdenum	--	0.011	0.0082
Sodium (Flame Phot.)	0.074	<0.1	0.074
Magnesium (A.A.)	<0.1	<0.1	<0.1

TABLE 2
(cont.)

FORT CALHOUN SG SLUDGE SAMPLES

SEMI-QUANTATIVE X-RAY FLUORESCNECE
VALUES REPORTED AS PERCENT FOUND
FALL 1978 INSPECTION

Element	8. SG "B" Off Top Of I-Beam Below Can Deck	9. SG "B" Off Top Of Tube Bundle
Aluminum	0.27	0.13
Silicon	0.077	--
Phosphorus	0.034	0.033
Sulfur	--	--
Chloride	--	--
Potassium	0.0026	0.0029
Calcium	0.045	0.019
Titanium	0.47	0.33
Chromium	1.0	0.97
Manganese	0.44	0.48
Iron	51.2	30.8
Nickel	0.25	0.31
Copper	23.9	53.3
Zinc	0.041	0.066
Lead	0.0073	0.016
Cobalt	--	--
Zirconium	0.015	--
Molybdenum	--	--
Sodium (Flame Phot.)	<0.1	0.074
Magnesium (A.A.)	0.060	<0.1

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Attach. III
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