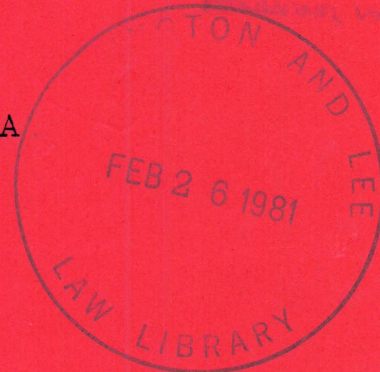


220VA930

DEC 26 1979

SUPREME COURT OF VIRGINIA

RECORD NO. 791583



VIRGINIA ELECTRIC AND POWER COMPANY,

Appellant,

v.

DIVISION OF CONSUMER COUNSEL,
OFFICE OF ATTORNEY GENERAL
AND STATE CORPORATION COMMISSION,

Appellees.

APPENDIX TO BRIEF FOR APPELLANT

EVANS B. BRASFIELD
RICHARD D. GARY
P. O. Box 1535
Richmond, VA 23212
Counsel for Appellant

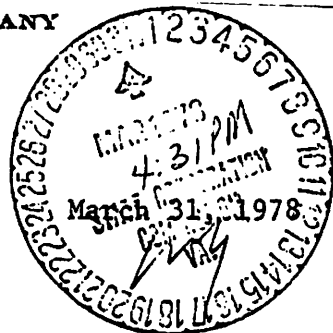
HUNTON & WILLIAMS
Of Counsel

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**Included at the request of Counsel for the State Corporation Commission.	

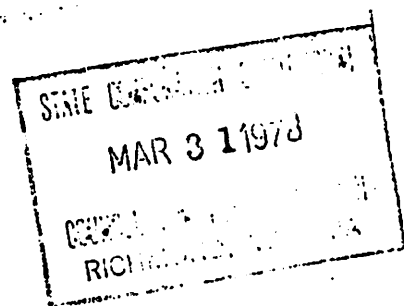
VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

W. L. PROFFITT
SENIOR VICE PRESIDENT



State Corporation Commission
P. O. Box 1197
Richmond, Virginia 23209

QUARTERLY FUEL CLAUSE HEARING
CASE NO. 19883



Gentlemen:

The Commission Staff requested in the March 15, 1978 Quarterly Fuel Clause Hearing that Vepco submit certain information concerning the forced outage of Surry Unit 2 from November 18, 1977 through November 27, 1977. That information is enclosed with this letter.

In reviewing that information it is essential to remember that the denting phenomena in the steam generator tubes experienced by the Surry units and other Pressure Water Reactors (PWR) in recent years had no precedent in the nuclear industry. The nature of this problem was of such serious proportions that it could have resulted in the shutdown of all PWR units in the country if a satisfactory solution had not been found. Needless to say, the impact of such an action would have had a disastrous effect on the economic well being of this Country.

To define and arrest this unique condition complex and expensive investigations were undertaken. Vepco, along with its nuclear steam supplier, took the lead in developing the required techniques, equipment and procedures to mitigate the consequence of the steam generator problem. As a direct result of these efforts, Vepco has recently been able to maintain 6-month run periods as compared with the typical one-month run periods achieved when the denting problem was first identified.

The Commission should recognize the contributions that the Company has made in bringing the Surry units to the high level of performance that has been sustained during the past year. Although we have experienced outages due to these steam generator problems the operating record for 1977 was well above the national capacity factor average for nuclear units. The national average was 64.4% while the Surry Station was 69.8%. This performance has resulted in a record kilowatthour production and a tremendous savings to our customers.

3/31/78

2

We will be available to meet with you or your Staff at any time to discuss this information further.

Sincerely yours,



W. L. Proffitt

Attachments

Q. a. An explanation of Vepco's Surry Units steam generator inspection program in effect prior to March, 1977, including, among other things, monitoring techniques and criteria for plugging dented tubes.

A. a. The steam generator inspection program in effect prior to March, 1977 is contained in Vepco's submittal to the Nuclear Regulatory Commission (NRC) for the Surry 2 outage on February 11, 1977. This submittal is enclosed as Attachment A.

The criteria for plugging dented tubes (Preventive Plugging Program) was based on field data of identified leaking dents and strain intensity profiles, obtained from a finite element model analysis of the tube support plates. With this information, a strain intensity level was selected at which failure was felt to occur and this formed the basis for tube plugging to provide a high degree of assurance that the steam generators would operate for the time period permitted by the NRC before reinspection of the steam generators were required.

SURRY UNIT 2 STEAM GENERATOR INSPECTION PROGRAM

4

1. Inspection of steam generator tubes and internals

A. Steam generator tubes

1. U-bends: All available tubes in each steam generator, in rows 2 through 5, will be inspected through the U-bend using the "540 beaded-flex" eddy current probe at 100 KHz. Any flaw indications found in the U-bends will be reinspected at 400 KHz with the "540 beaded-flex" probe.
2. Leaky dents: A special eddy current probe designed to provide meaningful data in dented regions is not yet fully developed. The latest information from Westinghouse indicated the probe will not be developed in a field worthy form before the end of February 1977. Therefore, no eddy current inspection of dented tubes is planned. However, if a field worthy eddy current probe becomes available, tubes in known dented regions will be inspected.

B. Steam generator internals

1. Tube support plates: The flow slots in the lower tube support plate will be gauged. This information will be used to verify the tube support plate expansion rate.
2. Other internals: Detailed visual inspections will be conducted through the handholes of each steam generator to assess the general conditions of the steam generator internals. Photographic and video tape records of this inspection will be made if possible.

2. Preventive plugging

- A. The preventive plugging program shown in figure 1 will be implemented in each steam generator. Since Unit No. 2 steam generators already have a significant number of tubes plugged, this program will result in all of row 1, 2, and the most strained tubes in row 3 being plugged. The program for leaky dents will be the same as that performance on Unit No. 1.

3. Program for continued operation

- A. After completing 61 equivalent days and completion of the program described herein, we request approval for Surry Unit No. 2 to operate for 60 equivalent days at a reactor coolant temperature greater than 350 degrees F. The following restrictions on reactor operation apply:
 1. Unit No. 2 shall be brought to the cold shutdown condition in order to perform an inspection of the steam generators within 60 equivalent days of operation from approval date. Nuclear Regulatory Commission approval shall be obtained before resuming power operation following this operating period.

For the purpose of this requirement, equivalent operation is defined as operation with a primary coolant temperature greater than 350 degrees F.

2. Total primary to secondary leakage shall be limited to 1.0 gpm and primary to secondary leakage through each steam generator shall be limited to 0.3 gpm. With any steam generator tube leakage greater than this limit the reactor shall be brought to the cold shutdown condition within 24 hours.
3. Reactor operation will be terminated if primary to secondary leakage which is attributable to 2 or more tubes occurs during a 20 day period. Nuclear Regulatory Commission approval shall be obtained before resuming reactor operation.
4. The concentration of radioiodine in the primary coolant shall be limited to 1 microcurie per gram during normal operation and to 30 microcuries per gram during power transients as defined in the Safety Evaluation.

- Q. b. An explanation of any changes in inspection program techniques or criteria between March 1, 1977, and September 30, 1977.
- A. b. In March, 1977 additional inspection techniques for Surry steam generators was implemented. A method for guaging tubes was developed that permitted us to monitor the degree of denting in the steam generator tubes. This method consisted of using three eddy-current probe sizes to determine the dented diameter of tubes.

The basic approach for a dented tube inspection is to predict the regions in the steam generator where severe denting is likely to occur. This is done by the Westinghouse finite element computer model. Within this region three guage sizes are used to determine the approximate diameter of the dented tubes. This information is compared to previous data to predict which tubes would become severely dented during the proposed operating period. Any tube that is predicted to become severely dented during the proposed operating period would be plugged.

A report submitted to NRC on September 30, 1977 for Surry Unit 2 shown as Attachment B, covers in detail the guaging techniques described above and outlines the tube plugging criteria based on guaging data obtained from the steam generator tubes.

TUBE PLUGGING PATTERN
FOR SURRY UNIT NO. 2

1. INSPECTION AND PLUGGING CRITERIA

As with previous evaluations of the Surry steam generators, the results of finite element analyses were used together with previous inspection results to arrive at the appropriate inspection program for the current shutdown.

Figure 1 illustrates the sequence of computer runs to current operation and for a period in excess of six additional months of operation. Figures 2 through 4 present the tube hoop strain contours for these computer runs.

The tube lane inspection program is defined, conservatively, by the 12.5% strain contours from the computer run which defines tube hoop strains at 5.5 EFPM beyond full flow slot closure. This region is identified in Figure 5.

An additional precautionary inspection criterion has been established so that the inspection will go two rows beyond any tube that restricts a .650 inch probe. The basis for using the above criteria is the leak history at this and other plants, and the results of recent gauging programs. These programs, when viewed in conjunction with the computer results have offered considerable insight into the relative tube condition in the tube lane region. In addition, inspection programs are defined for the wedge and patch plate regions in Figure 6. These include inspection of tubes two rows beyond any tube which restricts a 0.650 inch probe at the patch plate, and 0.610 inch probe at the wedges. The entire inspection program boundary is shown in Figure 6.

The logic applied to develop the plugging criteria remains consistent with that applied for the first Surry Unit No. 2 submittal. It is well to review that criteria in view of minor changes in both the inspection and plugging

criteria, and in view of the fact that this is the first reinspection under the gauging program. Locations of previous leakers, investigations which have indicated that the stress corrosion cracks in the tube lane region occur when tubes are deformed to the extent that they cannot pass 0.470 inch probes, and the location of tubes that cannot pass 0.540 and 0.610 inch probes have given extensive information on progression of the specific regions of severely deformed tubes. Based on the hoop strain plots shown in Figures 2 through 4, the growth of contours which are representative of the strains that exist at stress corrosion cracks is approximately 1/3 tube row per month over most of the tube lane, and 1 tube row per month at the outside columns. This is confirmed in Figure 7. It will be further confirmed by the evaluation of the current inspection findings which are reviewed in the next section of this submittal. The criteria still uses as the basis for plugging the occurrence of tubes that cannot pass 0.540 inch probes. This is still quite conservative in that all of our data shows that leakage has occurred in the tube lane region in tubes with a minimum diameter considerably below 0.540 inch, i.e., 0.470 inches. Based on the rates of growth of the high strain regions, each additional row beyond a tube which cannot pass a 0.540 probe affords 3 months of operation over most of the bundle and 1 month of operation at the outside columns. Indications are that tubes that cannot pass 0.610 probes, but can pass 0.540 probes, can sustain operation for periods close to 6 months. However, as a rather conservative measure, all tubes that do not pass the 0.610 probe will also be plugged at this time. The criterion established for plugging tubes in the region of the patch plate differs from that used for other regions of the bundle. Figure 8 shows all tubes in the vicinity of the patch plate which have either leaked or will not pass a 0.610 inch

probe. They have all occurred at the perimeter of the plate or next to the patch plate boundary, where plug welds connect the patch plate to the main body of the bundle. All data still indicates that the phenomenon at the patch plate is local in nature and should not be attributed to the general strained state of the plate, nor can the phenomenon be represented by the finite element model. While the hoop strains in this region are not high enough in themselves to cause severe tube deformations, they are high enough to act as catalysts for the local phenomenon which occurs at the patch plate. Due to these factors, the region of the patch plate requires its own inspection program (Figure 6) and a corresponding plugging criteria. Because of the fact that leakers in the region have not always restricted 0.540 inch probes, leakers and tubes that restrict the 0.540 inch probe will be treated alike, and the immediately adjacent tubes will be plugged. In addition, tubes that restrict the 0.610 inch probe will be plugged, and as a final conservatism, tubes on either side of the patch plate boundary (plate perimeter on one side and plug welds on the other three) that restrict the 0.650 inch probe will be plugged. Finally, due to the relatively low strains and the low rate of growth of these strains (Figures 2 through 4) the plugging criteria at the wedge locations call for plugging leakers, tubes that restrict 0.540 and 0.610 inch probes, and tubes surrounding leakers and those that restrict the 0.540 inch probe.

The complete plugging criteria which supports at least six months of operation are:

- a) All tubes which do not pass the 0.540 inch probe will be plugged.
- b) Additionally, for in excess of six months operation, two tubes beyond (i.e., higher row numbers) any tube in columns 15-79 which does not pass

the 0.540 inch probe will be plugged; for such tubes in columns 1-14 and 80-94 six tubes beyond will be plugged.

- c) All tubes which do not pass the 0.610 inch probe will be plugged.
- d) The tubes in any column for which plugging under criteria (a), (b) or (c) above is implemented will also be plugged in the lower row numbered tubes back to the tube lane if not already plugged.
- e) As a conservative measure, tubes completely surrounding any known leaky tubes including the diagonally adjacent tube will be plugged, if not already covered by the foregoing criteria.
- f) Additional preventive plugging will be implemented in the patch plate region. This plugging will include all tubes that:
 - (1) restrict the 0.540 inch probe
 - (2) restrict the 0.610 inch probe
 - (3) surround leakers and tubes that restrict the 0.540 inch probe - including the diagonally adjacent tube.
- (g) Additional preventive plugging will be implemented at the wedge locations. This plugging will include all tubes that:
 - (1) restrict the 0.540 inch probe
 - (2) restrict the 0.610 inch probe
 - (3) surround leakers and tubes that restrict the 0.540 inch probe - including the diagonally next tube.

- Q. c. Explain why the tube at location R5C26 in steam generator 2A was not inspected during the inspection/refueling shutdown in September, 1977.
- A. c. During the inspection/refueling outage in September, 1977 for Surry Unit 2, a total of 6144 tubes were inspected; this included 421 tubes in three steam generators which did not pass a 0.650 inch probe during the March, 1977 outage. The R5C26 tube was one of the tubes to be reinspected but a review of inspection data shows that it was missed. No reason for not probing the tube has been established. A sampling of data sheets versus strip chart results was done to monitor the accuracy of the data sheets. This consisted of 15%, 12% and 15% in 2A, 2B and 2C steam generators respectively. There were no differences found between the data sheets and the strip chart records. The results of the review provides reasonable assurance that no further scheduled-to-be-inspected tubes were missed.

- Q. d. The dollar amount of the net replacement energy costs associated with the forced outage of Surry Unit No. 2 from November 18, 1977 through November 27, 1977. Supply the supporting data for the calculations.
- A. d. The net replacement energy costs associated with the forced outage of Surry Unit 2 for the period November 18-27, 1977 is \$4,696,766. Supporting data for this cost is shown on Attachment C.

SURRY UNIT NO. 2 FORCED OUTAGE
NOVEMBER 18-27, 1977

ADDITIONAL OPERATING EXPENSE STUDY

General:

- (1) The purpose of this study is to determine the additional cost of generation and interchange receipts occasioned by the forced outage of Surry unit No. 2.
- (2) Study Period - November 18, 1977 through November 27, 1977
- (3) Surry No. 2 capability during the outage period was estimated to be 758 MW which was its average hourly output for the 31 day period preceeding the outage. (See Detail Sheet 1)
- (4) It was assumed that had Surry No. 2 been in service during the study period its energy output would have replaced equivalent energy from the highest cost sources actually used. These were combustion turbines, interchange received, and "In System" fossil steam generation.
- (5) Combustion turbine fuel cost (\$/MWH) during the study period was assumed to be equal to the monthly average for November, 1977. (See Detail Sheet 3)
- (6) In system fossil steam fuel cost (\$/MWH) during the study period was assumed to be equal to the monthly average for November, 1977. (See Detail Sheet 3).
- (7) Interchange energy received costs used in the base study were based upon actual costs in all cases except those related to CP&L transactions which were based on estimated preliminary costs. Where actual daily costs were available, such as those for Economy transactions and PJM Emergency transactions, they were used. In other cases monthly average costs were used. (See Detail Sheet 4)
- (8) Interchange energy received costs used in the revised study were the same as in the base study except those related to CP&L transactions. In the revised study the hourly average of actual monthly costs, as taken from the CP&L invoice, were used. (See Detail Sheet 4-Revised)

Power Supply Department
12/22/77
CRW

ADDITIONAL COST STUDY - SURRY NO. 2 FORCED OUTAGE NOV. 18-27, 1977

REVISED SUMMARY

(ACTUAL COSTS FOR CPEL INTERCHANGE RECEIPTS (INVOICE) WERE USED IN THE REVISION INSTEAD OF PREVIOUSLY USED, PRELIMINARY ESTIMATED COSTS)

Prepared By
Approved By

13

ACTUAL		DATA SOURCE
ACTUAL MWH	NOV. 1977	
IN SYSTEM FOSSIL STEAM GEN.	1602999	POWER REPORT-Pg. 2
MT. STORM FOSSIL STEAM GEN.	511361	" " "
NUCLEAR STEAM GEN.	558017	" " "
COMBUSTION TURBINE GEN.	92275	" " "
HYDRO GEN.	63691	" " "
PURCH. & INTCH. RECEIVED	202700	" " Pg. 1
INTERCHANGE DELIVERED	(62866)	" " "
VEPCO ENERGY SUPPLY MWH	2968177	
ACTUAL COST (\$)		
IN SYSTEM FOSSIL STEAM-FUEL	33109549	PROD. EXP. REPORT Pg. 1
MT. STORM FOSSIL STEAM-FUEL	5987378	" " "
NUCLEAR STEAM-FUEL	2542184	FINANCIAL REP. - Pg. 19-1
COMBUSTION TURBINE-FUEL	4336926	" " 19-2
HYDRO	—	— — —
PURCHASE & INTER. RECEIVED	4553396	STATISTIC (PURCH. & INT. LEDGER
INTERCHANGE DELIVERED	(43697)	DEPT. " " "
TOTAL COST	50585736	
PROFORMA SURRY NO. 2 ESTIMATED ADDITIONAL GENERATION		
SURRY #2 GEN. MWH	175443	
NUCLEAR FUEL RATE-¢/MWH	4.556	
PROFORMA MWH		
IN SYSTEM FOSSIL STEAM-GEN	1532480	
NUCLEAR STEAM GEN.	733460	
COMBUSTION TURBINE-GEN.	53701	
PURCH. & INTCH. - RECEIVED	136341	
MT. STORM + HYDRO - INTCH. DELIVERED	512186	
VEPCO ENERGY SUPPLY	2968168	
PROFORMA COST (\$)		
IN SYSTEM FOSSIL STEAM-FUEL	31652996	
MT. STORM FOSSIL STEAM-FUEL	5987378	
NUCLEAR STEAM-FUEL	3341644	
COMBUSTION TURBINE-FUEL	2523948	
PURCH. & INTCH. - NET	2383004	
	45888970	POWER SUPPLY DEPT.
		12-22-77
ADDITIONAL COST	4696766	(NEW)

SURRY NUC. POWER PLANT COST NOV. 18-27, 1977

ADDITIONAL FUEL COST SUMMARY

DESCRIPTION	NOVEMBER 1977	DATA SOURCE
IN SYSTEM FOSSIL STEAM - GEN.	1402997	POWER REPORT - PAGE 2
MT. STORM FOSSIL STEAM - GEN.	511341	" " " "
NUCLEAR STEAM - GEN.	558017	" " " "
COMBUSTION TURBINE - GEN.	72275	" " " "
HYDRO GEN.	67671	" " " "
PURCH. & INTERCH. RECEIVED	202700	" " PAGE 1
INTERCHANGE DELIVERED	(1-566)	" " PAGE 1
NET ENERGY SUPPLY - MWH	2768177	
NET FUEL COST (\$)		
IN SYSTEM FOSSIL STEAM - FUEL	33109549	PROD. EXPENSES PAGE 1
MT. STORM FOSSIL STEAM - FUEL	5187378	" " " "
NUCLEAR STEAM - FUEL	2542184	FINANCIAL REPORT PAGE 17-1
COMBUSTION TURBINE - FUEL	4336926	" " PAGE 17-2
HYDRO		
PURCHASE & INTERCHANGE RECEIVED	4553396	NET - FINANCIAL REPORT, PG. 17-2
INTERCHANGES DELIVERED	(43497)	PURCH. & INTERCH. LEDGER - STATE DEPT.
TOTAL COST	50585736	" " " "
PROGRAM SUMMARY NO. 2 ESTIMATED ADDITIONAL GENERATION		
SURRY #2 GENERATION - MWH	115943	DETAIL SHEET 2
NUCLEAR FUEL MWH - 1/MWH	4,356	LINE 13 + LINE 3
PRECEDING MWH		
IN SYSTEM FOSSIL STEAM - GEN.	1532480	LINE 1 - LINE 15 (DETAIL SHEET 5)
NUCLEAR STEAM - GEN.	733460	LINE 3 + LINE 21
COMBUSTION TURBINE - GEN.	53701	LINE 4 + LINE 14 (DETAIL SHEET 5)
PURCHASE & INTERCHANGE - RECEIVED	136341	LINE 6 - LINE 12 (DETAIL SHEET 5)
MT. STORM FUEL - INTERCH. DELIVERED	512186	LINE 24 - LINE 5 - LINE 7
NET ENERGY SUPPLY	2768168	
PROGRAM COST (\$)		
IN SYSTEM FOSSIL STEAM - FUEL	\$ 31652796	LINE 11 - LINE 34 (DETAIL SHEET 5)
MT. STORM FOSSIL STEAM - FUEL	5957378	LINE 12
NUCLEAR STEAM - FUEL	3341644	LINE 13 + (LINE 21 + LINE 32)
COMBUSTION TURBINE - FUEL	2533948	LINE 26 + (LINE 14 + LINE 4)
PURCHASE & INTERCHANGER - NET	2425016	(LINE 11 - LINE 17) - LINE 31 (DETAIL SHEET 5)
ADDITIONAL OPERATING COST	\$ 454354	LINE 18 - LINE 35

POWER SUPPLY DEPT.
12-22-77
CRW

DETAIL SHEET 1

SURRY NO. 2 FORCED OUTAGE NOV 18-27, 1977

ADDITIONAL EXPENSE STUDY

SURRY NO. 2 GENERATION RECORD OCT. 18 - NOV. 1, 1977

Prepared By

Approved By

DAILY
OUTPUT
MWH

1	10-18	18127							
2	19	18155							
3	20	18146							
4	21	18100							
5	22	18179							
6	23	18209							
7	24	18187							
8	25	18196							
9	26	18221							
10	27	18242							
11	28	18076							
12	29	18061							
13	30	18751	(25 hours)						
14	31	18055							
15	11-1	18084							
16	2	18239							
17	3	18281							
18	4	18367							
19	5	18210							
20	6	18356							
21	7	18354							
22	8	16390	off line 2125						
23	9	15487	on line 0120						
24	10	15262							
25	11	15252							
26	12	18151							
27	13	18201							
28	14	18213							
29	15	18218							
30	16	18202							
31	17	18219							

TOTAL 528316 EXCLUDING 11-8E9

HOURLY AVERAGE 158 MWH

POWER SUPPLY DEPT.

12-22-77

P/ed

13-D

	Initials	Date
Prepared By		
Approved By		

Prepared by

Approved by

POWER SUPPLY DEPT.
12-22-77
CJS

DETAIL SHEET 3

SURRY NO. 2 - FORCED OUTAGE - NOV. 18 - 27, 1977

ADDITIONAL EXPENSE STUDY

Prepared By

Initials Date

Approved By

13-E

COMBUSTION TURBINE GENERATION

	NOV.	MWH	\$/MWH
1			
2	FRI. 18, 1977	2419	
3	SAT. 19	2749	
4	SUN. 20	1980	
5	MON. 21	5410	
6	TUE. 22	5645	
7	WED. 23	6080	
8	THU. 24	1655	
9	FRI. 25	5132	
10	SAT. 26	4770	
11	SUN. 27	2725	
12		33565	\$47.00 (AV. NOV. '77 FINANCIAL REPORT PG. 19-2)

IN SYSTEM FOSSIL STEAM GENERATION

	NOV.	MWH	\$/MWH
23	18, 1977	75894	
24	19	80772	
25	20	71644	
26	21	66327	
27	22	56574	
28	23	57489	
29	24	64536	
30	25	70220	
31	26	73398	
32	27	76250	
33		693094	\$20.655 (AV. NOV. '77 PROD. EXP. REPORT PAGE 1)

POWER SUPPLY DEPT.

12-1-77

(C/S)

SUPPLY NO. 2 TERRY COTTAGE NOV. 18-27, 1977
ADDITIONAL EXPENSE \$71.22

[illegible]

13-1

DETAIL SHEET 4B PROVIDED
SUMRY NO. 2 FORCED OUTLIES NOV. 15-27, 1977
ADDITIONAL EXPENSE STATE

INTERCHANGE RECEIPTS

	11-15-77	11-18-77	11-20-77	11-21-77	11-23-77	11-24-77	11-25-77	11-27-77	11-27-77	
ACTUAL TRANSMISSION - MAIN										
PTM EMERGENCY	275	0	0	3773	12172	14367	0	4733	2025	0
CP&L EMERGENCY	400	0	0	0	0	0	0	240	0	0
SE&LG EMERGENCY	0	0	0	0	0	0	0	1350	0	0
AP&O EMERGENCY	0	0	0	1850	0	0	0	0	0	0
CP&L RESERVE	0	0	0	0	0	400	0	0	1375	0
SE&LG RESERVE	0	0	0	0	0	0	0	0	7700	4100
DUNE RESERVE	0	0	0	0	0	0	0	0	700	0
CP&L NONDISPLACEMENT	0	0	0	0	0	0	0	0	1405	728
PTM ECONOMY	0	0	0	0	0	250	0	0	2450	1375
AP&O ECONOMY	0	0	0	375	475	2075	2300	0	0	0
ACTUAL TRANSMISSION COST - MAIN										
(A) PTM EMERGENCY	\$ 37,847	-	-	\$ 32,778	\$ 30,562	\$ 34,707	-	\$ 18,753	\$ 33,451	-
(A) CP&L EMERGENCY	\$ 4552	-	-	-	-	-	-	\$ 4,552	-	-
(A) SE&LG EMERGENCY	-	-	-	-	-	-	-	15,645	-	-
(A) AP&O EMERGENCY	-	-	-	-	-	-	-	-	-	-
(A) CP&L RESERVE	-	-	-	-	-	53,176	-	-	53,176	-
(A) SE&LG RESERVE	-	-	-	-	-	-	-	-	36,75	32,75
(A) DUNE RESERVE	-	-	-	-	-	-	-	-	-	-
(A) CP&L NON-DISPLACEMENT	-	-	-	-	-	-	-	-	27,422	27,422
(A) PTM ECONOMY	-	-	-	-	-	22,615	-	-	27,320	26,711
(A) AP&O ECONOMY	-	-	-	23,50	24,800	21,371	22,641	-	-	-
SYSTEM OPERATIONS OFFICE RECORDS										
PRELIMINARY CP&L INTER STATEMENT										
SYSTEM OPERATIONS OFFICE RECORDS										
SYSTEM OPERATIONS OFFICE RECORDS										
PTM EMERGENCY COST (A)	\$ 10400	0	0	\$ 12813	\$ 13720	\$ 15805	0	\$ 18496	\$ 79895	0
AP&O ECONOMY COST (B)	0	0	0	8813	16744	44344	\$ 52075	0	0	0
PTM ECONOMY COST (C)	0	0	0	0	0	50883	0	0	66933	\$ 373286
POWER SUPPLY DEPT.										
2-22-77										
CP&L										
(A) LINE 27 ÷ LINE 2										
(B) AVERAGE FOR MONTH OF NOVEMBER, 1977 FROM CP&L INVOICE										
(C) "										

DETAIL SHEET 2
 SUPPLY No. 2 POWER OUTAGE NOV. 18-27, 1977
 ADDITIONAL EXPENSE STUDY

REPLACEMENT ENERGY - MWH	FRI. 11-18-77	SAT. 11-19-77	SUN. 11-20-77	MON. 11-21-77	TUE. 11-22-77	WED. 11-23-77	THU. 11-24-77	FRI. 11-25-77	SAT. 11-26-77	SUN. 11-27-77	TOTAL	
PSM EMERGENCY	275	—	—	3873	12192	11712	—	6433	2025	—	36520	
CPAL EMERGENCY	400	—	—	—	—	—	—	240	—	—	640	
SCBEG EMERGENCY	—	—	—	—	—	—	—	1820	—	—	1820	
APCO EMERGENCY	—	—	—	1650	—	—	—	—	—	—	1650	
CPAL RESERVE	—	—	—	—	—	900	—	—	1875	—	2775	
SCBEG RESERVE	—	—	—	—	—	—	—	—	7900	9100	17000	
DUNK RESERVE	—	—	—	—	—	—	—	—	—	—	—	
CPAL NON-DISPLACEMENT	—	—	—	—	—	—	—	—	1405	—	2032	
PSM ECONOMY	—	—	—	—	—	—	—	—	217	6049	6266	
APCO ECONOMY	—	—	—	375	355	—	2300	—	—	—	2930	
TOTAL INTR. REC. (REPLAC)	675	—	0	5908	12547	12112	2300	8523	13422	16872	66559	
COMBUSTION TURBINE GEN.	2419	12797	1980	5910	5645	6080	1655	5132	4770	2715	33515	DETAIL SHEET 3
IN SYSTEM FOSSIL GEN.	13216	15443	16212	6774	—	—	14237	4537	—	—	715	
TOTAL	16310	18192	18192	18192	18192	18192	18192	18192	18192	13597	175743	DETAIL SHEET 2
REPLACEMENT ENERGY COST - \$												
INTERCHANGE RECEIVED												
PSM EMERGENCY	\$ 10408	—	—	\$ 128151	\$ 372607	\$ 406488	—	\$ 184968	\$ 79774	—	\$ 118248	
CPAL EMERGENCY	14000	—	—	—	—	—	—	2400	—	—	22400	
SCBEG EMERGENCY	—	—	—	—	—	—	—	47443	—	—	47443	
APCO EMERGENCY	—	—	—	—	—	—	—	—	—	—	—	
CPAL RESERVE	—	—	—	—	—	14000	—	—	65625	—	79625	
SCBEG RESERVE	—	—	—	—	—	—	—	—	290325	150875	441200	
CPAL NON-DISPLACEMENT	—	—	—	—	—	—	—	—	41175	25480	74655	
PSM ECONOMY	—	—	—	—	—	—	—	—	5928	161441	167369	
APCO ECONOMY	—	—	—	8813	8306	—	51074	—	—	—	69053	
TOTAL	\$ 24408	0	0	\$ 136944	\$ 381415	\$ 420492	\$ 52074	\$ 240811	\$ 490947	\$ 337596	\$ 2089193	
GENERATION												
COMBUSTION TURBINE GEN.	\$ 113613	\$ 129203	\$ 13060	\$ 254270	\$ 265738	\$ 225760	\$ 97195	\$ 241204	\$ 224190	\$ 129075	\$ 1512478	
IN SYSTEM FOSSIL GEN.	272973	318971	334255	141951	—	—	299062	93711	—	—	1456573	
TOTAL	\$ 386666	\$ 448174	\$ 427915	\$ 396251	\$ 265738	\$ 225760	\$ 371947	\$ 334915	\$ 224190	\$ 129075	\$ 3269051	

POWER SUPPLY DEPT.
 12-22-77
 (SCL)

DETAILED SHEET 5 REVISED
 SUMMARY OF ENERGY OUTAGE - NOV. 18 - 24, 1977
 ADDITIONAL EXPENSE STUDY

REPLACEMENT ENERGY - AMH											
	FRI, 11-18-77	SAT, 11-19-77	SUN, 11-20-77	MON, 11-21-77	TUE, 11-22-77	WED, 11-23-77	THU, 11-24-77	FRI, 11-25-77	SAT, 11-26-77	SUN, 11-27-77	TOTALS
RTM EMERGENCY	275	-	-	3573	12172	11712	-	6433	2625	-	36520
CPIL EMERGENCY	400	-	-	-	-	-	-	340	-	-	640
SCELG EMERGENCY	-	-	-	-	-	-	-	1850	-	-	1850
APCO EMERGENCY	-	-	-	1650	-	-	-	-	-	-	1650
CPIL RESERVE	-	-	-	-	-	900	-	-	1875	-	2775
SCELG RESERVE	-	-	-	-	-	-	-	-	7200	4100	12000
SURV RESERVE	-	-	-	-	-	-	-	-	-	-	-
CPIL HANDISPLACEMENT	-	-	-	-	-	-	-	-	1405	728	2133
RTM ECONOMY	-	-	-	-	-	-	-	-	217	6042	6259
APCO ECONOMY	-	-	-	375	355	-	2300	-	-	-	3030
TOTAL INTCH. RSC. (REPLACE)	675	0	0	5708	12547	12112	2300	3523	13422	10872	62591
COMBUSTION TURBINE GEN.	2419	12749	11980	5910	5645	16080	1655	5132	4770	2715	37512
IN SYSTEM FOSSIL GEN.	13216	15443	16212	1774	-	-	14237	4537	-	-	71514
TOTAL	16210	15472	15192	19172	18192	18192	18192	15192	18192	13577	175403
REPLACEMENT ENERGY - COST											
INTERCHANGE RECEIVED											
RTM EMERGENCY	\$ 10408	-	-	\$ 128131	\$ 372609	\$ 406488	-	\$ 184768	\$ 77974	-	\$ 1182455
CPIL EMERGENCY	21821	-	-	-	-	-	-	13092	-	-	34913
SCELG EMERGENCY	-	-	-	-	-	-	-	47443	-	-	47443
APCO EMERGENCY	-	-	-	-	-	-	-	-	-	-	-
CPIL RESERVE	-	-	-	-	-	21278	-	-	77743	-	121621
SCELG RESERVE	-	-	-	-	-	-	-	-	290325	150675	441000
CPIL HANDISPLACEMENT	-	-	-	-	-	-	-	-	41338	21419	62757
RTM ECONOMY	-	-	-	-	-	-	-	-	5928	161441	167369
APCO ECONOMY	-	-	-	5113	8806	-	52024	-	-	-	65943
TOTAL	\$ 32229	-	-	\$ 136944	\$ 381415	\$ 427766	\$ 52074	\$ 245563	\$ 517219	\$ 333525	\$ 2122255
GENERATION											
COMBUSTION TURBINE GEN.	\$ 113673	\$ 1129203	\$ 73060	\$ 254270	\$ 265738	\$ 235760	\$ 77795	\$ 241204	\$ 124190	\$ 125075	\$ 1510378
IN SYSTEM FOSSIL GEN.	222773	318971	324555	141791	-	-	294062	93711	-	-	1455553
TOTAL	\$ 336446	\$ 447174	\$ 427415	\$ 396061	\$ 265738	\$ 235760	\$ 371957	\$ 334915	\$ 224190	\$ 125075	\$ 2965931

POWER SUPPLY DEPT.
 12-22-77
 GMD

VIRGINIA ELECTRIC AND POWER COMPANY
POWER REPORT-ENERGY SUPPLY

13-J

Megawatthours

	Month of November			Year to Date		
	<u>1977</u>	<u>1976</u>	<u>% Inc.</u>	<u>1977</u>	<u>1976</u>	<u>% Inc.</u>
Generated-Steam Nuclear	558,017	0	-	8,473,470	7,610,587	11.
-Steam Fossil	2,114,360	2,845,358	(25.7)	24,193,763	24,065,909	0.
-Hydro	63,691	74,231	(14.2)	386,707	536,496	(27.)
-Other	92,275	93,569	(1.4)	509,733	299,281	70.
Total	2,828,343	3,013,158	(6.1)	33,563,673	32,512,273	3.
Purchased	47	8,992	(99.5)	32,837	90,054	(63.)
Interchange Received	202,653	186,333	8.8	2,227,596	1,576,465	41.
Total	202,700	195,325	3.8	2,260,433	1,666,519	35.
Interchange Delivered	62,866	66,352	(5.3)	1,092,511	1,352,088	(19.)
Vepco Energy Supply	2,968,177	3,142,131	(5.5)	34,731,595	32,826,704	5.
Files Outside of Area	0	0	-	0	0	
Vepco System Output	2,968,177	3,142,131	(5.5)	34,731,595	32,826,704	5.
Int. Deliv. a/c Others	26,712	26,713	-	297,397	298,288	(0.)
Vepco Area Output	2,994,889	3,168,844	(5.5)	35,028,992	33,124,992	5.

<u>Year</u>	<u>Date</u>	<u>Time</u>	<u>MW</u>	<u>% Inc.</u>
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Vepco Area Peak Load - One Hour

1977	November 29	5-6P	5807	(8.4)
1976	November 30	6-7P	6342	

Vepco Area Maximum Load

(Not to be reported in official statistics)

1977	November 29	5:47P	5871	(9.3)
1976	November 30	6:06P	6470	

Total Firm Peak Load - One Hour

(Including Firm Sales Outside Service Area)

1977	November 29	5-6P	5807	(8.4)
1976	November 30	6-7P	6342	

Gas Supply

<u>AS - MCF</u>	<u>1977</u>	<u>1976</u>	<u>% Inc.</u>
Produced	1,040	1,462	(28.9)
Purchased	1,429,061	2,172,898	(34.2)
Total	1,430,101	2,174,360	(34.2)

Prepared by C.W.M.

) Denotes red figure or decrease.

Approved

Gary R. Keesecker
Manager-Power Supply

Kilowatthours

	<u>Month of</u>		<u>Year to Date</u>	
	<u>November 1977</u>	<u>November 1976</u>	<u>November 1977</u>	<u>November 1976</u>
<u>Generated Steam-Nuclear</u>				
erry	558,017,000	0	8,473,470,000	7,610,587,000
<u>Generated Steam-Fossil</u>				
emo	80,092,000	138,915,000	1,284,433,000	1,369,716,000
esterfield	410,167,000	619,882,000	3,580,214,000	4,760,229,000
. Storm	511,361,000	701,583,000	7,179,916,000	7,229,739,000
rtsmouth	153,566,000	238,774,000	1,708,400,000	2,349,727,000
ssum Point	488,220,000	479,339,000	4,983,600,000	4,170,847,000
rktown	470,954,000	666,865,000	5,457,200,000	4,185,651,000
Total	2,114,360,000	2,845,358,000	24,193,763,000	24,065,909,000
<u>Generated Hydro</u>				
shaw	2,120,000	1,879,000	13,564,200	20,230,500
ston	29,125,000	34,994,000	185,528,000	248,990,000
anoke Rapids	32,446,000	37,358,000	187,615,000	267,276,000
Total	63,691,000	74,231,000	386,707,200	536,496,500
<u>Generated-Other</u>				
etty Hawk	9,186,000	8,400,000	38,953,000	25,756,000
wmoor	11,632,000	13,099,000	65,063,000	45,560,000
. Storm	83,000	3,540,000	5,178,000	9,715,000
rthern Neck	18,070,000	12,226,000	92,300,000	45,905,000
rtsmouth-Oil	32,553,000	29,947,000	155,122,929	77,262,419
rtsmouth-Gas	0	0	30,822,071	9,741,581
Total Portsmouth	32,553,000	29,947,000	185,945,000	87,004,000
ssum Point	14,197,000	18,195,000	86,903,000	61,244,000
erry-Oil	6,554,000	8,162,000	30,547,000	21,510,000
erry-Gas	0	0	4,844,000	2,587,000
Total Surry	6,554,000	8,162,000	35,391,000	24,097,000
Total	92,275,000	93,569,000	509,733,000	299,281,000

OPERATION EXPENSES

ACCOUNT	CHESTERFIELD	PORTSMOUTH	YORKTOWN	POSSUM POINT	BREMO	TOTAL-IN-SYSTEM
9101 00	9,503	19,623	22,234	29,996	6,513	87,869
9101 02-19	7,513,233	3,181,466	9,855,402	11,179,559	1,379,089	33,109,549
9101 20	106,119	7,388	80,902	4,923	3,462	202,074
9101 30	56,660	19,123	20,545	29,186	26,936	160,450
9101 68-69	3,797	2,552	5,326	3,320	1,512	16,507
9101 70	56,769	34,516	32,829	55,165	17,939	197,218
9101 80-81	139,782	34,950	44,797	32,891	14,746	267,166
9101 90						
TOTAL OPERATION	7,885,663	3,299,610	10,070,115	11,335,040	1,450,997	34,041,633
TOTAL OPER LESS FUEL	372,630	118,152	214,713	155,401	71,108	932,084

ACCOUNT	MT. STORM	SUB-TOTAL	UNDISTRIBUTED	SYSTEM	TOTAL
9101 00	7,440	95,309	2,287-	74,682	167,704
9101 02-19	5,987,370	39,096,927			39,096,927
9101 20	3,309	206,263		5,144	211,457
9101 30	39,006	199,456			199,456
9101 68-69	284	16,791		22,178	38,96
9101 70	37,762	234,980			234,980
9101 80-81	59,265	326,431	352	878	327,661
9101 90					
TOTAL OPERATION	6,134,524	40,176,157	1,935-	102,882	40,277,104
TOTAL OPER LESS FUEL	147,146	1,079,230	1,935-	102,882	1,189,177

MAINTENANCE EXPENSES

ACCOUNT	CHESTERFIELD	PORTSMOUTH	YORKTOWN	POSSUM POINT	BREMO	TOTAL-IN-SYSTEM
9102 00	11,958	21,892	9,904	31,610	3,959	79,323
9102 10	347	18,672-	72,382	10,453	2,615	67,125
9102 20-29	396,257	402,109	267,700	327,710	48,979	1,442,755
9102 30-39	147,764	85,290	142,442	59,620	35,728	470,844
9102 40-49	71,978	10,743	21,952	18,407	4,818	127,898
9102 50-59						
9102 68-69	7,652	2,084	16,334	1,212	2,514	29,796
TOTAL MAINTENANCE	635,956	503,446	530,714	449,012	98,613	2,217,741
TOTAL STEAM GEN	8,521,819	3,803,064	10,600,829	11,704,052	1,549,610	36,259,374
TOTAL STEAM LESS FUEL	1,008,586	621,598	745,427	604,493	169,721	3,149,825

ACCOUNT	MT. STORM	SUB-TOTAL	UNDISTRIBUTED	SYSTEM	TOTAL
9102 00	19,037	98,360	840	18,637	117,337
9102 10	11,062	78,187			78,187
9102 20-29	704,431	2,147,186			2,147,186
9102 30-39	300,691	771,535		7,691	779,226
9102 40-49	92,350	220,248			220,248
9102 50-59			9,442-		9,442-
9102 68-69	16,992	46,788		1,652	48,440
TOTAL MAINTENANCE	1,144,980	3,362,721	8,602-	27,980	3,382,399
TOTAL STEAM GEN	7,279,504	43,538,878	10,537-	130,862	43,659,203
TOTAL STEAM LESS FUEL	1,292,126	4,441,951	10,537-	130,862	4,562,276

POWER PRODUCTION EXPENSES		CURRENT MONTH		CALENDAR YEAR TO DATE	
		THIS YEAR	LAST YEAR	THIS YEAR	LAST YEAR
	STEAM POWER GENERATION OPERATION				
500.0	OPERATION SUPERV. & ENG. (A)	117 701	119 399	1 664 800	1 294 582
501.0	FUEL	39 076 927	43 321 321	421 700 490	357 427 295
502.1	BOILER FEED WATER	211 407	131 291	1 505 745	1 255 765
502.2	STEAM EXPENSES	199 456	194 557	2 243 758	2 147 101
505.0	ELECTRIC EXPENSES	234 920	172 472	2 421 559	1 905 876
506.0	MISC. STEAM POWER EXPENSES	327 746	172 462	2 700 042	2 752 823
506.1	ENVIRONMENTAL EXPENSES	38 969	26 475	435 430	187 849
507.0	RENTS			17 219	955
	TOTAL OPERATION	40 277 184	44 122 718	450 872 259	359 111 144
	MAINTENANCE				
510.0	MAINTENANCE SUPERV. & ENG. (A)	117 837	82 006	1 125 361	886 831
511.0	STRUCTURES	78 187	79 278	1 020 915	547 168
512.0	BOILER PLANT	2 157 120	1 022 066	16 952 328	11 870 917
513.0	ELECTRIC PLANT	779 226	586 931	7 697 800	6 344 264
514.0	MISC. STEAM PLANT	220 665	144 677	2 052 235	1 181 870
514.0	MAINT. EXP. RESERVE - STEAM	< 9 4427	< 209 944	< 144 225	< 928 515
514.1	ENVIRONMENTAL EXPENSES	48 440	42 077	784 022	115 182
	TOTAL MAINTENANCE	3 382 077	1 749 671	27 522 447	20 201 617
	TOTAL STEAM POWER GENERATION	43 659 262	45 872 400	450 345 706	359 312 761
	COST PER KWHR GENERATED - MILLS OPERATION	19.1	15.5	18.6	15.3
	MAINTENANCE	1.6	.6	1.2	.9
	TOTAL STEAM POWER	20.7	16.1	19.8	16.2
	NUCLEAR POWER GENERATION OPERATION				
517.0	OPERATION SUPERV. & ENG. (A)	312 937	225 890	3 495 849	2 161 694
518.0	FUEL	2 542 184	< 322 242	37 635 514	27 824 765
519.0	COOLANTS & WATER	50 482	53 194	370 279	504 640
520.0	STEAM EXPENSES	227 695	275 523	1 578 329	1 551 934
521.0	STEAM FROM OTHER SOURCES			1 263	
522.0	STEAM TRANSFERRED - CREDIT			641	228
523.0	ELECTRIC EXPENSES	14 648	15 950	272 973	194 712
524.0	MISC. NUCLEAR POWER EXPENSES	26 891	246 712	257 622	1 076 442
524.1	ENVIRONMENTAL EXPENSES	298 536	15 921	2 206 249	80 243
525.0	RENTS	174	112	4 771	117
	TOTAL OPERATION	3 473 333	510 107	47 855 410	34 270 274
	MAINTENANCE				
528.0	MAINTENANCE SUPERV. & ENG.	45 309	51 453	494 193	443 645
529.0	STRUCTURES	46 542	4 703	144 609	38 462
530.1	REACTOR PLANT - PRIMARY	297 692	314 945	1 827 051	1 355 020
530.2	REACTOR PLANT - SECONDARY	95 255	552 836	1 458 478	1 812 144
531.0	ELECTRIC PLANT	109 076	146 322	1 392 502	1 214 307
532.0	MISC. NUCLEAR PLANT	85 033	119 277	879 736	884 774
532.0	MAINT. EXP. RESERVE - NUCLEAR	< 95 126	< 110 320	148 446	1 057 722
532.1	ENVIRONMENTAL EXPENSES		82	50 635	952
	TOTAL MAINTENANCE	583 737	1 023 712	6 345 700	6 877 986
	TOTAL NUCLEAR POWER GENERATION	4 057 070	1 533 819	54 199 110	41 148 260
	COST PER KWHR GENERATED - MILLS OPERATION	6.2		5.7	4.5
	MAINTENANCE	1.1		.7	.9
	TOTAL NUCLEAR POWER	7.3		6.4	5.4
	HYDRAULIC POWER GENERATION OPERATION				
535.0	OPERATION SUPERV. & ENG. (A)	9 781	8 236	105 139	84 622
536.0	WATER FOR POWER	20 167	43 527	413 706	474 225
537.0	HYDRAULIC EXPENSES	2 514	2 733	56 131	60 706
538.0	ELECTRIC EXPENSES	11 409	10 571	131 372	120 745
539.0	MISC. HYDRO POWER GEN. EXP.	8 890	7 352	77 456	51 620
539.1	ENVIRONMENTAL EXPENSES			1 816	
540.0	RENTS			7	7
	TOTAL OPERATION	62 211	123 344	785 655	806 925

() DENOTES RLD FIGURE

(A) INCLUDES ADMINISTRATIVE CREDIT TRANSFERRED TO CONSTRUCTION. DETAIL ON PAGE 19-5

POWER PRODUCTION EXPENSES (CONT'D)		CURRENT MONTH		CALENDAR YEAR TO DATE	
		THIS YEAR	LAST YEAR	THIS YEAR	LAST YEAR
	MAINTENANCE				
541.0	MAINTENANCE SUPERV. & ENG. (A)	4 026	2 476	39 686	24 789
542.0	STRUCTURES	3 605	3 647	46 301	27 252
543.0	RESERVOIRS, DAMS & WATERWAYS	1 150	2 503	20 144	27 062
544.0	ELECTRIC PLANT	5 826	5 412	83 366	208 783
545.0	MISC. HYDRAULIC PLANT	4 149	7 716	57 834	64 069
545.1	ENVIRONMENTAL EXPENSES	33		143	
	TOTAL MAINTENANCE	18 789	21 754	247 831	351 967
	TOTAL HYDRAULIC POWER GENERATION	92 050	145 103	1 033 442	1 158 902
	COST PER KWHR GENERATED - MILLS OPERATION	1.0	1.7	2.0	1.5
	MAINTENANCE	.3	.3	.6	.7
	TOTAL HYDRAULIC POWER	1.3	2.0	2.6	2.2
	OTHER POWER GENERATION OPERATION				
546.0	OPERATION SUPERV. & ENG.	14 523	8 696	121 790	97 204
547.0	FUEL	4 326 926	3 537 971	23 121 842	11 227 393
548.0	GENERATION EXPENSES	8 854	7 320	102 436	51 700
549.0	MISC. OTHER POWER GEN. EXP.	3 859	2 146	50 039	15 547
549.1	ENVIRONMENTAL EXPENSES	416	685	2 800	2 387
550.0	LEASED TURBINES:				
	RENTS	456 331	480 203	5 230 360	5 401 437
	INSURANCE				
	TAXES	18 273	55 392	236 041	243 020
	FEES				
	MISCELLANEOUS			300	
	TOTAL OPERATION	4 839 182	4 072 415	28 805 514	17 033 720
	MAINTENANCE				
551.0	MAINTENANCE SUPERV. & ENG.	16 438	16 462	169 263	145 362
552.0	STRUCTURES	653	67	724	16 402
553.0	GENERATING & ELECTRIC EQUIPMENT	127 672	51 573	1 495 056	454 313
554.0	MISC. OTHER POWER GENERATION PLANT	933	271	13 742	24 359
554.1	ENVIRONMENTAL EXPENSES				26
	TOTAL MAINTENANCE	145 196	68 354	1 672 845	1 176 472
	TOTAL OTHER POWER GENERATION	4 984 378	4 160 797	30 544 634	18 203 242
	COST PER KWHR GENERATED - MILLS OPERATION	52.4	43.7	56.6	56.9
	MAINTENANCE	1.6	.7	3.3	3.7
	TOTAL OTHER POWER	54.0	44.4	59.9	60.6
	OTHER POWER SUPPLY EXPENSES				
555.1	PURCHASED POWER	1 125 250	2 54 206	18 94 826	2 792 190
555.2	INTERCHANGE POWER	4 384 444	2 941 417	24 822 731	5 634 232
556.0	SYSTEM CONTROL & LOAD DISPATCHING	39 442	51 544	437 073	414 300
557.0	OTHER EXPENSES	306	221	3 252	6 547
557.1	DEFERRED FUEL ADJUSTMENT - CURRENT	5 750 23	10 297 755	2 790 914	7 570 411
	- SURCHARGE	773 551	1 152 325	22 767 168	14 537 272
	- TOTAL	4 976 684	9 143 720	25 552 082	6 766 661
	TOTAL OTHER POWER SUPPLY EXPENSES	4 976 684	9 143 720	25 552 082	6 766 661
	TOTAL POWER PRODUCTION EXPENSES	52 256 315	45 837 840	639 959 016	465 441 093
	COST PER KWHR GEN., PUR., & INT. - MILLS OPERATION	16.2	13.7	17.3	13.3
	MAINTENANCE	1.4	.9	1.1	.7
	TOTAL POWER PRODUCTION EXPENSES	17.6	14.6	18.4	14.2

() DENOTES RED FIGURE

(A) INCLUDES ADMINISTRATIVE CREDIT TRANSFERRED TO CONSTRUCTION. DETAIL ON PAGE 19-5

SUPPLY AND DISTRIBUTION OF ENERGY-MWHR	CURRENT MONTH		CALENDAR YEAR TO DATE	
	THIS YEAR	LAST YEAR	THIS YEAR	LAST
PLY				
GENERATION-STEAM	2 114 360	2 245 358	24 193 763	24 065 909
" -NUCLEAR	558 017	-0-	8 473 471	7 610 587
" -HYDRO-ROANOKE RAPIDS	32 446	37 358	127 615	267 276
" -HYDRO-GASTON	29 125	34 994	185 528	248 990
" -HYDRO-SMALL STATIONS	2 120	1 879	13 564	20 230
" -OTHER POWER GENERATION	92 275	93 569	509 733	299 281
URCHASE	47	8 992	32 837	90 054
INTERCHANGE-RECEIVED	202 653	186 333	2 227 596	1 576 465
INTERCHANGE-DELIVERED	63 866	66 352	1 092 311	1 352 087
VEPCO ENERGY SUPPLY	2 968 177	3 142 131	34 731 595	32 826 704
LESS: SALES OUTSIDE OF SERVICE AREA				
VEPCO SYSTEM OUTPUT	2 968 177	3 142 131	34 731 595	32 826 704
INTERCHANGE DEL. FOR ACCOUNT OF SEPA	26 712	26 713	297 397	298 285
VEPCO AREA OUTPUT	2 994 889	3 168 844	35 028 992	33 124 989
DISTRIBUTION				
RESIDENTIAL SALES	882 264	1 017 700	10 604 903	9 862 458
COMMERCIAL SALES	643 583	666 014	8 059 932	7 709 855
INDUSTRIAL SALES	518 761	501 660	5 537 161	5 523 767
PUBLIC STREET & HIGHWAY LIGHTING	13 943	13 149	151 067	146 274
OTHER SALES TO PUBLIC AUTHORITIES	3 466 37	348 136	3 915 125	3 826 046
SALES FOR RESALE-OTHER	334 218	390 357	3 922 034	3 681 967
SUB-TOTAL	2 739 396	2 939 956	32 190 222	30 755 284
SALES FOR RESALE OUTSIDE SERVICE AREA				
TOTAL SALES	2 739 396	2 939 956	32 190 222	30 755 284
COMPANY USE-ELECTRIC DEPT.-OPERATION	26 776	22 258	253 687	275 157
" " -ELECTRIC DEPT.-CONSTRUCTION	6 755	5 376	85 478	52 320
" " -GAS DEPT.	103	197	2 394	2 781
LOSSES AND UNACCOUNTED FOR	195 147	174 344	2 199 814	1 741 152
TOTAL DISTRIBUTION-ENERGY SUPPLY	2 968 177	3 142 131	34 731 595	32 826 704
LESS: SALES OUTSIDE OF SERVICE AREA				
TOTAL DISTRIBUTION-VEPCO SYSTEM	2 968 177	3 142 131	34 731 595	32 826 704
INTERCHANGE DEL. FOR ACCOUNT OF OTHERS-SEPA	26 712	26 713	297 397	298 285
TOTAL DISTRIBUTION-VEPCO AREA	2 994 889	3 168 844	35 028 992	33 124 989
CAPACITY (MAXIMUM NAME PLATE RATING) - MW			(A) July 21, 1977.	
STEAM PLANTS-OWNED	6 681	6 681	(B) July 29, 1976.	
NUCLEAR PLANTS-OWNED	1 695	1 695		
HYDRO PLANTS-OWNED	285	288		
OTHER POWER PLANTS OWNED	531	517		
TOTAL CAPACITY-NAME PLATE	9 192	9 211		
NET GENERATING CAPABILITY - SUMMER - MW	8 636	8 677		
ADD: PURCHASE	465	478		
LESS: SALES-OUTSIDE SER. AREA	0	0		
NET CAPABILITY FOR VEP CO AREA PEAK LOAD	9 101	9 155		
TOTAL VEP CO FIRM PEAK LOAD-CURRENT MONTH-MW	5 807	6 342		
LESS: LOAD-OUTSIDE SERVICE AREA	0	0		
NET AREA PEAK LOAD-CURRENT MONTH-MW	5 807	6 342		
TOTAL VEP CO FIRM PEAK LOAD-12 MOS.				
ENDING CURRENT MONTH-MW	7 902 (A)	7 016 (B)		
LESS: LOAD OUTSIDE SERVICE AREA	0	-		
NET AREA PEAK LOAD-12 MOS. ENDING CUR. MO.-MW	7 902 (A)	7 016 (B)		

- Q. e. An explanation of measures taken, if any, subsequent to November 27, 1977, to minimize the possibility of similar occurrences in the future.
- A. e. In order to prevent a similar occurrence in the future, any tube which does not pass a 0.650 probe will be included as part of all future gauging programs for scheduled inspections. At the conclusion of the gauging programs, the strip charts will be checked against the data sheet to insure that all required tubes have been probed.

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2
3 JAMES R. WITTINE, a witness called by and on
4 behalf of the Commission Staff, having first been duly
5 sworn, testified as follows:

6 WITNESS WITTINE: My name is
7 James Wittine, Director of the Division of
8 Energy Regulation.

9 To satisfy Judge Bradshaw's request,
10 as far as a very brief summary to tell the
11 nature of the report, basically what it amounts
12 to is on November 18th, 1977 Surry Unit Number 2
13 was forced out of service for a period of
14 approximately nine and a half days. The
15 forced outage was a result of the cracked
16 tube which caused leakage from the primary
17 system into the secondary system which
18 exceeded the allowable limits established
19 by NRC Order.

20 The Staff conducted a report as to
21 the cause of the outage, and the net replace-
22 ment energy cost associated with that nine
23 and a half day outage. Basically, what it
24 amounts to is the net replacement energy
cost, which is subsequently flowed through

Wittine - Direct

10

the fuel clause, amounted to approximately four point seven million dollars.

It's the Staff's position that those monies which the Company collected through the fuel clause for the net replacement energy costs should not be recovered -- should not have been recovered. Excuse me. And, therefore, it should be returned to the Company's customers.

The reasons for that statement are contained in my report which I propose to read. Basically, the report consists of three sections. There is an Executive Summary section, the Report itself which pertains to the facts surrounding the event, and a section dealing with attachments of which there are eight attachments.

I would like to first -- and it's a relatively short report in total, ten pages -- read the Report section first which begins on Page 4. At that time I will then go into an explanation of each of the eight attachments contained within the Report. I would ask that I be permitted to read the Report first without specifically answering questions

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11

and/or questions concerning each of the attachments, because I do plan to explain the purpose of each of the attachments after I have done reading the Report.

Also, after I have completed offering an explanation of the attachments I will conclude by reading the Executive Summary which is contained within the first three pages of the Report.

BY MR. ROGERS:

Q Go ahead and commence.

A All right. Commencing on Page 4, the Introduction. VEPCO is the holder of Facility Operating License Number DPR-37 which authorizes the operation of the nuclear power reactor known as Surry Power Station Number 2. The reactor is a pressurized water reactor.

The tubes within each of the three steam generators of Surry Unit Number 2 have, to varying degrees, been and continue to be deformed as a result of magnetite growth which causes support plate expansion. The continued growth of the tube support plate imposes stresses on the tubes and can and does result in the development of stress corrosion cracks

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in denting locations.

Leakage of primary coolant into the secondary system, as a result of cracked tubes, has exceeded allowable limits and has caused the forced outage of this unit on a number of occasions in the past.

An example of the extent to which Surry Unit Number 2 has been forced out of service due to steam generator tube leaks is shown on Attachment Number 1. Of the four thousand six hundred thirty-six total outage hours during this fourteen month period, three thousand three hundred fifty-three point nine hours, or seventy-two point three percent, were due to steam generator tube leaks.

In an effort to define and arrest the denting phenomenon, VEPCO, in conjunction with Westinghouse, developed a technique, equipment and procedures to investigate the consequences of the steam generator problems. This technique is commonly referred to as the Preventive Plugging Program.

Basically, the purpose of the program is to identify tubes which may be anticipated to attain the level of deformation which could lead to stress corrosion cracking during the next period of operation, plug those tubes and thereby minimize and/or

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eliminate the possibility of forced outages due to the leakage of cracked tubes.

The program calls for gauging the inside diameter of preselected tubes utilizing a series of different Eddy Current probe sizes; i.e., zero point five four zero, zero point six one zero, and zero point six five zero inches in probe diameter. The areas probed are chosen on the basis of the analysis of the critical strain contours in the tube support plate annulus.

This analysis predicts the rate of tube deformation and identifies regions of the tube/ tube support plate to be inspected. The tube hoop strain contour is used to define the gauging boundary.

The tubes are initially gauged with a zero point six five inch probe. Those tubes which do not allow passage of this probe are then gauged with a zero point six one inch probe. Any tube which does not allow passage of the zero point six one inch probe is then gauged with a zero point five four inch probe.

The result of this gauging process indicates a high degree of correlation between the strain predictions and field gauging results. The actual criteria used to determine which tubes shall be

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preventively plugged is included in the Attachment Number 2.

The second section is Background Discussion. On April 1st, 1977, the NRC Staff issued an Order for Modification of License Number DPR-37, which addressed operation of Surry Power Station Unit Number 2 under conditions in which steam generator tubes have been plugged as a result of tube denting caused by corrosion of the tube support plate in the annular spaces between the tube and the tube support plate.

On August 17th, 1977, an NRC Order was issued to permit the continued operation of Unit Number 2 to September 15th, 1977, under the conditions of the April 1st, 1977 Order.

The licensee was required to perform an inspection of the steam generators after the September 15th, 1977 shutdown and obtain NRC approval prior to resumption of power operations. The licensee's fuel cycle for Surry Unit Number 2 ended before September 15th, 1977 and during the resulting shutdown the licensee performed the required inspection and plugged one hundred eighty additional tubes.

Twenty-one tubes were plugged because of wastage degradation. The remaining one hundred

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fifty-nine tubes were plugged following the denting plugging criteria given in the licensee's September 30th, 1977 submittal.

The NRC Staff evaluated the results of this inspection and repair program and determined that the additional plugging performed as a result of the inspection using the preventive plugging criteria would provide adequate steam generator integrity for continued operation for an additional six months of equivalent operation.

By NRC Order dated October 8th, 1977, Facility Operating License Number DPR-37 was amended, permitting continued operation of Surry Unit Number 2 for six equivalent months of operation beyond the October 8th, 1977 under certain operational limitations.

Surry Unit Number 2 was subsequently brought back on-line on October 12th, 1977 and continued to operate until November 18th, 1977, at which time it was brought to a cold shutdown condition due to leakage of primary coolant from the primary to secondary system being in excess of the allowable operational limit established by the NRC in its Order of October 8th, 1977.

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By letter dated November 22nd, 1977 to NRC, VEPCO advised, among other things, that the unit was shut down due to a primary to secondary leak in excess of NRC operational limitations in "A" steam generator. And the A is in quotes.

VEPCO further advised that the only tube leaking after hydrostatic testing was R5C26 in "A" steam generator, that this tube did not pass a zero point six five inch probe during the March, 1977 inspection, and that this tube, R5C26 in "A" steam generator was scheduled to be inspected during the September, 1977 outage but, in fact, was not.

By letter dated November 23rd, 1977 to VEPCO, NRC-transmitted a copy of its Safety Evaluation and approved the return to operation of Surry Unit Number 2 in accordance with the provisions of the October 8th, 1977 NRC Order.

In the Evaluation portion of the Safety Evaluation, the NRC Staff concluded, among other things, the following:

"1. The tube, R5C26, that leaked and caused the November 18th, 1977 shutdown was a tube that should have been previously plugged but was missed, thus the cause of the leakage is understood."

It was upon the Division of Energy

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17

Regulation's receipt of copies of both VEPCO's November 22nd, 1977 letter to NRC and NRC's response of November 23rd, 1977 that an investigation was undertaken.

The third portion of the Report, the Investigation Findings. During the period November 23rd, 1978 -- excuse me. It should be November 23rd, 1977 through the date of this Report, various members of the Commission Staff have had discussions with VEPCO personnel regarding the November 18th, 1977 to November 27th, 1977 forced outage of Surry Unit Number 2. These discussions were aimed at attaining an in depth understanding as to the cause of the forced outage and why it occurred in view of the fact that Surry Unit Number 2 had just slightly over a month beforehand undergone a steam generator inspection.

In order to analyze the consequence of the forced outage, it is necessary to provide the sequence of events which is involved in the planning, organizing and the control of actual work accomplishment of an inspection program. The basic sequence of events is as follows:

1. Prior to the actual shutdown, regions in the steam generator where severe denting is likely to occur are predicted. This is done by the

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Westinghouse finite element computer model together with a previous inspection results to arrive at the appropriate inspection program for the current shutdown. From these data, Westinghouse provides VEPCO with a boundary list/index which outlines the regions to be inspected.

The boundary index is then drawn by VEPCO on a tube sheet map for each steam generator. The tube sheet map defines the row and column locations of each tube.

Number 3. After the boundary index is drawn on the tube sheet map, each tube within the region is identified by row and column and listed on a log identified as the Eddy Current Test Sequence. The tubes listed on these sheets are those which are to be inspected.

Number 4. Each tube listed on the Eddy Current Test Sequence log, unless previously plugged, is supposed to be Eddy Current probed starting with the zero point six five inch probe. The Eddy Current probe generates a signal which is recorded on a strip chart as well as a magnetic tape oscilloscope trace.

A copy of the Eddy Current Test Sequence Data sheet which lists the tubes to be probed,

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as well as the strip charts and the oscilloscope traces, are then given to a level three inspector whose job it is to interpret each strip chart and oscilloscope trace. The interpretation of these data is recorded by the inspector in the Inspection Height and Remarks columns of the Eddy Current Test Sequence data sheet.

6. For those tubes which do not pass a zero point six five inch probe, a second Eddy Current Test Sequence data sheet is prepared and the tubes listed are inspected using a zero point six one inch probe. Again, the inspector reviews each of the strip charts and oscilloscope traces generated by the zero point six one inch probe and records his interpretation in the Inspection Height and Remarks column of the data sheet.

7. For those tubes which do not pass the zero point six one inch probe, the process is repeated using a zero point five four inch probe.

The completed Eddy Current Test Sequence data sheets are then used by VEPCO in determining specifically what tubes should be plugged in accordance with the preventive plugging criteria.

9. The tubes are selected and then plugged.

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1
2 Tube R5C26 was within the boundary
3 index provided to VEPCO by Westinghouse for the
4 September, 1977 scheduled inspection and was within
5 the region when this index was transferred to the
6 tube sheet map for steam generator 2A. Likewise,
7 tube R5C26 was listed on the Eddy Current Test
8 Sequence data sheet provided to the team conducting
9 the actual Eddy Current probing.

10 Tube R5C26 was also on the copy of the
11 data sheet given to the level three inspector, commonly
12 referred to as interpretor also, so that the findings
13 of the review of the individual strip chart and the
14 oscilloscope trace for each tube probed could be
15 recorded.

16 A review of the completed copy of the
17 Eddy Current Test Sequence data sheet, which lists,
18 among others, tube R5C26, reveals that columns
19 Inspection Height and Remarks contain the inspector's,
20 or interpretor's, findings. These findings are,
21 according to the program, based upon review -- I
22 should insert the word "are" -- are based upon review
23 and interpretation of the strip chart and oscilloscope
24 trace of tube R5C26 using, in this case, a zero point
six five inch probe.

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21

1
2 However, there was no strip chart
3 or oscilloscope trace, using a zero point six five
4 inch probe, generated during the September program
5 and, therefore, the tube was not inspected. Because
6 the data sheet for tube R5C26 was erroneously com-
7 pleted by indicating that this tube, R5C26, was okay,
8 it was never inspected in the September, 1977 using
9 a zero point six one inch probe or a zero point five
10 four inch probe and, therefore, based upon the erro-
11 neous entry on the data sheet, was not determined to
12 require plugging.

13 MR. ROGERS: Before Mr. Wittine
14 goes through his attachments, could each
15 attachment, beginning with Attachment Number
16 1, be given an exhibit number, 1 through 8?

17 And I will have the Bailiff mark
18 them accordingly.

19 COMMISSIONER SHANNON: All right.
20 How are we going to mark these? He's got,
21 what, seven attachments?

22 WITNESS WITTINE: Eight.

23 MR. ROGERS: Eight.

24 COMMISSIONER SHANNON: All right.

MR. ROGERS: A new series of exhibits,

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22

beginning with 1, if we could.

COMMISSIONER SHANNON: All right.

It will be JRW-1 through JRW-8.

MR. ROGERS: And I will have the
Bailiff mark them accordingly.

COMMISSIONER SHANNON: All right.

BY MR. ROGERS: (Continuing)

Q Proceed, Mr. Wittine.

A All right. Exhibit Number 1 is used
in this Report simply to demonstrate the severity of
the steam generator denting problem. It is an exhibit
which was originally prepared by/or for Mr. Ragone and
prefiled in his testimony in Case Number 19818.

What the exhibit actually shows is
that there are a fourteen-month period, running from
January 1st of 1976 through February 28th, 1977.

Basically, although it's not reflected
on the Report, this is a period of approximately ten
thousand one hundred and seventy hours of the approximate
ten thousand hours within this fourteen-month period.
Four thousand six hundred thirty-six hours of total
outage hours which, in fact, if you were to compute an
availability factor the maximum availability factor
would be fifty-four point five percent for that fourteen-

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23

month period.

All right. Of the four thousand six hundred thirty-six total outage hours, steam generator leaks accounted for three thousand three hundred fifty-three point nine outage hours, or seventy-two point three percent, of all of the outage hours for that fourteen-month period.

And the sole purpose of that exhibit was basically to demonstrate that the tube denting phenomenon is extremely serious and has caused significant reductions in the availability of Surry Number 2.

Exhibit Number 2 is the Company's response to five questions which were asked by the Staff during the Quarterly Fuel Clause hearing in March of 1978. Mr. Rogers subsequently wrote a letter to the Company reducing to writing the five questions that were asked verbally during the hearing.

The questions which were specifically asked are listed on the last two pages of Exhibit Number 2. All right. Just some of the important points of this exhibit that I believe need to be pointed out at the present time is that the exhibit contains the inspection and plugging criteria for Unit Number 2.

It is the Company's written response stating that Tube R5C26 was one of the tubes to be

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reinspected but a review of the inspection data shows that it was missed.

It is also part of the Company's response stating that the net replacement energy costs associated with the forced outage of Surry Unit Number 2 for the November 18th through the November 27, 1977 shutdown was four million six hundred ninety-six thousand seven hundred sixty-six dollars. And this is included as part of the Company's calculations in the last couple pages of the exhibit.

This, I think, has an interesting aside. Shows that basically the equivalent outage hours during this period of approximately nine and a half days was two hundred thirty-one point four hours, or the equivalent outage days, to be specific, was nine point six four days. And you could equate this to basically a net replacement energy cost of four hundred eighty-seven thousand dollars -- excuse me, four hundred eighty-seven thousand two hundred sixteen dollars for every twenty-four hour period that one nuclear unit, Surry Number 2 specifically in this instance was out of service.

Attachment Number 3 -- excuse me.

Exhibit Number 3 is a copy of VEPCO's letter to the NRC dated November 22, 1977, describing the leaking

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1
2 steam generator "A", the findings of the subsequent
3 inspection, and the corrective actions in a request
4 that operation of Surry Unit Number 2 be permitted.

5 Some of the findings included in the
6 letter are: (1) That the only tube leaking after
7 the unit was shut down on November 18th, 1977 was
8 Tube R5C26. Another statement contained within that
9 letter is that the Tube R5C26 did not pass a zero
10 point six five inch probe in March of 1977 and now does
11 not pass a zero point five inch probe.

12 And the last item that I consider
13 especially worthy of note is that Tube R5C26 was
14 scheduled to be inspected in September of '77 but was
15 missed.

16 Q Could you point that language out
17 specifically in the Report?

18 A Yes. It is in the first paragraph
19 of Exhibit Number 3, and it's -- you start with the
20 first sentence, the fourth line down, it says: This
21 tube did not pass a zero point six five 0 inch probe
22 in March of 1977 and is now in the region of predicted
23 strain of greater than fifteen percent and does not
24 pass a zero point five four inch probe. A review of
the records from the September 1977 outage found this
tube was scheduled to be inspected but was not.

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26.

Exhibit Number 4 is NRC's response dated November 23rd, 1977 to VEPCO's November 22nd, 1977 letter, in which basically the NRC provided its Safety Evaluation and approved the return of operation of Surry Unit Number 2.

If we could refer over to the fourth page of Exhibit Number 4, under the Evaluation section, it shows that the NRC found, among other things, the following:

"The NRC staff has reviewed the information submitted by the licensee and concluded the following: ..." and I will only read it in part, and that is Number 1. "The tube, R5C26, that leaked and caused the November 18, 1977 shutdown was a tube that should have been previously plugged but was missed, thus the cause of the leakage is understood."

Exhibit Number 5 is a copy of a tube sheet map, and basically the map provides, through the use of identification by row and column number, the specific identification of each tube within each steam generator. It is on a tube sheet map, such as this, in which VEPCO actually draws the boundary index which is provided to it by Westinghouse after it conducts the finite element analysis.

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1
2
3 Basically, the first step in the
4 preventive plugging program is that Westinghouse
5 provides to VEPCO a boundary index for each of the
6 steam generators that are required to be inspected.
7 This index establishes basically the region that --
8 in which it is predicted should be inspected because
9 of increased strain during the, say, subsequent six
10 months of operation. And what you are attempting to
11 do is basically determine what tubes are likely to
12 dent and what is the rate of deformation and what
13 point will it reach such a denting situation in which
14 it is likely to cause stress corrosion cracking,
15 therefore, leakage and, therefore, in turn a primary
16 or secondary leakage rate in excess of allowable
17 limits, which is going to -- excuse me, or is going
18 to cause the unit to be shut down because that leakage
19 rate exceeded the allowable limits established by NRC.

17 Q And how do you read that chart? Just
18 show us how you read it to identify a particular tube.

19 A Okay. If we put the tube lane down
20 at the bottom of the page, flip it over where it says
21 "1A Steam Generator" down at the bottom of the page,
22 going up on the vertical each tube is identified -- or,
23 not each tube, each row is identified by a row number.
24

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28

Going across the horizontal each tube is identified by a specific column number, so if I give you any specific row and column number by saying, say, R5C26 specifically, all you do is go up Row 5 and go over until you hit Column 26, and that will be the specific tube to which we happen to be referring to.

All right. On this -- after Westinghouse provides the boundary index to VEPCO, VEPCO transfers the boundary index to the tube sheet map. Once the index is on the map, since it is a boundary index, it shows the regions of predicted strain and, therefore, specifically what tubes require inspection. Each of the tubes within the region are identified by row and column number, and each tube which is -- has previously been identified by row and column number is transferred to attachment -- excuse me, Exhibit Number 4, which is the Eddy Current Test Sequence.

Q Is that Number 4 or Number 6?

A Excuse me. It is Exhibit Number 6.

I'm sorry.

Now, if we could, we will just go over to Exhibit Number 6 and this particular exhibit is used for illustrative purposes only. All right.

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1
2 You are going to have to visualize
3 a couple of things when you look at the exhibit.
4 First of all, it's just actually basically a blank
5 document with the rows and columns. After the boundary
6 is placed on the tube sheet map, each of the tubes
7 within the regions, that are within that boundary, are
8 then listed on the Eddy Current Test Sequence log sheet,
9 which are the first two columns of Exhibit Number 6.

10 So that basically what you've got down
11 there is you've got the row and column or the specific
12 identification of each tube which is in that boundary
13 or that region that requires to be inspected. And by
14 inspected, I mean actual probing.

15 And the first probe size you would use
16 would be zero point six five inch probe. The remaining
17 portion of the columns are for remarks to be filled
18 out by an inspector or interpreter at a later date.
19 And which I will discuss now.

20 All right. Once Exhibit Number 6,
21 which is the Eddy Current Test Sequence data sheet,
22 which has already been filled in as far as the specific
23 identification of tubes by row and column number is
24 completed, that completed data sheet is then provided
to the actual team conducting the inspection or the
probing. As each of the tubes is probed, using certain

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size probes, the first probe being a zero point six five inch probe -- it's an Eddy Current probe, and the signal from the Eddy Current are generated by the Eddy Current probe is actually used to make what is referred to as a strip chart and a magnetic tape oscilloscope trace.

An example of a strip chart, which is generated by the Eddy Current probe, is shown as Exhibit Number 7. It wasn't possible for me to get a copy of the magnetic tape oscilloscope trace but I also felt it wasn't necessary that I absolutely have a copy either.

So I think what is important, or that needs to be remembered at this point, is that for each tube that is probed a strip chart, such as the one you see, Exhibit Number 7, is generated, so that every tube that was probed should have a strip chart and a magnetic tape oscilloscope trace.

After the team concludes its actual probing of each of the tubes identified on the data sheet for a specific size probe, the strip charts, the oscilloscope traces and the Eddy Current Test Sequence data sheet, or a copy of that Eddy Current Test Sequence data sheet, which identifies each of the tubes that were supposed to have been probed, is then given to a level three interpreter, or also commonly

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referred to as an inspector. It is the inspector's job to analyze each strip chart and each magnetic tape or oscilloscope trace and to record his interpretation or findings from each of those strip chart and traces.

He records his finding in the third and fourth columns of the Eddy Current Test Sequence data sheet. All right. And he records those in the columns listed Inspection Height and Remarks. And those remarks -- or those findings are based upon, you know, his analysis of the strip charts and the traces.

If you take a look at Exhibit Number 8, it specifically lists Tube R5C26.

Q And that's the tube that caused the unit to go down?

A That's right. This is the completed copy, or a completed copy, of the Eddy Current Test Sequence data sheet which, among others, contains tube R5C26 for the September, 1977 scheduled inspection of Surry Unit Number 2 for "A" steam generator of Surry Unit Number 2.

COMMISSIONER SHANNON: That's not shown on your JRW-5, is it, because this is an earlier computer printout; is that correct?

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1
2 WITNESS WITTINE: No, sir. Number 5,
3 as I indicated, is only used for illustrative
4 purposes only, to basically make people aware
5 of what an Eddy Current Test Sequence data
6 sheet is, as well as what information does
7 it contain, and how that information actually
8 gets put on that Report after certain things
9 are done.

10 Exhibit Number 8, again, is for the
11 September inspection, using a zero point six
12 five inch probe. And you can see, once you
13 identify Tube, Row 5, Column 26, by going over
14 you can see that the Inspection Height column
15 is filled in with a +7C and under the Remarks
16 column it is filled in as being OK.

17 Now I would like to point out that
18 the only way -- the only proper way that either
19 of these two columns are supposed to be com-
20 pleted is that it's based upon an analysis of
21 the strip chart and oscilloscope trace for
22 that particular tube. Yet, no strip chart or
23 oscilloscope trace has ever been found for
24 that tube.

So, therefore, there was basically
no raw data by which the interpreter could

Wittine - Direct

33

1
2 have made findings. And, therefore,
3 findings should not have been recorded
4 in either of those two columns.

5 As a result of findings being
6 recorded in those columns, Tube R5C26
7 was never inspected in September using
8 either a sixty-one hundredths inch probe
9 or a fifty-four hundredths inch probe.
10 And as a result of completion of these
11 columns, no additional work was done; the
12 tube was not inspected; it was believed
13 to have been okay.

14 CHAIRMAN HARWOOD: Who wrote --
15 who wrote "Not True", while we are on that
16 exhibit, Exhibit 8?

17 WITNESS WITTINE: What actually
18 happened is the words "Not True" came about
19 in the following fashion. They were not on
20 there as far as a completed document after
21 the September inspection. On November 18th
22 when the unit went down, about a day later or
23 so, when the Company was able to get into
24 the unit and it found out that it was Tube
R5C26, tried to find out basically, you
know, what happened, you know, and realized

Wittine - Direct

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1 that this was the tube that was supposed
2 to have been inspected back in September,
3 and they wanted to see what were the
4 results in September, because there is
5 basically a relatively high degree of
6 correlation between what is predicted to
7 dent, you know, versus the actual measure-
8 ments as far as the fuel gauging results
9 are concerned.

10 So, when I went back to the data
11 sheet, found that Tube R5C26 passed a
12 sixty-five hundredths inch probe, or at
13 least that is what the record agent said
14 it did, and when they actually inspected
15 it in November found that it did not even
16 pass a fifty-four inch probe, fifty-four
17 hundredths inch probe. So they wanted to
18 go back and actually review the strip chart
19 and the oscilloscope trace for that particular
20 Tube R5C26.

21 It was at that time, after November
22 18th and prior to November 22nd, within
23 that four-day period, that the Company found
24 basically that there was no strip chart, there
was no oscilloscope trace and, therefore, the

Wittine - Direct

35

tube could not have been inspected.

BY MR. ROGERS: (Continuing)

Q Let me point out, you have an absolute check there? You could check it by a series of one, two or three people, by even going home and matching up your Eddy Current Test Sequence against your strip chart?

A That's correct. I --

CHAIRMAN HARWOOD: But I understand Company personnel wrote the words "Not True"?

WITNESS WITTINE: That's right. I'm sorry. I didn't complete my response, really.

After they realized in November that there wasn't a strip chart or oscilloscope trace -- I don't know if the data sheet was already out at that time but, you know, in other words the words "Not True" were just written in on this document some time between the 18th and the 22nd of November.

But prior to that time it was assumed that, in fact, the tube was okay.

BY MR. ROGERS: (Continuing)

Q The problem is not with the check procedure. It's the problem with following the

Wittine - Direct

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procedure?

A That's right. I really have on final comment as it relates to the exhibits, and that is, you know, it's important to realize that there is an automatic cross reference built into the inspection program to ensure that each tube listed on the data sheet is inspected, provided people do their jobs properly.

The cross check is that each tube listed on the data sheet is supposed to be probed; as each tube is probed a strip chart and oscilloscope trace is generated; the level three inspector analyzes each strip chart and oscilloscope trace and, then, he records his findings on the copy of the Eddy Current Test Sequence data sheet.

If a tube is not probed, neither a strip chart or oscilloscope trace will be generated. Since there is no strip chart or trace to interpret the inspector can have no findings. If there are no findings, the Inspection Height and Remarks column of the data sheet cannot properly be completed.

If it is not completed, one would know that the tube wasn't inspected and, therefore, could go back and inspect the tube.

Wittine - Direct

37

I would like to conclude now by reading the first three pages of the entire Report which begins as far as an Executive Summary is concerned. And it starts with Forward.

VEPCO has incurred substantial expenses in attempting to define and arrest the tube denting phenomenon. This is witnessed by at least two facts: First, VEPCO, in its March 18th, 1978 response to the SCC states -- which is also Exhibit Number 2: "...complex and expensive investigations were undertaken."

Secondly, VEPCO in its most recent application for a permanent increase in rates, Case Number 19960, has requested that it be able to recover nine hundred twenty thousand dollars from its Virginia jurisdictional customers for a one point three million total -- three million dollar total electric system expense incurred in 1977 for work done under a User Group Agreement.

The purpose of this Agreement is to seek means for extending the life of the steam generators for as long as possible until a solution to the problem of dented steam generator tubes may be accomplished.

Wittine - Direct

39

On November 18th, 1977 Surry Unit

Number 2 was brought to a cold shutdown condition as a result of primary coolant leakage from the primary system to the secondary system which exceeded allowable limits. The unit remained in this mode for a period of approximately nine and a half days.

Upon inspection of the steam generators after the November 18th, 1977 shut down, it was determined that the cause of the unacceptable leakage rate was a cracked tube, R5C26, in steam generation 2A. Further investigation of this matter revealed that the tube, R5C26, which cracked and caused the leakage, was a tube that was identified and scheduled to be inspected prior to the planned September 1977 outage for refueling and steam generator inspection.

Tube R5C26 did not allow passage of a zero point five four inch Eddy Current probe when inspected after the November 18th, 1977 forced outage. Had this same datum been revealed during the planned September 1977 outage, tube R5C26 would have been plugged at that time.

During the nine and a half day, November 18th through the 27th, 1978, forced outage

1
2 of Surry Unit Number 2 its unavailability neces-
3 sitated the increased reliance on and use of fossil
4 fuel fired generation and purchased power to replace
5 the energy which would have been produced by Surry
6 Unit Number 2 had it not been forced out of service.

7 The additional system fuel expense,
8 net replacement energy costs, has been estimated to
9 be four million six hundred ninety-six thousand seven
10 hundred sixty-six dollars. These additional expenses
11 have been flowed through the Fuel Adjustment Clause and
12 have, therefore, been incurred by the Company's
13 customers.

14 In conclusion, the Commission has
15 an obligation to assure that the charges rendered
16 for service are reasonable and just. In a review of
17 this particular forced outage of Surry Unit Number 2,
18 November 18th through the 27th of 1977, no appraisal
19 of VEPCO's reasonable business judgment needs to be
20 made by this Commission.

21 The November 1977 forced outage did
22 not occur because of the lack of a plan, procedure,
23 skill or knowledge. It did not involve a misunderstanding
24 or misconception. At best, it was a lack of

Wittine - Direct

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attention and the actual recordation of false test results.

The actual physical probing of a particular tube requires no judgment. Tube R5C26 was identified and listed as a tube which required inspection in September 1977. Although the actual raw data, strip chart and oscilloscope trace, requires judgment in its interpretation, the recordation of this interpretation requires no judgment.

In this instance, there was no raw data, strip chart and oscilloscope trace, to be interpreted and, therefore, there could have been no test results. Yet, test results were recorded.

Had the predetermined plan and procedures been followed during the September 1977 steam generator inspection of Surry Unit Number 2, the unit would not have been forced out of service for a period of approximately nine and a half days, commencing on November 18, 1977. Likewise, the additional expense of four million six hundred ninety-six thousand seven hundred sixty-six dollars, the net replacement energy costs, associated with the November 1977 forced outage would have been avoided.

Wittine - Direct

41.

Recommendation. The Company cannot expect its customers to bear the expenses associated with the development of procedures and techniques designed to prevent the consequence of a steam generator tube leak and, then, have its customers bear the consequences when the procedures are not followed.

Therefore, the Staff recommends that the Company should not be permitted to retain the monies which it collected from its customers for the net replacement energy costs associated with the nine and a half day, November 1977, forced outage of Surry Unit Number 2.

And as a note to the recommendation, I would like to point out that the approximate four point seven million dollars net replacement energy costs are total system fuel expense. First of all, it excludes maintenance and engineering expenses. It is just total fuel expense. All right. But system fuel expense. If the Commission were to decide that the monies collected through the fuel clause needed to be refunded to its customers, the Virginia jurisdictional portion of that four point seven million

Wittine - Direct

42

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2 is something less than four point seven. You
3 would actually have to take a look at the kilowatt
4 hours that were sold to Virginia jurisdictional
5 versus the rest of the system.

6 I think generally on an annual basis
7 it approximates approximately seventy percent
8 of the Company's business. So it would be roughly
9 in the neighborhood of seventy percent of four point
10 seven million dollars.

11
12 MR. ROGERS: That is the report
13 of the Staff and recommendation of the
14 Staff. And the report, as written, although
15 it was read, I would like for it to be
16 introduced as Exhibit Number 9.

17 COMMISSIONER SHANNON: All right.
18 It will be Exhibit JRW-9.

19 MR. ROGERS: And we've asked the
20 Company to be here, and I don't know what
21 response they have planned. And depending
22 on their response --

23 COMMISSIONER SHANNON: Do you have
24 any questions of Mr. Wittine, Mr. Gary?

1
2 MR. GARY: Judge, I will. I have
3 a couple. But before I do, I would like to
4 make a couple of points.

5 We were invited to this meeting,
6 I think it was Tuesday afternoon, and asked
7 to be here. And with our response, if we
8 thought we could get one together and, if
9 not, to be here.

10 We have two witnesses that we will
11 near from, Mr. Ralph Sylvia, who is the
12 Director of Nuclear Operations for the
13 Company, and Mr. Proffitt, who is Senior
14 Vice President in charge of Power.

15 But before we get to them, it seems
16 to me we ought to put this in prospective a
17 little bit, primarily because we have not
18 seen this document before nor had any idea
19 what its conclusions would be. And I think
20 we would like to request an opportunity to
21 rebut this, either through further cross
22 examination at a later date, or through a
23 further submittal, if that's possible.

24 COMMISSIONER SHANNON: Well, would

1
2 you like some additional time to study
3 this and, then, you could come back for
4 a further hearing?

5 MR. GARY: Yes.

6 COMMISSIONER SHANNON: I think
7 that is only fair, Mr. Rogers.

8 MR. ROGERS: That is very fair,
9 if the Company will agree with one thing,
10 that the further time progress that we take
11 in resolving this doesn't complicate the
12 refund that we've recommended at this time.

13 MR. GARY: I believe --

14 COMMISSIONER SHANNON: That is an
15 ascertainable figure, isn't it?

16 MR. GARY: Yes.

17 COMMISSIONER SHANNON: The refund,
18 if any.

19 MR. GARY: Let me add, though, we
20 want to present our documents today that we
21 have today to you. We will just come back
22 to rebut this, or to discuss this further.

23 COMMISSIONER SHANNON: All right.
24 It won't be in August.

1
2 MR. GARY: We are available any-
3 time.

4 COMMISSIONER SHANNON: So it will
5 probably have to be some time in September.

6 MR. GARY: This is a very serious
7 issue for the Company. We feel it needs
8 utmost attention by all the Company personnel
9 involved.

10 COMMISSIONER SHANNON: We certainly
11 want to give you every opportunity to explain
12 your side of it, Mr. Gary. And we will.

13 MR. GARY: All right.

14 COMMISSIONER SHANNON: Did you want
15 to ask --

16 MR. GARY: Just a couple of questions
17 right now.

18 COMMISSIONER SHANNON: Did you want
19 to put your witnesses on today, or would
20 you rather wait?

21 MR. GARY: We would rather put
22 them on today while they are here. And we
23 have all the instruments that we need.

24 COMMISSIONER SHANNON: All right.
Well, go ahead.

CROSS EXAMINATION

BY MR. GARY:

Q First, Mr. Wittine, do you know how many tubes the Company probed or looked at that were not in error in the scope of this inspection?

A Yes. I think I'm aware of the scope of the inspection. And it is adequately responded to and contained within Exhibit Number 2, which was the Company's March 18th, 1978 response to the Commission's questions that were asked during the Quarterly Fuel Clause hearing.

And, let's see if I can find it. Basically, if memory serves me properly, the Company indicated that during the September 1977 inspection they had to inspect six thousand one hundred forty-four tubes. And I would like to point out also, of those six thousand one hundred forty-four tubes, there are only four hundred tubes in the March of 1977 inspection which did not pass the sixty-five hundredths inch probe and, therefore, definitely should have been earmarked for inspection in September.

So, for the September program there

Wittine - Cross

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1
2 were approximately, say, six thousand one hundred
3 forty-four tubes to be inspected and of those six
4 thousand I -- I shouldn't say of those six thousand.
5 There were only four hundred tubes as a result of
6 the March 1977 inspection which did not pass the
7 sixty-five hundredths inch probe and, therefore, should
8 have been reinspected in September.

9 Q But sixteen ^{thousand one} hundred forty-four tubes
10 were inspected in September with only one causing
11 problem later on, having been missed?

12 A That's what the Company says. Now,
13 I'm not certain whether or not each and every strip
14 chart was in fact actually cross referenced with each
15 of the six thousand probings. Now, I should say that
16 six thousand tubes were probed. I don't know if it
17 is actually six thousand individually different tubes
18 that were probed or if it was six thousand one hundred
19 forty-four probings that were made, because sometimes
20 you are going to make one, two, three probings of the
21 same tube, you know.

22 Q Would you know how many have been
23 probed since the beginning of the inspection program
24 without error?

48

If I remember correctly, in their response to the NRC dated November 22nd, which is included as Exhibit Number 3, it says here --

A Exhibit Number 3. What it says here --
is November 22nd, 1977, VEPCO's letter to
er the November 18 shutdown, is that -- and this
last sentence of the first paragraph: "To assure
ditional tubes were not missed, the following
of past data were made: (1) For all tubes
ld not pass the zero point six five inch probe
ne March 1977 inspection, the ..." and I remind
t there is only four hundred tubes in the March
inspection that did not pass the zero point

Wittine - Cross

49

1
2 six five inch probe -- "the data was reviewed to
3 assure that they were inspected in September, 1977."

4 So what that first sentence tells me
5 is that as a minimum four hundred tubes were cross
6 referenced to assure that there was a strip chart and
7 oscilloscope trace.

8 Q Mr. Wittine, the question is, do you
9 know how many tubes were inspected since the beginning
10 of the inspection program many years ago?

11 A You asked me. Also, I told you I
12 could not tell you specifically how many tubes were
13 like cross referenced as far as assuring each of the
14 tubes were inspected.

15 What I was trying to do was expand on
16 that to demonstrate I don't know if a hundred percent
17 cross reference was made of all the March 1977
18 inspection results.

19 Q I asked you if you know how many
20 tubes?

21 A From this letter there was four hundred
22 tubes cross referenced to assure that there was at least
23 a strip chart and oscilloscope trace for those specific
24 tubes. But I cannot say with certainty that all six

1
2 thousand one hundred forty-four tubes that were
3 inspected during the September inspection were in
4 fact cross referenced at a later date. And, as a
5 matter of fact, part two of this letter would indicate
6 it is just a sampling of those tubes and not six
7 thousand --

8 Q I'm talking about the inspection
9 program from the beginning when VEPCO knew it had a
10 problem with steam generators?

11 A For what it's worth, I will say
12 probably. Say, you've got three thousand three
13 hundred eighty-eight tubes per steam generator and
14 there are three steam generators, or approximately ten
15 thousand tubes total, of which during each inspection
16 program approximately six thousand tubes are identified
17 and supposed to be probed.

18 And the probing first began with the
19 March 1977 inspection, if I'm not mistaken, so there was
20 an inspection in March of '77, there was an inspection
21 in September of '77 and there was an inspection in
22 April of 1978. So if you assume that that's three
23 inspections since the probing began, and if there is a
24 total of six thousand tubes, say, approximately that need

Wittine - Cross

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2 to be inspected at each inspection program. Three
3 times six thousand gives you eighteen thousand tubes.

4 Q And two Surry units?

5 A And there is two Surry units, so that
6 would be thirty-six thousand tubes. But, again, I would
7 like to stress that I don't think that has any, you know,
8 significance.

9 Q You don't think it is significant that
10 there are literally tens of thousands of tubes inspected
11 and there is one tube that failed to be inspected?

12 A That's not the point. That's not the
13 point. The whole point in this report is that the
14 actual recordation of results on the Eddy Current Test
15 Sequence log for the September 1977 inspection, those
16 columns were completed.

17 The only way that those columns can be
18 completed is by actually having a strip chart and
19 oscilloscope trace for that specific tube for a
20 particular probe size. There was no strip chart and
21 there was no oscilloscope trace. So if the tube was
22 missed -- let's say, at best, if it was missed you
23 ought to just have a blank row going across there and
24 not something that has been completed which would indicate

Wittine - Cross

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1
2 or cause one to believe that it was actually
3 inspected using a particular size probe.

4 Q. The last question on that is how many
5 tubes have been missed to your personal knowledge?

6 A To my personal knowledge? R5C26.
7 On the Company's Exhibit Number -- not the Company,
8 my Exhibit Number 3, which is their letter to NRC,
9 they say on Page 2 of that letter there were at least
10 four other tubes that were missed. Page 2 of that
11 letter says the following tubes were -- Page 2, it
12 says: "The following tubes were plugged in C steam
13 generator since they were missed during the September
14 1977 outage: Row 38, Column 73; Row 34, Column 73;
15 Row 33, Column 75 and 77."

16 Now, these tubes were -- they were
17 missed as far as plugging is concerned. I don't know
18 whether or not they were inspected. I couldn't tell
19 you. To my knowledge, I know that one tube specifically,
20 R5C26 was missed.

21 Q That's fine. Okay. One final thing,
22 Mr. Wittine. Do you know whether in the ten day, or
23 nine point six days, outage of Surry if that was all
24 caused by the leakage of the tube, the single tube we

Wittine - Cross

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1
2 are talking about, or was it a combination of other
3 reasons for the outage?

4 .A According to VEPCO's letter to NRC
5 and NRC's response of November 23rd, they say that
6 this is NRC's response: "The tube, R5C26, that
7 leaked and caused the November 18, 1977, shutdown
8 was a tube that should have been previously plugged
9 but was missed, thus the cause of the leakage is
10 understood."

11 And in all of my conversations with
12 the Company that I've had since the November 23rd (sic)
13 outage, I've never been advised that there was any
14 other reason, that I recall, that this unit was shut
15 down approximately one month after it was -- a
16 steam generator inspection because of other reasons
17 other than that one leaking tube.

18
19 MR. GARY: ~~Gay~~. We reserve cross
20 for another day.

21 COMMISSIONER BRADSHAW: I have a
22 couple of questions. I should address this
23 to counsel. I'm not sure of this procedure
24 this afternoon. Something bothers me about

1
2 the way we are proceeding here.

3 If you read Mr. Wittine's conclusion
4 here, this particular forced outage, we zeroed
5 in this afternoon by saying on a particular
6 period of time VEPCO, November 18-November 27,
7 that they were out point nine six days and
8 they cut off four hundred -- whatever the
9 number is -- all this has come so fast and
10 so heavy with no prefiling it's hard to
11 follow.

12 But procedure is what is bothering
13 me, Mr. Wittine. Now, we are saying in a nut-
14 shell that they were negligent on that particular
15 occasion, or they were not efficient on that
16 particular occasion and, therefore, a refund
17 is due the customers. I'm all for giving
18 refunds to any customer that is due any
19 amount. I think everybody knows that.

20 But it seems, at the same time, I
21 look at our role as regulators and your role
22 as Director of Energy Department downstairs.
23 I realize that the public expects us to manage
24 the Company, and that's what you are really

1
2 doing on this particular occasion.

3 I'm not finished yet, Mr. Rogers.

4 Like I say, I agree with what you
5 are doing. If someone is owed something,
6 if the consumer is owed something, they
7 should get it. If the Company is owed
8 something they should get it. I would
9 have no quarrel with an argument in a rate
10 case of you or Mr. Rogers advancing some
11 argument when money is requested. But you
12 put in exhibits of availability versus out-
13 put.

14 I think if it was way off the mark
15 that would be reason or cause to mitigate
16 or reduce the amount requested. But I ask
17 you this question, Mr. Rogers. Now you can
18 stand and answer it.

19 This reduction from the -- refund to
20 the consumers, it is suggested to us today
21 because of a report, if I followed your
22 testimony, which was prompted by the Safety
23 Evaluation team of NRC. Now, suppose some
24 reputable person makes a complaint to the

1
2 State Corporation Commission that they
3 saw three men putting up an electric pole
4 when in their opinion two could put it up.
5 Are we going to come in here and have a
6 hearing and give a refund because they
7 spent too much money on that particular
8 occasion. To me the principle is the same.
9 And we are just opening ourselves, I'm
10 afraid, with this procedure to a flood
11 of little mini hearings of reductions.

12 Now you can talk, Mr. Rogers.

13 MR. ROGERS: Let me get the law
14 out first. First of all, you have the
15 Quarterly hearings and you have required
16 certain information to be filed by the
17 Staff, a ten day outage of a Surry unit
18 at a cost of five million dollars is going
19 to be seen by the Staff aside from any
20 Safety Evaluation.

21 So you ask about it. And, then,
22 you get to the safety questions that come
23 around as a result of information you have
24 required to be filed with the Staff.

1
2 But if you go to 56-249.3 of the
3 Code it says: Certain electric utilities
4 to file reports in relation to fuel trans-
5 actions, fuel prices, fuel adjustment
6 clauses, and so forth. So you are required
7 by the General Assembly to obtain this
8 information, which the Staff is doing on
9 behalf of the Commission.

10 And this is where we got our informa-
11 tion. And, then, it says: There shall be
12 a quarterly hearing.

13 But I want to read one little section
14 particularly. 56-249.4(b): All such informa-
15 tion and reports filed pursuant to this
16 section shall be open to the public and
17 available for inspection. The Commission
18 shall hold quarterly hearings to review and
19 evaluate the information filed and there-
20 after disallow any increased charges pursuant
21 to electric utilities' fuel adjustment clause
22 that cannot be supported by said information
23 and the testimony filed at this quarterly
24 hearing. In such event the amount is allowed

1 shall be credited to the utilities'
2 customers as the Commission may order
3 in the calculation of subsequent charges
4 pursuant to the utility's fuel adjustment
5 clause.
6

7 Whether we like it or not, the
8 General Assembly said you shall go and
9 find if management is reasonable.

10 COMMISSIONER BRADSHAW: I buy that.
11 I don't have any quarrel with this.

12 Let me ask Mr. Wittine the next
13 question. Did you investigate every outage?

14 WITNESS WITTINE: Let me say --

15 COMMISSIONER BRADSHAW: Now, they've
16 been out a whole lot during the past year.

17 Why do they just pick on this one?

18 WITNESS WITTINE: Okay. For a
19 couple of reasons. The report -- the Division
20 of Energy Regulation did not sit downstairs
21 and wait until they received the November 22nd,
22 November 23rd letters. All right.

23 When the investigation actually begins
24 is every time we recognize that there is a forced

1
2 outage of a nuclear unit or any major
3 base loaded facility, for that matter,
4 all right. There are certain information
5 which we ask for. Okay. To make a determina-
6 tion as to what additional steps, if any,
7 need to be taken.

8 What happened in this instance is
9 that there is only, say, five days between
10 November 18th and November 23rd. We already
11 received the letters, you know, at the same
12 time we were looking into it. All right.
13 As it relates to, say, other outages. Okay.

14 It's a decision which is made either by
15 myself or members of my staff to determine
16 to what extent we are actually going to
17 conduct an investigation of a specific outage.
18 And the reason I say that is that a perfect
19 example could be on September -- during the
20 September 1977 outage we got all of the
21 documentation from NRC related to that outage.
22 All right. But we did not investigate it
23 any further at that time, because, first of
24 all, the September outage had already been

1
2 scheduled as a result of an Order which I
3 believe was issued April 1st, 1977. So,
4 we knew that outage was going to take place.
5 We knew specifically the reasons as to why
6 the outage was going to take place and the
7 approximate time period by which the unit
8 should be down, or, you know, the converse,
9 when it should come back on-line.

10 What happened is, such as like with
11 the September outage, the September inspection
12 seemed to go fairly well. It was relatively
13 on schedule. I think it started a couple of
14 days ahead of actually September 15th,
15 lasted a couple of weeks like it was indicated
16 it was going to last. And the unit was lit
17 off on October 12th after VEPCO got NRC approval
18 by an NRC Order of October 8th.

19 So everything was pretty smooth. There
20 was no reason to, you know, conduct a more in
21 depth investigation of that. So it depends upon
22 the specific nature of the outage as to what
23 depth we are going to conduct an actual
24 inspection. But each outage is reviewed as to

1
2 the reasons as to why.

3 And I suppose without actually
4 reducing it to writing, a determination is
5 made by either myself or someone on my staff
6 with my input that nothing more needs to be
7 done as relates to, say, that particular
8 outage.

9 COMMISSIONER BRADSHAW: Well, would
10 it be a fair statement to say that the reason
11 this one cropped up as the subject matter of
12 a separate hearing, and if the Company can't
13 explain when they come back why it shouldn't be
14 deducted, because of the Fuel Adjustment
15 Quarterly hearings imposed upon the Commission
16 to determine the reasonableness -- but it
17 strikes me that the reason we are dealing
18 with this one, it was just so apparent, just
19 popped right up and you say that, in your
20 testimony, that it did not even require any
21 reasonable business judgment on the part of
22 VEPCO, another reason we should take a look
23 at it.

24 All I'm asking you, are we going

1
2 to start looking at every outage and are
3 we going to limit ourselves to those that
4 don't require any business judgment?

5 WITNESS WITTINE: No. I --

6 MR. ROGERS: Could I --

7 WITNESS WITTINE: No. I will
8 respond to that first.

9 First of all, I personally, as part
10 of the role or the job and how I perceive
11 filling that job, am going to review the
12 reason for every outage. And if in my own
13 mind I cannot satisfy myself that that outage
14 was reasonable and just, I'm going to conduct
15 a further investigation to find out why.

16 And to the extent I am not satisfied
17 with the results of that investigation,
18 satisfied as to the reasonableness and so
19 forth, then, I feel like I have an obligation
20 to bring it to our General Counsel and before
21 the Commission.

22 COMMISSIONER BRADSHAW: Okay. I
23 buy that. And that's what you have done in
24 this case..

1
2 Are you going beyond outages to
3 look to see if it -- as to the negligence?

4 WITNESS WITTINE: Yes, sir. Let me
5 say this. The problem is, you know, I hate
6 personally dealing with the word "negligence"
7 and so on.

8 COMMISSIONER BRADSHAW: Isn't that
9 what this is?

10 WITNESS WITTINE: It presents a lot
11 of problems. We, right now --

12 COMMISSIONER BRADSHAW: Someone has
13 a duty and doesn't do it, they are negligent.

14 WITNESS WITTINE: That's your --
15 you know, that's your definition.

16 COMMISSIONER BRADSHAW: Okay.

17 WITNESS WITTINE: What I'm saying is
18 that in past testimony in previous cases
19 people have attempted to, say, assess the
20 overall performance of the utility and,
21 therefore, say, possibly management. You
22 know. And I think a lot of utility responses
23 have been, you know, you are dealing with
24 generalities. You can't be specific. You

1
2 know, there is no true precise measure and
3 so on. So, therefore, we can't -- you can't
4 make a reasonable assessment of management
5 overall.

6 So, what that leaves left is that
7 you've got to be specific, since you can't
8 make generalities; you've got to be specific.
9 And in this particular instance, this nine
10 and a half day forced outage, it is specific.
11 We are dealing with facts here. There is
12 very little in the way of opinion.

13 COMMISSIONER BRADSHAW: Like I said
14 at the outset, I don't question this report.
15 I think it is well done on your part. And
16 the reason and the logic for it.

17 WITNESS WITTINE: I would like to add,
18 too, though, Judge, that the Staff is in fact
19 in the process right now of taking a look at
20 the five year performance of each of the
21 Company's generating units, looking at its
22 availability factors, its equivalent availability
23 factors, its capacity factors. To the extent
24 we can we are going to attempt to make comparisons

1 with comparable sized units of the same
2 fuel types and so on to try and get a grip
3 on whether or not the performance of a
4 particular unit is in fact satisfactory.
5 And it's a long drawn out process. I've
6 had, say, approximately two and a half
7 people, one person working on it for about
8 five months, not his entire time devoted
9 exclusively to that study, and two additional
10 people working on it for the last two months.
11 It is extremely complex.

12 But, yes, the Staff is looking at
13 it and it is an area which we are going to
14 pursue with great diligence as far as the
15 future is concerned, because we feel as though
16 it is a necessity.

17 MR. GARY: May I make one comment
18 here, Your Honor? You brought up exactly our
19 point, and that is what standard we use to
20 judge these outages by and general operations
21 of the Company. We will not quarrel with the
22 right of the Commission to investigate these
23 outages, or to investigate any part of the
24

1
2 Company's business.

3 COMMISSIONER BRADSHAW: You don't?

4 MR. GARY: Well, as our regulators
5 you have a right to inquire into that.

6 What we do think is essential is a
7 standard by which VEPCO is measured, and
8 we take strong exception to Mr. Wittine's
9 statement on Page 2 "no appraisal of VEPCO's
10 reasonable business judgment needs to be
11 made by this Commission". I believe that
12 is precisely what needs to be done by this
13 Commission, because this program must be
14 looked at as a program and we believe that
15 VEPCO's program is reasonably efficient
16 and is in the best benefits for its customers.

17 As far as our repair program and our
18 inspection program, Mr. Sylvia and Mr. Proffitt
19 are here to tell you why.

20 MR. ROGERS: Let me clear up one
21 thing. We do not intend to go and look for
22 errors and bring them over here. There is
23 a lot -- if I may use the term -- soul
24 searching on this particular one. It was the

1
2 type of error you cannot afford to have.
3 And, to us, it was a gross error. It
4 wasn't a lack of procedures, it was a
5 complete failure to follow the procedures
6 when there was adequate opportunity for
7 follow check throughs, check throughs which
8 could be made off the site.

9 And, to us, there are certain errors
10 you just have the adequate procedure to
11 cover. You check through. You've got a
12 good procedure. They should have followed
13 it.

14 COMMISSIONER BRADSHAW: Yeah,
15 but where do you draw the line, Mr. Rogers,
16 is my question?

17 MR. ROGERS: Well, I think this is
18 the first time you have the Staff bringing
19 something like this before you. I think
20 this one merits your attention and hopefully --

21 COMMISSIONER BRADSHAW: Because it
22 is for a whole lot of money or because of
23 the principle involved?

24 MR. ROGERS: Because of the type of

1
2 error made and because of the money. You
3 cannot afford to have errors like this.

4 And we follow through on our
5 recommendation. We recommend that the
6 money be returned. And if you find we
7 brought an appropriate error before you
8 this time, then, we don't need to be cautioned
9 on that. Wait until we bring one that don't
10 deserve your attention.

11 I just don't think we need to be
12 questioned on it now, because this is the
13 first time and I think it merits your
14 attention. And we don't intend to bring
15 frivolous matters before the Commission,
16 no way, no how.

17 COMMISSIONER BRADSHAW: Well, if a
18 customer is due ten cents versus four hundred
19 thousand dollars, he is due ten cents.

20 MR. ROGERS: But an error that costs
21 the Company ten cents doesn't require the
22 magnitude of attention of one that costs the
23 customer five million dollars.
24

1
2 COMMISSIONER BRADSHAW: Well, I
3 did not mean to open up a -- something
4 that maybe should be the subject matter
5 of Staff policy or Staff procedures.

6 WITNESS WITTINE: Judge, I would
7 just like --

8 MR. ROGERS: But I am concerned
9 about opening the flood gates. But I
10 don't think we have abused it at this point
11 at any time.

12 COMMISSIONER BRADSHAW: Zeroing in
13 for four hundred here, fifty dollars there,
14 a hundred dollars there, or complaints that
15 someone has been dilatory and negligent,
16 inefficient, whatever you want to call it,
17 I don't think that is our role.

18 MR. ROGERS: Businesses with five
19 thousand or ten thousand employees are going
20 to make mistakes everyday. They are going to
21 have errors everyday, and they are going to
22 cost money. You have them everywhere you
23 have business.

24 But this should be an exception.

1
2 That's our case.

3 COMMISSIONER BRADSHAW: Why is
4 it an exception?

5 MR. ROGERS: That is what Mr.
6 Wittine tried to explain. Not only was --
7 you have to ensure against errors to
8 prevent ten days down time on a nuclear
9 unit. I mean, we have heard for years
10 what it costs us.

11 COMMISSIONER BRADSHAW: I think one
12 day down on a nuclear unit, if the replacement
13 energy is going to cost five thousand dollars,
14 is worth looking into.

15 MR. ROGERS: If there has been an
16 error in judgment. But a procedure that
17 could have been checked, we want the Commis-
18 sion to make sure it don't happen again.
19 If it needs two follow throughs, then --

20 COMMISSIONER SHANNON: I think this.
21 We are getting into the realm of argument here.
22 I think this is something the Commissioners
23 can discuss among themselves as a policy
24 matter.

1
2 I know we have got to discontinue
3 this at four o'clock because we have another
4 matter coming up. But this is primarily a
5 fact finding investigation right at this
6 moment.

7 MR. GARY: Your Honor, can we show
8 our slides? There are only a few slides.
9 It won't take very long and we won't have
10 to bring this back next time.

11 COMMISSIONER SHANNON: All right.
12 You may stand down.

13 WITNESS WITTINE: Judge Shannon, I
14 was wondering if I might make one additional
15 comment as it relates to Judge Bradshaw's --

16 COMMISSIONER SHANNON: No. I think
17 that is getting into the realm of argument.
18 I think we ought to confine ourselves here
19 to facts.

20 WITNESS WITTINE: I would stick with
21 facts. It wouldn't be argument.

22 COMMISSIONER SHANNON: All right.
23 If you have got a factual statement you want
24 to put in, go ahead.

1
2 WITNESS WITTINE: The comment that
3 was made by Company's counsel is that the
4 Company doesn't have a standard, and we need
5 a standard by which to make judgments.

6 If the Commission were to establish
7 the standard that the average capacity factor
8 of all nuclear power plants was adopted as
9 being the standard VEPCO would have refunded
10 considerably more money than four point six
11 million dollars over the first four years of
12 operation for Surry Unit Number 2.

13 And my point in making that statement
14 is that you need to look at the specifics
15 of each outage to make a determination as
16 to whether or not they are reasonable and
17 just. You just can't -- I don't think you
18 can just assume -- I don't think you can just
19 sit down and establish a standard. You know,
20 it's extremely complex.

21 COMMISSIONER SHANNON: Are you saying
22 you judge each situation on its individual
23 merits?

24 WITNESS WITTINE: That is correct.

COMMISSIONER SHANNON: All right.

Thank you.

* * * * *

WITNESS STOOD ASIDE.

COMMISSIONER SHANNON: Mr. Owens.

MR. OWENS: Your Honor, I was just going to reiterate somewhat what Staff Counsel and Mr. Wittine said in partial response to Judge Bradshaw's answer.

It is our view, and I know it is the Commission's view, that you said as a surrogate for competition and questions involving efficiency or prudence of operation are matters for your deliberation and your determination, because if you do not make it, then, no one else will make it.

I think this case that Mr. Wittine has brought to your attention is a very clear cut case where the Company established a procedure. It did not follow the procedure. It recorded results that required not one piece of evidence but two different pieces of evidence for that result to be put down. And as a result of not following its own procedure, which is probably no more than an administrative act of probing the tube has

1
2 cost the customer, the consumers, almost
3 five million dollars.

4 COMMISSIONER SHANNON: You are getting
5 into the realm of argument here. As I said,
6 we will reserve that for later in this
7 proceeding, Mr. Owens.

8 But I don't think anybody disagrees,
9 I don't think Mr. Gary, Mr. Rogers, or even
10 the Commission agrees that we are very
11 interested in the efficiency of all utilities.
12 In fact, we've had two very extensive studies
13 made going into the efficiencies of various
14 aspects of VEPCO. This is our responsibility,
15 and we will continue to do so.

16 COMMISSIONER BRADSHAW: I think every-
17 body in this room has misunderstood what I
18 continue to say.

19 MR. ROGERS: I understand what you
20 say.

21 COMMISSIONER BRADSHAW: I know you do,
22 Mr. Owens. You just repeated it.

23 My sole concern -- and I'm going to quit
24 after this one line -- is we don't look at them

1
2 one at a time on just one little complaint
3 here and one there.

4 MR. OWENS: This was brought up in
5 conjunction with the Fuel Clause hearing.
6 And this is a matter under that docket
7 number.

8 COMMISSIONER SHANNON: All right.
9 Mr. Gary.

10 MR. GARY: If we could, could we
11 change our batting order and put Mr. Proffitt
12 on first?

13 COMMISSIONER SHANNON: All right.
14 Go ahead.
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2
3 W. L. PROFFITT, a witness called by
4 and on behalf of the Company, Virginia Electric and
5 Power Company, having first been duly sworn, testified
6 as follows:

7 DIRECT EXAMINATION

8 BY MR. GARY:

9
10 Q Would you state your name and business
11 address for the record, please?

12 A W. L. Proffitt, Virginia Electric and
13 Power Company, 7th and Franklin Streets. I am Senior
14 Vice President for Power for the Company.

15 Q Go ahead.

16 A Well, I think there are several points
17 that the Company would want the Commission to understand,
18 and I would have to say that I think Mr. Wittine's
19 presentation this afternoon has attempted to reduce this
20 situation to a very clear, concise error at one particular
21 point in time.

22 And I would hope to present to you hopefully,
23 if we have time, through Mr. Sylvia here with some slide
24 presentations, that we are dealing with a very complex

Proffitt - Direct

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1 situation. And I think that the Commission is
2 probably aware that the steam generator problem
3 that has been identified at Surry is by no means
4 unique to Surry.
5

6 And the same problems have been
7 reported, not only in Westinghouse units and other
8 parts of the country, but in pressurized water reactor
9 plants designed and built by other suppliers. And
10 this is a serious problem and the seriousness with
11 which the industry views this is reflected in the
12 formation of an Owners Group that at the present time,
13 with the support of the Electric Power Research Institute,
14 has undertaken major research aimed at alleviating
15 the effects of this problem.

16 And twenty-two utilities have bound
17 together in a cooperative effort and have committed
18 twenty-eight million dollars to address this situation.
19 And I hope Mr. Sylvia will be given time this afternoon
20 to show you what a complex situation we are dealing
21 with.

22 Mr. Wittine, I think, attempted to
23 suggest to you that this is a very simple thing, that
24 you transfer one thing to one piece of paper and anybody

Proffitt - Direct

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1 that even is half paying attention to what they are
2 doing ought to be perfectly aware that, you know, the
3 area is obvious. And I hope that Mr. Sylvia will
4 be able to show you that it's more complex than that,
5 that there are remote indicators involved, there is a
6 remote gauging, there is a question of accessibility
7 and visibility, and all of these factors go into --

8
9
10 MR. ROGERS: I object to that
11 characterization of Mr. Wittine.

12 WITNESS PROFFITT: And all these
13 factors go into that to understand this.

14 And I hope the Commission would
15 understand that when we began this
16 problem -- and it was first identified
17 at Surry and Florida Power and Light, that
18 there was very little known about the failure
19 mechanism. And there was a serious question
20 in the minds of the NRC Staff with which
21 the Company has to deal about the safety
22 implications and continued operation of
23 Surry.

24 And I would say in all sincerity that

1 there was a question at one point in
2 time in my mind as to whether or not
3 Surry units would be allowed to be
4 operated at all because of this problem.
5 But as a result of the investigation that
6 has been primarily spearheaded by our
7 own people, supported certainly by
8 Westinghouse and others, that these
9 safety concerns have been resolved, and
10 that the development of these innovative
11 programs have contained the problem and
12 identified it and have provided continued
13 operation of these units at capacity
14 factors exceeding the national average
15 for all reactor plants.

16 And I would suggest that this
17 effort has resulted in the passing on
18 of many millions of dollars through the
19 fuel savings to our customers. And I
20 would have to say with this outstanding
21 performance it is very disappointing to
22 the Company's management and to those
23 employees who have worked with such
24

Proffitt - Direct

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1 dedication to have the Staff ignore this
2 effort and this accomplishment of the
3 ultimate improved performance in favor
4 of focusing on a single event and its
5 negative impact.
6

7 It appears to me that in the
8 Staff's view near perfect performance is
9 not quite good enough to avoid a penalty.
10 Mr. Wittine could not recall the figure
11 that was -- or didn't know the figure --
12 how many tubes that the Company has
13 successfully probed in this program since
14 its beginning, and it's in the excess of
15 one hundred thousand tubes that have been
16 successfully probed without error.

17 And to the best of our knowledge and
18 the best of our understanding, this one tube
19 is the one tube that all the attention is
20 being focused on.

21 Mr. Wittine has suggested that for
22 the ten days in question we should not recover
23 the fuel clause differential for the replace-
24 ment generation. But I think he failed to

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1
2 consider two important factors. Perhaps
3 the first and most important is that the
4 energy that was in the nuclear core that
5 was to be perhaps generated during that
6 period of time that he has referenced wasn't
7 lost. It stayed in the core, and it was
8 used at a later date. And I believe that
9 we can provide, if necessary, adequate
10 basis to show that the value of that
11 generation, as it was used, ultimately
12 later had a greater value to the customers
13 than it did during the period in question.

14 He also did not suggest that the
15 ten day question, or approximately ten day
16 outage question, was not due entirely to the
17 tube failure, but that the Company, based on
18 its own judgment and its own feeling of the
19 situation, elected to do additional work
20 during that time that we believed improved
21 the availability and gave this unit a greater
22 performance than perhaps would have been
23 realized otherwise.

24 And it really seems to me that the

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question that the Commission should address in its overall consideration is not did the Company operate error-free. If we are to be judged by a one hundred percent standard, I assure you we will never reach it.

But were the Company's programs properly established? Have they been responsibly executed? And I believe that on balance the facts would indicate that the Staff's position and suggestion is without merit.

And I will close by pointing out to the Commission that as a result of the work that the Company has done, there has not been a single forced outage of either unit at Surry in 1978 associated with steam generator tube leakage. I point to that with pride and as an accomplishment that our Company and the people responsible for it can be proud of.

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1
2 BY MR. GARY: (Continuing)

3 Q Mr. Proffitt, you mentioned the
4 capacity factors of the Surry units in 1977; November,
5 the year in which the outage was.

6 Do you have the numbers of the Surry
7 capacity factors versus the national average?

8 A I have them. I have them back here.
9 The national average and the basis of this figure is
10 in what is called the NRC Gray Book Reporting, the
11 national average was sixty-four point four percent,
12 while the Surry station was sixty-nine point eight
13 percent.

14 MR. ROGERS: What year is that
15 for? I'm sorry.

16 WITNESS WITTINE: 1977.

17
18 BY MR. GARY: (Continuing)

19 Q So with the outage your units were above
20 the national average?

21 A Yes.

22
23 MR. GARY: No further questions.
24

Proffitt - Direct

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COMMISSIONER SHANNON: Any questions?

MR. ROGERS: Do you want me to cross

now?

COMMISSIONER SHANNON: I think it might
be well to defer. We have got to stop here.

MR. ROGERS: I do want to cross in
a couple of areas some time.

COMMISSIONER SHANNON: Well, you may
stand down. You will return later when we
continue this, Mr. Proffitt.

* * * * *

WITNESS STOOD ASIDE

1
2
3 B. RALPH SYLVIA, a witness called by
4 and on behalf of the Company, Virginia Electric and Power
5 Company, having first been duly sworn by the Bailiff,
6 testified as follows:

7 DIRECT EXAMINATION

8 BY MR. BRASFIELD:

9
10 Q Mr. Sylvia, do you want to plug that
11 in before you get started?

12 Mr. Sylvia, would you please state
13 your name and position with VEPCO?

14 A B. Ralph Sylvia. I'm Director of
15 Nuclear Operations.

16 Q What are your responsibilities in that
17 position as Director of Nuclear Operations?

18 A I'm responsible for the overall operation
19 of both of our nuclear power stations.

20 Q What is your special background and
21 education, just a summary?

22 A I have a BS degree from Virginia
23 Polytechnic Institute in electrical engineering, a graduate
24 degree from N.C. State in nuclear engineering and thirty
25

Sylvia - Direct

12

semester hours toward a Master of Commerce degree, have a Senior Reactor Operator's license on Surry Units 1 and 2.

Q Have you been employed with VEPCO since finishing school?

A I've been with VEPCO since January of 1962.

Q Now, are you familiar with the problems the Company has encountered with its steam generators at the Surry Power Station?

A Yes, I am. I have been involved with that in detail since it was initially encountered.

Q Have you been involved with the Company's efforts to identify and correct those problems?

A Yes, sir, I have.

Q All right. Would you please give the Commission a summary, using the slides, and you can move around if you choose to, of what the problem is and how the Company has dealt with that?

A Yes, sir. I have a slide presentation that, first of all, defines the problem; secondly, I have a discussion on how we developed the program for dealing with the problem; third, I want to discuss how we implement an

Sylvia - Direct

13

1 inspection and plugging outage. And, fourth, the -- I
2 want to discuss aspects which make implementation of the
3 program very difficult.
4

5 After this discussion, I think you
6 will see why we didn't expect the program to be thoroughly
7 error-free. Our goal in this program, from the very
8 beginning, has been to maximize the capacity factor of
9 both of those units, Surry 1 and Surry 2. We looked at
10 it in terms of combining an inspection outage with a run
11 time in a manner which would maximize the capacity factor.
12 And I think we have accomplished that goal.

13 If you compare 1977 and '78 capacity
14 factors with the national average, you will see that we
15 are well above average. In 1977, the Surry Station had
16 a capacity factor of over sixty-nine percent. The national
17 average was sixty-four percent. In 1978, our capacity
18 factor was seventy-four point two percent, and the
19 national average was sixty-seven point two percent.

20 So, even with this problem we are well
21 above average compared to the other nuclear units in the
22 nation.

23 First of all, I would like to define
24 the problem. This first slide shows where the steam
25

Sylvia - Direct

14

generators are in the plant. They are inside the concrete dome. The containment and the inside of a concrete shield wall. The steam generators -- there are three on each unit -- and the steam generators function to transfer heat from water that is being circulated through the reactor and through the steam generators to water in a secondary system. So, heat is transferred to that water and it makes the steam which turns the turbine.

This next slide -- the next slide is a more detailed look at a steam generator itself. As we go through the slides, if you have any questions --

COMMISSIONER SHANNON: I think as you refer to them, I think you ought to say one and two and so forth, so when we get the transcript -- so, this is the second slide.

WITNESS SYLVIA: Number 2. This slide shows a steam generator itself. It is seventy feet high, seventy feet tall; it is twelve feet in diameter at the lower section where the U-Tubes are contained. It is fourteen feet in diameter up in the moisture

Sylvia - Direct

15

separator section above this transition cone.

The walls of this steam generator steel walls are two point eight inches thick.

There are thirty-three -- three thousand three hundred and eighty-eight U-Tubes in each steam generator.

COMMISSIONER SHANNON: How many?

WITNESS SYLVIA: Three thousand three hundred and eighty-eight. So, it's double that many tube ends to be inspected.

I will discuss how it functions briefly. The water from the reactor coolant system comes into one side of these U-Tubes; it goes up through the tubes, back out the steam generator through the other side. Other water from the secondary system is on the outside surface of these U-Tubes in the shell part of this steam generator, and it picks up the heat from the surface, the metal surface of those tubes in order to make steam.

There are seven tube support plates in our steam generator. The tube support

Sylvia - Direct

16

plates are three-fourths of an inch, three-quarters of an inch, thick; they are made of carbon steel. The hole in the tube support plates where the tube passes through is point eight nine 0 inches in diameter. The outside diameter of the tube itself, each tube is point eight seven five inches in diameter.

So, the angulus area between the tube, the outside of the tube, and the tube hole is seven point five mills, or seven and a half one-thousandths of an inch.

This third slide, Slide Number 3, shows the U-Tubes passing -- this is an elevation view of the steam generator. It shows the U-tubes passing through the tubes, tube support plates. The -- what is happening in the steam generators is that these tube support plates made of carbon steel, which is three-fourths of an inch thick, are corroding. And the corrosion product of the tube support plate occupies twice the volume as the carbon steel itself did.

Sylvia - Direct

17

So, what is happening is that these seven tube support plates are expanding, and as they expand they are moving outward and at the same time they are pushing in on the tubes themselves, because there was only a small gap, seven and a half mill gap initially. So, soon after the corrosion began that gap filled with corrosion products.

And, then, the corrosion of the corrosion product began to exert pressure on the tubes in the steam generator. And that is the denting problem; that's what we call denting.

COMMISSIONER SHANNON: It's just where the -- where that plate -- what do you call the red?

WITNESS SYLVIA: That is the steam tube support plate.

COMMISSIONER SHANNON: It's just where the support plate comes in contact with the steam generator tubes, when you have the denting?

WITNESS SYLVIA: Yes, sir. And

Sylvia - Direct

18

the big picture is, there are seven of these,
seven different levels in the steam generator.

And it's where the tubes pass
through these carbon steel tube support
plates which are three-quarters of an inch
thick. So, it's in this three-quarters of
an inch thickness that this pressure, this
denting, the tubes as they pass through
that plate.

1-1

Sylvia - Direct

19

Slide Number 4 shows where the denting occurred initially. This is also a view of one of the tube sheets. In the middle of the tube sheets, there are slots to allow fluid flow, for the distribution of fluid flow for good transfer characteristics.

In between these flow slots, there is nothing but metal, whereas throughout the support plate it is primarily holes because of so many tubes. Three thousand, three hundred and eighty-eight tubes, but where there is more metal and less holes, the tube support plate itself is more rigid so, therefore, it doesn't dare move as much as this corrosion product builds up. So since it doesn't give it exerts more pressure in that area on the tubes themselves.

And that is why the denting began.

Initially, looking at these tubes close to the flow slots, or close to the metal between the flow slots, we probed those to find out. We probed leaking tubes to find out how much they had to be dented before they leaked, and we found out from that program that tubes apparently began to leak when they were denting to about five hundred mills, half an inch, inside diameter.

The original inside diameter is point

1-2

Sylvia - Direct

20

seven seven five inches. So when these tubes dented to about half an inch from point seven seven five inches, they began to leak.

So we used that knowledge to probe tubes around what we call hard spot areas where there was a lot of metal to find out when tubes were approaching five hundred mills, so that we could plug those tubes before they leaked and return the unit to service, hoping that the problem would be confined to this area, and when we plugged those tubes in that particular area, the problem would go away. But that wasn't the case. After we plugged all these tubes around these hard spot areas, the leaks continued and they continued to occur more often, and they continued to occur out at other places in the steam generator where the tube support plate was more resistive to movement.

So we figured then that we needed to go through a much more sophisticated program for dealing with this problem.

So, what we did was develop an analytical model, a computer model, a finite element analysis

1-3

Sylvia - Direct

21

of the tube support plate. The purpose of that model was to determine what parts of the steam generator would dent first. If this model is like a contour map of a -- well, a contour map. I have a handout on that --

Q Excuse me, Mr. Sylvia. I believe I am correct as identifying this slide that he is now talking from as Slide No. 4?

COMMISSIONER SHANNON: Yes, it is Number 4.

MR. BRASFIELD: I think we ought to try to identify each one for the record.

Bailiff: Exhibit 1, sir?

COMMISSIONER SHANNON: Let's see.

Mr. Wittine's was JRW-9. We had this before. I am not sure -- I am not sure whether 10 would be the next number or not.

Let's see. Let me look at the transcript. Yes, ten is the next number.

BRS-10.

MR. BRASFIELD: Mr. Sylvia, what is it you want to show as BRS-10?

MR. SYLVIA: This is a strain model

1-4

Sylvia - Direct

22

1 of the steam generator tube support plate.
2 We use this to tell us what areas of the
3 tube support plate would be subject to the
4 highest amount of denting. In addition
5 to modeling the steam support plate to get
6 a strained profile, or a denting profile,
7 denting would be proportioned to strain,
8 we also took measurements at different points
9 in time to determine at what rate each part
10 of the steam generator would be denting.
11

12 So if we could find out what area
13 of the steam generator to inspect, based on
14 where the straining was, and we could determine
15 the rate at which it was denting, we felt we
16 could come up with a preventive to the
17 plugging program which would allow us to run
18 a period of time without having leaks.

19 Our goal, there again, was to not
20 make a research program out of this. The
21 data we had was empirical, it was hard to
22 obtain, and what we tried to do was combine
23 an inspection time with a one-time that
24 would allow us to maximize the overall capacity

1-5

Sylvia - Direct

23

factor of the unit.

COMMISSIONER SHANNON: In that red circle, are there three thousand, three hundred and eighty-eight tubes in each one of those?

WITNESS SYLVIA: Yes, sir. Through each support plate there are three thousand, three hundred and eighty-eight tubes going up. Well, it is actually double that. Three thousand, three hundred and eighty-eight on each side.

COMMISSIONER SHANNON: On each side.

WITNESS SYLVIA: Right. This is the middle of the steam generator. It is called the tube lane.

COMMISSIONER SHANNON: That is a cross section of the U-Tube that we are looking at?

WITNESS SYLVIA: Right. That is a cross section of the steam generator. That would be looking right down on top of the tube.

COMMISSIONER SHANNON: All right. Go ahead.

1-6

Sylvia - Direct

24

1
2 WITNESS SYLVIA: This would be the
3 top support plate if you looked at this
4 slide and you looked at this one -- or this
5 sketch -- in conjunction with that one. This
6 would be the top support plate, and these would
7 be where the tubes are coming up one side, and
8 back down the other.

9 COMMISSIONER SHANNON: And I am looking
10 at a cross section of just one U-Tube?

11 WITNESS SYLVIA: No, sir. On this side
12 of the steam generator, this would be a --

13 COMMISSIONER SHANNON: I see; I see.

14 WITNESS SYLVIA: This would be an
15 elevation view, a side view, and going up this
16 side would be three thousand, three hundred and
17 eighty-eight --

18 COMMISSIONER SHANNON: How many U-Tubes
19 are there in each generator?

20 WITNESS SYLVIA: Coming down this side
21 would be three thousand, three hundred and eighty-
22 eight tubes. If you transferred this over there,
23 looking at it from a planned view, coming stright
24 up, you stand on top looking down, coming straight

1-7

Sylvia - Direct

25

up, you have got the tubes coming up -- that would be the tubes coming up this side of the steam generator, three thousand, three hundred and eighty-eight. It makes that U up here, turns and go back down to the bottom.

COMMISSIONER SHANNON: Are there a series of U-Tubes?

WITNESS SYLVIA: Yes, sir.

COMMISSIONER SHANNON: How many U-Tubes in each generator?

WITNESS SYLVIA: Three thousand, three hundred and eighty-eight in each steam generator. You see, there are over ten thousand in all three steam generators.

COMMISSIONER SHANNON: I guess I was a little confused, because I thought these smaller steam generating tubes were actually contained within each set of U-Tubes. They all form the U-Tubes.

WITNESS SYLVIA: Yes, sir. The tubes, referring to themselves, are called U-Tubes. Any time we say tubes, we mean U-Tubes.

COMMISSIONER SHANNON: And what is the

1-8

Sylvia - Direct

26

diameter of each one of those tubes?

WITNESS SYLVIA: The inside diameter is point seven-seven-five inches, and the outside diameter is point eight-seven-five inches.

And the hole through which each of these three thousand, three hundred and eighty-eight tubes pass is point eight nine zero inches in diameter.

COMMISSIONER SHANNON: That is in the support plate?

WITNESS SYLVIA: Slightly larger than the outside diameter of the tube itself.

COMMISSIONER SHANNON: What is that again?

WITNESS SYLVIA: Point eight nine zero.

BY MR. BRASFIELD (Continuing)

Q Mr. Sylvia, you have said that your objective was to maximize capacity factors, and you also said that you did not want to extend outage times for inspection. Would you elaborate on that?

A When we found out that we had the problem in these areas other than these hard spot areas, we felt

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27

about inspecting the entire steam generator each time,
and we figured that would take us about three months to
do that.

COMMISSIONER BRADSHAW: When you said
each time, you mean when you had it down?

WITNESS SYLVIA: Each time we had a
leak and had to shut down. Each time we had
a leak the Nuclear Regulatory Commission required
us to shut down. When we discovered this
problem, they reduced the leakage rate by a
factor of three. We were allowed to have a
leakage of one gallon per minute, but when we
found that we had this denting problem, for
safety reasons or to be conservative, they
reduced that leakage to point three gallons
per minute.

So that is almost zero leakage. So
any time we had a leak, we had to shut down
and go through one of these inspection programs.
And as it became obvious the tube leaks would
be in areas other than these hard spot areas,
we either had to come up with some program
for evaluating what is part of the steam generator

1-10

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should be inspected, or we had to do it all.

Doing it all would have been the more perfect way to do it, but that would take about three months.

The program that we came up with allowed us to do an inspection in about three weeks.

COMMISSIONER BRADSHAW: That was just doing a portion of it.

WITNESS SYLVIA: That is right. Based on the strained contour maps that we get from a computer model which we developed in conjunction with the denting of the steam generator.

BY MR. BRASFIELD (Continuing)

Q Taking -- by taking more time with the outages, could you have made your program more nearly --

A Yes, we could have inspected more tubes. We could have double checked each one we inspected. We could have come up with more checks and balances that would have been quite time consuming, and we could have made a more perfect program, but we felt that looking at the program itself, that was derived, based on the

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29

1 practical approach rather than the more scientific
2 approach, it was an empirical program developed on
3 limited data, we felt that we would double check and
4 have checks and balances on the more practical or more
5 likely ways to make an error, and concentrate on getting
6 the unit back on line rather than staying down and
7 checking and double checking and getting more data each
8 time we had inspection outage.

10 We felt this was the best way to meet
11 the overall goal of maximizing capacity factor, and I
12 think the capacity factor itself has proven that our
13 approach to this was the proper one.

14 COMMISSIONER SHANNON: Just to better
15 orient myself, now the water from the secondary
16 system surrounds the steam generator tubes?

17 WITNESS SYLVIA: Yes, sir.

18 COMMISSIONER SHANNON: And it also
19 surrounds the support plate?

20 WITNESS SYLVIA: That is right.

21 COMMISSIONER SHANNON: And of course,
22 your water from the primary system is in the
23 steam generating tubes? Inside?

24 WITNESS SYLVIA: Yes, sir; that is
correct.

1-12

Sylvia - Direct

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2 COMMISSIONER SHANNON: To what do you
3 attribute the corrosion on the support plate?
4 Is it something in the water that surrounds it?
5 Or -- is there any theory on that?

6 WITNESS SYLVIA: This is what is called
7 the generic problem. Most all of the steam
8 generators -- not only the ones made by
9 Westinghouse, but those made by the others --
10 have experienced these type of steam generator
11 problems. I think it is a combination of
12 things. I think the commercial unit that
13 we have, the size of it and so forth, caused
14 us to have the steam generator that had not
15 been previously demonstrated anywhere else.
16 I think the higher temperatures, the metals
17 used and so forth led to this corrosion problem.
18 When we initially started out, we had what was
19 called a thinning problem based on the original
20 chemistry treatment that was used, and this
21 thinning problem was getting out of hand.

22 We were plugging a significant number
23 of tubes to each outage, because it is thinning.
24 So as a result of that, Westinghouse recommended

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2 that we go to a different form of chemistry
3 treatment. We did, and when we went to the
4 different form of chemistry treatment --

5 COMMISSIONER SHANNON: In treating
6 the water?

7 WITNESS SYLVIA: Treating the secondary
8 water, yes, sir. We got into this denting
9 problem. I think the switch over recommended
10 by Westinghouse maybe accelerated the program,
11 but I mention that most all pressurized water
12 reactors have some type of tube problems in their
13 steam generators.

14 The Surry units and the units at
15 Florida Power and Light experienced a problem
16 more severely than others initially. We are
17 ahead of some of the other units in severity,
18 because we are located on salt or brackish
19 water.

20 COMMISSIONER SHANNON: This denting
21 occurred only where the support plate comes in
22 contact with the steam generator tubes, is that
23 correct?

24 WITNESS SYLVIA: Yes, sir. The corrosion

1-14

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product from the support plate.

COMMISSIONER SHANNON: I believe you said that was carbon steel?

WITNESS SYLVIA: Yes, sir.

COMMISSIONER SHANNON: How do we know that is not going to continue when you get your new units in?

WITNESS SYLVIA: The new units don't have carbon steel support plates, first of all. They are standard steel support plates. And the new units don't have circular holes. They have what is called quadrofoil. It is like a four leaf clover. The small currents is only over a very small area of the hole -- around the entire hole. Plus we are putting in additional equipment in our condensate system, the system the water comes from that goes into the steam generator to make that water more pure. We are designing components into the rest of the system that is compatible with the new type of chemistry treatment. It is called the all volitile treatment.

Remember I said that initially we weren't

1-15

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33

1
2 designed for that type of treatment, so
3 therefore we didn't have that initial equipment.
4 The equipment in the rest of the system, the
5 secondary system; the secondary system -- the
6 feed water and condensate system wasn't designed
7 for all volatile treatment.
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CHAIRMAN BRADSHAW: Mr. Sylvia,
if you have a leak, how do you know which
one it is? Can you see it?

WITNESS SYLVIA: What you do if
you have a leak, you know you have a leak,
the water leaking out of it. If you have
a leak, the rack cooling system --

CHAIRMAN BRADSHAW: I mean, can
you tell which one of the three thousand
tubes is leaking?

WITNESS SYLVIA: Yes, sir. If
you have a leak, what you know -- first of
all, while you are operating, you know you
have a leak, and you know that because
this reactant coolant inside the tubes is
at a higher pressure than the water on the
outside of the tubes. So, the -- and
the water on the secondary side of the
steam generator has no radioactivity in
it. The water on the primary side --

CHAIRMAN BRADSHAW: So, you've got
a leak, you shut it down?

WITNESS SYLVIA: Yes, sir. You

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monitor the fact that you have a leak by picking up some activity and the amount of activity allows us to calculate the leak rate. And we shut down.

CHAIRMAN BRADSHAW: Okay. Once you shut down you can go right to the one that is leaking?

WITNESS SYLVIA: Yes, sir. Once we shut down we open up these man ways and go up under it so that we have access to the tube sheets. This is where all of the tubes terminate, is in the tube sheet.

Once we shut down, we reduce the pressure on the primary side and we increase the pressure outside the tubes and go underneath the tube sheet, and we look at which tube the water is running out of.

CHAIRMAN BRADSHAW: Okay.

WITNESS SYLVIA: Do you have any other question on what denting is and what our approach was to try and live with the problem and operate the unit as a result of having the problem?

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If not, I would like to go through how we perform one of these inspection programs. First of all, looking back on the strain profile --

MR. BRASFIELD: BRS-10.

WITNESS SYLVIA: We get that information from the computer model. We get that information from Westinghouse and from that we determine what parts of the steam generator is to be inspected. An example of that is shown on the next --

BY MR. BRASFIELD: (Continuing)

Q Is that Page 2 of BRS-10?

A That would be Page 2. This is an actual tube sheet map for one of the inspection outages.

CHAIRMAN BRADSHAW: Is this the one that is headed up "Series 51"?

WITNESS SYLVIA: Yes, sir. You see the crosshatch section in the middle?

CHAIRMAN BRADSHAW: Yes.

WITNESS SYLVIA: That's what is not

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to be inspected on the hot leg.

CHAIRMAN BRADSHAW: The computer tells you --

WITNESS SYLVIA: Everything in there is not swaying enough to warrant inspection. Below the dotted line, at near the tube lane, is everything to be inspected on the hot leg side. So that map tells us what tubes are to be inspected.

And from that map we make a data sheet listing all the tubes to be inspected. And that's Page 4 of BRS-10.

CHAIRMAN BRADSHAW: Is this the actual sheet that you relied on for this particular tube in question?

WITNESS SYLVIA: Yes, sir. Yes, sir. We make this, what's called -- this is called an Eddy Current Test Sequence Sheet. We make this sheet up so that the operators of the Eddy Current equipment will know what tubes to run the probe up into.

And they take this into the containment and they, with the idea, or the intent,

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of probing each one of the tubes listed.

CHAIRMAN BRADSHAW: All right.

This tube we are talking about,
R5C26, that's the one in question, isn't it?

WITNESS SYLVIA: Yes, sir.

CHAIRMAN BRADSHAW: Where would
that be on this little chart?

WITNESS SYLVIA: Well, I didn't
try to pick out the chart that had that
particular one on it. I have that. I can
get it for you.

MR. BRASFIELD: That's ^J GRW-8 in
this proceeding, Your Honor.

WITNESS SYLVIA: That's right.
That's in the other testimony.

CHAIRMAN BRADSHAW: I thought that
is what I just asked him, if this was the
sheet in question.

MR. BRASFIELD: I think he gave
you the wrong answer, Your Honor.

WITNESS SYLVIA: No.

BY MR. BRASFIELD: (Continuing)

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Q The sheet you have before you on
your exhibit is not the sheet that shows the tubing?

A That's what I thought I said.

CHAIRMAN BRADSHAW: I misunderstood
you, then.

COMMISSIONER SHANNON: I think
JRW-5 shows that, doesn't it?

WITNESS SYLVIA: Right. You have
a sheet.

COMMISSIONER SHANNON: Mr. Wittine's,
JRW-5.

CHAIRMAN BRADSHAW: Well, regardless --

WITNESS SYLVIA: This is a typical
sheet just to show you are talking about how
we go through the program.

CHAIRMAN BRADSHAW: Okay.

WITNESS SYLVIA: And this is just
a typical sheet to show you what we do to
get the information to the Eddy Current
equipment operators in order for them to
know which tubes to inspect.

CHAIRMAN BRADSHAW: Was this a tube

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that, this R5C26, was it --

WITNESS SYLVIA: It was listed.

CHAIRMAN BRADSHAW: As one to be inspected?

WITNESS SYLVIA: Yes, sir. It was listed as one to be inspected.

CHAIRMAN BRADSHAW: Okay. Was it in fact inspected?

WITNESS SYLVIA: No, sir.

CHAIRMAN BRADSHAW: Well, isn't that the sole issue here?

WITNESS SYLVIA: Yes, sir. Yes, sir. But I think in order to address this we need to understand the entire --

CHAIRMAN BRADSHAW: Go ahead. I didn't mean to short -circuit things too much.

WITNESS SYLVIA: On this particular outage where we missed the tube, it was the second one of these outages that we have done. There were over six thousand tubes to be inspected, many of which were to be inspected with three different sized probes. We inspect with three different size probes to try to get

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a feel for how much each of these tubes listed,
each of these six thousand some tubes, have
dented.

Okay. The field equipment operators
take this data sheet into the containment
and they use this device --

BY MR. BRASFIELD: (Continuing)

Q Excuse me, Mr. Sylvia. You are refer-
ring to Slide 5?

A 5. They use this device to remotely
position Eddy Current probes up into the U-Tubes. What
we are looking at now is a mock-up showing from under the
tube sheet. And this probe, this device, you go in and
you attach it to tube poles themselves and, then, you can
program it from outside to move through the tube support
plate remotely and automatically through to monitor or
probe the tube as far as the probes will go.

CHAIRMAN BRADSHAW: How long did
you say the tubes were? Near seventy feet?

WITNESS SYLVIA: The steam generator
is seventy feet. The tube bundle goes up to

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a little over forty feet.

CHAIRMAN BRADSHAW: Does that little probe go all the way up?

WITNESS SYLVIA: It goes all the way up each side. Most probes will not go around the U-Bend so we do each side separately.

CHAIRMAN BRADSHAW: Can you ever check the turns?

WITNESS SYLVIA: We have checked the turns, but that takes a special probe. And when we check the turns we are not looking for denting because the denting only occurs at the support plates. We are looking for some other type of flaw or crack.

And we have been required to inspect those also. And we developed a technique for doing it.

CHAIRMAN BRADSHAW: That -- I might be oversimplifying it, but that's like a mike isn't it? You just mike the diameter of the tube.

WITNESS SYLVIA: Remotely. But at the same time we are getting Eddy Current

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2 information which is a signal that tells you
3 the condition of the tube. We are monitoring
4 this. This Eddy Current probe will tell us
5 each time it goes through a support plate
6 which allows us to know where the probe is
7 when you look at the printout we get from it,
8 which is a strip chart and a magnetic tape,
9 and also will pick up any flaws in the tube
10 such as a crack, or thin spot, or scrape on
11 it, or anything that we should be concerned
12 about, anything that would cause a leak and
13 cause us to shut down.

14 So, we are doing a lot more with
15 this than just gauging.

16 COMMISSIONER SHANNON: Would you say
17 this is all done through the computer,
18 electronically?

19 WITNESS SYLVIA: It's done remotely.
20 I can, on the next slide, which will be 6,
21 show you. One of the later slides will show
22 you the remote equipment and how they are
23 operating it remotely.

24 But this slide shows -- this is the
25

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bottom of the steam generator, and this slide shows the cabling coming out on that -- what is called the finger water. That remote position. And this slide here shows the worker in order to give you an idea of the size of the hole that he has for access to the steam generator and gives you a little feel for the type of protective clothing that he has to wear while he is performing these duties.

COMMISSIONER SHANNON: What is the level of radioactivity?

WITNESS SYLVIA: It's very high. Up in the steam generator near the tube sheet it's so high that when a worker goes in to do anything, at times he can only stay about three minutes and that further complicates the problem. Because, just to perform a simple task, you have a lot of turnover of people.

COMMISSIONER SHANNON: How about the gentleman operating the remote control?

WITNESS SYLVIA: We get him out into an area that is much less radioactive.

COMMISSIONER SHANNON: But, still --

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WITNESS SYLVIA: Right. There is still some radioactivity, but it's a level where he can work normal working hours and perform his duties.

This is the drive unit for the remote device. It's located right near the steam generator.

BY MR. BRASFIELD: (Continuing)

Q That was Slide 7?

A Yes, sir. This is Slide 8. This is another look at the remote device up under the tube sheet. This overhead is sixteen inches in diameter.

COMMISSIONER SHANNON: That's one of the openings at the bottom of the steam generator?

WITNESS SYLVIA: Yes, sir. There are two openings, one on the hot leg side, one on the cold leg side. It's the only access to the area under the tube sheet, sixteen inches in diameter.

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BY MR. BRASFIELD: (Continuing)

Q Does your worker have to go up in there to position --

A He has to crawl up in there to position this device. You have to move it. It won't get the entire steam generator. And he is only allowed to stay three minutes at times. So, just to do that one task we have a turnover of several people.

And, then, when we plug it -- plug the steam generators, they have to crawl up in there and put the plugs in manually. Also, you can only take three plugs at one time. And these tube sheets aren't marked. There is no identification. And there are forty-six rows of tubes in ninety-six columns.

So he has to go up in there and look up under the tube support plate which looks like a bunch of holes and has to start counting in order to plug a tube or to probe a tube that he is supposed to probe.

COMMISSIONER SHANNON: Is that a VEPCO employee that does that, or is that a contract employee?

WITNESS SYLVIA: Both. This -- each one

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2 of these tube plugging outages, that's about one hundred
3 people and we supplement our people with contract labor.
4 And Westinghouse also, their personnel also help us with
5 the program.
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A As a matter of fact, the plugging is -- they do the plugging. We have to supply the manpower.

Q Do some of the tubes have to be probed manually? You can't use your remote tubing probing?

A That is right. The device for remote probing of the tubes will not get all locations. And then, too, we saw back on the other slides, some of the tube holes that are used to hold the device itself through cam locks, so, therefore, we can't do all of the plugging -- all the probing with the remote device. We always miss some tubes, and when the Eddy Current interpreter is looking at the data sheets that the field operators get for him on each tube, that is one thing he does. He looks at the flaws, he looks at the signal to determine when it went through a support plate, and figures out which one it stops at. And he looks for missed tubes.

He looks for places on the data sheets he is supposed to have a signal, and he didn't get it, or the signal doesn't look right. He will know something is wrong. A tube needed to be reprobbed, and there are always a number of tubes during each inspection to be reprobbed, and they are identified by the interpreter.

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I might add here, too, that that interpreter is a highly specialized person. It is a real art in the reading of the data. He reads it from just getting samples from known flaws and known dents, and just practices and practices and practices until he can understand what the signals that he is getting is telling him.

There are only about five in the country, and we are very fortunate to have gotten an interpreter -- a qualified interpreter to Surry, such that he didn't hold up the outage.

Not having an interpreter would hold up the outage, and normally we are only able to get one. We feel fortunate to get one, and he works long hours.

COMMISSIONER SHANNON: For whom does he work, Westinghouse?

WITNESS SYLVIA: We get him from a place called Zetex Corporation. Westinghouse has one interpreter, but if we have a problem, the interpreter we hire identifies the problem. We use the Westinghouse interpreter as a back-up.

COMMISSIONER SHANNON: Just to confirm, say.

2-3

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MR. BRASFIELD: How does the interpreter know what strip chart and oscilloscope ^{trace} ~~traits~~ relates to what tube?

WITNESS SYLVIA: Let me go to the next slide. These are the --

MR. BRASFIELD: This is Number 9?

COMMISSIONER SHANNON: Nine.

WITNESS SYLVIA: These are the field Eddy Current test operators. This gentleman here is positioning the Eddy Current device -- remote device. This is a device which remotely probes the tubes. We get three signals out. This is an oscilloscope, and that is just for current reading. The reading -- the value that is showing up now. Then we record it on the magnetic tape, and a strip chart, and these fellows here have the data sheets that generate from the tube sheets, and they mark on each strip chart what tube they think they are probing. What tube they are supposed to be probing.

MR. BRASFIELD: How do they know that, what tube they are probing?

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WITNESS SYLVIA: Well, they get a reference when they put the remote position up the first time. The -- they count rows and columns, and they have a reference, and they go to that reference.

MR. BRASFIELD: They can just move it automatically? They start off in row one, and just move it over to three, and they would know the --

WITNESS SYLVIA: But occasionally they will get to a tube that it won't go up in, because they won't get every place in the steam generator, plus they can't get the holes that are being used to hold the device itself.

MR. BRASFIELD: They can't see what is going on in the steam generator. They are just reading the instruments.

WITNESS SYLVIA: Right. So they get the data, they mark the strip charts as to what they are supposed to be in --

COMMISSIONER BRADSHAW: Can they make a mistake?

WITNESS SYLVIA: Sir?

2-5

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COMMISSIONER BRADSHAW: Can they put down data from one tube that really is another tube?

WITNESS SYLVIA: Oh, yes; that is likely, that they might make a mistake. And this is why we need this highly specialized interpreter, because he can identify something unusual about the signal. He would know, based on his knowledge of the -- of what the signal should look like, and he would have a pretty good idea of what the signal should look like for each tube, because these strained profiles give him an idea of what to expect the reading to be.

And if we have something that was real strange, that is something he does. He would identify that, and he would have us go in and hand probe that over again. This is what I mean. This is by no means an exact science.

COMMISSIONER BRADSHAW: What do you mean by, 'hand probe?'

WITNESS SYLVIA: Well, instead of using a remote device, a guy would go in and count these columns and be sure he put the device up

2-6

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1
2 into the right tube.

3 COMMISSIONER BRADSHAW: Okay.

4 WITNESS SYLVIA: So these gentlemen get
5 the data, and then they turn it over to this
6 interpreter.

7 COMMISSIONER SHANNON: What do you call
8 the gentlemen that collect the data?

9 WITNESS SYLVIA: Field test equipment
10 operators. Field operators. Eddy Current test
11 equipment.

12 COMMISSIONER SHANNON: And then you say
13 it goes to the interpreter for his evaluation,
14 and if there is a question then you have it
15 confirmed by another interpreter?

16 WITNESS SYLVIA: Yes, if he gets a signal
17 that is questionable. The first thing we would
18 do is we would probe that tube over again. If it
19 still is questionable, we would get another
20 interpreter to give an opinion. It is an art.
21 It is not an exact science. To read the signals
22 is definitely pure art, and he would give an idea
23 of what he thinks that signal means.

24 Let's move on to ten.

2-7

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1 This slide shows how a worker has to
2
3 dress out to go up into the generator, up under
4 the generator where the tube sheets are. Normally,
5 he has on two sets of cotton coveralls, protective
6 clothing. And he has on this wet suit that is
7 plastic, and it is all taped up so there are no
8 holes in that.

9 Then he has on an air hood which is supplied
10 from a breathing air source. So anybody working
11 up under the steam generator has to dress in that
12 manner in order to work.

13 This will be 11. This is the Eddy Current
14 interpreter. The field Eddy Current operators
15 have gotten the information, and they have given
16 it to him, so he has the strip chart right here,
17 and mark on this chart what tube they were
18 probing, and then he has -- as a back-up, he has
19 the magnetic tape. He normally uses a strip chart
20 first, and this is the data sheet that he has
21 in front of him, and he is marking on this data
22 sheet information from the strip chart.

23 When he looks at the strip chart he
24 first looks to see the signals on the strip chart

2-8

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55

1
2 -- if they are detecting any flaws. If you
3 get a flaw, you plug that tube, whether it was
4 -- whether the flaw was caused by denting or
5 whether it was caused by some other reason.

6 COMMISSIONER BRADSHAW: Is he interpreting
7 while they are in a particular tube, or does he
8 look at the strip charts and do this later?

9 WITNESS SYLVIA: He does that later.
10 He likes to work back in a quiet, clean place.
11 He normally works in the back of a motel, and
12 he wants to get away from everybody to do this,
13 and he works long hours to try to keep that
14 from becoming -- he is the critical path at one
15 time, and he works long hours to keep from holding
16 the unit off line.

17 So, what he is looking for first of all
18 is to pick up any flaws. He is looking to watch
19 -- he marks or notes the signal each time a probe
20 passes a tube support plate, and he identifies
21 where the probe stops. Which support plate it was.
22 Which of the seven it would not pass. And if it
23 won't pass, they start out with a six-fifty probe.
24 If it won't pass the six-fifty probe, then he makes

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1 a list of tubes that needs to be marked with
2 a six-ten probe point -- point six one zero.
3

4 Then, when he gets the data from the six-
5 ten probe, he makes a list of all the tubes that
6 need to be monitored with a point five four zero
7 probe, and then we get all that data and give
8 it back to him, and he also tells us if there are
9 tubes in the program to be inspected. Tubes to be
10 inspected. Tubes that we missed. And we always
11 miss some, because of the way we have to go about
12 doing it.

13 He tells us which ones we miss, and then
14 we go back and hand probe those. And he can tell
15 us which ones we may have a strange reading from,
16 and we go back and hand probe those.

17 Then we get all the data -- we get the
18 flaws and make a list of any flaws we may have,
19 and thin tubes, and tubes that appear to be
20 cracked. We found out what tubes will pass the
21 five-forty, which tubes won't pass the six-ten,
22 which won't pass the six-fifty. And from that
23 we apply the plugging criteria, which is listed
24 in the testimony already.

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We plug two beyond which won't pass the five-forty.

We plug anything that won't pass the six-ten.

This is just a concept of the plugging program.

COMMISSIONER BRADSHAW : What is the mechanics of plugging?

WITNESS SYLVIA: Sir?

COMMISSIONER BRADSHAW: How do you plug them? You can't go up there and weld.

WITNESS SYLVIA: We do weld if the plugs leak, but the -- if they don't hold properly. But the method of plugging is exposing. You pick the tube up, plug up in the tube, and you remotely detonate the charge, and it swells it out and makes the seal.

COMMISSIONER SHANNON: You inspect what, about eighteen thousand tubes in a unit?

WITNESS SYLVIA: Yes. The program has been expanded. It is not as large as it was, but this particular outage that we are discussing had over six thousand, and many of them had to be probed three times; six-fifty, six-ten, and five-forty. And I would estimate that each outage -- we probe ten to fifteen thousand tubes, and

2-11

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we have had, I think, ten outages -- eleven.

So we have plugged over, I guess I would estimate, a hundred and twenty-five -- excuse me, I estimate we have probed around a hundred and twenty-five thousand tubes.

COMMISSIONER SHANNON: How is a tube like this missed? Is it human error?

WITNESS SYLVIA: On this particular one, the Eddy Current interpreter put down data that we didn't have.

COMMISSIONER SHANNON: I don't follow you. When you say you put down data you didn't have.

WITNESS SYLVIA: The tube wasn't probed, and as he was going through here, this data sheet, putting down the information from the strip chart, he was getting routine readings for this particular area of the steam generator, and he said he had been working twelve or fourteen hours, and he was seeing a trend in this direction, and he inadvertently put down a reading on the data sheet for a tube he didn't have.

COMMISSIONER BRADSHAW: You mean the two

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operators that we showed on the previous slide
didn't give him any information, but he --

WITNESS SYLVIA: He recorded it on the
data sheet anyway.

COMMISSIONER BRADSHAW: He made a judgment
on the tube that wasn't inspected?

WITNESS SYLVIA: Well, one of the things
he is supposed to do is tell us if we missed a
tube, and that is where the error was made.

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WITNESS SYLVIA: He didn't tell us we missed a tube. He recorded the fact that some data did exist. He recorded that it did.

COMMISSIONER SHANNON: It was the interpreter's error?

WITNESS SYLVIA: Right. And, as I say, he -- his knowledge of the steam generator, what he expects to see, probably hurt him here, because he was looking at this particular area and the other tubes in that area were passing the six-fifty, and he just probably was going too fast and it was a long day and he put down data that did not exist.

COMMISSIONER SHANNON: Then, how did you discover that the tube had been missed after he put down the wrong data?

WITNESS SYLVIA: What we did, after the tube leak, after the tube leak, we didn't know what had happened, and the first thing -- well, what -- we had an idea that there was something -- that something was wrong, because even after the unit went on -- went back on the line we began to compare a March data, the

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1
2 data on the previous outage with the data we
3 got from the September outage, and we found
4 that this particular tube passed -- that he
5 had recorded as passing, I believe it was
6 a six-fifty in September, didn't pass it
7 in March.

8 So, we knew something was wrong. We
9 knew he must have missed data on the tube we
10 didn't probe, because the tube definitely
11 didn't -- the dent didn't go away.

12 COMMISSIONER SHANNON: Well, where you
13 have this many tubes, if you miss one at
14 least would that still show up on your checks?
15 It would look like the radioactivity that would
16 come -- would be so remote it would be difficult.

17 WITNESS SYLVIA: Well, they cranked
18 down the limit so bad that any leak, if you
19 have any leak at all we will have to shut
20 down. You see, if we had our normal leakage
21 rate that we had before we discovered the problem,
22 we could have continued to operate. But they
23 cranked down on the limit as a safety precaution
24 to add more conservatism.
25

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COMMISSIONER SHANNON: You mean the
NRC?

WITNESS SYLVIA: The NRC, yes, sir.
Any leakage will shut you down.

CHAIRMAN BRADSHAW: Well, now let me --

WITNESS SYLVIA: We have -- we had
checks to make sure that all the tubes in the
program -- or, we thought we had checks to make
sure that all the tubes in the program were
checked. And our checks consisted of taking
the tube maps which identifies all the tubes
to be inspected and, then, taking maps that
show all the tubes that pass the six-fifty,
compare that map with the ones we had to
inspect, and make sure all of them were in-
spected with the six-fifty, and we would, then,
take the maps for those that did not pass the
six-fifty, we would look at maps back here in
Richmond to see that all the ones that didn't
pass the six-fifty were inspected with a six-
ten, then, we would take the maps to show --
to see that all of them that didn't pass the
six-ten were inspected with the five-forty.

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We thought that would be the best way to check against missing a tube from the program. I feel that recording data that doesn't exist was just an unlikely way to make a mistake.

And we, ahead of time, did not think of -- did not think that that was a likely way.

BY MR. BRASFIELD: (Continuing)

Q Do you have checks for that now?

A Yes, sir, we do. We have two different ways of checking.

CHAIRMAN BRADSHAW: Mr. Sylvia, let me get something straight. This outage was in November.

WITNESS SYLVIA: Right.

CHAIRMAN BRADSHAW: And you had inspected it in September?

WITNESS SYLVIA: Yes, sir.

CHAIRMAN BRADSHAW: Just a couple of months before?

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WITNESS SYLVIA: Yes, sir.

CHAIRMAN BRADSHAW: And the previous inspection was the March inspection of the same year, the preceding March?

WITNESS SYLVIA: Yes, sir.

CHAIRMAN BRADSHAW: And this particular tube in March was one you were put on notice about that didn't pass what size test?

WITNESS SYLVIA: We weren't put on notice but we -- in March the tube passed the -- would not pass a six-fifty probe.

CHAIRMAN BRADSHAW: That's what I mean. In March it did not pass a six-fifty.

WITNESS SYLVIA: But it did pass a six-ten. So in March it wasn't required to be plugged by a plugging criteria.

CHAIRMAN BRADSHAW: But the March test of this particular tube pointed it out as one for you to inspect in September?

WITNESS SYLVIA: Well, the program itself, a strain profile, pointed it out as one to be inspected in September. It was also -- the strain profile in March showed that

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it was one to be inspected, too.

CHAIRMAN BRADSHAW: Okay. I'm just moving up in time, though, from March to September. In September it was on -- in the area to be probed again because of the March test.

WITNESS SYLVIA: Yes, sir. That's correct.

CHAIRMAN BRADSHAW: And your operator did not test it? They gave this interpreter no data for that particular tube?

WITNESS SYLVIA: That's right. This was one of the tubes that they missed. And missing tubes is not at all unusual. We count on the interpreter to identify which ones are missed.

CHAIRMAN BRADSHAW: But he interpreted without any data in front of him?

WITNESS SYLVIA: Yes, sir. And we didn't have a check against that. We -- our checks show that -- we checked to see that we had data on each tube in the program and we --

CHAIRMAN BRADSHAW: When you went in

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in September, how many tubes were you supposed --
how many tubes had you planned to check in
September?

WITNESS SYLVIA: A little over six
thousand. I don't recall.

CHAIRMAN BRADSHAW: A little over
six thousand.

COMMISSIONER SHANNON: I believe you
testified before six thousand a hundred forty-
four.

CHAIRMAN BRADSHAW: And did you in
fact test that many?

WITNESS SYLVIA: Yes, sir.

CHAIRMAN BRADSHAW: And this --

WITNESS SYLVIA: All except for one.

CHAIRMAN BRADSHAW: All except for
one?

WITNESS SYLVIA: Right. And let me
clarify what you were getting at. I think you
got it, but let me make sure.

This particular tube that leaked, the
September data that the interpreter recorded showed
that it passed the six-fifty, but in going back

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and looking at the March data it did not pass the six-fifty and that's how we found we probably missed it.

CHAIRMAN BRADSHAW: Well, then, he interpreted it wrong in September, didn't he?

WITNESS SYLVIA: Exactly right. That's how we identified it.

COMMISSIONER SHANNON: In the past it passed the six-ten probe in March, you say?

WITNESS SYLVIA: Right. Therefore, it wasn't plugged.

COMMISSIONER SHANNON: Then, he inadvertently put down it had passed the six-fifty probe in September? That was the subsequent check to show that there was this disparity that would cause you to --

WITNESS SYLVIA: Right. That's right. And in our original check and balance program, as I've said before, assured us that we had inspected it and had the data on each tube in the program, but it did not check against recording data that did not exist.

CHAIRMAN BRADSHAW: Right.

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WITNESS SYLVIA: We never thought that likely that anybody would make a mistake.

CHAIRMAN BRADSHAW: The biggest puzzle to me is how he could make a judgment on something without the data. I could see him missing it.

WITNESS SYLVIA: Well, we wondered about that, too, and we asked him. And he said in this particular area they were all passing the six-fifty, it was getting late in the day, and he was just going fast, trying to get his job done because -- and he made a mistake.

COMMISSIONER SHANNON: Is the interpreter an independent contractor?

WITNESS SYLVIA: Yes, sir.

COMMISSIONER SHANNON: For whom does he work?

WITNESS SYLVIA: ConAm is a contractor that comes from Zetex. That's in California.

COMMISSIONER SHANNON: How do you spell that?

WITNESS SYLVIA: Z-e-t-e-x.

CHAIRMAN BRADSHAW: What do ya'll pay him

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to come down here and interpret these charts?

Do you have any idea?

WITNESS SYLVIA: I don't have any
idea.

CHAIRMAN BRADSHAW: Do you know, Mr.
Brasfield?

MR. BRASFIELD: I have no idea.

CHAIRMAN BRADSHAW: Did you pay him
on this occasion?

WITNESS SYLVIA: Yes, sir. He has
done an excellent job. He has saved us just a
tremendous amount of time.

CHAIRMAN BRADSHAW: But if he had
done a little bit better job, it would have
been a little bit better.

WITNESS SYLVIA: Well, I'm tickled
to death that he did as well as he has. As a
matter of fact, that's what I said about this
whole program.

CHAIRMAN BRADSHAW: I understand that,
but seventy-five percent, that's good if the
average is sixty-five, but eighty is even better,
isn't it?

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WITNESS SYLVIA: Well, we check one hundred twenty-five thousand tubes and when I get through with the rest of this program, you will see all the ways that -- likely ways you can make a mistake. To me, that we've only missed that one is almost a miracle.

CHAIRMAN BRADSHAW: Okay. Go ahead.

WITNESS SYLVIA: Okay. What I would like to discuss now are some aspects of the program which make it difficult to -- for us to implement -- to make us believe or not expect for it to be an absolutely error-free program.

BY MR. BRASFIELD: (Continuing)

Q Is this Slide 12?

COMMISSIONER SHANNON: Right.

WITNESS SYLVIA: This is another slide of the worker going up into the lower part of the steam generator and many of these items that I had planned to mention I have already mentioned, but one key thing is that the radiation levels

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up in the steam generator at times limits the stay time to about three minutes. So, to do a simple task, put some tubes in, to just count where a tube belongs, and so forth, requires a turnover of people just to perform a simple little task. Another problem associated with this program is the temperature up in the channel head up under the tube sheets where they work is about one hundred and forty degrees at times.

And they've got these three suits of clothes and the plastic coverall that makes working conditions extremely difficult. A hundred and forty degrees is a temperature where you can hardly touch anything.

CHAIRMAN BRADSHAW: Do they ever wear air-conditioned suits?

WITNESS SYLVIA: We tried to use those, but if we added that to what this guy has already got on, I don't think he would be able to move.

CHAIRMAN BRADSHAW: Because the temperature on the average in a stock car on

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a hot day is a hundred -- the temperate in an average stock car during a race -- some of them have air condition. I just wondered --

WITNESS SYLVIA: Right. We've wondered -- we've tried to experiment with everyone that we have known was on the market. We tried to take advantage of those suits, and we haven't been able to get one that allows a person to move around and work.

The workers feel like they really can't do anything with them on. But we are still pursuing that.

We have people that said they would try to design what we needed, but so far no one has come up with anything.

CHAIRMAN BRADSHAW: This is a collateral issue, it doesn't have anything to do with this, but how much do you have to pay the employees an hour to go inside? What does the average worker make going inside?

WITNESS SYLVIA: The average worker, roughly ten dollars an hour. Because of the high temperatures, we have a lot of equipment

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failures to these probes, won't operate at the high temperature and moisture that's in there. So, it's a real struggle to get through the Eddy Current program.

We wear out and ruin many of the probes. You get halfway through a tube and the probe fails. You've got to figure out -- make sure you get it back into the right one and make sure you've got your data right on that tube. So, that adds to the complex of the problem also.

I mentioned before where he has to go through in order to do the work is only sixteen inches. It's very difficult to get in and out.

BY MR. BRASFIELD: (Continuing)

Q That's Number 13?

A Right. This is Number 13. This is the worker halfway into the man way looking up at the tube sheet, but he has to go all the way up in there in order to be able to reach the tube sheet.

Q Number 14.

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A Number 14. We build steps around the bottom of this area and put down exhaust fans to control the radioactivity, keep any other part of the containment from being contaminated.

Q Number 15.

A 15. Another problem, as I mentioned before, that makes it extremely difficult, or makes it likely to make errors, is all these holes are identified by row and column, three thousand three hundred and eighty-eight tubes, and you have to count columns to work on the one you want to work on, whether it be plugging or whether it be inspecting.

So, what we try to use is templates, or remote T.V. cameras, and so forth, to make sure we are in the tube that we think we are in.

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1 3-1 Sylvia - Direct 75
2 We mark the template and put that
3 on top of that. But when it comes to plugging, you
4 can't use a template, so once we identify the tubes
5 to be plugged, we have to get a worker to go in and
6 count, and he marks the tube to be plugged with white
7 paint, and then later another worker takes in --

8 COMMISSIONER BRADSHAW: How much space
9 between the holes?

10 WITNESS SYLVIA: Less than half an inch.
11 A third of an inch. This is mostly all holes.

12 COMMISSIONER BRADSHAW: Like a piece
13 of screen wire, isn't it?

14 WITNESS SYLVIA: Right. Again, after
15 we plugged the tubes, we then take photographs
16 to find out if we have plugged the tubes.
17 We take photographs of this -- of the tube sheet --
18 to find out if we plugged the tubes that we
19 were supposed to plug, and we have never done
20 any plugging where we didn't make errors. The
21 photographs most always show that we missed some
22 tube that we should have plugged, or plugged some
23 that should not have been plugged.

24 I have some examples of these photographs.

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They are very difficult to read. It is hard to tell whether there is a plug in there or not.

BY MR. BRASFIELD (Continuing)

Q What do you do when you discover errors.

A We go back in and plug them. So we always have errors in the program, we always have errors in the plugging. And through checks and balances we have been able to identify which ones we missed, and we have gone back and plugged them before we put the unit back on line, except for this one.

And we missed that because we recorded data that we did not have.

Another thing I might mention, on this particular outage, I believe we shut down on November the 18th, -- on November the 15th we had identified a pressurized valve as leaking. And while we were down -- when you have a leak on a valve, it doesn't get better. It just gets worse. So in all probability in a few days we were going to have to shut down anyway to fix this valve.

COMMISSIONER SHANNON: When was this?

What date was that?

WITNESS SYLVIA: On the 15th we had

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a maintenance report.

COMMISSIONER SHANNON: 15th of
November?

WITNESS SYLVIA: That identified
a valve leaking. And to work on this valve
dictated the duration of the outage. That
is why the outage was nine and a half days,
or nine point six days.

We identified in plugging this tube
that was supposed to be plugged would only
have taken about four and a half days, and
we have our critical path schedule, computer
print-outs for the outage.

COMMISSIONER BRADSHAW: Where is this
valve, up on the inside?

WITNESS SYLVIA: The valve is in the
~~containment~~
~~curtailment~~, inside the biological seal wall.
You have to come to a cold shut-down condition,
and you have to drain the primary system to
repair this particular valve.

In summary I would say the program has
gone extremely well. It has been a lot more
successful than we ever thought it would be when

3-4

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1
2 we first started into it.

3 COMMISSIONER SHANNON: To your knowledge,
4 have any of the other sister utilities, Florida
5 or elsewhere, that has the same type of reactor
6 that you have at Surry, had a similar experience
7 with missed tubes?

8 WITNESS SYLVIA: They have missed tubes.
9 They didn't detonate some plugs. The plugs came
10 loose.

11 COMMISSIONER SHANNON: Did they shut down
12 as a result of that?

13 WITNESS SYLVIA: Yes, sir; they had
14 outage time that resulted from this program
15 not being perfect.

16 COMMISSIONER SHANNON: Specifically, which
17 utilities?

18 WITNESS SYLVIA: Florida Power and Light.
19 I followed them more closely than anyone else,
20 because our situation is more similar to theirs
21 than anyone else's.

22 BY MR. BRASFIELD (Continuing)

23 Q Mr. Sylvia, you indicated, I think, that
24 you had eleven such inspections, and that this was the

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second one you had?

A Yes, sir. This was the second of the six months.

Q How -- what has your record been since that shut down in November of 1977?

A Essentially, perfect. We run six months except when we purposely shut down. Shut down for some other reason before the six months period was up, except for one time -- this was about the middle of December -- we shut down after about five months, and in a few days we planned to shut that unit down anyway to do an inspection.

And the purpose of doing that inspection was to get another inspection over with so we could have a six months run time while we were replacing the steam generation on Surry Unit 2. According to my records, that is what I have. We didn't run six months at a time, but I don't believe this shut us down. The tube leaks shut us down short of the six months one other time besides this one.

Q That was just a --

A Since this particular one.

Q That was just a couple of days earlier?

A Yes.

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1
2 COMMISSIONER SHANNON: Is it your
3 testimony, Mr. Sylvia, that if it had just
4 been a missed tube, plugging alone, you would
5 have been shut down how long?

6 WITNESS SYLVIA: Like four and a half
7 days.

8 COMMISSIONER SHANNON: Whereas you
9 were shut down what, nine -- ?

10 WITNESS SYLVIA: Nine point six.

11 COMMISSIONER SHANNON: And the balance
12 was necessary to correct the valve situation?

13 WITNESS SYLVIA: Yes, sir. Actually,
14 the entire outage, the duration of the outage
15 was dictated by the work on the valve.

16
17 BY MR. BRASFIELD (Continuing)

18 Q Did you start work on the valve as soon
19 as you had the outage for the leak?

20 A Yes, sir; as soon as we could get the
21 plant into a condition to work on the valve, we began
22 to work on the valve.

23 Q Would you say that the program has
24 performed as well as it was designed to perform?

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A In my opinion, it has done better than I had expected it to.

MR. BRASFIELD: I believe that is all I have, Your Honor.

COMMISSIONER SHANNON: Anything further from any other parties? All right, if not, Mr. Harrison, you can cut the lights back on. Mr. Sylvia, thank you very much, and you may stand down, and Mr. Brasfield, do you want to make closing comment?

WITNESS STANDS ASIDE.

MR. BRASFIELD: Let me suggest that we identify the fifteen slides. We will provide prints of the slides, but identify them as BRS-11.

COMMISSIONER SHANNON: All right. The fifteen slides will be identified as Exhibit No. BRS-11. And you will furnish a description of those.

MR. BRASFIELD: That is right.

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1
2 MR. BRASFIELD: If the Commission will
3 indulge me, I would just like to try to put what
4 you heard today in perspective relative to what
5 Mr. Wittine testified to and what we think the
6 applicable standards ought to be.

7 Mr. Wittine testified on July 27th, and
8 on page 41 of the transcript, recommended, 'that
9 the Company should not be permitted to retain
10 the monies which it collected from its customers
11 for the net replacement energy costs associated
12 with the nine and a half days, November 1977,
13 forced outage at Surry Unit No. 2.'

14 He noted that the total replacement costs
15 on a system basis was four point seven million
16 dollars, and that the Virginia jurisdictional
17 portion of this would be around seventy percent
18 of that figure.

19 Now, Vepco disagrees strongly with this
20 recommendation. The basis for this recommendation
21 also appears on page 41 of the transcript, and
22 I am quoting, 'the Company cannot expect its
23 customers to bear the expenses associated with
24 the development of procedures and techniques

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1
2 designed to prevent the consequence of steam
3 generator tube leaks, and then have its customers
4 bear the consequences when the procedures are
5 not followed.'

6 Mr. Wittine concludes that the procedures
7 were not followed because the tube that was
8 scheduled to be probed was erroneously recorded
9 as having passed inspection, despite the absence
10 of the necessary supporting records.

11 We believe the evidence is that the
12 procedures were followed. Mr. Wittine's analysis
13 and his conclusion suggests that the probing of
14 steam generator tubes and the accurate recording
15 of the results is a relatively uncomplicated
16 procedure that will, in the absence of some
17 negligent error, always assure that the appropriate
18 tubes are tested.

19 Unfortunately, as Mr. Sylvia testimony
20 makes clear, this is not the case. The innovative
21 and unprecedented program of inspection and
22 plugging that Vepco developed was designed to give
23 the best information possible within a reasonable
24 time frame. It was never intended to be fool proof

3-10

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1 because to make it so would have necessitated
2 much longer outages of nuclear units.
3

4 COMMISSIONER SHANNON: Let me stop
5 you there. Did Vepco develop this program?

6 MR. BRASFIELD: Together with Westinghouse
7 and other utilities.

8 MR. SYLVIA: Primarily Westinghouse.

9 MR. BRASFIELD: Now, Mr. Sylvia testified
10 in detail as to some of the difficulties, there are thr
11 thousand, three hundred and eighty-eight tubes
12 in each steam generator. Each of these tubes
13 penetrates the tube sheet twice, once at each
14 end. So there are six thousand, seven hundred
15 and seventy-six openings that have a potential
16 to being checked; since there are three steam
17 generators in the unit, there are twenty thousand,
18 three hundred and twenty-eight openings all
19 together. Some of these must be probed several
20 times, with probes of different sizes, and over
21 the life span of this project about one hundred
22 and twenty-five thousand probe readings have
23 been taken.

24 During the September 1977 outage, the

1
2 Company had to inspect six thousand, one hundred
3 and forty-four tubes, many of which were probed
4 with three different probes.

5 COMMISSIONER BRADSHAW: Mr. Brasfield,
6 you are saying because of the numbers, it can't
7 be measured. Is that what you are saying?

8 MR. BRASFIELD: I am saying the numbers
9 and the time constraints and the physical
10 constraints all make this a process in which
11 there is a reasonable possibility of human error
12 on occasion.

13 And to expect the program to go for
14 eighteen months without any possibility of human
15 error, and penalize the Company in the one
16 proven instance of human error, is going too
17 far.

18 COMMISSIONER BRADSHAW: Well, suppose
19 your truck went up Broad Street three thousand,
20 three hundred and thirty-eight times, and didn't
21 have any accidents. And on the next trip it
22 ran over somebody. You don't think they wouldn't
23 be liable, do you?

24 MR. BRASFIELD: I don't think trucks have

3-12

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1
2 to operate under the same constraints that
3 this program has to operate under either.

4 And if you were probing these tubes one a day,
5 for three thousand three hundred and eighty-
6 eight days, I think the results would be different,
7 too,

8 This program was designed to achieve
9 a reasonable balance between the outage time for
10 the inspection process and the maximization of
11 capacity factor on the other hand. And we believe
12 that the results achieved have been very satisfactory,
13 and indeed, better than they were designed to be.
14

15 COMMISSIONER SHANNON: Does Zetex carry
16 any kind of insurance or protection in protecting
17 their interpreter?

18 MR. BRASFIELD: I have no idea.

19 COMMISSIONER SHANNON: Go ahead.

20 MR. BRASFIELD: I would guess they do
21 carry some kind of insurance.

22 COMMISSIONER BRADSHAW: You all don't
23 think there is any claim against Zetex?

24 MR. BRASFIELD: No. We think this man

3-13

has performed as Mr. Sylvia said, splendidly.

COMMISSIONER BRADSHAW: Well, he also stated that he made a judgment without any data. That he must have been tired or asleep, and just missed it. Would you call that following procedure?

MR. BRASFIELD: I think you have to look at the program as a whole, and not isolate a single segment of the program. You look at the program as a whole. We have achieved a remarkable result of reliability. If you carve out that segment, and you carve out that man's performance on that particular day, he made a mistake, and he admitted to that. We are suggesting that it is wrong to look at that in isolation. You have to look at the whole thing and recognize the difficulties and constraints that everybody is not aware of.

Mr. Sylvia has shown how difficult these inspections can be. Probing must be done in a radioactive area, in which at certain times

1 a man is allowed to stay for only three minutes
2 at a time. Thence, the operation must be done
3 by relay force. A large number of different
4 men, about a hundred for the total operation,
5 each of whom performs a portion of it within a
6 very small, brief period of time.

7 These men must be -- those men that
8 work on the inside must be dressed in protective
9 coveralls and wet suits, and operate in an area
10 where the humidity is high and the temperature
11 gets to a hundred and forty degrees.

12 The probing is done within the steam
13 generator itself, with a probing mechanism which
14 is specially designed for the job, and must be
15 operated from a remote location. It is very
16 difficult under these circumstances to keep
17 a precisely accurate record of which tube has been
18 probed.

19 In addition, the probing device cannot
20 reach all of the tubes that are required to be
21 probed, so those have to be done manually.

22 Considerable effort must be devoted to
23 trying to make certain that all of the tubes that
24

3-15

89

1
2 require probing have been probed, but because
3 of the different people involved, the difficulty
4 of identifying the tubes in question, and the
5 extraordinary, trying circumstances under which
6 the work must be done, the Company frequently has
7 to go back and check and recheck to be reasonably
8 certain that the proper coverage has been attained.

9 In addition, the plugging of the tubes
10 is performed, and the Company frequently has
11 to make return trips to plug tubes that were
12 missed because of the extraordinary difficulty
13 the persons doing the plugging have in identifying
14 the tubes to be plugged.

15 The strip chart and the oscilloscope
16 trace that ^{are} analyzed to determine whether a
17 tube needs to be plugged are not automatically
18 identified with that tube's specific number, nor
19 can that identification be made in any fool
20 proof way.

21 So it is quite possible that the
22 strip chart and oscilloscope trace will be wrongly
23 identified.

24 The analysis of these records must be

3-16

90

performed by a highly skilled interpreter,
furnished by a contractor. And there are only
a hand full of them in the country, and when they
are on a job for Vepco they work very long
hours.

1
2 Mr. Wittine says that the customers
3 should not pay when the procedures that have
4 been established were not followed. But in
5 this case, we submit that when viewed in its
6 entirety the procedures were followed.

7 The problem is that the procedures
8 are not, nor were they ever, expected to be
9 ~~fail~~ proof. In this one case they proved
10 deficient. Even with their deficiencies, the
11 procedures have proved enormously successful,
12 much more so than the Company had expected
13 when they were developed. In all of 1978,
14 there was only a single outage resulting from
15 tube leak in the Surry steam generators.

16 And that, as Mr. Sylvia just said,
17 was in December and it came at a time when the
18 unit was about to be taken out of service for
19 inspection anyway.

20 Mr. Sylvia indicated that it was
21 truly remarkable the testing program has worked
22 as well as it has. The Company expected that
23 even with the testing procedures that there
24 would have been more tube failures.
25

1
2 In short, while acknowledging that
3 a tube was missing that should have been
4 inspected and plugged, we submit it is a
5 program that was developed by VEPCO and
6 Westinghouse and paid for by VEPCO's
7 customers and has done an exceptional job
8 of preventing forced outages to the extent
9 that substantially exceeds what was expected
10 of it or even hoped for.

11 Under the circumstances, it would
12 be a gross injustice, and we believe without
13 legal basis, to penalize VEPCO for an outage
14 that was well within the margin of error ex-
15 pected for the program. Thus, our strongly
16 held view is that this is not a case where
17 costs have been increased by reason of the
18 failure of Company personnel to administer a
19 cost saving program properly. It is rather
20 merely an instance, reasonable in light of all
21 the circumstances in which the program fell
22 short of perfection.

23 When the performance of the program
24 over time is considered, we can properly say
25

1
2 that the overall result has been to avoid
3 increases in cost to a greater extent than
4 was reasonably expected.

5 But if the Commission should
6 conclude that the November, 1977, outage was
7 the result of Company error, we ask that the
8 Commission consider the reasonableness of
9 that error under all of the circumstances and
10 the implications of requiring the Company to
11 measure up to a standard of perfection that
12 does not tolerate reasonable human error.
13 Obviously, human error exists in every
14 business and imposes costs on every business,
15 and where those costs do not exceed a
16 reasonable level they are passed onto con-
17 sumers.

18 This question has been considered
19 by the Public Utilities Commission of Hawaii
20 in a case, re: Kohala Ditch Company, 1922 PUR 1.
21 In that case, the Commission, in considering
22 an excessive investment that had been made as
23 a result of error by the Company made several
24 statements that we think are relevant here.
25

1 And I'm quoting: It must be at all times borne
2 in mind that in the consideration of public
3 utility affairs that a public utility business
4 is just as any other business, an enterprise
5 subject to human management, carrying with
6 such management the resulting fallibility
7 regarding the mistakes and errors in business
8 judgment. Courts and commissions too often
9 take the position of examining the entire
10 situation from the standpoint of the date of
11 the examination and in the light of present
12 knowledge as to past happenings, wisely,
13 learnedly and sometimes costly criticizing
14 and penalizing for honest mistakes in judgment
15 that under the circumstances would have perhaps
16 been made with the fullest great facility by
17 the court or the commission had the court or
18 commission been in the shoes of management,
19 and looking at the enterprise from the stand-
20 point of the present and future as distinguished
21 from the advantageous standpoint of looking
22 backward with full opportunity to examine the
23 entire transaction in the light of things as
24
25

1
2 they actually happened, and not as they might
3 reasonably be expected to transpire.

4 The homely maxim that hindsight is
5 better than foresight applies to public utilities
6 as well as to other matters of business concern.
7 We do not wish to be understood as holding or
8 implying that the consumers of a public utility
9 should be penalized for gross mistakes and
10 errors in judgment on the part of organizers
11 and managers of utilities simply because they
12 have been made honestly and in the exercise
13 of their best judgment. But we do believe and
14 we do hold that a reasonable latitude should
15 be allowed by the Commission for honest,
16 reasonable mistakes and honest, reasonable
17 errors of judgement, not necessarily to the
18 extent of enabling the utility to recoup for
19 its mistakes at the expense of its consumers,
20 but certainly likewise not to the extent of
21 penalizing the utility to the uttermost limits
22 of every mistake or error in judgment.

23 Now, I realize this case is talking
24 about errors in business judgment and no one
25

1
2 is asserting that here. But I believe the
3 language used is equally applicable to what
4 might be described as operating errors.

5 I reiterate that Company does not
6 consider this incident to have been an
7 operating error; it was a natural consequence
8 of substantial difficulty inherent in the
9 probing and plugging of the program.

10 I am almost through. I will just
11 quote briefly further from this Hawaii decision.

12 To go, then, to the extent of holding
13 that a public utility should be penalized to
14 the uttermost for every mistake in judgment
15 reasonably made under all circumstances, and
16 to make the fullest extent of such mistake --
17 and to the fullest extent of such mistake is,
18 in our opinion, neither justice nor sound public
19 policy. If utilities are ever placed on a
20 basis where the return is limited to a fair
21 return under the most skillful management subject
22 to further deduction by way of penalization to
23 the uttermost farthing for every error in judg-
24 ment, the result will necessarily be the rendering
25

1
2 so unattractive for public utility investments
3 that the further development and expansion of
4 public utilities will, from a business stand-
5 point, necessarily become practically impossible.

6 On the whole, we submit that VEPCO
7 has dealt not only responsibly but creatively
8 and successfully with the enormous difficulties
9 resulting from its steam generator problems at
10 Surry and that its Virginia customers have
11 benefited substantially as a result.

12 Accordingly, we submit that it would
13 be entirely inappropriate to require the
14 Company to refund the amounts collected to
15 recover the replacement energy costs during
16 the November, 1977, outage.

17 COMMISSIONER SHANNON: Mr. Ivey.

18 MR. IVEY: The Staff would like to
19 reserve its rights to make a closing argument
20 and will notify the Commission if it desires
21 to do so.

22 COMMISSIONER SHANNON: All right.

23 MR. PAGE: That is the Attorney
24 General's position also.
25

1
2 COMMISSIONER SHANNON: All right.

3 We will continue this matter generally until
4 we hear from the Staff and Attorney General.
5

6 NOTE: The hearing is adjourned at
7 3:48 o'clock P.M. on June 25, 1979.
8

9 * * * * *

10 HEARING ADJOURNED
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Ex. JRW-1

180

OUTAGES FOR SURRY UNIT NO. 2
JANUARY 1, 1976 THROUGH FEBRUARY 28, 1977

<u>DATE</u>	<u>TYPE</u> F-Forced S-Scheduled	<u>DURATION (HRS)</u>	<u>REASON</u>
1-17-76	F	203.1	Steam Generator tube leak
2-3-76	F	200.6	Steam Generator tube leak
3-4-76	F	133.5	Steam Generator tube leak
3-10-76	F	3.4	Loop flow instrumentation malfunction
4-22-76	S	1172.5	Refueling
6-9-76	F	2.4	Feed Control Sensitivity during startup
6-9-76	F	1.8	Feed Control Sensitivity during startup
7-30-76	F	92.9	Valve leakage in primary
9-15-76	F	1835.2	Steam Generator tube leak
12-1-76	F	451.3	Steam Generator tube leak and GRDM replacement
12-22-76	F	90.9	Steam Generator tube leak
12-26-76	F	2.5	Operator error on startup
12-26-76	F	1.3	Feed Control Sensitivity on startup
1-17-77	F	5.3	Ice buildup on intake screen
2-10-77	F	439.3	Steam Generator tube leak
TOTAL OUTAGE HOURS		4,636.0	

Exhibit JRW-2 is the letter of W. L. Proffitt to the State Corporation Commission dated March 31, 1978, together with enclosures, that appears at pages 1-14 of this Appendix.

Exhibit JRW-2 also consisted of a two-page letter from Richard D. Rogers to Richard D. Gary, and those pages follow.

COMMONWEALTH OF VIRGINIA
STATE CORPORATION COMMISSION
RICHMOND

March 20, 1978

Richard Gary, Esquire
Hunton & Williams
707 E. Main Street
Richmond, Virginia 23219

Re: Quarterly Fuel Adjustment Clause Hearing

Dear Mr. Gary:

The Commission agreed that Vepco should file a report on the forced outage of Surry Unit No. 2 from November 18, 1977 through November 27, 1977. Company will file its report by March 31, 1978, and the Staff will have until April 10, 1978, to make any recommendations to the Commission. The information requested by the Staff and agreed to by the Commission is:

- a. An explanation of Vepco's Surry Units steam generator inspection program in effect prior to March, 1977, including, among other things, monitoring techniques and criteria for plugging dented tubes.
- b. An explanation of any changes in inspection program techniques or criteria between March 1, 1977, and September 30, 1977.
- c. Explain why the tube at location R5C26 in steam generator 2A was not inspected during the inspection/refueling shutdown in September, 1977.
- d. The dollar amount of the net replacement energy costs associated with the forced outage of Surry Unit No. 2 from November 18, 1977 through November 27, 1977. Supply the supporting data for the calculations.

March 20, 1978
Page 2

- e. An explanation of measures taken, if any, subsequent to November 27, 1977, to minimize the possibility of similar occurrences in the future.

I realize this outline is sketchy. Should you have questions contact either me or James Wittine.

Sincerely,

Richard D. Rogers, Jr.
General Counsel

RDRjr/mt

cc: James R. Wittine

CASE	14383
ENCL	10-3
FILED	JUL 27 1977
<i>James R. Whitte</i> <i>J. R. Harrison</i>	

180-D

ATTACHMENT NO. 3

Is Vepco's letter to NRC dated November 22, 1977 describing the leak in steam generator 2A, the findings of the subsequent inspection and the corrective actions and the request that operation of Surry Unit No. 2 be permitted.

Some of the findings included in this letter are

- o The only tube leaking was R5C26
- o That tube R5C26 did not pass a 0.650 inch probe in March, 1977 and now does not pass a 0.540 inch probe
- o That tube R5C26 was scheduled to be inspected in September, 1977 but was not.

November 22, 1977

Ex. TRW-3

see 11-23-77 nph

181

Mr. Edison G. Case, Acting Director
Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20535

Serial No. 528
FORM/TAP:dyt
Docket Nos. 50-280
50-281

Attention: Mr. Robert W. Reid, Chief
Operating Reactors Branch 4

License Nos. DPA-32
DPA-37

Dear Mr. Case:

On November 13, 1977, Perry Unit No. 2 was shutdown due to a primary to secondary leak slightly greater than 0.3 gpm in "A" steam generator. After shutdown "B" and "C" steam generators were hydrotested and no tube leakage was found. The only tube leaking in "A" steam generator was R5-C26. This tube did not pass a 0.650 inch probe in March of 1977 and is now in the region of estimated margin of greater than 15% and does not pass a 0.340 probe. A review of the records from the September 1977 outage found this tube was scheduled to be inspected but was not. To assure that additional tubes were not missed, the following reviews of past data were made:

- 1) For all tubes which did not pass the 0.650 probe during the March 1977 inspection, the data was reviewed to assure that they were inspected in September 1977. This consisted of 190 tubes in A, 123 tubes in B, and 108 tubes in C. The results of this review showed that the Row 2 Col. 16 tube of A was the only scheduled tube not inspected in September.
- 2) A sampling of data sheets versus strip chart results was done to monitor the accuracy of the data sheets. This consisted of 13% of the tubes inspected in A, 12% in B and 13% in C. There were no differences found between the data sheets and the strip chart records.

The results of the above reviews give a high assurance that no further scheduled tubes were missed. To improve the future accuracy of our steam generator inspection program: any tube which does not pass a 0.650 probe will be probed at all future scheduled inspections; the tubes which are part of the gauging program will be re-checked at the end of the program by comparing strip charts with data sheets.

During the shutdown, the following tubes surrounding the leakers were gauged and all passed a 0.650 probe:

182

Row 6	Col. 16
7	26
4	27
3	27
6	27
7	27
4	28
5	28
6	28
7	28

The following tubes in "A" steam generator were plugged in accordance with the criteria stated in our letter of September 20, 1977:

Row 5 Col. 16 - leaking and would not pass a G.340 probe

Row 6,7 Col. 26 - two tubes beyond any tube in col. 12-79 which does not pass a G.340 probe

Row 4,5,6 Col. 27 - tubes surrounding a leak

The following tubes were plugged in "C" steam generator since they were missed during the September 1977 outage:

Row 18	Col. 73
34	73
33	73
33	77

We request that operation of Ferry Unit No. 2 be permitted in accordance with the order of October 8, 1977. The health or safety of the public will not be adversely affected as the safety evaluation for the order remains valid.

Very truly yours,

(C. M. Stallings)

C. M. Stallings
Vice President-Power Supply
and Production Operations

cc: Mr. James P. O'Reilly

bc: Mr. W. L. Proffitt
Mr. C. H. Stallings)
Mr. E. R. Sylvia)1
Mr. E. A. Baum ✓
Mr. T. L. Eason
Mr. W. F. Bennett
Mr. J. L. Perkins
Mr. T. A. Peoples



NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Attachment No. IV

November 23, 1977

Ex. JRW - 4

183

see #528

Docket No.: 50-281

Virginia Electric & Power Company
ATTN: Mr. W. L. Proffitt
Senior Vice President - Power
P. O. Box 26666
Richmond, Virginia 23261

NOTED NOV 28 1977 E.A. BARNUM
NOTED NOV 28 1977 W.L.P.

COPIES: BAVU
STOUJ
SYLW
DOLM
BAVCC
DLM
PETUL
MGM
PEZIS

No reply necessary

Gentlemen:

This letter is in regard to your letter of November 22, 1977, requesting that Surry Unit No. 2 be allowed to operate for the remainder of the six-month period of the NRC Order dated October 8, 1977. Your November 22 letter described the leak in steam generator 2A causing the shutdown, the findings of the subsequent inspection, and the corrective actions. The results of our review of your request are contained in the enclosed Safety Evaluation.

We hereby approve return to operation of Surry Unit No. 2 in accordance with the provisions of the October 8, 1977 NRC Order.

Sincerely,

Karl R. Goller

Karl R. Goller, Assistant Director
for Operating Reactors
Division of Operating Reactors

Enclosure:
Safety Evaluation

cc w/enclosure: See next page



JRW:4
(contin)

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING ORDER FOR MODIFICATION OF LICENSE

VIRGINIA ELECTRIC AND POWER COMPANY

184

SURRY POWER STATION UNIT NO. 2

DOCKET NO. 50-281

INTRODUCTION

By Order for Modification of License, dated October 8, 1977, Surry Unit 2 was given approval to return to power for six equivalent months of operation following completion of the steam generator tube inspection program and necessary plugging. Subsequent to return to power a primary to secondary leak developed in steam generator 2A and the unit was shutdown on November 18, 1977 after achieving a leak rate of slightly greater than 0.3 gpm.

The licensee, Virginia Electric and Power Company (VEPCO), found that the leaking tube was at location R5C26 in steam generator 2A. This tube and ten (10) tubes surrounding it were then gauged to discern the degree of denting. The leaking tube did not allow passage of a 0.540" eddy current probe. All other tubes passed a 0.650" probe.

Since the leaking tube was included in the September, 1977 inspection program and no indication of denting in this tube had been indicated then, VEPCO went back and re-examined the September and previous March inspection data more carefully. It was discovered that the March, 1977 inspection results had indicated that this tube would not pass a 0.650" probe at that time. Upon reviewing the records from the September, 1977 inspection, VEPCO found that this tube had, in fact, not been inspected during the September program. Closer re-examination of previous tube inspection results by the licensee revealed a number of potential inconsistencies between the March and September data.

VEPCO then made a thorough evaluation of the potential inconsistencies that had been uncovered. To assure that additional tubes were not missed in the September inspection, the following review of past data was made by the licensee:

1. For all tubes which did not allow passage of the 0.650" probe during the March, 1977 inspection, the data were reviewed to assure that they were inspected in September, 1977. This consisted of 190 tubes in generator 2A, 123 tubes in 2B and 108 tubes in 2C. The results of this review showed that the leaking tube, located at R5C26 of generator 2A, was the only tube that should have been inspected in September, but was not.
2. A sampling of data sheets versus strip chart results was done to monitor the accuracy of the data sheets. This consisted of 15% of the tubes inspected in generator 2A, 12% in 2B and 15% in 2C. There were no differences found between the data sheets and the strip chart records.

In order to improve the accuracy of all future steam generator inspection programs, VEPCO has stated that: (1) any tube which does not pass a 0.650" probe will be probed at all future scheduled inspections and, (2) the tubes which are part of the gauging program will be re-checked at the end of the program by comparing strip charts with data sheets. 185

Steam generators 2B and 2C were subsequently hydrotested and no tube leakage was found.

In conformance with the licensee's current plugging criteria, approved by the NRC in the October 8, 1977 Safety Evaluation, VEPCO has plugged, in addition to the leaker, tubes at locations R5, R6C26 and R4, R5, R6C27. Additionally, in accordance with operational limitation 4. of the October 8, 1977 Safety Evaluation, tubes at locations R33C75, C77, R34C73 and R38C73 in generator 2C were plugged.

EVALUATION

The NRC staff has reviewed the information submitted by the licensee and concluded the following:

1. The tube, R5C26, that leaked and caused the November 18, 1977, shutdown was a tube that should have been previously plugged but was missed, thus the cause of the leakage is understood.
2. The results of the extensive reviews performed by the licensee of the March, 1977 and September, 1977 tube inspection data give a reasonable assurance that no further scheduled-to-be-inspected tubes were missed in the September inspection program.
3. The evaluation and conclusions of the October 8, 1977 Safety Evaluation are still valid.

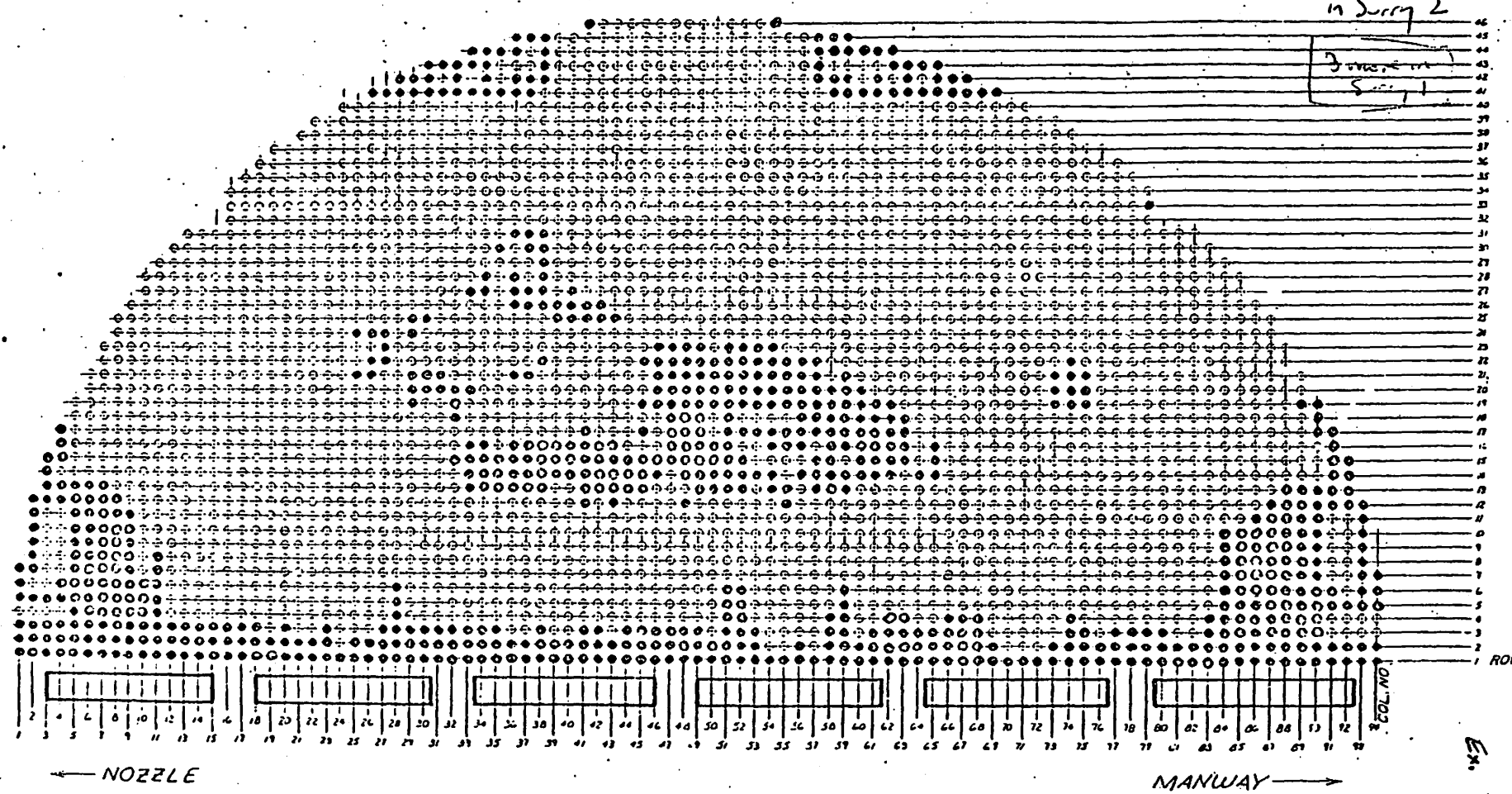
CONCLUSION

We have concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations and in accordance with the Order of October 8, 1977, and will not be inimical to the common defense and security or to the health and safety of the public.

Dated: November 23, 1977

3 Steam generators
in Series 2

3 rows in
Series 1



DATE 1-25-77
WSP: JAMES
NUMERING SYS: AS
COMMENTS:
ORIGINAL ISSUE

Tube Sheet MMS

Eddy Current Prof, and Sheet WSP

Attachment No. VI
TOP. SECT.
187 Ex. JRW-6
+ 7

EDDY CURRENT TEST SEQUENCE

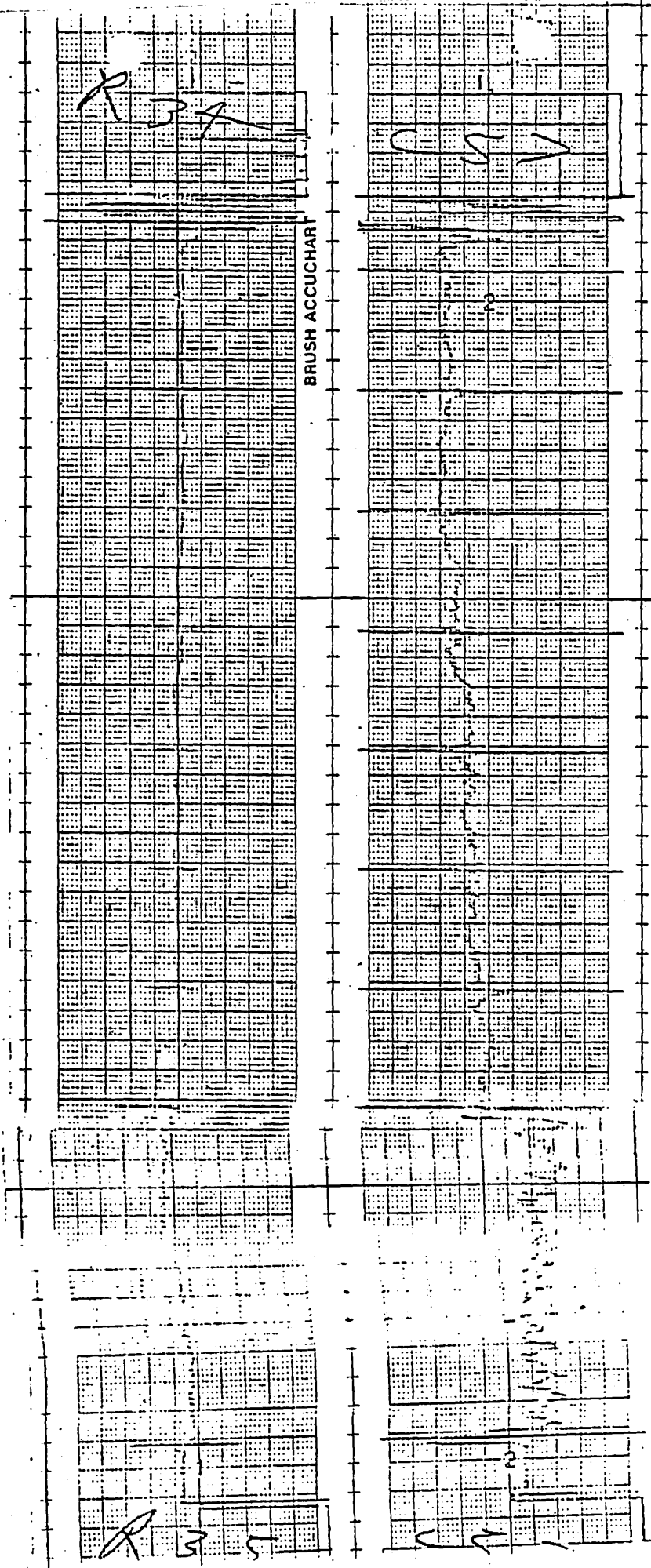
STATION: SURRU UNIT II A DATE _____
HEAT EXCHANGER _____ TEST FREQ. 400 KHz

ROW	COLUMN	INSP. HT.	OPERATOR	REMARKS
43	24			skipped
44	34			skipped
44	35			skipped
43	35			
42	35			
41	35			skipped
40	35			
39	35			
38	35			
37	35			
37	36			
38	36			
39	36			
40	36			
41	36			skipped
42	36			
43	36			
44	36			skipped
45	36			skipped
45	37			skipped
44	37			
43	37			
42	37			skipped
				skipped

Strip Chart

Ex. JRW-7

188



189. GSO. JRW
GR. 8

ROW	COLUMN	INSP. HT.	OPERATOR	REMARKS
13	24	+7C		A.K.
12		+7C		OK
11		+7C		OK
10		+7C		OK
9		+7C		OK
8		+7C		OK
7		+7C		OK
6		+7C		OK
5		+7C		OK
4				Plugged
3				Plugged
2				Plugged
1				Plugged
10				Plugged
9				Plugged
8		+7C		OK
7		+7C		OK
6		+7C		OK
5		+7C		OK
4		+7C		OK
3		+7C		OK
2		+7C		OK
1		+7C		OK

COMMONWEALTH OF VIRGINIA
STATE CORPORATION COMMISSION
RICHMOND

JRW. 2xh. 9

REPORT OF THE
DIVISION OF ENERGY REGULATION
ON
SURRY UNIT No. 2

James R. Wittine
Director

EXECUTIVE SUMMARYFORWARD

Vepco has incurred substantial expenses in attempting to define and arrest the tube denting phenomenon. This is witnessed by at least two facts: first, Vepco in its March 18, 1978 response to the SCC states; "...complex and expensive investigations were undertaken." Secondly, Vepco in its most recent application for a permanent increase in rates, Case No. 19960, has requested that it be able to recover approximately \$920,000 from its Virginia jurisdictional customers for a \$1.3 million total electric system expense incurred in 1977 for work done under a User Group Agreement. The purpose of this Agreement is to seek means for extending the life of the steam generators for as long as possible until a solution to the problem of dented steam generator tubes may be accomplished.

On November 18, 1977 Surry Unit No. 2 was brought to a cold shutdown condition as a result of primary coolant leakage from the primary system to the secondary system which exceeded allowable limits. The Unit remained in this mode for a period of approximately 9½ days.

Upon inspection of the steam generators after the November 18, 1977 shutdown, it was determined that the cause of the unacceptable leakage rate was a cracked tube (R5C26) in steam generator 2A. Further investigation of this matter revealed that the tube (R5C26) which cracked and caused the leakage, was a tube that was identified and scheduled to be inspected prior to the planned September, 1977 outage for refueling and steam generator inspection.

Tube R5C26 did not allow passage of a 0.540 inch eddy current probe when inspected after the November 18, 1977 forced outage. Had this

same datum been revealed during the planned September, 1977 outage, tube R5C26 would have been plugged at that time.

During the 9½ day (November 18-27, 1978) forced outage of Surry Unit No. 2 its unavailability necessitated the increased reliance on and use of fossil fuel fired generation and purchased power to replace the energy which would have been produced by Surry Unit No. 2 had it not been forced out of service. The additional system fuel expense (net replacement energy costs) has been estimated to be \$4,696,766. These additional expenses have been flowed through the Fuel Adjustment Clause and have, therefore, been incurred by the Company's customers.

CONCLUSION

The Commission has an obligation to assure that the charges rendered for service are reasonable and just. In a review of this particular forced outage of Surry Unit No. 2 (November 18-27, 1977) no appraisal of Vepco's "reasonable business judgment" needs to be made by this Commission. The November, 1977 forced outage did not occur because of the lack of a plan, procedures, skill or knowledge. It did not involve a misunderstanding or misconception. At best, it was the lack of attention and the actual recordation of false test results.

The actual physical probing of a particular tube requires no judgment. Tube R5C26 was identified and listed as a tube which required inspection in September, 1977. Although the actual raw data (strip chart and oscilloscope trace) requires judgment in its interpretation, the recordation of this interpretation requires no judgment. In this instance, there was no raw data (strip chart and oscilloscope trace) to be interpreted and, therefore, there could have been no test results, yet, test results

were recorded.

Had the predetermined plan and procedures been followed during the September, 1977 steam generator inspection of Surry Unit No. 2, the Unit would not have been forced out of service for a period of 9½ days commencing on November 18, 1977. Likewise, the additional expense of \$4,696,766 (net replacement energy costs) associated with the November, 1977 forced outage would have been avoided.

RECOMMENDATION*

The Company cannot expect its customers to bear the expenses associated with the development of procedures and techniques designed to prevent the consequence of a steam generator tube leak and then have its customers bear the consequences when the procedures are not followed. Therefore, the Staff recommends that the Company should not be permitted to retain the monies which it collected from its customers for the net replacement energy costs associated with the 9½ day November, 1977 forced outage of Surry Unit No. 2

*Note: The \$4,696,766 net replacement energy costs are for total electric system of which the Virginia jurisdictional portion is some value less than this amount. If the Commission accepts this RECOMMENDATION it will be necessary to determine the amount to be refunded to the Company's Virginia customers.

REPORTINTRODUCTION

Vepco is the holder of Facility Operating License No. DPR-37 which authorizes the operation of the nuclear power reactor known as Surry Power Station No. 2. The reactor is a pressurized water reactor (PWR).

The tubes within each of the three steam generators of Surry Unit No. 2 have, to varying degrees, been and continue to be deformed as a result of magnetite growth which causes support plate expansion. The continued growth of the tube support plate imposes stresses on the tubes and can and does result in the development of stress corrosion cracks in denting locations. Leakage of primary coolant into the secondary system, as a result of cracked tubes, has exceeded allowable limits and has caused the forced outage of this unit on a number of occasions in the past. An example of the extent to which Surry Unit No. 2 has been forced out of service due to steam generator tube leaks is shown on Attachment No. 1.^a Of the 4,636.0 total outage hours during this fourteen month period, 3,353.9 hours or 72.3% were due to steam generator tube leaks.

In an effort to define and arrest the denting phenomenon, Vepco, in conjunction with Westinghouse, developed a technique, equipment and procedures to investigate the consequence of the steam generator problem (see Attachment No. 2).^b This technique is commonly referred to as the

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- a. This document was included as a part of Mr. Stanley Ragone's prefiled testimony in Case No. 19818, Exhibit No. _____ (SR-4, pg. 2).
 - b. Vepco's response dated March 31, 1978 to information requested by Commission Staff during the March 15, 1978 Quarterly Fuel Clause hearing in Case No. 19883.

Preventive Plugging Program.

Basically, the purpose of the program is to identify tubes which may be anticipated to attain the level of deformation which could lead to stress corrosion cracking during the next period of operation, plug those tubes and thereby minimize and/or eliminate the possibility of forced outages due to the leakage of cracked tubes.

The program calls for gauging the inside diameter of preselected tubes utilizing a series of different eddy current probe sizes; i.e., 0.540, 0.610 and 0.650 inches in probe diameter. The areas probed are chosen on the basis of the analysis of the critical strain contours in the tube support plate annulus. This analysis predicts the rate of tube deformation and identifies regions of the tube/tube support plate to be inspected. The tube hoop strain contour is used to define the gauging boundary.

The tubes are initially gauged with the 0.650 inch probe. Those tubes which do not allow passage of this probe are then gauged with the 0.610 inch probe. Any tube which does not allow passage of the 0.610 inch probe is then gauged with the 0.540 inch probe. The result of this gauging process indicates a high degree of correlation between the strain predictions and field gauging results. The actual criteria used to determine which tubes shall be preventively plugged is included in Attachment No. 2.

BACKGROUND DISCUSSION

On April 1, 1977 the NRC Staff issued an Order for Modification of License No. DPR-37 which addressed operation of Surry Power Station Unit No. 2 under conditions in which steam generator tubes have been plugged as a result of tube denting caused by corrosion of the tube support plate in

the annular spaces between tube and tube support plate. On August 17, 1977 an NRC Order was issued to permit the continued operation of Unit No. 2 to September 15, 1977 under the conditions of the April 1, 1977 Order. The licensee was required to perform an inspection of the steam generators after the September 15, 1977 shutdown and obtain NRC approval prior to resumption of power operations. The licensee's fuel cycle for Surry Unit No. 2 ended before September 15, 1977 and during the resulting shutdown the licensee performed the required inspection and plugged 180 additional tubes. Twenty-one tubes were plugged because of wastage degradation; the remaining 159 tubes were plugged following the denting plugging criteria given in the licensee's September 30, 1977 submittal.

The NRC Staff evaluated the results of this inspection and repair program and determined that the additional plugging performed as a result of the inspection using the preventive plugging criteria would provide adequate steam generator integrity for continued operation for an additional six months of equivalent operation. By NRC Order dated October 8, 1977, Facility Operating License No. DPR-37 was amended permitting continued operation of Surry Unit No. 2 for six equivalent months of operation beyond October 8, 1977 under certain operational limitations.

Surry Unit No. 2 was subsequently brought back on-line on October 12, 1977 and continued to operate until November 18, 1977 at which time it was brought to a cold shutdown condition due to leakage of primary coolant from the primary to secondary system being in excess of the allowable operational limit established by the NRC in its Order of October 8, 1977.

By letter^{LC} dated November 22, 1977 to the NRC, Vepco advised, among other things, that the Unit was shut down due to a primary to secondary

c. Identified as Attachment III.

leak in excess of NRC operational limitations in "A" steam generator. Vepco further advised that the only tube leaking after hydrostatic testing was R5C26 in "A" steam generator, that this tube did not pass a 0.650 inch probe during the March, 1977 inspection and that this tube (R5C26) in "A" steam generator was scheduled to be inspected during the September, 1977 outage but, in fact, was not.

By letter dated November 23, 1977^d to Vepco, NRC transmitted a copy of its Safety Evaluation and approved the return to operation of Surry Unit No. 2 in accordance with the provisions of the October 8, 1977 NRC Order. In the Evaluation portion of the Safety Evaluation the NRC staff concluded, among other things, the following:

- "1. The tube, R5C26, that leaked and caused the November 18, 1977 shutdown was a tube that should have been previously plugged but was missed, thus the cause of the leakage is understood."

It was upon the Division of Energy Regulation's receipt of copies of both Vepco's November 22, 1977 letter to NRC and NRC's response of November 23, 1977 that an investigation was undertaken.

INVESTIGATION FINDINGS

During the period November 23, 1978 through the date of this report, various members of the Commission Staff have had discussions with Vepco personnel regarding the November 18, 1977 to November 27, 1977 forced outage of Surry Unit No. 2. These discussions were aimed at attaining an indepth understanding as to the cause of the forced outage and why it occurred in view of the fact that Surry Unit No. 2 had, just slightly over a month beforehand, undergone a steam generator inspection.

d. Identified as Attachment IV.

In order to analyze the consequence of the forced outage it is necessary to provide the sequence of events which is involved in the planning, organizing and the control of actual work accomplishment of an inspection program.

The basic sequence of events is as follows:

1. Prior to the actual shutdown, regions in the steam generator where severe denting is likely to occur are predicted. This is done by the Westinghouse finite element computer model together with previous inspection results to arrive at the appropriate inspection program for the current shutdown. From these data Westinghouse provides Vepco with a boundary list/index which outlines the regions to be inspected.
2. The boundary index is then drawn by Vepco on a tube sheet map^e for each steam generator. The tube sheet map defines the row and column locations of each tube.
3. After the boundary index is drawn on the tube sheet map, each tube within the region is identified by row and column and listed on a log identified as the Eddy Current Test Sequence.^f The tubes listed on these sheets are those which are to be inspected.
4. Each tube listed on the Eddy Current Test Sequence log, unless previously plugged, is supposed to be eddy current probed starting with the 0.650 inch probe. The eddy current probe generates a signal which is recorded on a strip chart ^g as well as a magnetic tape oscilloscope trace.
5. A copy of the Eddy Current Test Sequence data sheet which lists the tubes to be probed, as well as the strip charts and oscilloscope traces, are then given to a level three inspector whose job it is to interpret each strip chart and oscilloscope trace. The interpretation of these data is recorded by the inspector in the INSP. HT and REMARKS columns of the Eddy Current Test Sequence data sheet.

e. Attachment V is a copy of the tube sheet map.

f. Attachment VI is a copy of the Eddy Current Test Sequence.

g. Identified as Attachment VII.

6. For those tubes which do not pass a 0.650 inch probe, a second Eddy Current Test Sequence data sheet is prepared and the tubes listed are inspected using a 0.610 inch probe. Again, the inspector reviews each of the strip charts and oscilloscope traces generated by the 0.610 inch probe and records his interpretation in the INSP. HT and REMARKS columns of the data sheet.
7. For those tubes which do not pass the 0.610 inch probe, the process is repeated using a 0.540 inch probe.
8. The completed Eddy Current Test Sequence data sheets are then used by Vepco in determining specifically what tubes should be plugged in accordance with the preventive plugging criteria.
9. The tubes selected are then plugged.

Tube R5C26 was within the boundary index provided to Vepco by Westinghouse for the September, 1977 scheduled inspection and was within the region when this index was transferred to the tube sheet map for steam generator 2A. Likewise, tube R5C26 was listed on the Eddy Current Test Sequence data sheet provided to the team conducting the actual eddy current probing. Tube R5C26 was also on the copy of the data sheet given to the level three inspector (interpreter) so that the findings of the review of the individual strip chart and oscilloscope trace for each tube probed could be recorded.

A review of the completed copy of the Eddy Current Test Sequence data sheet^h which lists, among others, tube R5C26, reveals that columns INSP. HT and REMARKS contain the inspector's (interpreter's) findings. These findings are, according to the program, based upon review and interpretation of the strip chart and oscilloscope trace of tube R5C26 using, in this case, a 0.650 inch probe. However, there was no strip chart or oscilloscope trace, using a 0.650 inch probe, generated during the September

h. Identified as Attachment VIII.

program and, therefore, the tube was not inspected. Because the data sheet for tube R5C26 was erroneously completed by indicating that this tube (R5C26) was OK, it was never inspected in September, 1977 using a 0.610 or 0.540 inch probe and, therefore, based upon the erroneous entry on the data sheet, was not determined to require plugging.

201

Ex. BRS-10

MIN .032562
 1 .05000
 3 .10000
 5 .15000
 7 .20000
 9 .25000
 11 .30000
 13 .35000
 15 .40000
 17 .45000
 MAX .470193

Tube Hoop Strain:

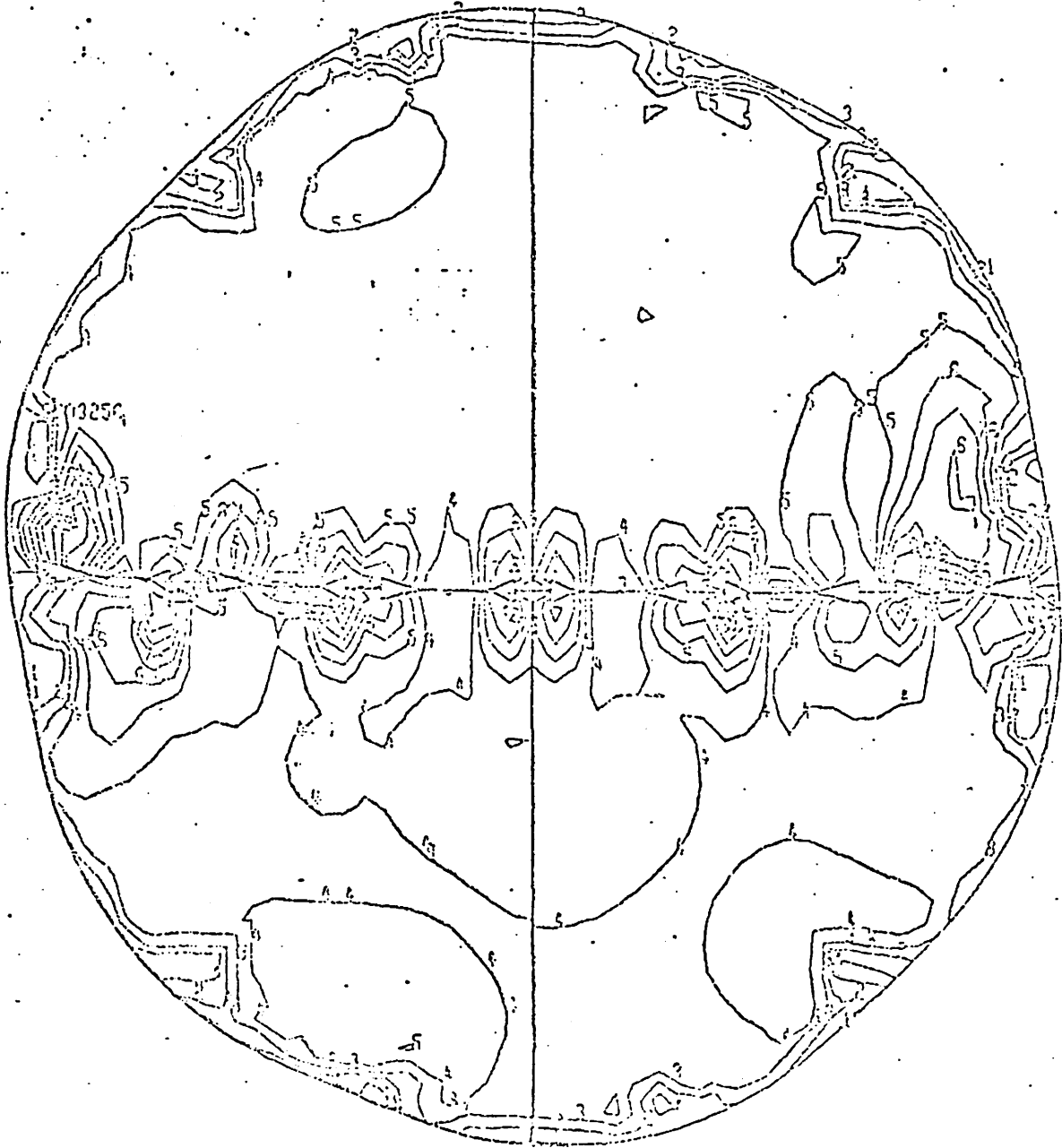
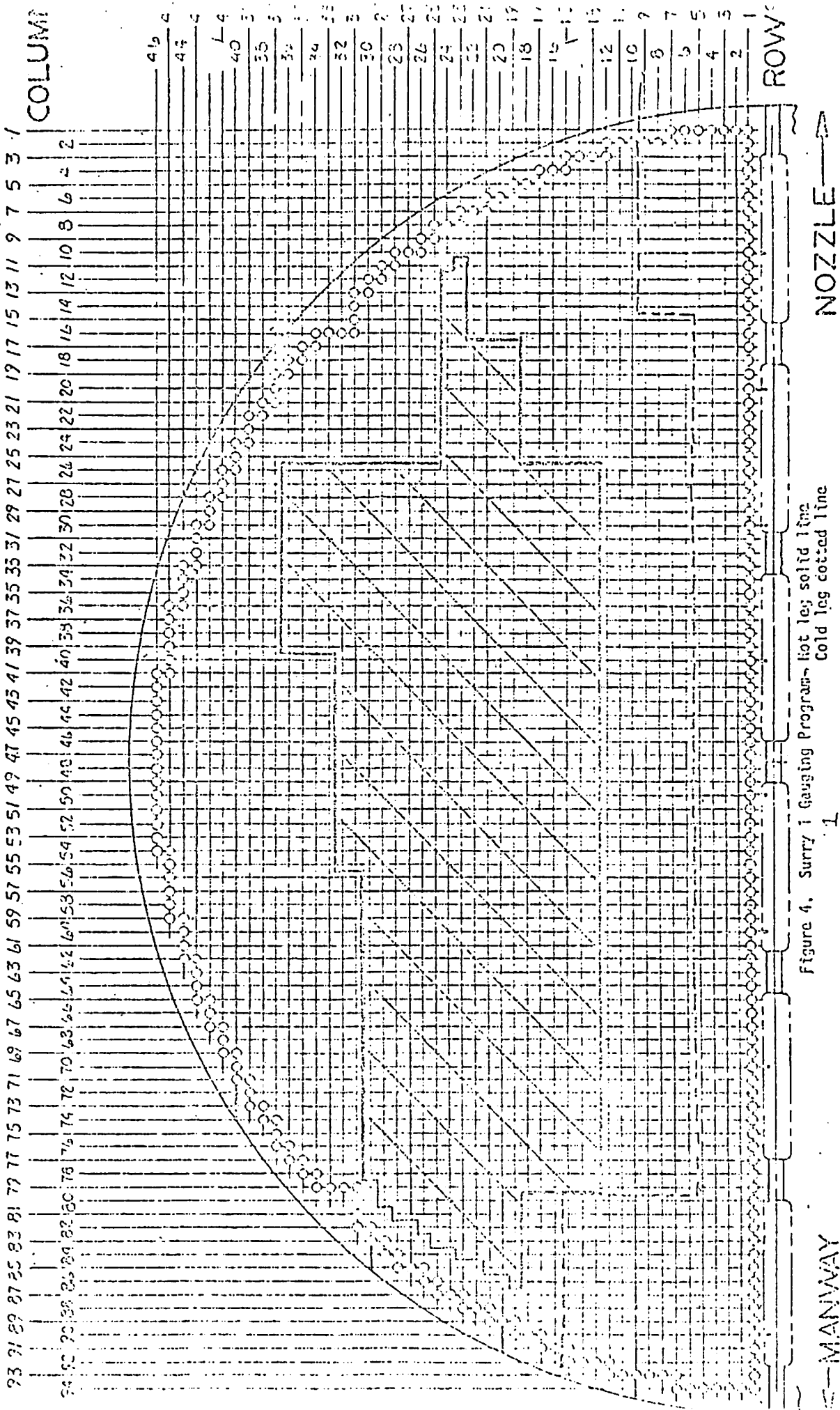


Figure 1. Tube Hoop Strain at 11.5 EFEM's
 Beyond Full Closure

SERIES 51



SERIES 51

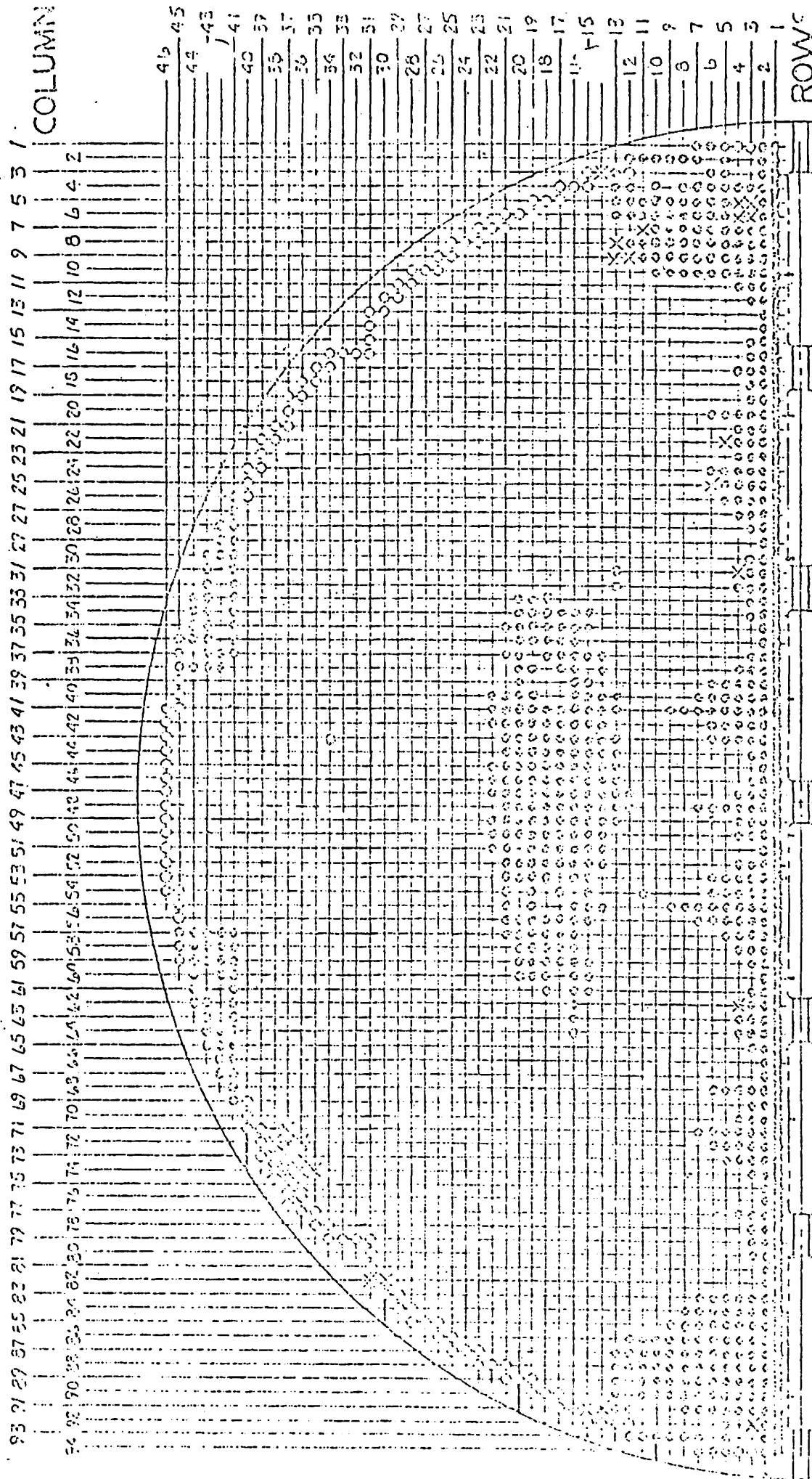


FIGURE 11
SURREY 1C STEAM GENERATOR PREVENTIVE PLUGGING PATTERN

X = TUBES TO BE PLUGGED
O = TUBES PREVIOUSLY PLUGGED

EDDY CURRENT TEST SEQUENCE

150110m 1-12-11

+ 7 + 204

STATION:

SUREY

UNIT

ILB

DATE

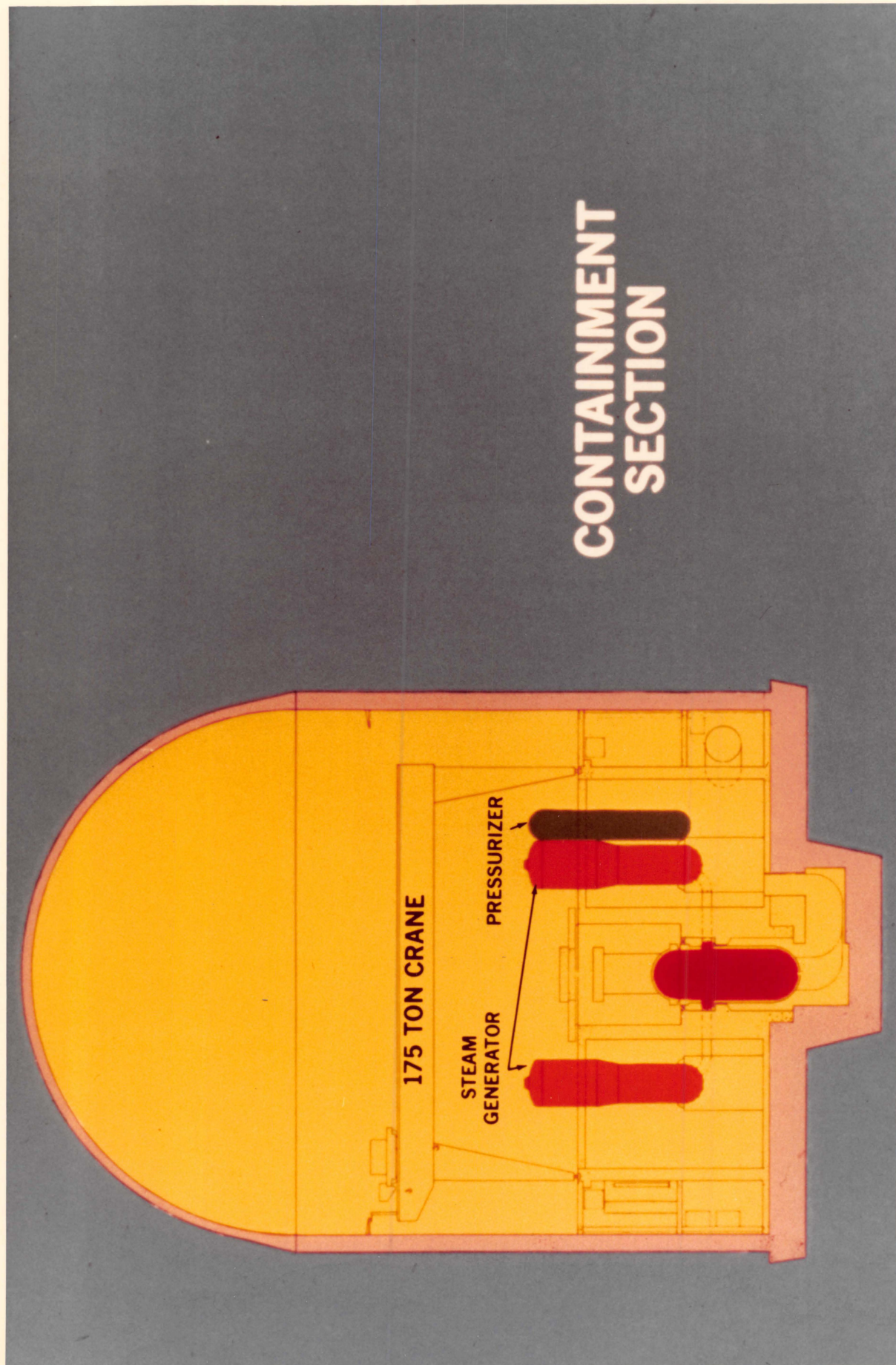
April

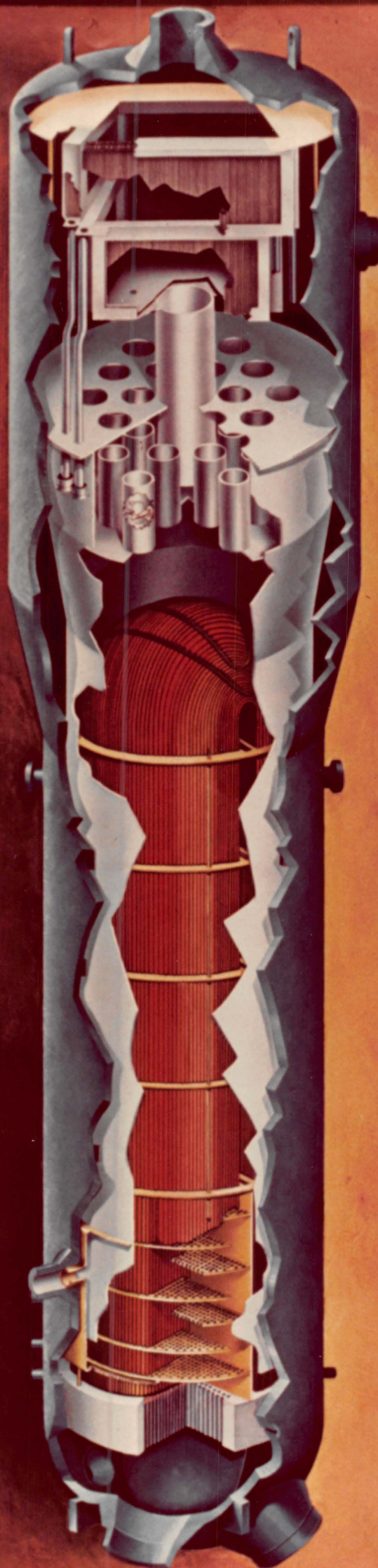
HEAT EXCHANGER

TEST FREQ.

400 KHz

ROW	COLUMN	INSP. HT.	OPERATOR	REMARKS
14	6			
13	6			slipped
12	6			slipped
11	6			slipped
10	6			slipped
9	6			slipped
8	6			slipped
7	6			slipped
6	6			slipped
5	6			slipped
4	6			slipped
3	6			slipped
2	6			slipped
2	7			slipped
3	7			slipped
4	7			slipped
5	7			slipped
6	7			slipped
7	7			slipped
8	7			slipped
9	7			slipped
10	7			slipped
11	7			slipped





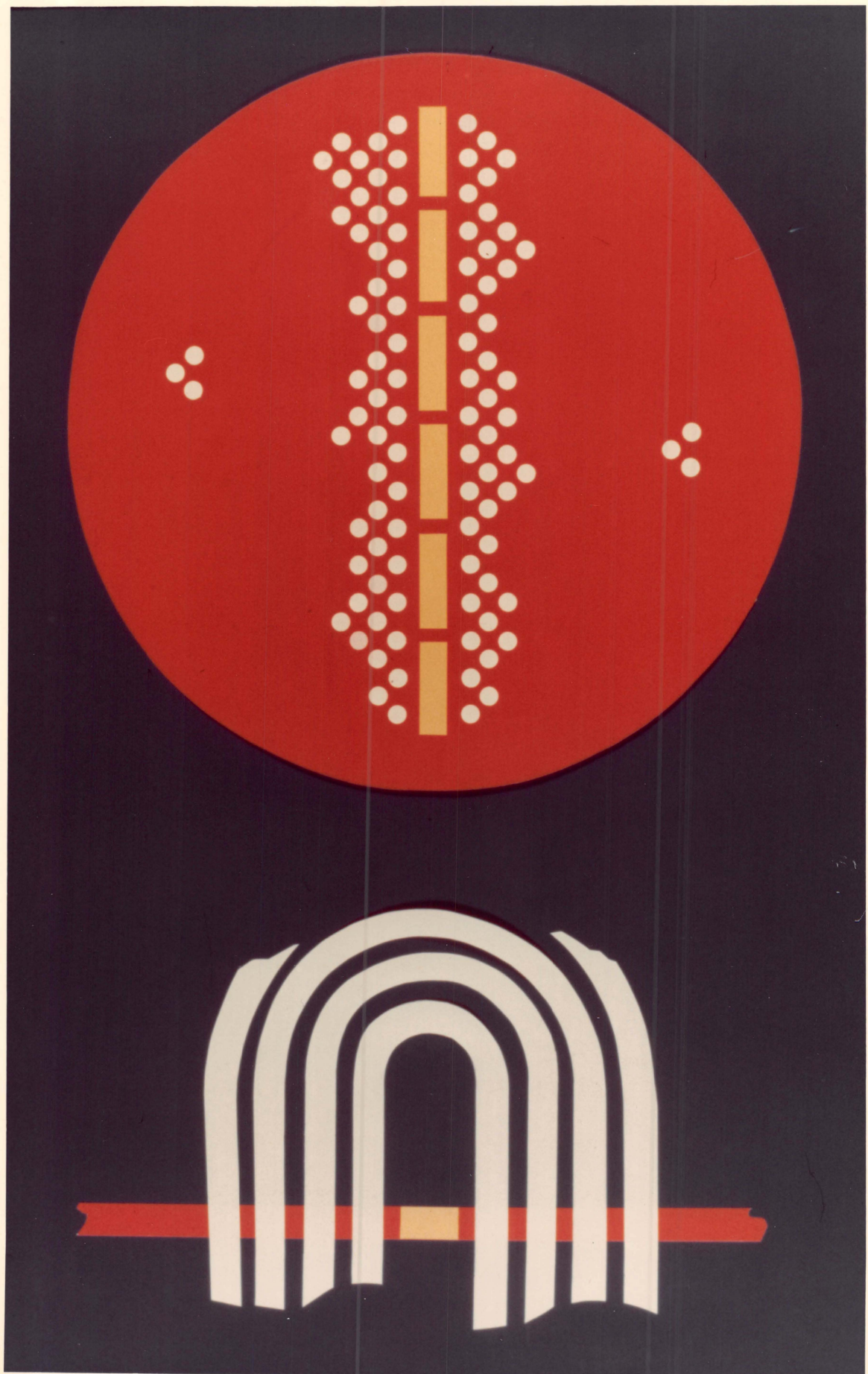
Westinghouse

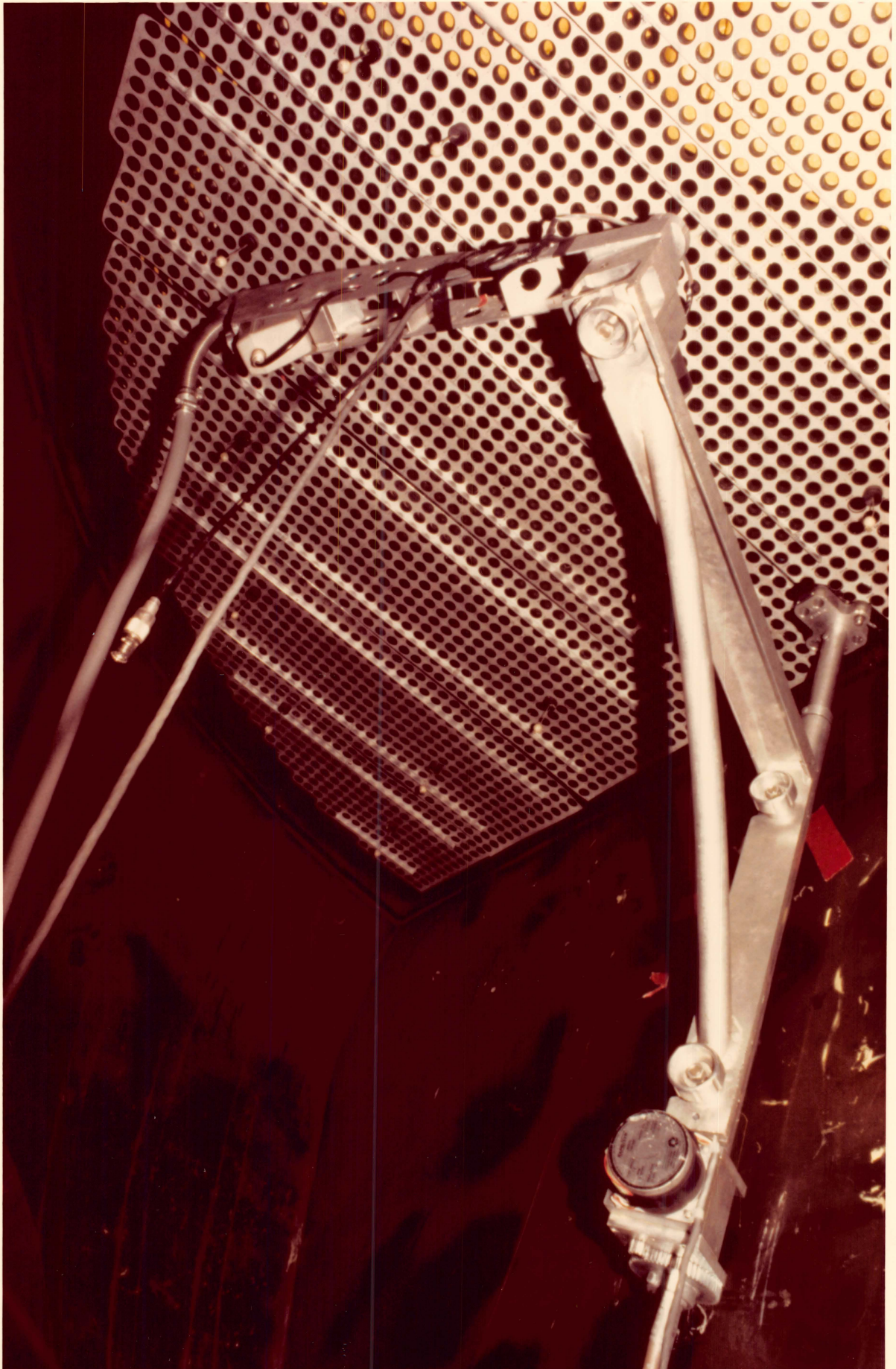
NUCLEAR PLANT
STEAM GENERATOR

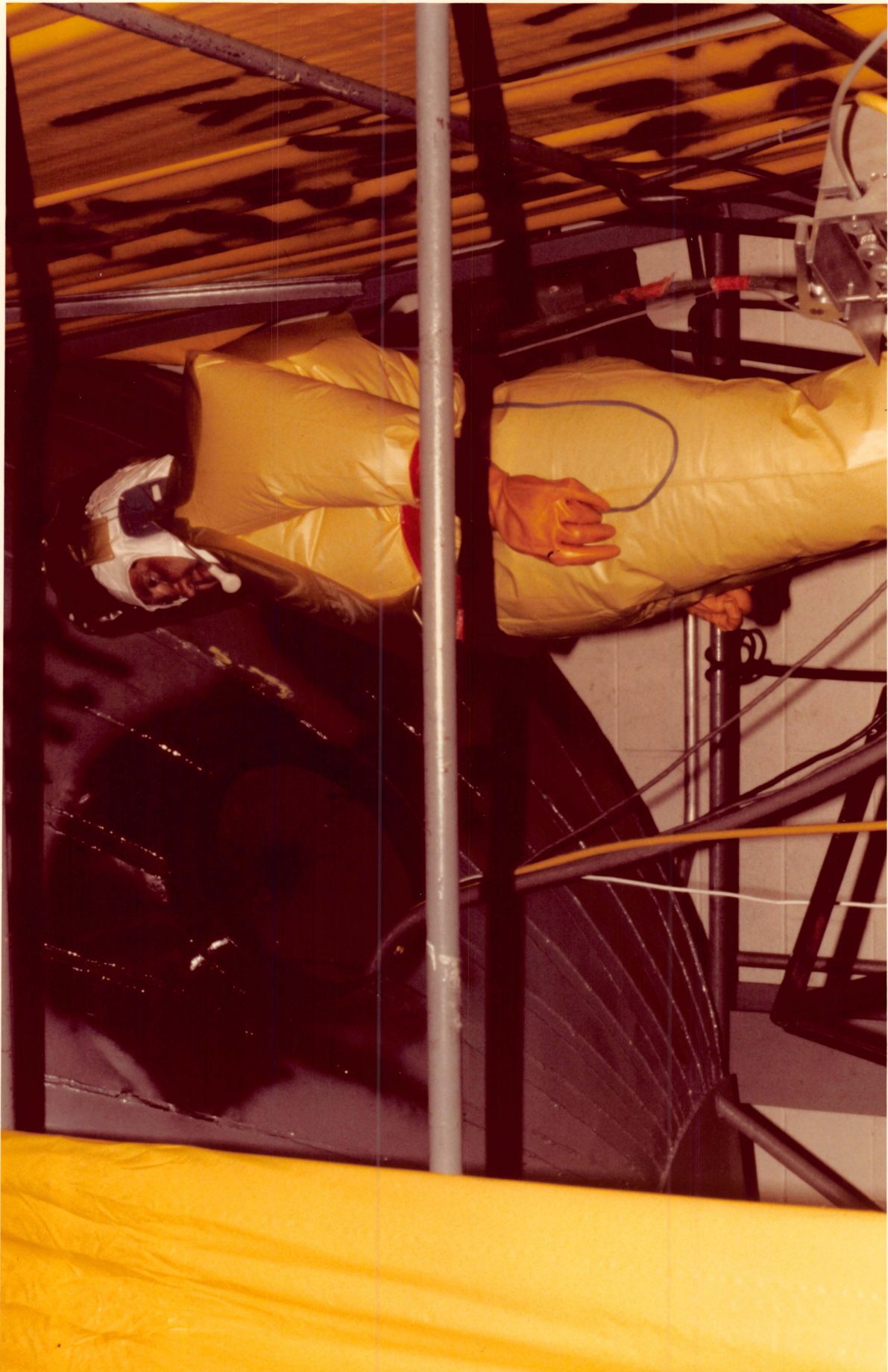


DENTING

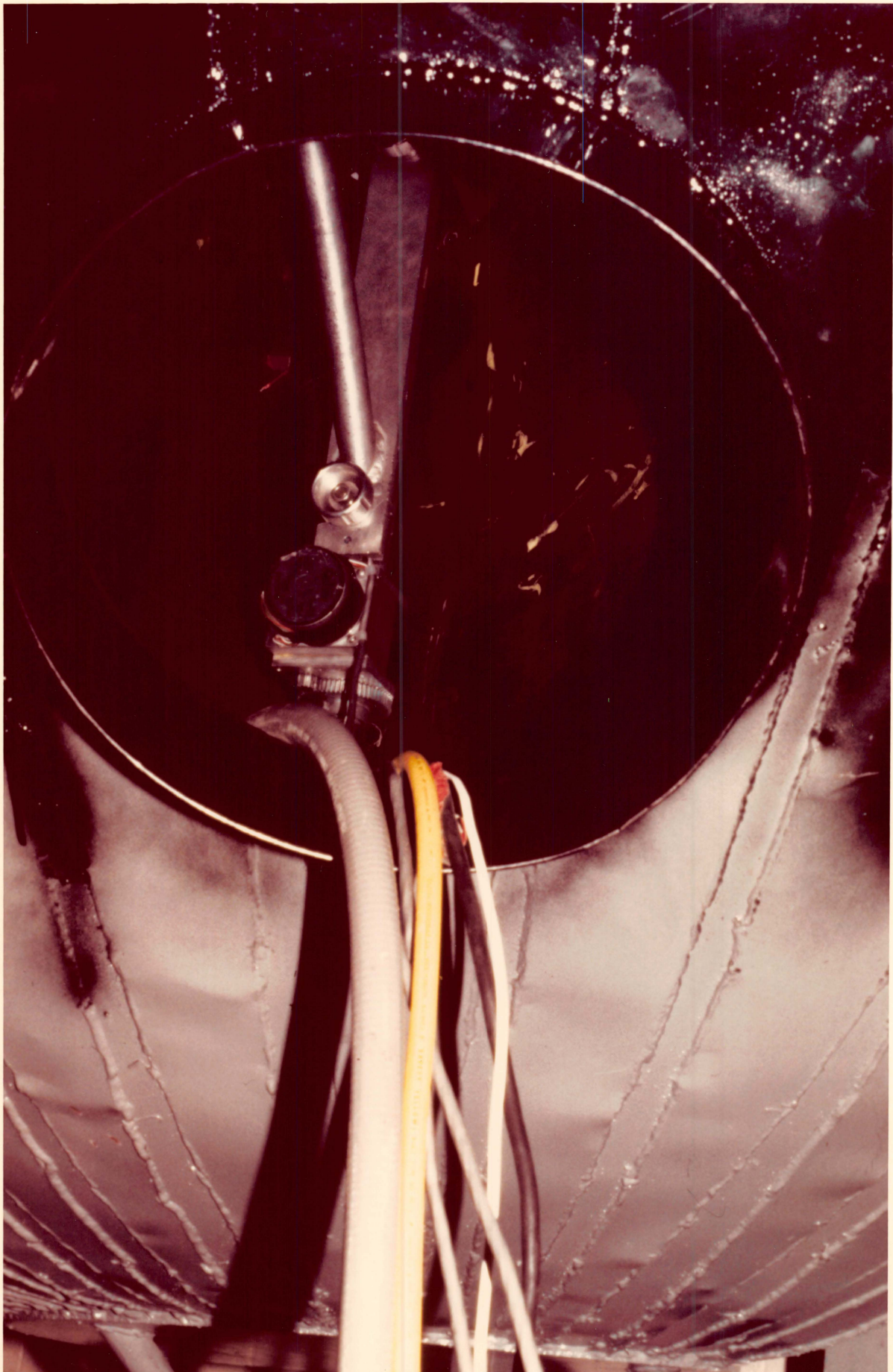






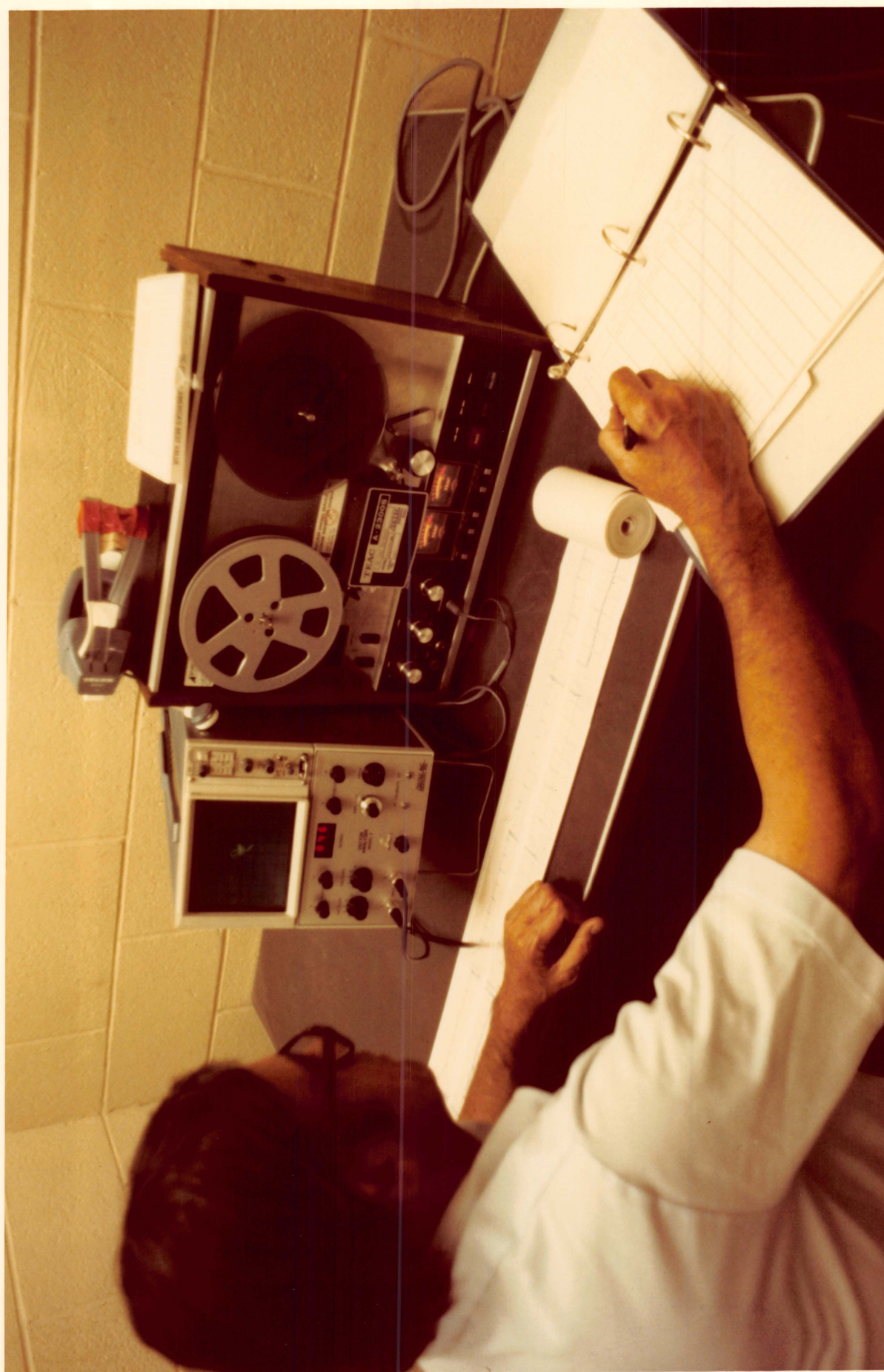








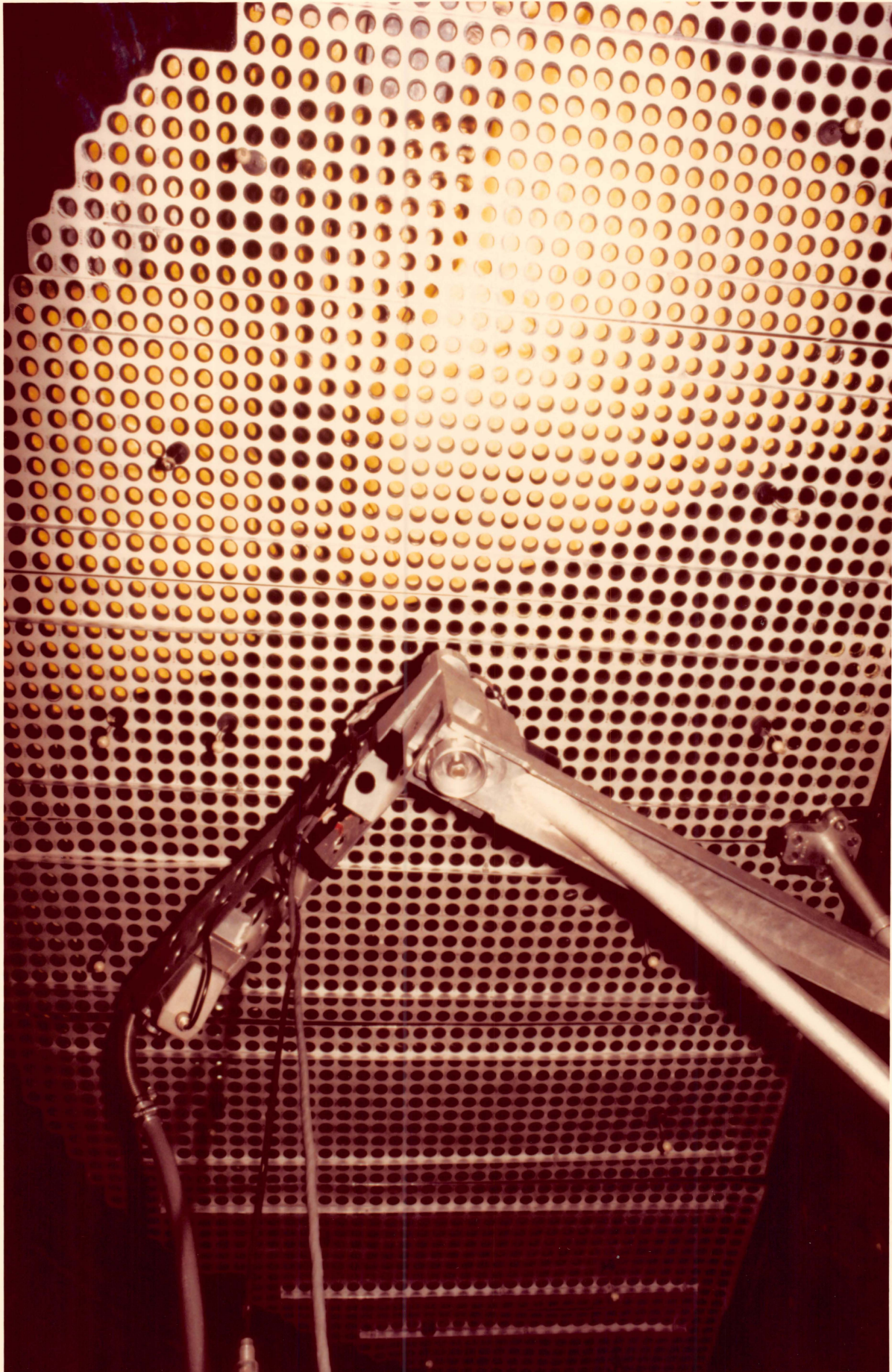












COMMONWEALTH OF VIRGINIA
OFFICE OF
THE ATTORNEY GENERAL
RICHMOND 23219

204-P

June 29, 1979

Mr. William C. Young, Clerk
State Corporation Commission
P. O. Box 1197
Richmond, Virginia 23209

Re: Quarterly Fuel Clause Hearing
Report On Surry Unit No. 2 Outage
Case No. 19983

Dear Mr. Young:

This letter is to set forth my comments on behalf of the Division of Consumer Counsel of my Office, concerning the forced outage of Surry Unit No. 2 from November 18, 1977 through November 27, 1977. This matter has been pending before the Commission for over a year and a half, and I am pleased that the issue will be resolved expeditiously. This matter was first discussed at a July 27, 1978 Quarterly Fuel Clause Hearing. At a special hearing on June 25, 1979, the Commission invited comment from the Division.

On November 18, 1977, Vepco's Surry Unit No. 2 was shutdown as a result of primary coolant leakage from the primary system to the secondary system. This shutdown lasted approximately 9½ days, resulting in a fuel costs to Virginia ratepayers of \$4,696,766. It is the opinion of the Division that the added fuel costs were imprudently incurred by Vepco, and therefore should not be passed on to Virginia ratepayers. The Division concurs with the recommendations made by the Commission's Staff and its witness, James R. Wittine, at the June 25, 1979 and July 27, 1978 hearings.

Vepco witness B. Ralph Sylvia, Director of Nuclear Operations, testified at the June 25, 1979 hearing that a tube in Steam Generator 2A was scheduled to be inspected,

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Mr. William C. Young, Clerk
June 29, 1979
Page Two

but that this inspection was not carried out. Mr. Sylvia admitted that an employee of a Vepco contractor inspecting the generator tubes recorded information that he did not have. At the time of the inspection in 1978, the utility company employed no checks to see if the data reported was actually in existence. However, stricter safeguards are employed now. In his closing remarks, Vepco counsel conceded that the Vepco contractor did not inspect a tube that should have been inspected and plugged.

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In his "Report of the Division of Energy Regulation on Surry Unit No." 2, Staff witness Wittine reports: "The November, 1977 forced outage did not occur because of the lack of a plan, procedures, skills, or knowledge. It did not involve a misunderstanding or misconception. At best, it was the lack of attention in the actual recordation of false test results." The Division concurs with the Staff's conclusion. Wittine concludes that the cost associated with the error committed by Vepco's contractor should be borne by the utility: "Had the predetermined plan and procedures been followed during the September, 1977 steam generator inspection of the Surry Unit No. 2, the Unit would not have been forced out of service for a period of 9½ days commencing on November 18, 1977. Likewise, the additional expense of \$4,696,766 (net replacement energy costs) associated with the November, 1977 forced outage would have been avoided." At page 41 of the transcript of the July 27, 1978 hearing before the Commission, Mr. Wittine recommended that customers not bear the costs of consequences of procedures that were not followed by Vepco. Although Vepco's counsel argues that established procedures were indeed followed in this case, the fact is that the Company admits that an inspector of steam generator tubes recorded information that he had not received. This incorrect procedure resulted in fuel costs of \$4.7 million that were passed on to Virginia ratepayers.

Vepco's counsel submits a 1921 decision of the Hawaii Public Utilities Commission to stand for the proposition that Vepco should not absorb the loss caused by incorrect procedures employed in the inspection of steam generator tubes at Surry Unit No. 2. Re Kohala Ditch Company, Limited, 1922A PUR 1, (1921). However, it is a well-established principle of law when an electric utility makes imprudent decisions in the operation of its facilities, that utility

Mr. William C. Young, Clerk
June 29, 1979
Page Three

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must bear the cost associated with the consequences of those decisions. Priest recognizes that the Commission should disallow operational expenses when "inefficiency or improvidence or economic waste or abuse of discretion or action inimical to the public interest have been demonstrated." A.J.G. Priest, Principles of Public Utility Regulation: Theory and Application, at 23 (1969). Recent cases hold that a utility company's rates must be based only upon prudently incurred costs. Midwestern Gas Transmission Company v. Federal Power Commission, 388 F.2d 444, 448 (7th Cir. 1968), cert. denied, 392 U.S. 928 (1968); Acker v. United States, 298 U.S. 426, 430-431 (1936); New England Telephone and Telegraph Company v. State, 95 N.H. 353, 64 A.2d 9, 17 (1949).

Recently, the Federal Energy Regulatory Commission (FERC) faced an issue concerning the prudent operation of gas storage facilities which is similar to the issue in this case. In Metzenbaum v. Columbia Gas Transmission Corporation, 26 PUR 4th 144 (1978), the Commission found that the utility company was imprudent in the operation of its storage facilities in October, 1976, resulting in "unnecessary costs" of \$1,954,525 that could not be charged to ratepayers.

Thus, it is well settled that any imprudently incurred cost by a public utility cannot be passed on to the customers of a public utility. In this case, testimony by Staff witness James R. Wittine and admissions by Company witness B. Ralph Sylvia show that the \$4.7 million in increased fuel costs were incurred due to the failure of the Company to conduct the required inspection of the steam generator tube which failed, and to the subsequent recording of data which did not exist. These facts constitute imprudence on the part of the Company. The cost of that imprudence must not be passed on to Virginia ratepayers. Vepco should absorb this loss itself or attempt to collect damages from its contractor.

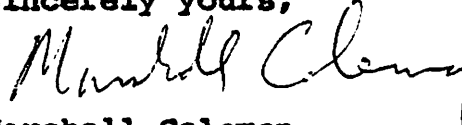
Section 56-249.4 of the Code of Virginia (1950), as amended, gives the Commission authority to order refunds of amounts charged through the fuel clause, should the Commission determine later that the amount should be disallowed. The overwhelming evidence in this case dictates that the State

Mr. William C. Young, Clerk
June 29, 1979
Page Four

Corporation Commission should require Vepco to refund to its customers the Virginia jurisdictional share of a system total of \$4.7 million.

I will not insist that the Division of Consumer Counsel be permitted closing argument and further cross-examination of Vepco witnesses at this time. However, if Vepco should submit further testimony or present further argument in this case, the Division does not waive its right to present evidence or further argument.

Sincerely yours,



Marshall Coleman
Attorney General

5:52:125

cc: Evans B. Brasfield, Esq.
Hunton & Williams
P. O. Box 1535
Richmond, Virginia 23212

Richard D. Rogers, Esq.
General Counsel
State Corporation Commission
P. O. Box 1197
Richmond, Virginia 23209

AT RICHMOND, JULY 2, 1979

COMMONWEALTH OF VIRGINIA, ex rel.

STATE CORPORATION COMMISSION

Ex Parte, in re:

CASE NO. 20068-79

ORDER

Investigation to determine appropriate tariffs pursuant to Code §56-249.6 for electric utilities which purchase fuel for generation including; Virginia Electric and Power Company, The Potomac Edison Company, Appalachian Power Company, Delmarva Power and Light Company of Virginia, and Potomac Electric Power Company (Respondents)

COMMONWEALTH OF VIRGINIA, ex rel.

STATE CORPORATION COMMISSION

Ex Parte: In the matter of quarterly hearings on fuel adjustment clauses, etc.

CASE NO. 19883

ORDERConsolidation of Orders

During the Quarterly Fuel Adjustment Clause hearing (Case No. 19883) of June 15, 1978, the Commission's Staff raised questions about a forced outage from November 18, 1977, through November 28, 1977 of Virginia Electric and Power Company's ("VEPCO" or "Company") Surry Unit No. 2. Special hearings were held on July 27, 1978 and June 25, 1979 in which evidence on this outage was submitted by the Commission's Staff and VEPCO. The Commission finds it appropriate to rule in this order on both VEPCO's proposed adjustment to its fuel factor (Case No. 20068-79) and the costs resulting from the November 18 to November 27, 1977 Surry Unit No. 2 forced outage.

Case No. 20068-79.

Quarterly Review of Fuel Expenses
of Virginia Electric and Power Company

VEPCO proposes to increase the fuel factor component of its rates, effective July 1, 1979, to produce additional gross annual revenues through the remainder of the year

of \$53.9 million. VEPCO's proposed revision is based in large part on the projected operations of its nuclear units through the remainder of the year. On at least two occasions in the past month, VEPCO has changed the availability forecasts of nuclear units. On review of the evidence offered in this proceeding the Commission is of the opinion that VEPCO's proposal should be denied. The availability of its units for the remainder of the year is uncertain and should be reviewed again in a subsequent quarterly hearing. However, for the first five months of calendar year 1979, the evidence shows that VEPCO under-recovered actual fuel expenses in the amount of \$13,115,760 from Virginia jurisdictional customers.

Case No. 19883
The Forced Outage of Surry
Unit No. 2 in November, 1977

On November 18, 1977, approximately 5 weeks after Surry Unit No. 2 was returned to service upon completion of a scheduled refueling and steam generator inspection, VEPCO was required to bring this unit to a cold shutdown condition because of primary coolant leakage into the secondary system at a rate in excess of the allowable operational limit.

Special hearings regarding this matter were held on July 27, 1978 and June 25, 1979. During the July 27, 1978 hearing the Commission received the formal Staff Report from James R. Wittine, Director, Division of Energy Regulation, and the testimony of W. L. Proffitt, Senior Vice President for Power, VEPCO. During the June 25, 1979 hearing the Commission received the testimony of B. Ralph Sylvia, Director of Nuclear Operations, VEPCO.

In our review of the record, there are a number of facts in which the Staff and VEPCO are in agreement. Specifically:

- a. Surry Unit No. 2 was forced out of service on November 18, 1977 due to primary coolant leakage into the secondary system being in excess of the allowable operational limit.
- b. The duration of this forced outage was approximately 9 1/2 days.
- c. The cause of the leakage was a cracked tube in "A" steam generator.
- d. The tube that cracked and caused the forced outage was R5C26.
- e. Tube R5C26 did not pass a .650 inch probe during the March, 1977 inspection.
- f. Tube R5C26 was specifically identified as being a tube to inspect in September, 1977.
- g. Tube R5C26 was not inspected in September, 1977.
- h. The .650 inch probe data sheet on which tube R5C26 was listed was improperly completed because there was no strip chart or oscilloscope trace to interpret.
- i. That VEPCO's Virginia customers paid increased charges through the fuel adjustment clause as a result of the 9 1/2 day forced outage.

The Staff's position is that the Company should not be permitted to retain the monies which it collected from its customers for the net replacement energy costs associated with the 9 1/2 days forced outage of Surry Unit No. 2.

A question which this Commission must consider is:

"Could the error which was made during the September, 1977 scheduled inspection have been avoided based upon the program, plan, information, techniques and equipment available to the Company at that time?"

The answer to this question, in our opinion, is yes. Based upon both the Company's and Staff's testimony it is obvious that there were at least two separate and distinct ways to insure each tube was inspected. First, the team which actually probes the tubes was provided with a list specifically identifying each tube to be probed. Secondly,

the interpreter was given a duplicate list of the tubes which were supposed to be probed and on which he must record his findings from his review of the strip chart and oscilloscope trace. The team did not probe the tube (R5C26) and no strip chart or oscilloscope trace was made. The interpreter recorded results for which there was no data. Additionally, the Company in March, 1977, had been put on notice that tube R5C26 was only one of 190 tubes in "A" steam generator and one of a total of 421 tubes in all three steam generators which did not pass a .650 inch probe.

One other aspect was raised by the Company which should be addressed, that being, the Company's position that the Commission is establishing perfection as a standard by which to gauge the Company's performance. This is far from an accurate characterization. A capacity factor of 100 percent is perfect. Recognizing that a unit must periodically (annually) be taken out of service for refueling, inspection, and preventive maintenance for about 5 weeks, the theoretically ideal capacity factor, taking the above factors into consideration, would be approximately 90 percent. In 1977 the annual capacity factor of Surry Unit No. 2 was 65.7 percent and on a cumulative basis, from the date of commercial operation through year end 1977, the capacity factor is 58.5 percent.

We would trust that no reasonably knowledgeable individual would consider either 1977 or the cumulative performance of Surry Unit No. 2 to be perfect. Nevertheless, we in the past have not disallowed expenses associated with the differential between perfection and the actual results.

Having considered the evidence and the applicable law, the Commission finds:

(1) That the error made during the September, 1977 inspection is unacceptable;

(2) That had this error not occurred, Surry Unit No. 2 would not have been forced out of service for 9 1/2 days in November, 1977 as a result of the cracked tube R5C26 and that the higher level of fuel expenses charged to customers would have been avoided;

(3) That VEPCO's Virginia jurisdictional customers paid an additional \$3,287,736 through Company's Fuel Adjustment Clause as a result of the forced outage of Surry Unit No. 2 from November 18 through November 27, 1977;

(4) That VEPCO's Virginia jurisdictional ratepayers should not bear these expenses.

(5) That the amount, \$3,287,736, previously collected from the Virginia jurisdictional ratepayers should be returned through the operation of the Company's existing fuel factor.

Conclusion

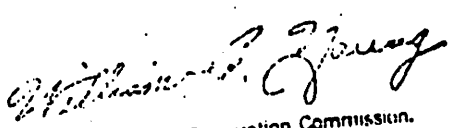
VEPCO shall be allowed to revise its fuel factor to collect additional revenues of \$9,828,024 (\$13,115,760 less \$3,287,736).

Accordingly, IT IS ORDERED that VEPCO file revised tariffs conforming to the above findings, such tariffs to become effective immediately upon the filing of same.

AN ATTESTED COPY hereof shall be sent to each of the five Respondents; to counsel for the following parties: the Virginia Committee for Fair Utility Rates; Fairfax County; the Division of Consumer Counsel of the Attorney General; Consumer Congress; Senator Clive DuVal; City of Alexandria; and an attested copy shall be delivered to the Commission's Divisions of Energy Regulation, Accounting and Finance and Economic Research and Development.

A True Copy

Teste:


Clerk of State Corporation Commission.

VIRGINIA: BEFORE THE STATE CORPORATION COMMISSION

COMMONWEALTH OF VIRGINIA, ex rel.

STATE CORPORATION COMMISSION

Ex Parte: In the matter of
quarterly hearings on fuel
adjustment clauses, etc.

CASE NO. 19883

PETITION FOR REHEARING OR RECONSIDERATION

Pursuant to Rule 7:9 of the Commission's Rules of Practice and Procedure, Virginia Electric and Power Company (the Company) hereby petitions for a rehearing or reconsideration with respect to the Commission's order of July 2, 1979 requiring the Company to return to its Virginia jurisdictional ratepayers through the operation of the Company's fuel factor \$3,287,736 previously collected. The Company states as follows in support of its Petition:

I.

1. The Commission's determination on the basis of the record in this case that the Company must refund to customers funds collected as the result of incurred fuel expenses is erroneous as a matter of law and unfair as a matter of fact. The tube inspection and plugging program has functioned well and saved customers many millions of

dollars. When it is considered as a whole, as it should be, its implementation by the Company has more than met any reasonable test of utility performance, and the Commission's action in disallowing replacement fuel expenses establishes a standard of perfection that cannot be met in fact and is an improper standard as a matter of law. The Commission should reconsider this matter, rescind its order requiring repayment and adjust the fuel factor to allow retention of the amount in question. If a rehearing is deemed necessary for such reconsideration, it could conveniently be held at the time of the next quarterly fuel factor hearing.

II.

2. In its order the Commission enumerated the facts on which it based its conclusion that \$3,287,736 should be returned to ratepayers. From this enumeration of facts it is clear that the Commission believed that the full 9.6-day outage of Surry Unit 2 that took place in November 1977 was attributable to the fact that leakage of primary coolant into the secondary system was in excess of the allowable operational limit, as a result of the Company's failure to inspect and plug tube R5C26.

3. From the record it is clear that this was not the case. While the tube leak was the reason the unit had to be taken out of service at that particular time, it

eliminated the need for a separate outage for necessary repairs to a primary coolant valve. Moreover, the steam generator tube leak required only 4 1/2 days to repair, while the 9.6-day duration of the outage resulted from the valve repairs. This was clear from the testimony of B. R. Sylvia:

Another thing I might mention, on this particular outage, I believe we shut down on November the 18th, -- on November the 15th we had identified a pressurized valve as leaking. And while we were down -- when you have a leak on a valve, it doesn't get better. It just gets worse. So in all probability in a few days we were going to have to shut down anyway to fix this valve.

COMMISSIONER SHANNON: When was this? What date was that?

WITNESS SYLVIA: On the 15th we had a maintenance report.

COMMISSIONER SHANNON: 15th of November?

WITNESS SYLVIA: That identified a valve leaking. And to work on this valve dictated the duration of the outage. That is why the outage was nine and a half days, or nine point six days.

We identified in plugging this tube that was supposed to be plugged would only have taken about four and a half days, and we have our critical path schedule, computer print-outs for the outage.

COMMISSIONER BRADSHAW: Where is this valve, up on the inside?

WITNESS SYLVIA: The valve is in the containment, inside the biological seal wall. You have to come to a cold shut-down condition, and you have to drain the primary system to repair this particular valve. (6/25/79 Tr. 76-77)

COMMISSIONER SHANNON: Is it your testimony, Mr. Sylvia, that if it had just been a missed tube, plugging alone, you would have been shut down how long?

WITNESS SYLVIA: Like four and a half days.

COMMISSIONER SHANNON: Whereas you were shut down what, nine -- ?

WITNESS SYLVIA: Nine point six.

COMMISSIONER SHANNON: And the balance was necessary to correct the valve situation?

WITNESS SYLVIA: Yes, sir. Actually, the entire outage, the duration of the outage was dictated by the work on the valve.

BY MR. BRASFIELD (Continuing)

Q. Did you start work on the valve as soon as you had the outage for the leak?

A. Yes, sir; as soon as we could get the plant into a condition to work on the valve, we began to work on the valve. (6/25/79 Tr. 80)

4. The only non-Company witness to address this issue, Mr. James R. Wittine, when he was asked whether the entire outage was attributable to the tube leak, merely stated that as of that date (July 27, 1978) he had not been advised that there was any other reason for the outage (7/27/78 Tr. 52-53). Thus the Company's testimony that the

valve repairs accounted for the entire duration of the outage, and that the tube leak repairs involved less than half of that period, stands unrebutted and unrefuted.

5. The Commission's failure to mention this testimony or comment on this issue in its order suggests that the issue was overlooked. Under these circumstances the appropriate remedy is for the Commission to reconsider this matter, rescind its order requiring repayment and adjust the fuel factor to allow retention of the amount in question. Even if the Commission were to ignore the time required to repair the valve and were to charge all of that outage time to the tube leak repairs, which would be an unjust result, it should amend its order to require the Company to return to its Virginia jurisdictional customers only that portion of the replacement fuel cost that was incurred during that period. That amount would be \$1,541,126, based on the ratio of 4.5 to 9.6 days.

6. The Commission's Staff, in its memorandum of June 29, 1979 to the Commissioners, requested an opportunity to cross-examine the Company's witness, B. R. Sylvia, and to present Mr. Wittine in rebuttal, but the Commission entered its order without providing that opportunity. If such cross-examination and rebuttal were intended to deal with the issue raised herein, or if the

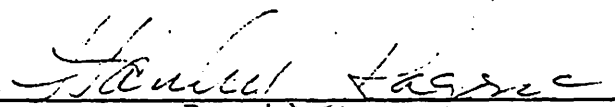
Commission would like to have more information concerning the valve leak and its repairs, the appropriate remedy would be a rehearing to consider further evidence on this issue. Such rehearing could conveniently be held at the time of the next quarterly fuel factor hearing.

WHEREFORE, the Company respectfully requests the Commission to reconsider its order of July 2, 1979 and rescind it for the reasons stated herein. If the Commission persists in the belief that some replacement fuel costs must be returned to customers, the Company, without waiving any rights hereunder, requests that the order of July 2, 1979 be amended to reduce the amount to be returned to customers from \$3,287,736 to an amount not larger than \$1,541,126, or, in the alternative, that this matter be set for a rehearing.

Respectfully submitted,

VIRGINIA ELECTRIC AND POWER COMPANY

By


President

Dated: July 16, 1979

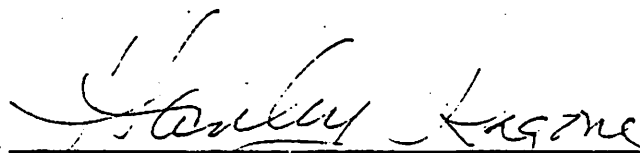
Evans B. Brasfield
Richard D. Gary
Hunton & Williams
P. O. Box 1535
Richmond, VA 23212
Of Counsel

VERIFICATION

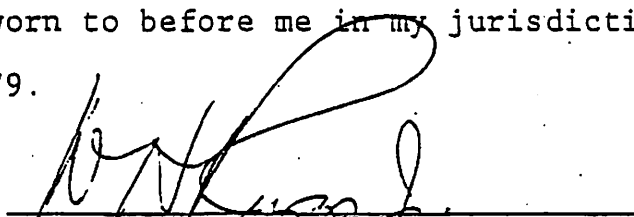
STATE OF VIRGINIA

CITY OF RICHMOND

Before me, the undersigned notary public, on this day personally appeared Stanley Ragone, whose name is signed to the foregoing Petition as President of Virginia Electric and Power Company, and being by me first duly sworn, declared that he is President of Virginia Electric and Power Company, and that the statements contained in the foregoing Petition are true and correct to the best of his information, knowledge and belief.


Stanley Ragone

Subscribed and sworn to before me in my jurisdiction this 16th day of July, 1979.


Notary Public

My commission expires APRIL 3, 1982

CERTIFICATE

I certify that I have, this 17th day of July, 1979, mailed a copy of the foregoing Petition for Rehearing or Reconsideration to all parties of record.

Ernest H. Baker

AT RICHMOND, JULY 20, 1979

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COMMONWEALTH OF VIRGINIA, ex rel.

STATE CORPORATION COMMISSION

CASE NO. 19883

In the matter of quarterly
hearings on fuel adjustment
clauses, etc.

ORDER DENYING PETITION FOR
REHEARING OR RECONSIDERATION

On July 17, 1979, Virginia Electric and Power Company filed herein a petition asking the Commission for a rehearing or reconsideration "with respect to the Commission's order of July 2, 1979, requiring the Company to return to its Virginia jurisdictional ratepayers through the operation of the Company's fuel factor \$3,287,736 previously collected."

And, after consideration of Vepco's petition for rehearing or reconsideration, it is the opinion of the Commission that the petition of Vepco should be denied and it is so ordered.

AN ATTESTED COPY hereof shall be sent to each of the five Respondents; to counsel for the following parties: the Virginia Committee for Fair Utility Rates; Fairfax County; the Division of Consumer Counsel of the Attorney General; Consumer Congress; Senator Clive DuVal; City of Alexandria; and an attested copy shall be delivered to the Commission's Divisions of Energy Regulation, Accounting and Finance and Economic Research and Development.

A True Copy
Tested:

George N. Bryant
First Assistant Clerk of the
State Corporation Commission

VIRGINIA: BEFORE THE STATE CORPORATION COMMISSION

COMMONWEALTH OF VIRGINIA, ex rel.

STATE CORPORATION COMMISSION

Ex Parte: In the matter of
quarterly hearings on fuel
adjustment clauses, etc.

CASE NO. 19883

NOTICE OF APPEAL

Pursuant to Rule 5:18(c) of the Rules of the
Supreme Court of Virginia, Virginia Electric and Power
Company hereby gives notice of appeal from the Com-
mission's order of July 2, 1979 in this proceeding.

VIRGINIA ELECTRIC AND POWER COMPANY

By


Counsel

July 23, 1979

Evans B. Brasfield
Richard D. Gary
Hunton & Williams
P. O. Box 1535
Richmond, VA. 23212
Of Counsel

CERTIFICATE OF SERVICE

I certify that I have this 23rd day of July, 1979, mailed a copy of the foregoing Notice of Appeal to the following: John L. Walker, Jr., Esquire, Woods, Rogers, Muse, Walker & Thornton, P. O. Box 720, 105 Franklin Road, SW, Roanoke, VA 24004, John W. T. Webb, Esquire, 106 W. Main Street, Salisbury, MD 21801, Philip J. Bray, Esquire, The Potomac Edison Company, Downsville Pike, Hagerstown, MD 21740, William D. Shapiro, Esquire, 1900 Pennsylvania Avenue, NW, Washington, D.C. 20068, Richard D. Rogers, Jr., Esquire, A. Lynn Ivey, III, Esquire, State Corporation Commission, P. O. Box 1197, Richmond, VA 23209, Anthony Gambardella, Esquire, Eric M. Page, Esquire, Shockoe Center, 11 S. 12th Street, Richmond, VA 23219, A. C. Epps, Esquire, Charles F. Midkiff, Esquire, Christian, Barton, Epps, Brent & Chappell, 1200 Mutual Building, Richmond, VA 23219, Richard A. Golden, Esquire, Assistant County Attorney, 4100 Chain Bridge Road, Fairfax, VA 22030, Erwin S. Solomon, Esquire, Drawer R, Hot Springs, VA 24445, The Honorable Clive L. DuVal, 2d, 2007 Fifteenth Street, North, Arlington, VA 22201, Ms. Wendy Alfsen-Cleveland, Alexandria Office of Consumer Affairs, Box 178, City Hall, Alexandria, VA 22313.

Erwin S. Solomon

COMMONWEALTH OF VIRGINIA
STATE CORPORATION COMMISSION

COMMONWEALTH OF VIRGINIA, ex rel.

STATE CORPORATION COMMISSION

Ex Parte: In the matter of
quarterly hearings on fuel
adjustment clauses, etc.

CASE NO. 19883

NOTICE OF INTENTION TO PARTICIPATE

The Division of Consumer Counsel, Office of the Attorney General of Virginia, hereby gives notice, pursuant to Rule 5:18(f) of the Rules of the Supreme Court of Virginia, that it intends to participate as an appellee in the appeal of the order of the Commission entered in this action on July 2, 1979.

Respectfully submitted,

DIVISION OF CONSUMER COUNSEL

By: Anthony Gambardella

Marshall Coleman
Attorney General

Anthony Gambardella
Eric M. Page
Assistant Attorneys General

11 South 12th Street
Richmond, Virginia 23219
(804) 786-4075

CERTIFICATE OF SERVICE

I certify that I have this 1st day of August, 1979, mailed a copy of the foregoing Notice of Intention to Participate to the following: Evans B. Brasfield, Esquire, P. O. Box 1535, Richmond, Virginia 23212, John L. Walker, Jr., Esquire, Woods, Rogers, Muse, Walker & Thornton, P. O. Box 720, 105 Franklin Road, S.W., Roanoke, Virginia 24004, John W. T. Webb, Esquire, 106 W. Main Street, Salisbury, Maryland 21801, Philip J. Bray, Esquire, The Potomac Edison Company, Downsville Pike, Hagerstown, Maryland 21740, William D. Shapiro, Esquire, 1900 Pennsylvania Avenue, N.W., Washington, D.C. 20068, Richard D. Rogers, Jr., Esquire, A. Lynn Ivey, III, Esquire, State Corporation Commission, P. O. Box 1197, Richmond, Virginia 23309, A. C. Epps, Esquire, Charles F. Midkiff, Esquire, Christian, Barton, Epps, Brent & Chappell, 1200 Mutual Building, Richmond, Virginia 23219, Richard A. Golden, Esquire, Assistant County Attorney, 4100 Chain Bridge Road, Fairfax, Virginia 20030, Erwin S. Solomon, Esquire, Drawer R, Hot Springs, Virginia 24445, The Honorable Clive L. DuVal, 2d, 2007 Fifteenth Street, North, Arlington, Virginia 22201, Ms. Wendy Alfsen-Cleveland, Alexandria Office of Consumer Affairs, Box 178, City Hall, Alexandria, Virginia 22313.

Anthony Lombardella

COMMONWEALTH OF VIRGINIA
STATE CORPORATION COMMISSION
RICHMOND

AT RICHMOND, NOVEMBER 2, 1979

COMMONWEALTH OF VIRGINIA, ex rel.

STATE CORPORATION COMMISSION

Ex Parte: In the matter of
quarterly hearings on fuel
adjustment clauses, etc.

CASE NO. 19883
OPINION

VIRGINIA ELECTRIC AND POWER COMPANY

On December 15, 1977, as required by law,¹ the Commission held its regular quarterly fuel hearing to review and evaluate information relating to fuel transactions, fuel purchases, fuel adjustment clauses and other data which investor-owned electric generating utilities are required² to file.

At that hearing, the Commission's General Counsel stated that Mr. James R. Wittine, Director of Energy Regulation for the Commission, was exploring with officers of Virginia Electric and Power Company ("Company" or "VEPCO") the reasons for a mid-November, 1977, forced outage of one of that Company's nuclear units. According to the General Counsel's

¹ Code §56-249.4 requires the Commission, among other things, to hold quarterly hearings to review and evaluate the information filed as required by §56-249.3; the Commission must disallow any increased charges arising from an electric utility's fuel adjustment clause which cannot be supported by the information and testimony filed at the quarterly hearing.

² Code §56-249.3 requires certain publicly and privately owned electric utilities to file monthly data related to fuel transactions, cost and output, or efficiency.

statement, Mr. Wittine expected to obtain information from both VEPCO and the Nuclear Regulatory Commission ("NRC") on the unit outage and to determine the cost of replacement energy -necessitated by the outage - which was passed-on to consumers through VEPCO's fuel adjustment clause.

During the next quarterly fuel hearing, in March, 1978, the General Counsel requested the Commission to direct VEPCO to file a full report of the facts surrounding the forced outage at Surry Nuclear Unit 2 from November 18, 1977, through November 27, 1977. To be included in the report were responses to the following five points:

1. An explanation of the Surry Unit's steam generator inspection program in effect prior to March, 1977, including, among other things, monitoring techniques and criteria for plugging dented tubes.
2. An explanation of any changes in inspection program techniques, or criteria, made between March 1, 1977, and September 30, 1977.
3. Why the tube at location R5C26 in steam generator 2A was not inspected during the inspection/refueling shutdown in September, 1977.
4. The dollar amount of the net replacement energy costs associated with the forced outage of Surry Unit No. 2 between November 18 and November 27, 1977; to be supplied with supporting data.
5. An explanation of measures taken, if any, subsequent to November 27, 1977, to minimize the possibility of similar occurrences.

VEPCO agreed to file the requested report and did so on March 31, 1978. The Staff, Attorney General and other parties to the quarterly fuel hearing in March, 1978, were permitted to respond to Company's report. The Staff responded with its own report and recommendations, presented to the Commission on July 27, 1978. On the latter date, and continuing on the day of June 25, 1979, Company presented evidence intended to rebut Staff's conclusions on the reasonableness of the nuclear unit outage.³ The written comments of the Attorney General were filed with the Commission on June 29, 1979.

The Staff recommended refunding the net replacement energy cost incurred by VEPCO as a result of the nuclear unit outage in November of 1977, and passed on to VEPCO's customers through its fuel adjustment clause. That recommendation was adopted, and by order entered July 2, 1979, Company was directed to make customer refund in the amount of \$3,287,736. The amount of the refund was credited to an approved increase in the recovery of Company's 1979

³ At the quarterly fuel hearing held June 15, 1978, Company and Staff agreed to meet and develop a schedule for formal presentations before the Commission in support of their respective positions.

fuel costs amounting to the sum of \$13,115,760, for a net increase of \$9,828,024.⁴

BACKGROUND OF OUTAGE

VEPCO holds licenses from the NRC to operate nuclear power reactors. NRC Operating License No. DPR-37 authorizes Company to operate Surry Power Station No. 2. The Surry reactor is a pressurized water reactor. Water circulates through the reactor and steam generator tubes ("primary system") and transfers heat to water surrounding the steam generator tubes ("secondary system"). The heat transfer from the primary to the secondary system produces the steam required to run turbines.

At Surry, tubes carrying the water through the primary system (known as "U" tubes) run through seven carbon steel support plates, each of which are 3/4 inch thick. The holes in the support plates are .89 inch in diameter. The outside diameter of each tube is .75 inch. Thus, the space between the surface of each tube and the inside surface of each hole measures .0075 inch, or 7.5 mills.

⁴ By order entered September 27, 1979, Company was permitted to increase recovery of 1979 fuel costs by the sum of \$37,051,471. This increase was in addition to the \$9,828,024 increase authorized by order entered July 2, 1979.

U-tubes in each of the three steam generators at Surry Unit 2 have been subject to "denting".⁵ Denting occurs because the carbon steel support plates are subject to corrosion. In effect, oxidation expands the inner surface of the holes through the support plates which exerts pressure on the tubes and causes them to crush, or dent, and eventually to leak.⁶

VEPCO, in a joint effort with Westinghouse, developed the equipment and technique to deal with tube denting. It is predicated upon the circumstance that if tubes which are likely to dent can be identified and plugged before leakage occurs, the risk of leaks of the primary coolant, and the attending shutdown of the nuclear units, is reduced. The VEPCO-Westinghouse program, therefore, seeks: (1) to identify all U-tubes which can be expected to dent sufficiently to cause tube cracks during the next period of a unit's operation and; (2) to plug all such tubes. The sequence of events in identifying and plugging tubes which can be

⁵ The denting problem has had a significant impact on VEPCO operations. For example, from January 1, 1976, through February 28, 1977, Surry Unit 2 was out of operation for 4,636 hours. Steam generator tube leaks accounted for 3,353.9 or 72.3 percent of the outage hours.

⁶ According to VEPCO witness Sylvia, the permissible NRC leakage rate is virtually "zero leakage". Consequently, any time a steam generator develops a leak it has to be shutdown, inspected, and leaking tubes plugged.

expected to leak were described by Mr. Wittine in his direct testimony as follows:

1. Prior to the actual shutdown, regions in the steam generator where severe denting is likely to occur are predicted. This is done by the Westinghouse finite element computer model together with previous inspection results to arrive at the appropriate inspection program for the current shutdown. From these data Westinghouse provides Vepco with a boundary list/index which outlines the regions to be inspected.
2. The boundary index is then drawn by Vepco on a tube sheet map for each steam generator. The tube sheet map defines the row and column locations of each tube.
3. After the boundary index is drawn on the tube sheet map, each tube within the region is identified by row and column and listed on a log identified as the Eddy Current Test Sequence. The tubes listed on these sheets are those which are to be inspected.
4. Each tube listed on the Eddy Current Test Sequence log, unless previously plugged, is supposed to be eddy current probed starting with the 0.650 inch probe. The eddy current probe generates a signal which is recorded on a strip chart as well as a magnetic tape oscilloscope trace.
5. A copy of the Eddy Current Test Sequence data sheet which lists the tubes to be probed, as well as the strip charts and oscilloscope traces, are then given to a level three inspector whose job it is to interpret each strip chart and oscilloscope trace. The interpretation of these data is recorded by the inspector in the INSP. HT and REMARKS

⁷ The Eddy Current probe provides VEPSCO with a signal on the condition of each U-tube. The signal is recorded on a strip chart and a magnetic tape.

columns of the Eddy Current Test Sequence data sheet.

6. For those tubes which do not pass a 0.650 inch probe, a second Eddy Current Test Sequence data sheet is prepared and the tubes listed are inspected using a 0.610 inch probe. Again, the inspector reviews each of the strip charts and oscilloscope traces generated by the 0.610 inch probe and records his interpretation in the INSP. HT and REMARKS columns of the data sheet.
7. For those tubes which do not pass the 0.610 inch probe, the process is repeated using a 0.540 inch probe.
8. The completed Eddy Current Test Sequence data sheets are then used by Vepco in determining specifically what tubes should be plugged in accordance with the preventive plugging criteria.
9. The tubes selected are then plugged.

According to Mr. Wittine, and Mr. Ralph Sylvia, VEPCO's Director of Nuclear Operations, the U-tube in row 5, column 26 (R5C26), the tube under scrutiny in this proceeding, was in the boundary index provided to VEPCO by Westinghouse for inspection by VEPCO during the September, 1977, scheduled outage for refueling. Also, tube R5C26 was properly listed on the Eddy Current Test Sequence data sheet provided the field operators who were to conduct the actual probing. The tube number also appeared on the data sheet provided the strip chart and oscilloscope trace interpreter.

According to Mr. Wittine, a review of the Eddy Current Test Sequence data sheet shows that the interpreter appeared to have reviewed and made findings from a strip chart and oscilloscope trace on the condition of tube R5C26. But no field operator had probed tube R5C26 during the September inspection! Consequently, no strip chart or oscilloscope trace could have been available to permit the interpreter to have analyzed the tube's condition. Nevertheless, the interpreter recorded results of an analysis which indicated that the condition of the tube was satisfactory. Since no plugging of tube R5C26 appeared to be necessary, no plugging took place.

On October 12, 1977, after refueling, Surry Unit 2 was returned to operation. On November 18, 1977, the unit was brought to a cold shutdown because of a leak from the primary system to the secondary system in excess of the allowable NRC limits. By letter dated November 22, 1977, VEPCO advised the NRC of the leakage. The letter, in pertinent part, reads as follows:

On November 18, 1977, Surry Unit No. 2 was shutdown due to a primary to secondary leak slightly greater than 0.3 gpm in "A" steam generator. After shutdown "B" and "C" steam generators were hydrotested and no tube leakage was found. The only tube leaking in "A" steam generator was R5-C26. This tube did not pass a 0.650 inch

probe in March of 1977 and is now in the region of predicted strain of greater than 15% and does not pass a 0.540 probe. A review of the records from the September 1977 outage found this tube was scheduled to be inspected but was not. To assure that additional tubes were not missed, the following reviews of past data were made.

1. For all tubes which did not pass the 0.650 probe during the March 1977 inspection, the data was reviewed to assure that they were inspected in September 1977. This consisted of 190 tubes in A, 123 tubes in B, and 108 tubes in C. The results of this review showed that the Row 5 Col. 26 tube of A was the only scheduled tube not inspected in September.
2. A sampling of data sheets versus strip chart results was done to monitor the accuracy of the data sheets. This consists of 15% of the tubes inspected in A, 12% in B and 15% in C. There were no differences found between the data sheets and the strip chart records.

The results of the above reviews give a high assurance that no further scheduled tubes were missed. To improve the future accuracy of our steam generator inspection program, any tube which does not pass a 0.650 probe will be probed at all future scheduled inspections; the tubes which are part of the gauging program will be re-checked at the end of the program by comparing strip charts with data sheets.

The NRC's Safety Evaluation Report, prepared after receipt of VEPCO's letter of November 22, 1977, describes

the reason for the outage. As here pertinent, the report reads as follows:

By Order for Modification of License, dated October 8, 1977, Surry Unit 2 was given approval to return to power for six equivalent months of operation following completion of the steam generator tube inspection program and necessary plugging. Subsequent to return to power a primary to secondary leak developed in steam generator 2A and the unit was shutdown on November 18, 1977 after achieving a leak rate of slightly greater than 0.3 gpm.

The licensee, Virginia Electric and Power Company (VEPCO), found that the leaking tube was at location R5C26 in steam generator 2A. This tube and ten (10) tubes surrounding it were then gauged to discern the degree of denting. The leaking tube did not allow passage of a 0.540" eddy current probe. All other tubes passed a 0.650" probe.

Since the leaking tube was included in the September, 1977 inspection program and no indication of denting in this tube had been indicated then, VEPCO went back and re-examined the September and previous March inspection data more carefully. It was discovered that the March, 1977 inspection results had indicated that this tube would not pass a 0.650" probe at that time. Upon reviewing the records from the September, 1977 inspection, VEPCO found that this tube had, in fact, not been inspected during the September program. Closer re-examination of previous tube inspection results by the licensee revealed a number of potential inconsistencies between the March and September data.

THE COMMISSION'S DECISION

The questions to be considered by the Commission in this matter were couched by Company Senior Vice President W. L. Proffit in the following language: ". . . [W]ere the Company's programs properly established? Have they been responsibly executed?" (Transcript of hearing on July 27, 1978, page 83.)

No one disputes the fact that the outage resulted from two mistakes. First, U-tube R5C26, earmarked by Westinghouse Corporation for inspection during VEPCO's scheduled September outage of the Surry Unit, mistakenly was not probed by VEPCO's field operators. Consequently, neither strip chart nor oscilloscope trace was available to the field interpreter. Second, notwithstanding that both strip chart and oscilloscope trace for tube R5C26 were missing, the interpreter recorded on the Eddy Current Test Sequence data sheet the results of an analysis which could not have been made. According to Company witness Sylvia, "[the interpreter] just probably was going too fast and it was a long day and he put down data that did not exist". (Transcript of hearing on June 25, 1979, page 60.)

Company acknowledges these mistakes, but maintains that when the overall performance of the VEPCO-Westinghouse program is considered, it has kept increases in costs to

a level lower than was reasonably expected. From this, Company argues that because human error exists in every business, costs attributable to error should be passed on to consumers if they do not exceed a reasonable level.⁸

We fully agree with Company's position that human mistakes evermore will occur. Mistakes are part and parcel of human frailty. However, it is quite a different thing to conclude that a utility should not be held accountable for unnecessary expenses resulting from improvident management decisions, or omissions. The very realization that mistakes are likely to occur, as recognized by VEPCO, requires prudent planning and reasonable foresight by management to identify the areas where mistakes can occur, together with likely consequences, and to take reasonable precautions at least to catch those mistakes before the consequences ensue.

The record here clearly shows VEPCO management to be acutely aware of the potential for mistakes in the plugging program. Mr. Sylvia testified that Company does not expect the program to be error free. No other conclusion could

⁸ It seems to us that the proper position to be taken is not whether costs resulting from human mistakes are at a reasonable overall level, but rather, is it economically feasible to eliminate all such costs - or, at least, to minimize them even further.

be reached in light of Mr. Sylvia's testimony that during any scheduled outage - such as the one in September, 1977 - there may be as many as 6,000, or more tubes, to be inspected, many requiring the use of different sized probes.

The probes, according to the Company witness, Mr. Sylvia, are operated by remote control and cannot reach all locations. Further, the Company witness stated ". . . missing tubes is not at all unusual." (Transcript of hearing on June 25, 1979, page 65.)

VEPCO, however, did install checks in most of the stages of the plugging program in order to catch errors. Ordinary foresight requires checks for mistakes. VEPCO obviously did not expect perfection from the Eddy Current Probe field operators and the other persons, totalling over 100, who were involved in the probing operation. But Company management, tacitly, did expect perfection from the Eddy Current interpreter.

There were no checks against the inevitability that the Eddy Current interpreter would, sooner or later, make a recording mistake. Mr. Sylvia explains this in the following words: ". . . our original check and balance . . . assured us that we had inspected . . . [the tubes] and had the data on each tube in the program, but it did not check against recording data that did not exist." (Transcript of hearing on June 25, 1979, page 67.)

For each tube that is probed a strip chart and magnetic tape oscilloscope trace is produced. After the team probing the tube completes its task, the strip charts, oscilloscope traces, and Eddy Current Test Sequence data sheets (which identify each tube the field operators were responsible for probing) are given to the interpreter. It is then his job to analyze each strip chart and magnetic tape oscilloscope trace, and record his findings on the Eddy Current Test Sequence data sheet beside the number of the tube represented by the material he has just examined. If the interpreter records his findings beside the wrong tube identification number, or beside the number of a tube which was never inspected, it is obvious that a tube requiring plugging could go unplugged.⁹

The record leaves no doubt that the part played by the interpreter in the plugging program is critical. Whether a dented tube is plugged or not depends upon his evaluation of its condition. A single mistake can, as it did here, result in the shutdown of a multimillion dollar nuclear

⁹ According to the evidence presented by Mr. Wittine and Mr. Sylvia, not only was U-tube R5C26 defective in September, 1977, but Company's March, 1977, inspection results show that the tube did not pass a 0.650 inch probe at that time. Obviously, there were inadequate safeguards to ensure that tubes not passing a 0.650 inch probe test would be probed and analyzed by the interpreter during the next inspection.

unit, requiring the substitution of much more costly energy for sale to the public.

In our opinion, Company expectations of perfection from the interpreter add up to improvident planning on the part of VEPCO management. The resulting costs were unnecessary. The nature and mechanics of the interpreter's work - highly skilled, but very demanding - carries with it a great potential for severe economic consequences from only one mistake. We conclude that VEPCO should have taken steps to ensure the presence of a strip chart and oscilloscope trace for each tube to be inspected.

The record shows that it was customary for the interpreter to work long hours at a stretch. On the day he mistakenly recorded findings which appeared from his data sheet to relate to the condition of U-tube R5C26, he had been working 12 to 14 hours. Absent a showing that safeguards would be unreasonably expensive, we cannot accept as reasonable the cost to the ratepayer of the interpreter's mistake.

VEPCO, of course, contends that there is a point at which the cost of checks and cross-checks installed in a system outweigh the benefit to be derived from such checks and cross-checks. We have previously expressed agreement with this. However, no evidence was presented from which it could be concluded that the cost of ensuring the availability

of a strip chart and oscilloscope trace to the interpreter for each tube identified to be inspected would outweigh the benefit. To the contrary, VEPCO's evidence proposes a check against further mistakes by the interpreter. In its letter to NRC dated November 22, 1977, Company states:

(1) any tube which does not pass a 0.650 inch probe will be probed at all future scheduled inspections and, (2) the tubes which are part of a gauging program will be rechecked at the end of the program by comparing strip charts with data sheets. We think it fair to assume that this proposed procedure is economically reasonable.

A corollary issue in this proceeding is the extent to which the forced outage can be fully attributed to the leak in U-tube R5C26. During the quarterly fuel hearing in March of 1978 (confirmed by subsequent letter, dated March 20, 1978), the Commission's General Counsel requested VEPCO to file a report on the outage, including information on the following:

* * *

The dollar amount of the net replacement energy costs associated with the forced outage of Surry Unit No. 2 from November 18, 1977 through November 27, 1977. Supply the supporting data for the calculations.

VEPCO's response, submitted as a report on March 31, 1978, (see page 3, above) under cover letter signed by Senior Vice President W. L. Proffit, reads as follows:

The net replacement energy costs associated with the forced outage of Surry Unit 2 for the period November 18-27, 1977 is \$4,696,766. Supporting data for this cost is shown on Attachment C.

During the hearing on June 25, 1979, (see page 3, above), Mr. Sylvia testified that, three days before the November outage, Company identified a leaking pressurized valve. While Surry Unit No. 2 was shutdown to plug the steam generator tube leak, the pressurized valve was also repaired and, according to Mr. Sylvia, the latter repairs "dictated" outage of the 9.6 days. According to this witness, identification and plugging of the leaking tube would have taken only 4.5 days.

The Commission is faced with conflict, or at least ambiguity, in the evidence pertaining to the outage. In the report submitted by Company Senior Vice President W. L. Proffit, 9.6 days and \$4,696,766 in net replacement energy costs are attributed to the forced outage to plug the tube leak. There is no mention in that report, or accompanying cover letter, of a pressurized valve leak.

Mr. Sylvia's testimony, that repairs to a pressurized valve in some manner extended the outage of Surry Unit 2, is inconsistent with the report forwarded by Mr. Proffit more than a year earlier. The record provides no answer to this apparent inconsistency of the two VEPCO witnesses.

It is our conclusion that we are fully warranted in accepting as correct the report filed by VEPCO on March 31, 1978, responding to the Commission's request for the details of the outage (see page 2, above).

CONCLUSION

The Commission is of the opinion and finds that Surry Unit No. 2 was forced out of service on November 18, 1977, due to primary coolant leakage into the secondary system in excess of the allowable operational limit; (2) that the duration of the forced outage was 9.6 days; (3) that the total net energy replacement cost was \$4,696,766; (4) that the jurisdictional net replacement energy cost charged Company's customers through operation of the fuel adjustment clause was \$3,287,736; (5) that Company's evidence fails to support the reasonableness of the \$3,287,736 net replacement energy cost within the meaning of Va. Code §56-249.4; (6) that the amount, \$3,287,736 should be refunded to customers through operation of Company's 1979 fuel factor, said amount

to be applied as a credit; and (7) that by order entered July 2, 1979, VEPCO was allowed to revise its 1979 fuel factor to collect additional revenue in the amount of \$13,115,760, less said \$3,287,736.

There appearing nothing further to be done in this proceeding, it is hereby ORDERED that the papers be filed with ended causes.

AN ATTESTED COPY hereof shall be sent to Evans B. Brasfield, Esquire, Hunton & Williams, P.O. Box 1535, Richmond, Virginia 23212; Anthony Gambardella, Esquire, Assistant Attorney General, 11 S. 12th Street, Shockoe Center, Richmond, Virginia 23219; and an attested copy shall be delivered to the Commission's Divisions of Energy Regulation, Accounting and Finance, and Economic Research and Development.

A True Copy

Teste:



Clerk of State Corporation Commission.

SUPREME COURT OF VIRGINIA

Virginia Electric and
Power Company,

Appellant,

against Record No. 791583
 S.C.C. Case No. 19883

Division of Consumer Counsel,
Office of Attorney General and
State Corporation Commission,

Appellees.

ASSIGNMENTS OF ERROR

Virginia Electric and Power Company, the Appellant herein, assigns error as follows to the Order appealed from:

1. The Commission erred in its determination that the replacement fuel costs incurred by the Appellant as a result of the November 18, 1977 outage of its Surry Unit No. 2 were unreasonable and should not be recovered from the Appellant's customers.

2. The Commission erred as a matter of law in basing its determination of whether such replacement fuel costs should be recovered from the Appellant's customers on whether the error that initially caused the outage could have been avoided.

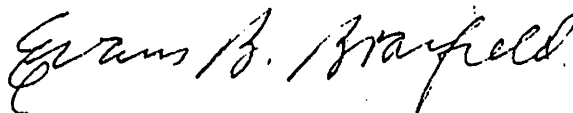
3. The Commission erred as a matter of law in basing its determination of whether such replacement fuel costs should be recovered from the Appellant's customers on whether it would have been economically feasible to have

installed safeguards that would have prevented the error from taking place.

4. The Commission erred in its determination that the 9.6 day duration of the November 18, 1977 outage of its Surry Unit No. 2 was attributable to unacceptable error by the Appellant and therefore the total cost of replacement fuel (for Virginia jurisdictional service) resulting from the outage should not be recovered from customers.

Dated: November 15, 1979

Respectfully submitted,



EVANS B. BRASFIELD
RICHARD D. GARY
P. O. Box 1535
Richmond, Virginia 23212

HUNTON & WILLIAMS
Of Counsel

CERTIFICATE OF SERVICE

I certify that I have this 15th day of November, 1979, mailed a copy of the foregoing Assignments of Error to Marshall Coleman, Attorney General of Virginia, Supreme Court Building, Richmond, Virginia 23219, Anthony Gambardella, Assistant Attorney General, Suite 308, Shockoe Center Building, 11 South 12th Street, Richmond, Virginia 23219, and Richard D. Rogers, Jr., General Counsel, State Corporation Commission, Blanton Building, P. O. Box 1197, Richmond, Virginia 23209, Counsel for Appellees.

Ernest S. Brayfield