Florida Power & Light Company

St. Lucie Unit #2

Nuclear Plant

Special Report

For

EDDY CURRENT EXAMINATION OF STEAM GENERATORS TUBING DURING APRIL, 1986

Nuclear Energy Services

Materials, Codes and Inspections Department

Juno Beach, Florida. 33408

Required by Plant Technical Specifications
Sections 4.4.5.5 (b) and 6.9.2

MCI1:4

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 April, 1986. 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.

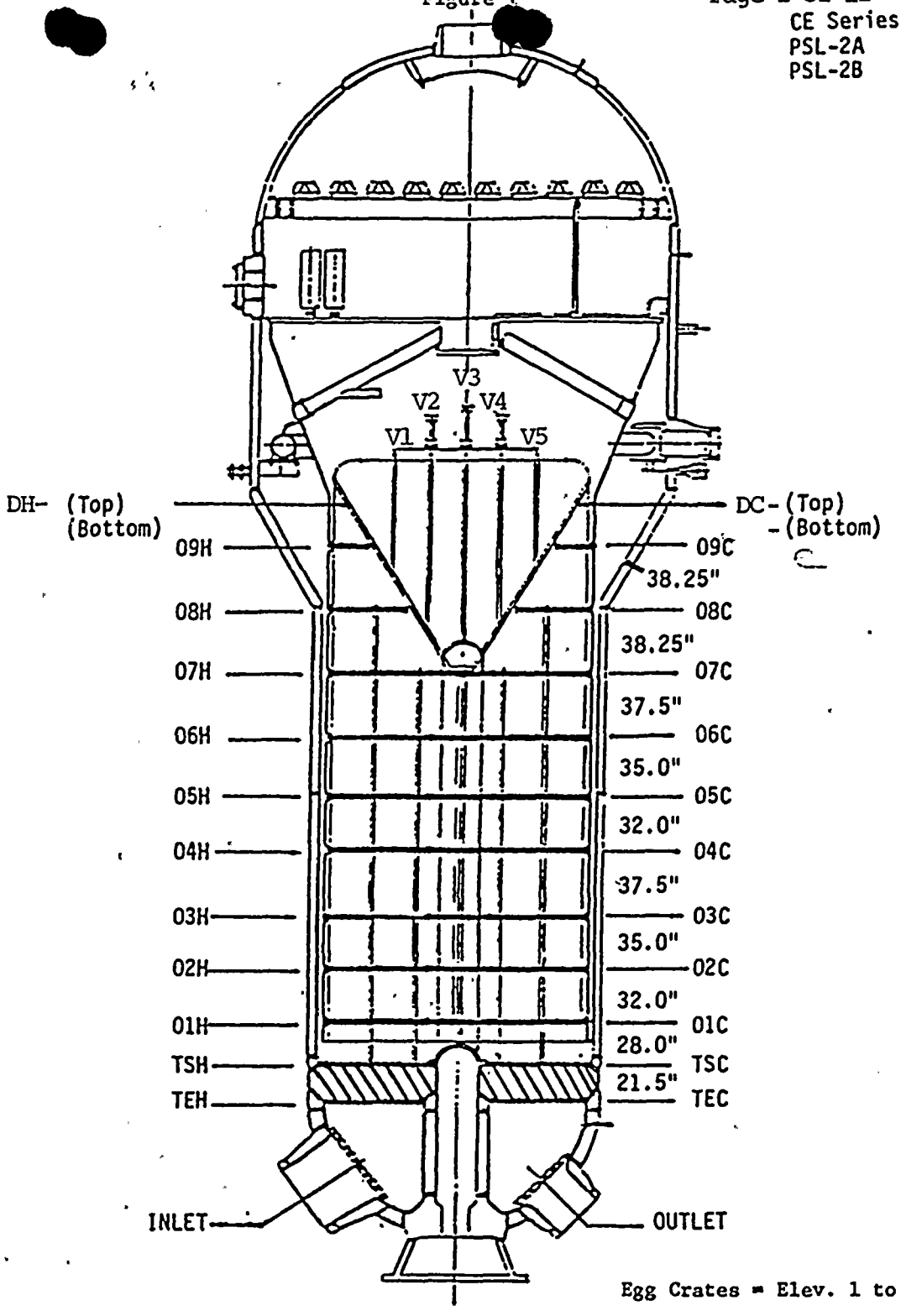
St. Lucie Unit #2 contains two Combustion Engineering series 67 recirculating steam generators identified as PSL-2A and PSL-2B. Each steam generator contains approximately 8,411 u-bend tubes made of inconel 600. A baseline eddy current examination was performed in July, 1982 and the first inservice eddy 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 April, 1986 outage resulted in "preventative maintenance plugging" of seven (7) additional tubes in PSL-2A and eight (8) 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 April, 1986 examination and application of wear progression models. Refer to Figure 1 as a key to location codes. A total of 18 tubes were plugged in the PSL-2A generator and 12 tubes were plugged in the PSL-2B generator. All 18 tubes in PSL-2A were plugged as a result of wear at the batwing support straps. In the PSL-2B, ten (10) tubes were plugged as a result of wear at the batwing support straps and two (2) tubes were plugged due to a small amplitude indication in the free span hot leg portion of each tube.

Table 3 provides a listing of all indications of tube wall penetration by location for each steam generator. A summary of indications by "flaw range" is also included.

Table 4 contains a listing of indications located at the batwing areas which represent the initiation of tube wall damage from vibrational as discussed above. However, the wear at these areas have not advanced to the point which will produce a measurable result in terms of wall penetration. Therefore, these indications are identified as "Distorted Strap Signals" (DSS) and the affected tubes will be treated as degraded tubes and monitored during subsequent examinations or otherwise dispositioned.

Figure 1

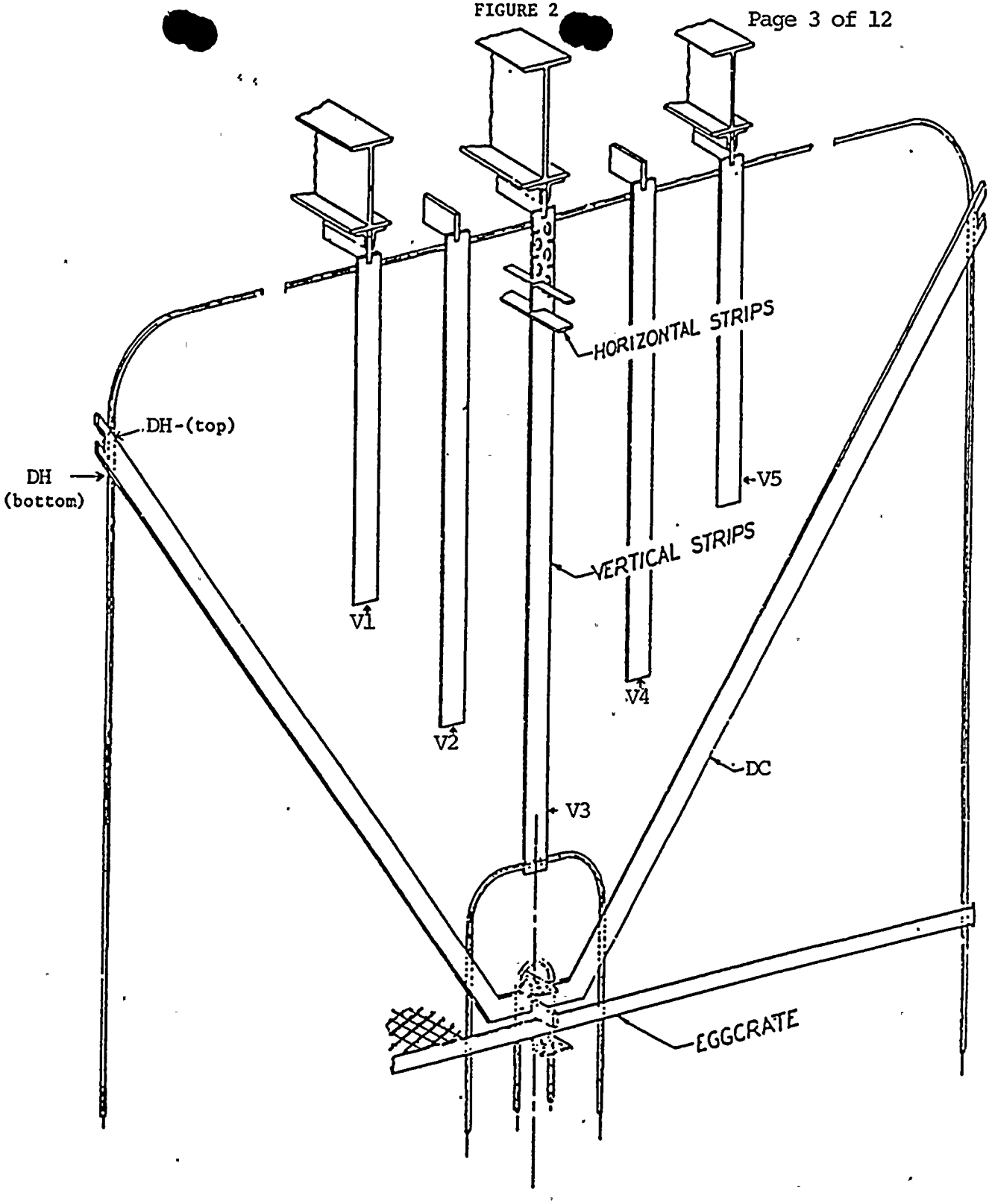


Egg Crates = Elev. 1 to 7

Drilled Supports = Elev. 8 & 9

ST. LUCIE II

STEAM GENERATOR ARRANGEMENT



BEND REGION TUBE SUPPORTS

PLANT ST. LUCIE UNIT 2

TABLE 1

St. Lucie Unit #2 - Summary of
Inservice Eddy Current Examination
Results for April 1986

	PSL-2A	PSL-2B
TOTAL TUBES EXAMINED	8229	8278
Indications of Wall Penetration	IND/TUBES	IND/TUBES
Less than 20%	50/48	38/37
20 to 39%	30/30	21/16
40 to 100%	11/11	5/4
Total	91/89	64/57
Tubes Plugged based on Wear Progression Analysis and Management Conservatism	7	8
Tubes Plugged Which Exceeded Plugging Limits	11	4
Total Tubes Plugged	18	12
Total Tubes Plugged To Date	200	145

TABLE 2

St. Lucie Unit 2 Steam Generator
Tubes Plugged During the April 1986 Outage

Steam Generator A

Line	Row	Indication	Location
60	88	68	V5 +15.1
74	40	41	DC
76	50	45	DC
76	52	22	DC
77	49	34	DC
79	59	40	DC
80	50	31	DC
81	49	33	DH
83	49	27	DH
83	55	40	V3
83	57	25	DC
97	39	29	DH
97	49	48	V3
100	34	41	V3 + .08
101	33	49	V3
102	46	47	V3
118	94	46	V4
140	32	65	DH

Steam Generator B

Line	Row	Indication	Location
26	72	38	V3 + .7
28	96	57	V2 + 1.1
		45	V2
82	54	38	V3
89	47	31	DH
89	131	34	5H + 20.6
90	46	35	DH
91	43	39	DH
91	49	25	DC
110	96	43	V2
		38	V3
		24	V2 + .6
119	97	56	V3
131	61	48	1H + 8.4
153	63	28	V2 + 8.5
		27	V2 + 5.6
		26	V2 + 10.0
		24	V2 + 12.7

TABLE 3

St. Lucie Unit 2 Examination Program - April, 1986
Steam Generator PSL-2A
List of all Tubes with Flaws

Line	Row	Indication	Location
12	20	20	4C + 7.60
12	36	20	6H + 28.50
22	86	28	V3 + .50
28	60	20	3C + 28.40
48	126	30	DH
52	84	24	V3
53	127	20	DH
54	128	20	DH
55	25	20	V3
56	94	32	V4 + .10
56	106	20	3C + 10.50
57	131	20	DH
58	132	20	DH
59	131	22	DH + 4.00
59	133	23	DH
60	88	68	V3 + 15.10
60	130	31	DH
61	131	27	DH
64	94	28	V2
64	134	26	DH
64	136	20	DH
65	133	20	DH
73	47	25	V3
74	40	41	DC + 4.00
76	42	23	DH
76	50	45	DC
76	52	22	DC
76	96	34	2H + 18.70
77	47	29	DC + 4.00
77	49	34	DH + 4.00
77	51	20	DH
78	44	23	DH
79	59	40	DC
80	48	20	DC
80	50	31	DC + 4.00
80	54	22	DC + 4.00
81	49	33	DH + 4.00
82	132	20	8H + 3.20
83	49	27	DH
83	53	20	DC
83	55	40	V3
83	57	25	DC + 4.00
84	46	20	DC + 4.00
84	50	20	DC
84	54	20	DC
85	47	20	DC
85	47	20	DH

TABLE 3

St. Lucie Unit 2 Examination Program - April, 1986
Steam Generator PSL-2A
List of all Tubes with Flaws

Line	Row	Indication	Location
85	53	20	DC
85	61	20	TSH + 6.10
85	65	20	1H + 16.00
86	52	20	DC + 4.00
86	60	20	DH
86	108	20	3C + 1.40
86	128	20	7H + 18.10
86	140	20	DC
87	47	20	DC + 4.00
87	51	23	DC + 4.00
87	53	22	DC + 4.00
87	69	20	5C + 8.80
87	121	20	TSC + 10.90
87	121	20	TSC + 12.70
89	139	20	DH
91	109	20	TSC + 5.20
92	42	20	DH + 4.00
92	124	20	TSC + 26.20
93	103	20	2H 14.60
94	40	29	DH + 4.00
94	64	020	2C + 18.70
97	39	29	DH
97	49	48	V3
97	53	20	4C + 28.50
99	43	30	4C + 11.30
99	75	20	4C + 12.60
100	34	41	V3 + .08
101	33	49	V3
101	137	20	DH
102	46	47	V3
110	44	20	5H + 10.80
114	76	20	1C + 26.90
114	88	20	5C + 23.00
115	23	20	2C + 2.90
116	124	20	6H + 7.80
118	94	46	V4
124	100	20	TSH + 5.80
129	117	20	TSH + 12.40
132	78	20	6C + 23.30
138	92	26	2H + 33.30
140	32	65	DH
140	56	20	TSH
143	51	20	1H + 12.60
153	47	32	2H + 16.80

TABLE 3

St. Lucie Unit 2 Examination Program - April, 1986
Steam Generator PSL-2A
List of all Tubes with Flaws

Flaw RANGE	NUMBER OF OCCURRENCES	NUMBER OF TUBES IN RANGE
0 - 19	50	48
20 - 29	22	22
30 - 39	8	8
40 - 49	9	9
50 - 59	0	0
60 - 69	2	2
70 - 79	0	0
80 - 89	0	0
90 - 99	0	0

TABLE 3

St. Lucie Unit 2 Examination Program - April, 1986
Steam Generator PSL-2B
List of all Tubes with Flaws

Line	Row	Indication	Location
26	72	38	V3 + .70
28	96	57	V2 + 1.10
28	96	45	V2
33	47	20	2C + 30.80
35	75	20	5H + 7.60
38	96	28	V4
42	90	20	5C + 16.30
45	35	20	2C
50	116	20	5H + 32.30
51	57	20	V3
53	59	20	3H + 7.80
54	2	20	TSC + 6.60
57	63	20	2H + 3.90
65	131	20	9H + 17.30
68	32	20	DH
68	134	20	5H + 4.70
77	43	20	DC
78	48	20	DC
79	47	20	DH + 4.00
80	46	22	DH
80	48	20	DC + 4.00
80	52	22	DH
80	54	20	DH
81	47	20	DH + 4.00
82	46	20	DH
82	54	38	V3
83	89	26	V3 + .80
85	47	21	DC
86	52	20	DC
88	46	26	V3
89	47	31	DH
89	131	34	5H + 20.60
90	46	35	DC
90	134	20	1C + 11.60
90	134	20	1C + 3.50
91	43	39	DH
91	49	25	DC
97	97	20	TSH + 21.40
100	64	22	DH
100	136	20	TSC + 15.90
101	33	20	DC
104	52	20	4C + 26.50
104	56	20	4H + 26.00
108	80	20	TSH + 3.40
108	82	20	TSH

TABLE 3

St. Lucie Unit 2 Examination Program - April, 1986
Steam Generator PSL-2B
List of all Tubes with Flaws

Line	Row	Indication	Location
110	96	43	V2
110	96	38	V3
110	96	24	V2 + .60
111	119	20	6H + 28.90
114	96	20	V2
116	52	20	TSC + 11.50
116	112	20	6C + 14.70
119	97	56	V3 + 14.70
124	108	20	3C + 13.30
125	71	20	8C
130	94	20	V2
131	61	48	1H + 8.40
133	17	20	TSH + 2.00
136	108	20	1C + 31.00
153	63	28	V2 + 8.50
153	63	27	V2 + 5.60
153	63	26	V2 + 10.00
153	63	24	V2 + 12.70
159	53	20	5C + 17.20

Flaw RANGE	NUMBER OF OCCURRENCES	NUMBER OF TUBES IN RANGE
0 - 19	38	37
20 - 29	14	10
30 - 39	7	6
40 - 49	3	2
50 - 59	2	2
60 - 69	0	0
70 - 79	0	0
80 - 89	0	0
90 - 99	0	0

TABLE 4

St. Lucie Unit 2 Examination Program - April, 1986
Steam Generator PSL-2A
Tubes with Distorted Support Strap (DSS) Indications

Line	Row	Indication	Location
27	93	DSS	V4
27	93	DSS	V4
47	111	DSS	V4
47	111	DSS	V3
50	124	DSS	V2
50	124	DSS	V1
50	126	DSS	V1
52	78	DSS	V4
57	95	DSS	V2 + .80
58	94	DSS	V2
59	93	DSS	V4
59	95	DSS	V3
59	127	DSS	V1 + .80
61	83	DSS	V3 + .60
63	133	DSS	V1
64	128	DSS	V1 + .90
66	94	DSS	V4
66	124	DSS	V5
70	136	DSS	V1
73	135	DSS	V1
78	96	DSS	V3
79	49	DSS	V3 + .50
86	92	DSS	V4
90	94	DSS	V3
96	40	DSS	V3
96	50	DSS	V3
98	134	DSS	V3
119	51	DSS	V3
129	87	DSS	V3
131	47	DSS	V3
131	93	DSS	V2

TABLE 4

St. Lucie Unit 2 Examination Program - April, 1986
Steam Generator PSL-2B
Tubes with Distorted Support Strap (DSS) Indications

Line	Row	Indication	Location
25	89	DSS	V2
26	72	DSS	V2 + .80
34	96	DSS	V2
38	96	DSS	V2
69	133	DSS	V1 + .90
87	49	DSS	V3
88	52	DSS	V3
88	56	DSS	V3
91	45	DSS	V3
92	54	DSS	V3
98	34	DSS	V3
99	37	DSS	V3
100	92	DSS	V2
102	34	DSS	V3
104	40	DSS	V3
110	96	DSS	V3 + .70
111	89	DSS	V4
111	93	DSS	V2
117	89	DSS	V2
123	97	DSS	V3
143	95	DSS	V2