

Florida Power & Light Company

St. Lucie Unit #2

Nuclear Plant

Special Report

For

EDDY CURRENT EXAMINATION OF  
STEAM GENERATOR TUBING  
DURING OCTOBER, 1987

Nuclear Energy Services

Materials, Codes and Inspections Department

Juno Beach, Florida 33408

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## Introduction

The Nuclear Energy Services, Materials, Codes & Inspection Department, conducted an inservice eddy current examination of the Florida Power & Light St. Lucie Unit #2 Steam Generator Tubing in October, 1987. The extent of this examination included 100% of non-plugged hot leg and cold leg tubes in accordance with plant technical specifications using multi-frequency eddy current equipment and differential bobbin coil test probes. The eddy current data was subjected to two independent analyses using certified data analysts from Combustion Engineering, NDE Technology and Zetec, Inc. Discrepancies in the independent analyses were resolved by Level III individuals from the respective agencies.

St. Lucie Unit #2 contains two Combustion Engineering series 67 recirculating steam generators identified as PSL-2A and PSL-2B. Each steam generator contains approximately 8,411 u-bend tubes made of inconel 600. A baseline eddy current examination was performed in July, 1982 and the first inservice eddy current examination was performed in October, 1984. An unscheduled inservice eddy current examination was last performed in March, 1985, due to primary to secondary tube leakage which was identified and attributed to flow induced vibrational wear at the diagonal and vertical support straps, referred to as batwings (Figures 1 and 2). To obtain wear progression data, 29 tubes which were plugged in March, 1985 were de-plugged in April, 1986 and examined using a standard bobbin coil and a segmented bobbin coil probe. The segmented bobbin coil probe provides wear data at both sides of the tube in contact with the batwing. The results of this wear progression analyses is presented in Combustion Engineering report CEN-328 dated May, 1986. Application of the wear progression model and conservative management practice during the October, 1987 outage resulted in "preventive maintenance plugging" of six (6) additional tubes in PSL-2A and two (2) additional tubes in PSL-2B. Table 1 provides a summary by steam generator of tubes examined, indications of tube wall penetration and tubes plugged.

Table 2 provides a listing of tubes plugged as a result of the October, 1987 examination and application of wear progression models. Refer to Figure 1 as a key to location codes. A total of 8 tubes were plugged in the PSL-2A generator and 10 tubes were plugged in the PSL-2B generator. Seven (7) tubes in PSL-2A were plugged as a result of wear at batwing or vertical support straps. One (1) tube was plugged as a result of wear from a foreign object; identified by visual examination to be a length of weld wire at the periphery of the tube bundle. Ten (10) tubes were plugged in PSL-2B as a result of wear at batwing or vertical support straps.

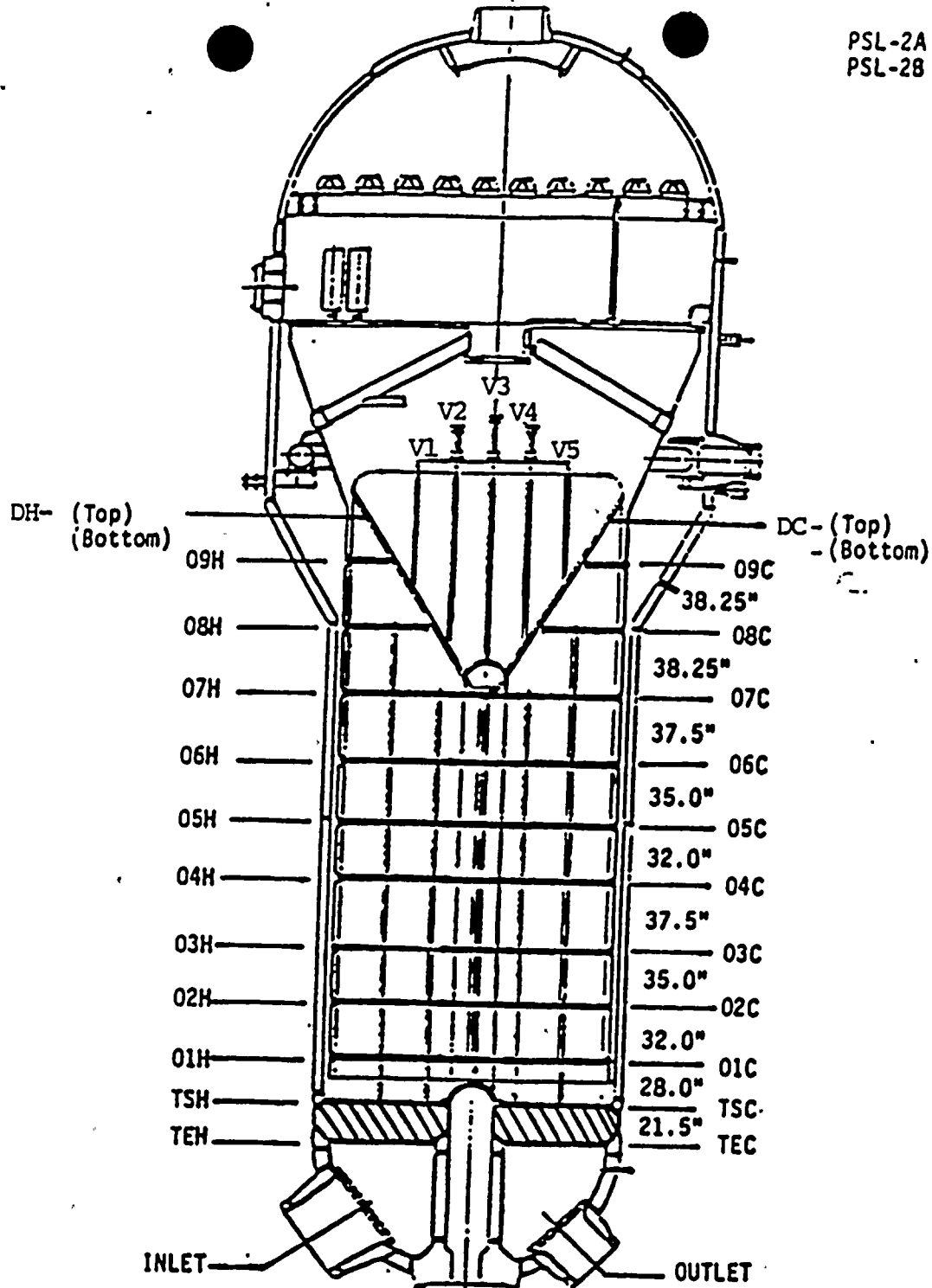
Table 3 provides a listing of all indications of tube wall penetration by location for each steam generator.



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A number of tubes had indications located at the batwing areas which represent the initiation of tube wall damage from vibration as discussed above. However, the wear at these areas has not advanced to the point which will produce a measurable result in terms of wall penetration. Therefore, these indications are identified in the eddy current database and the affected tubes will be monitored during subsequent examinations or otherwise dispositioned.



Egg Crates = Elev. 1 to 7  
Drilled Supports = Elev. 8 & 9

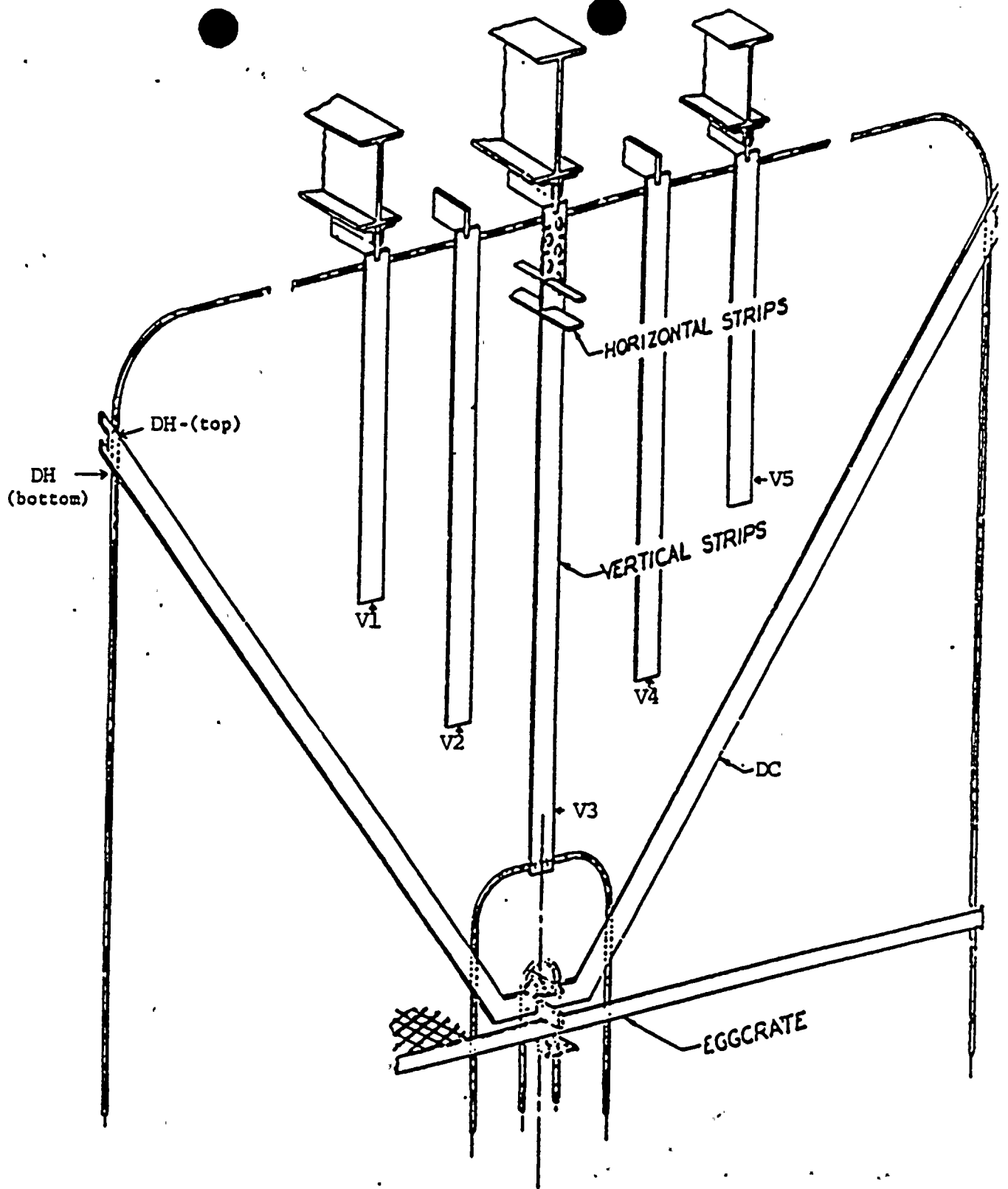
ST. LUCIE II

STEAM GENERATOR ARRANGEMENT

Figure 1



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BEND REGION TUBE SUPPORTS

PLANT ST. LUCIE UNIT 2

Figure 2



TABLE 1

St. Lucie Unit #2 - Summary of  
Inservice Eddy Current Examination  
Results for October 1987

	PSL-2A	PSL-2B
<b>TOTAL TUBES EXAMINED</b>		
Indications of Wall Penetration	<u>IND</u>	<u>IND</u>
Less than 20%	337	186
20 to 39%	27	16
40 to 100%	2	9
<b>Total</b>	<b>366</b>	<b>211</b>
Tubes Plugged based on Wear Progression Analysis and Management Conservatism	6	2
Tubes Plugged Which Exceeded Plugging Limits	2	8
<b>Total Tubes Plugged</b>	<b>8</b>	<b>10</b>
<b>Total Tubes Plugged To Date</b>	<b>208</b>	<b>155</b>

TABLE 2

St. Lucie Unit 2 Steam Generator  
Tubes Plugged During the October 1987 Outage

Steam Generator A

Line	Row	Indication	Location
56	94	40	V4
59	133	40	DH
82	52	33	DC
92	42	37	DH
92	44	36	DH
94	40	34	DH
98	38	35	DC
130	116	33	TSH + 11.3

Steam Generator B

Line	Row	Indication	Location
25	89	43	V2
38	96	51	V2
		62	V4
69	133	45	V1
75	41	53	V3
80	48	33	DH
87	49	47	V3
88	46	47	V3
100	36	28	DC
100	92	42	V2
111	93	53	V2

TABLE 3

St. Lucie Unit 2 Examination Program - October 1987  
Steam Generator PSL-2A  
List of all Tubes with Flaws

Line	Row	Indication	Location
27	93	33	V4 + 1.0
33	105	31	V2 + 0.2
48	126	27	DH + 0.9
52	84	36	V3 + 0.2
56	94	25	V4 + 0.1
		40	V4 + 0.9
57	95	32	V2 - 0.8
58	132	28	DH + 0.0
59	133	40	DH + 0.0
61	83	20	V3 + 0.9
64	94	29	V2 + 1.0
64	134	21	DH + 0.0
73	47	25	V3 + 0.9
81	47	20	V3 + 0.8
82	52	33	DC + 0.0
87	69	24	5C + 8.9
91	109	34	TSC + 4.0
92	42	37	DH + 0.0
92	44	36	DH + 0.0
94	40	34	DH + 0.0
96	40	26	V3 - 0.7
96	50	30	V3 - 0.8
98	38	35	DC + 0.0
98	138	22	DH + 0.0
108	96	27	V2 + 0.7
117	113	22	5H + 29.7
127	53	22	V3 + 0.8
129	87	28	V3 + 0.7
130	116	33	TSH + 11.3

TABLE 3

St. Lucie Unit 2 Examination Program - October 1987  
Steam Generator PSL-2B  
List of all Tubes with Flaws

Line	Row	Indication	Location
24	96	30	8H - 1.0
25	89	43	V2 - 0.9
34	96	26	V2 + 0.5
38	96	51	V2 - 0.8
		62	V4 - 0.9
68	32	22	DH + 0.0
69	133	45	V1 + 0.8
75	41	53	V3 - 0.9
76	112	36	7C + 0.0
78	50	21	DC + 0.0
79	47	21	DH + 0.0
79	49	25	DC + 0.0
80	48	33	DH + 0.0
83	89	35	V3 - 0.7
87	49	47	V3 - 0.8
88	46	47	V3 + 0.0
88	56	39	V3 + 0.8
97	97	26	TSH + 20.8
99	35	28	DC + 0.0
100	36	28	DC + 0.0
100	92	42	V2 - 0.9
111	93	53	V2 + 0.6
122	94	21	V2 - 1.1
123	97	23	V3 + 0.7
134	104	20	V1 + 0.5