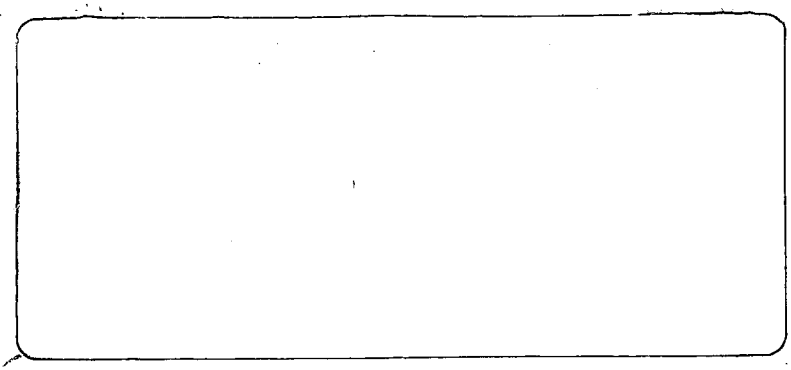


H. B. ROBINSON UNIT NO. 2

ROUTINE OPERATING REPORT NO. 4

FOR PERIOD

APRIL 1, 1972 THROUGH SEPTEMBER 30, 1972

Submitted: Benny J. Fury

Benny J. Fury, Manager
H. B. Robinson S. E. Plant

Approved: N. B. Bessac

N. B. Bessac
Manager - Nuclear Generation

PREFACE:

This fourth Routine Operating Report is submitted in accordance with section 6.6.4 of the H. B. Robinson Unit No. 2 Technical Specifications. The report covers plant operation during the period of April 1, 1972 to September 30, 1972.

SUMMARY:

The major event occurring during this six month period was a thirty-five day outage for repairs to steam generator tube leaks. These repairs are described in detail in Appendix II. Other significant work accomplished during the period was the completion of various plant modifications. One such change, Modification of Waste Evaporator and Boric Acid Evaporators, is related in Appendix I. The monthly summaries and maintenance reports include listings of the routine maintenance items and descriptions of plant incidents.

CAROLINA POWER & LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT

November 20, 1972

REPORT FOR APRIL, 1972

The unit was operated during the month of April without the occurrence of any abnormal conditions.

The monthly work was of a routine nature. Major effort was directed toward completion of various design changes, and the five following modifications were concluded during this monthly period:

1. Relocation of Primary Water Storage Tank Level Transmitter
2. Addition of Boric Acid and Waste Evaporator Vent and Drain Lines
3. Provision for flushing "A" Boric Acid Storage Tank Sample Line
4. Addition of Noise Filter to Tave and Δ T Control Channels
5. Modification of Boric Acid and Waste Evaporators

See the monthly maintenance list for further details. A full report of the Boric Acid and Waste Evaporator modification is included in Appendix I.

A maximum unit output of 2200 megawatts thermal was achieved on April 10.

April, 1972

CAROLINA POWER AND LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT
UNIT NO. 2

OPERATING SUMMARY

I. Nuclear

A. Number of hours the plant was operated. 719

B. Number of times the reactor was made critical. 0

C. Gross thermal power generated (MWH). 1,564,147.2

D. Equivalent full power hours. 710.976

II. Electrical

A. Gross power generated (MWH). 510,708

B. Net power generated (MWH). 487,332

C. Length of time generator was on line (Hours). 719

III. Radioactive Liquid Waste Discharged on Site

A. Total curie activity discharged (excluding Tritium) (Curies). 0.02344

B. Total curies of Tritium discharged (Curies). 20.63582

C. Total volume of liquid waste discharged (Gallons). 68,093.4

D. Total volume of dilution water used (Gallons). 2,987,000,000

E. Average concentration at discharge canal outfall (uc/cc). 2.0737×10^{-12}

F. Time and date of the maximum concentration released (for any consecutive 24 hours during the reporting period).

Time 2:24 A.M. Date April 1, 1972

G. MPC used 1×10^{-7} uci/ml Basis Technical Specifications for Unidentified Activity

IV. Radioactive Liquid Waste Shipped off Site

A. Total curie activity shipped (excluding Tritium) (Curies) --

B. Total curies of Tritium shipped (Curies). --

Operating Summary Cont'd.

C. Total volume of liquid waste shipped (Gallons). --

D. Average concentration of liquid waste shipped (uc/cc). --

E. Time and date of the maximum concentration shipped (for any consecutive 24 hours during the reporting period). --

Time -- Date --

V. Gaseous Waste

A. Total curie activity discharged (Curies). 0.21817

B. Time and date of maximum activity released (for any consecutive 24 hours during the report period).

Time 1:40 P.M. Date April 12, '72

C. The MPC used, if greater than:

1. $3X10^{-8}$ uc/cc for noble and activation gas. --

2. $1.43X10^{-13}$ for halogens with greater than an eight day half-life, and for particulates with greater than an eight day half-life. --

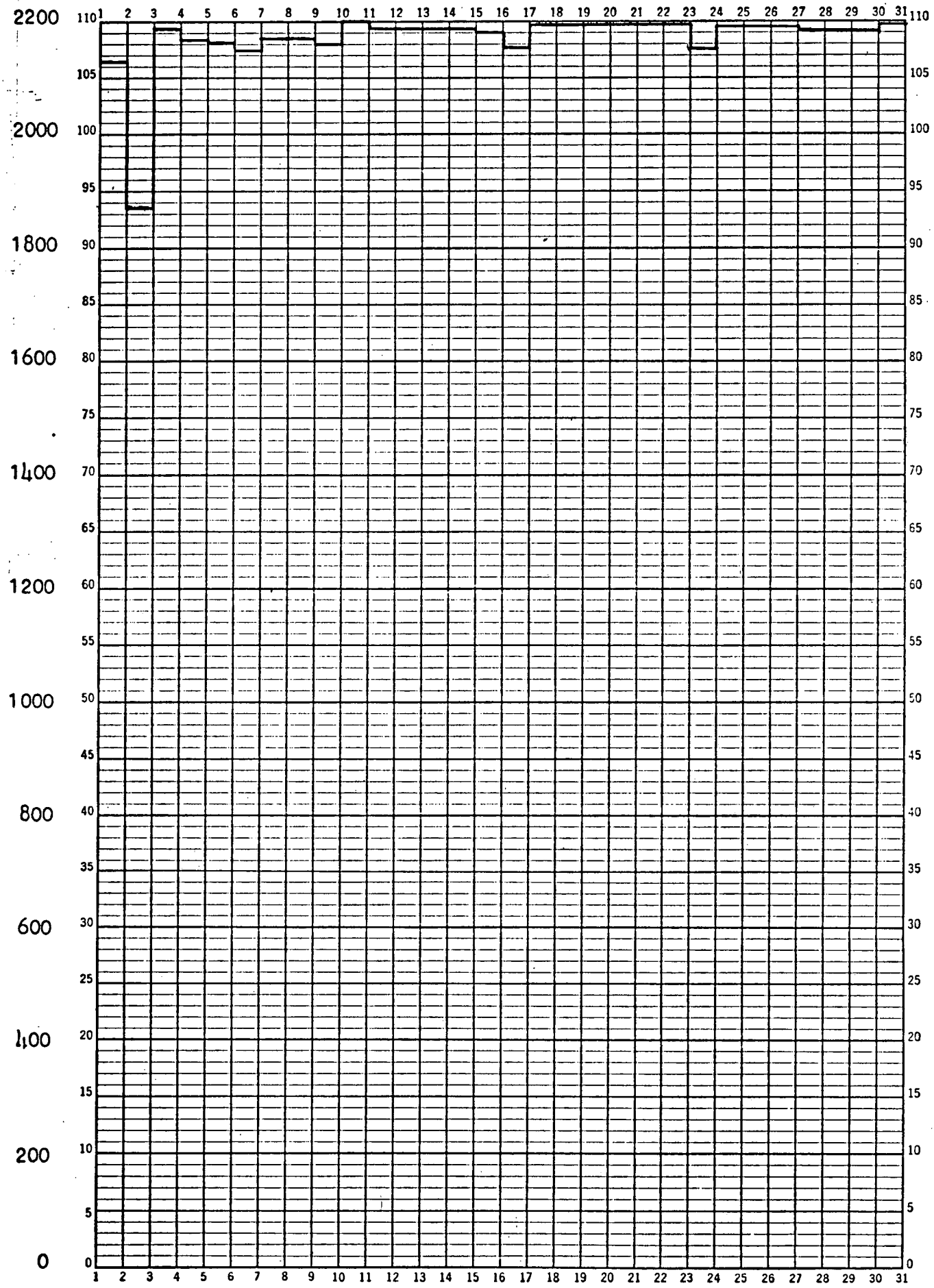
VI. Solid Radioactive Waste

A. Total volume of solid waste generated (Cubic Feet). --

B. Gross curie activity involved (Curie). --

C. Disposition of materials shipped off site.

Quantity	Shipped to
--	--



OUTAGE REPORT FOR APRIL, 1972

NUMBER	DATE	TYPE	PLANT CONDITION	REASON	DURATION
0	--	--	--	--	--

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Primary Water Deareator	Corrective	None	Level controller and valve position controller were out of adjustment	Erroneous high level alarm	Re-adjusted the controllers	3 Hr.
HVS-6 Cooler	Corrective	None	Leak in level float	Cooler basin was overflowing	Replaced the defective float	3 Hr.
Waste Condensate Tanks Alarms	Corrective	None	High level alarms out of adjustment	Erroneous alarms	Alarms were adjusted	--
Gas Analyzer	Corrective	None	Analyzer out of calibration	Improper indication	Calibrated the analyzer	½ Hr.
"A" Waste Condensate Tank Level Transmitter	Corrective	None	Level transmitter out of adjustment	Level indication 10% high	Rezeroed the transmitter	1 Hr.
Pressure Regulating Valve in Waste Gas System	Corrective	None	Valve positioner was malfunctioning	Failure to maintain set pressure	The positioner was adjusted for proper control	3 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" & "B" Service Water Booster Pumps	Corrective	None	Packing was defective	Excessive packing leakage	Repacked pumps	5 Hr.
Plant Vent Stack	Corrective & Preventive	None	Latches on inspection door were broken	Possibility of door coming open when subjected to pressure	Replaced inspection door and added two additional latches	½ Hr.
Vacuum Pump on R-21 Radiation Monitor	Corrective	None	The impeller vanes were broken	Pump was frozen	Replaced the broken vanes.	8 Days
Radiation Control Valve (RCV-014)	Corrective	None	Rough threads on adjusting shaft	Adjusting shaft was binding	Cleaned up shaft threads with a die	1 Hr.
E.H. System	Corrective	None	Limit switch on GRU valve was defective	The SR-2 valve would not indicate closed position	Replaced the defective switch	8 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Feedwater Flow Narrow Range Level Recorder	Corrective	None	Potentiometers were not operating properly	Recorder indication was unstable	The potentiometers were cleaned	2 Hr.
Boric Acid Filter Inlet Pressure Gauge	Corrective	None	The gauge was out of adjustment	Gauge was not indicating properly	Gauge was rezeroed and adjusted	½ Hr.
Reactor Coolant Pump Vibrometer	Corrective	None	The meter movement was binding	Meter would not calibrate properly	Meter was freed and calibrated	6 Hr.
Pressure Recorder PR-444	Corrective	None	Drive gear out of alignment	Recorder paper would not advance	Realigned gear for proper engagement	2 Hr.
Heating Circuit No. C-11	Corrective	None	The circuit was broken	Circuit would not function	The circuit was repaired	1 Hr.
"A" Waste Condensate Tank	Corrective	None	The high level alarm was out of adjustment	Alarm was set higher than required	Alarm was adjusted to actuate at proper level	2 Hr.
Acid Conductivity Meter in Make-Up Water System	Corrective	None	Two fuses were blown and there was an un-insulated wire	Improper meter indication	The fuses were replaced and the wire was insulated	4 Hr.
Condensate Conductivity Indicator	Corrective	None	There were four transistors, 2 capacitors, and one zenerdiode that were defective	Improper indication	Replaced the defective elements	14 Hr.
"A" Boric Acid Distillate Cooler Component Cooling Discharge	Corrective	None	The safety valve seat was pitted	Leakage through the valve seat	The disc and valve seat were lapped	4 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" Boric Acid Transfer Pump	Corrective	None	Pump failure	Loss of transfer capability	Installed a new pump	4 Hr.
Primary Water Storage Tank Level Transmitter	Design Change (Mod. and Setpoint Rev. Approval No. 42)	None	Level indication would peg high during tank fill due to pressure transients in fill line	--	Relocated level transmitter from tank fill line to tank drain line at bottom of loop seal	5 Hr.
Waste Evaporator and Boric Acid Evaporator Vent and Drain Lines	Design Change (Mod. and Setpoint Rev. Approval No. 6)	None	Feed and distillate tank would overflow onto floor resulting in contaminating area. Size of boric acid evaporator drain line could result in overflow flooding into air duct through vent line	--	Installed vents and drains on feed and distillate tanks. Vents were run to exhaust duct and drains into floor drain. Replaced 3/4" IPS drain on boric acid evaporator drain line with a 2" IPS drain	--
Boric Acid "A" Storage Tank	Design Change (Mod. and Setpoint Rev. Approval No. 60)	None	After sampling the tank boric acid would solidify in sample line	--	Provided a water supply line for flushing out the sample line	--
Tave and Delta-T Control Channels	Design Chg. (Mod. and Setpoint Rev. Approval No. 56)	None	--	--	Added a noise filter of two seconds or less in order to reduce noise & increase accuracy and dependability	--

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Waste Evaporator Feed Pump Suction Valve	Corrective	None	Stem pin was sheared	Handwheel would not operate valve	Replaced broken pin	2 Hr.
"1B" Moisture Separator Reheater	Corrective	None	Leak in line running to '6B' heater	Leakage from reheater	Leak was peened as a temporary fix and will be repaired later	2 Hr.
Emergency Fire Pump	Corrective	None	Faulty battery terminal	Pump would not start	Terminal was replaced and cleaned	½ Hr.
Transformer Yard Fire Alarm	Corrective	None	Defective micro-switch	Erroneous alarm	Switch will be replaced at later date	--
Heat Tracing Recorder No. 3	Corrective	None	Pen drive cord was faulty	Recorder was not functioning	Replaced drive cord	2 Hr.
"A" Boric Acid Evaporator	Corrective	None	Faulty feed tank level switch	Annunciator horn sounded when alarm was cleared.	Replaced switch	1½ Hr.
Governor Valve No. 3	Corrective	None	Limit switch out of adjustment	No indication of a closed position.	Limit switch was ad-adjusted	1 Hr.
Heat Trace Circuit No. 66 & 63	Corrective	None	Current set too high	Fuses were being blown	Current was adjusted	--
Mobile Air Particulate Monitor	Corrective	None	Flow rate controllers were out of calibration	Improper flow-rate control	Controllers were re-calibrated	1½ Hr.
Steam Generator Blowdown Tank Discharge Valve	Corrective	None	Torque switch was out of position	Indication of both open and close when valve was closed	Set torque switch properly	2 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Primary Water Storage Tank Level	Corrective	None	Level Transmitter out of adjustment	Low indication resulting in tank over-flowing when filling	Adjusted level trans-mitter	1 Hr.
Condenser Vacuum Pump Discharge Diversion Valve	Corrective	None	SNAP-LOC switch was hanging up	Improper position in-dication	Replaced defective switch	2 Hr.
Heat Tracing Circuits Nos. 15 and 20	Corrective	None	Circuits were set improperly	Circuits were reading too low	Reset the tracing circuits to correct values	3 Hr.
Water Treatment Alarms	Corrective	None	Setpoint out of adjust-ment on No. 1 cation bed conductivity exhaustion alarm	Spurious alarms	Cleaned switches and adjusted setpoint	6 Hr.
Penetration Cooling Flow Indicator FI-1980	Corrective	None	Indicator was stuck at zero indication	No indication of flow	The flow indicator was freed from stuck position	2 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Tave. and ΔT Control Loops	Design Chg Mod & Set-point Rev. Approval Form #56	None	This change was initiated in an effort to produce a 2 second lag in the loops	--	Twenty micro-farads of capacitance were installed in control loops TM 411C, TM 421B, TM 421C, TM 431B and TM 431C	33 Hr.
Radiation Monitor R-4	Corrective	None	The check source solenoid was defective causing excessive vibration of capacitor C-8210	Terminal connection on the capacitor had broken and monitor was giving erroneous indication	The solenoid was replaced and the capacitor terminal resoldered	9 Hr.
Pressurizer Level Recorder	Corrective	None	Faulty capacitor in amplifier power supply	Erratic pen operation	The capacitor was replaced and new bearings were installed in the servo-motors	4 Hr.
Demineralized Water System #1 Cation Bed Sample Valve	Corrective	None	Solenoid operator was faulty	Valve would not operate	Replaced solenoid	3 Hr.
"A" Boric Acid Transfer Pump	Corrective	None	Pump was defective	Pump would not operate properly	Replaced pump	8½ Hr.
Heating and Ventilation Fan HVE-15	Corrective	None	Control circuit did not provide a means to insure exhaust louvers were open	Fan was starting prior to opening of exhaust louver dampers	Installed a limit switch on dampers to prevent fan starting prior to opening of dampers	10 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
RTGB Recorder LR 459 (Pressurizer Level Recorder)	Corrective	None	The feedback potentiometer on pen two amplifier was malfunctioning	The level set-point pen was operating erratically	The potentiometer was cleaned	2 Hr.
Main Coolant Hot Leg Sample Heat Exchanger	Corrective	None	Failure of the cooling coil	Tube leakage	Replaced the cooling coil. (This failure occurred in August of 1971 and was reported at that time)	--
Heat Circuits - 48, 50, 51, 53, and 60	Corrective	None	Blown fuse in circuit 51 and circuits out of adjustment	Improper temperature control	Replaced fuse and adjusted circuits	12 Hr.
Waste Evaporator Distillate Conductivity Cell	Corrective	None	Cell was out of calibration	Erroneous indication	Recalibrated conductivity cell	3½ Hr.
RTGB Pressurizer Pressure Recorder	Corrective	None	Clutch on take-up reel was in need of adjustment	Recorder reel was turning too rapidly	The take-up reel clutch was adjusted	2 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Boric Acid and Waste Evaporators	Design Change (Mod. and Setpoint Rev. Approval No. 59)	None	The units had not met design parameters of output or decontamination factor; vacuum systems lacked reliability. AMF provided modification plans.	----------	Added new steam jet ejectors to vacuum systems. Modified internals of waste concentrator. Installed new steam supply piping and regulator on waste evaporator hot water-converter system.	-------

CAROLINA POWER & LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT

November 15, 1972

REPORT FOR MAY, 1972

The plant was operated on seven of the thirty-one days in this month. An outage was initiated on May 7 to facilitate pressurizer spray valve repair and replacement of moisture separator reheater tube bundles. Failure of moisture separator reheater tubes had first been detected in September of 1971 and proved to be a recurrent problem over the following months. The failures were traced to a vibration problem which resulted in tubes striking each other and eventually cracking. To alleviate this problem, all four moisture separator reheater tube bundles were cut out and replaced. This work was completed on May 12.

During the above repair outage an abnormal plant condition occurred at 12:30 P.M. on May 8. At that time, the reactor was being maintained in a cold shutdown condition utilizing "B" residual heat removal (RHR) pump and heat exchanger to remove decay heat. Three component cooling pumps were in service with a flow of 17,000 GPM which was divided between the shell sides of "A" and "B" RHR heat exchangers. Reactor coolant flow through the tube side of "B" RHR heat exchanger was 3600 GPM. With the above conditions existing, an alarm was received on the component cooling radiation monitor R-17. Concurrent with the alarm the level in the component cooling surge tank began to increase. In that a primary to component cooling leak in "B" RHR heat exchanger was indicated, action was taken to isolate the heat exchanger and place "A" RHR heat exchanger in service. This was accomplished at 12:40 P.M. The component cooling water surge tank was then drained to its normal level. Within four hours after

the incident occurred, activity in the component cooling system had begun to decay off.

The tube bundle and shell on "B" RHR heat exchanger were lifted, and an air test performed on the shell side. This test revealed one tube leaking. The tube was located as the end tube on the fifth row from the divider plate as viewed from the outlet nozzle. Repair was accomplished by welding a plug in each end of the defective tube. This was followed by an air test. The heat exchanger was then reassembled and returned to service on May 11.

On May 14 plant start up was initiated following the moisture separator reheater repairs. A leak test of the primary system revealed excessive primary to secondary leakage in "A" steam generator. A small leakage had been present in the steam generator since October 25, 1971, and was within the limits specified by H. B. Robinson Technical Specifications. This initial leak was on the order of 55 GPD whereas the leak rate measured on May 14 was 12 GPM. As a result of this large leak rate, the plant was returned to a cold shutdown condition. Investigation of the source of leakage revealed that one tube in "A" steam generator was leaking. Eddy current testing to detect further tube deterioration ensued. This was followed by explosive tube plugging and weld repairs. A modification was also performed on the steam generator secondary sides in an attempt to alleviate the tube failure problem.

In all, twenty-seven tubes were plugged in "A" steam generator; four tubes in "B" steam generator; and two tubes in "C" steam generator. These repairs and modifications proceeded through the month of May and into

the first week of June. The entire outage from the shutdown for moisture separator reheater repairs until return to full power operation spanned some thirty-five days. For details of the steam generator repairs refer to Appendix II of this report.

On May 15, during the steam generator repair phase of the outage, another incident occurred concerning the residual heat removal system. An increase of four percent (4%) was noted in the waste hold up tank with the waste evaporator in service. This occurred over a four-hour period. In that the waste evaporator operation should have resulted in a decrease in the waste hold up tank level, an investigation was initiated to locate the cause of the rising water level. This search revealed a failed seal on "A" RHR pump which resulted in primary coolant leaking into the RHR pit and subsequently being pumped to the waste hold up tank. The tank level at the time of the detection of the problem was 81%. Plant conditions were a reactor coolant temperature of 275°F at 410 psig with a flowrate of 3500 GPM to the RHR system. The RHR system was aligned with "A" RHR pump and heat exchanger in service. "A" RHR pump was secured, isolated, and drained by 10:56 P.M. on May 15. The seal was then replaced, and the pump was ready for service on May 16. This item is included on the enclosed maintenance list.

When it became apparent that the outage was to be of an extended nature, work was directed to correcting various minor problems and performing maintenance work that would have otherwise been subordinated to the immediate priority of getting the plant back in operation. An enumeration of these maintenance items is included in the monthly maintenance list.

Some six design changes were also completed this month and are described in the maintenance list.

On May 5, the maximum monthly thermal unit output of 2193.4 megawatts was achieved.

CAROLINA POWER & LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT
UNIT NO. 2

May, 1972

OPERATING SUMMARY

I. Nuclear

A.	Number of hours the plant was operated.	147.22
B.	Number of times the reactor was made critical.	4
C.	Gross thermal power generated (MWH).	291,139.2
D.	Equivalent full power hours.	132.336

II. Electrical

A.	Gross power generated (MWH).	96,086
B.	Net power generated (MWH).	88,180
C.	Length of time generator was on line (hours).	139.43

III. Radioactive Liquid Waste Discharged on Site

A.	Total curie activity discharged (excluding Tritum) (Curies).	0.07249
B.	Total curies of Tritum discharged (Curies).	65.17258
C.	Total volume of liquid waste discharged (Gallons).	339,598.64
D.	Total volume of dilution water used (Gallons).	2,509,739,000
E.	Average concentration at discharge canal outfall (uc/cc).	7.59881×10^{-12}
F.	Time and date of the maximum concentration released (for any consecutive 24 hours during the reporting period).	
	Time 4:00 P.M. Date	May 13, 1972
G.	MPC used 1×10^{-7} uci/ml Basis Technical Specifications for Unidentified Activity	

IV. Radioactive Liquid Waste Shipped Off Site

A.	Total curie activity shipped (excluding Tritum) (Curies)	5.41030
B.	Total curies of Tritum shipped (Curies).	0.0840

Operating Summary Cont'd.

C. Total volume of liquid waste shipped (Gallons). 25,900.0

D. Average concentration of liquid waste shipped (uc/cc). 5.52×10^{-2}

E. Time and date of the maximum concentration shipped (for any consecutive 24 hours during the reporting period).

Time 12:00 Noon Date May 24, 1972

V. Gaseous Waste

A. Total curie activity discharged (Curies). 15.68532

B. Time and date of maximum activity released (for any consecutive 24 hours during the report period).

Time 9:14 A.M. Date May 8, 1972

C. The MPC used, if greater than:

1. $3X10^{-8}$ uc/cc for noble and activation gas. --

2. $1.43X10^{-13}$ for halogens with greater than an eight day half-life, and for particulates with greater than an eight day half-life. -- / --

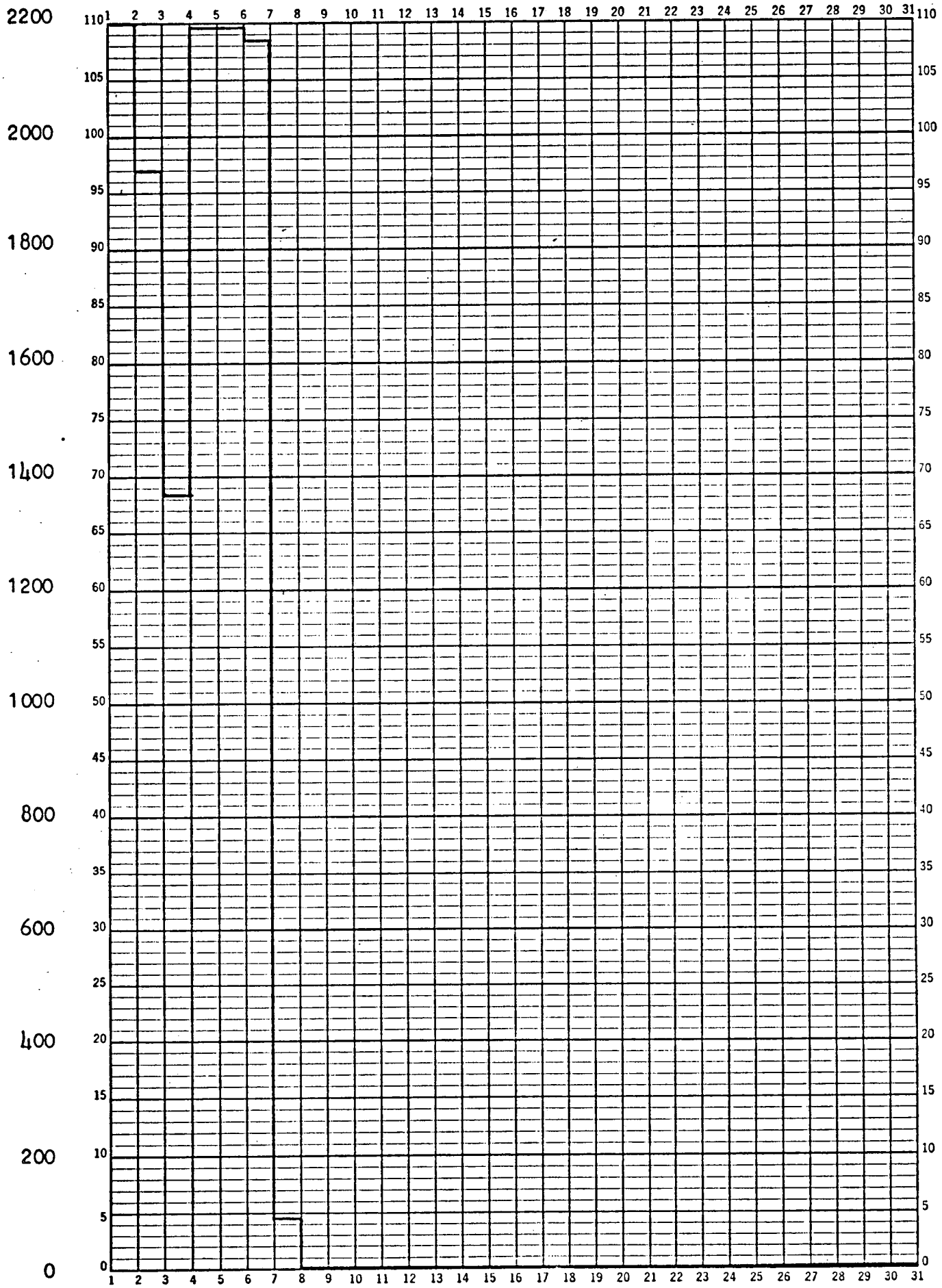
VI. Solid Radioactive Waste

A. Total volume of solid waste generated (Cubic Feet). --

B. Gross curie activity involved (Curie). --

C. Disposition of materials shipped off site.

Quantity	Shipped to
--	--



OUTAGE REPORT FOR MAY, 1972

NUMBER	DATE	TYPE	PLANT CONDITION	REASON	DURATION
1	3	Trip	Power Level - 99.7% Electrical Load - 575 MW	Steam Generator water level control system was not responsive to turbine runback initiated by spurious dropped rod signal and a high level occurred in SG-3.	2Hr., 20 Min.
2	7	Shutdown	----------	Shutdown for replacement of moisture separator reheater tube bundles.	167Hr., 6Min.
3	7	Trip	Power Level - 450 CPS Electrical Load - 0	Spurious signal unblocked low pressure pressurizer trip.	----------
4	14	Shutdown	----------	Shutdown for training startups.	35 Min.
5	14	Shutdown	----------	Shutdown for training startups.	13 Min.
6	14	Shutdown	----------	Shutdown for repairs to leaking steam generator tubes.	597 Hr., 42 Min
7	14	Trip	Power Level - 1000 CPs Electrical Load - 0	Low level in No. 3 S.G. when steam dump was isolated.	----------

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Instrument Air Compressor "B"	Corrective	None	Worn internal parts	Pump would not carry load	Installed new piston rings, scraper, and shaft packing	10 Hr.
"B" Battery Charger Control Power Transformer	Corrective	None	Defective transformer	"B" battery charger would not function	Installed new transformer	6 Hr.
"B" Emergency Diesel Air System	Corrective	None	Defective solenoid plungers	Air leakage	Replaced plunger	2 Hr.
Component Cooling Water "A" Pump Suction Gages	Corrective	None	Gages were defective	No indication	Gages were replaced	1 Day
"B" Service Water Booster Pump	Corrective	None	Pump inlet pressure switch was out of calibration	Erratic operation of control relay	Calibrated the inlet pressure switch	2 Hr.
Pressure Transmitter No. 1025 on WDSBR Panel	Corrective	None	Transmitter in need of calibration	Erroneous indication	Calibrated transmitter	3 Hr.
"A" Boric Acid Tank Heaters	Corrective	None	Temperature controller mechanically binding	Improper temperature control	Freed up the controller	1 Hr.
Generator Hydrogen System	Corrective	None	Ineffective sealing of bearing bracket horizontal joints	Hydrogen leakage	Packed joints with sealant and tightened the bearing brackets	14 Hr.
"A" Service Water Booster Pump	Corrective	None	Defective oil seals	Oil leakage	Replaced the seals	4 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Auxiliary Drain Collecting Tank Pump	Corrective	None	Defective Seal	Leakage from packing gland	Installed new seal	2 Hr.
Nitrogen Supply to "B" Condenser North Side Dump Valve	Corrective	None	Pipe was broken	Valve was inoperative	Repaired the broken pipe	3 Hr.
Seal Water Injection Filter Inlet and Outlet Valves	Corrective	None	Defective packing	Stuffing box leakage	Repacked the valves	4 Hr.
Feedwater Heater "1B" Condenser Vent Valve	Corrective	None	Defective gasket	Body to bonnet leakage	Replaced defective gasket	2 Hr.
"B" Charging Pump Speed Controller	Corrective	None	Malfunctioning pilot nozzle assembly	Excessive air bleeding out of controller vents	Replaced the pilot nozzle assembly	1½ Hr.
Nuclear Instrumentation NI-36	Corrective	None	Defective source range detector	No indication	Installed new source range detector	12 Hr.
Residual Heat Removal Pump "A"	Corrective	None	Defective shaft seal	Excessive leakage	Installed new seal assembly consisting of gaskets, shaft sleeve, seat, seat ring, bellows, and packing	16 Hr.
"B" Acid Pump	Corrective	None	Faulty joint	Excessive leakage around discharge check	Installed a new head gasket and teflon seal	

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Gas Driven Fire Pump	Corrective	None	Capacitive pickup was being obtained in cable run	Spurious alarms every time engine run signal was sent	Capacitors were added to short out pickup	8 Hr.
Heat Tracing Circuits - No. 35 and 37	Corrective	None	Fuse was blown on circuit 35	Improper temperature control	Replaced the blown fuse	1 Hr.
Steam Driven Feedwater Pump Discharge Valve V2-148	Corrective	None	Limit switch was out of adjustment	Fully closed indication could not be obtained	Adjusted the limit switch to indicate proper valve position	2 Hr.
Condenser Vacuum Pump Run Time Meter	Corrective	None	Defective motor	Meter would not operate	Replaced motor	9 Days
Condensate Conductivity Meter	Corrective	None	Meter out of adjustment	Meter would not check properly	The meter was cleaned and adjusted	2 Hr.
"A" and "B" EH System Pump Discharge Gauges	Corrective	None	The indication pointers were broken	No pressure indication	The pointers were replaced	5 Hr.
"A" Gas Stripper	Corrective	None	Low level alarm light socket was defective	Low level alarm light would not function	Replaced the light socket	5 Days
Steam Dump Valves No. 1325A, 1325B, 1325D, and 1324A-1	Corrective	None	Worn valve parts	Excessive leakage	Machined seat and installed new stem and packing	48 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Condensate Discharge Valve No. V-5-3	Corrective	None	Limit switches not properly set	Valve movement not correct	Cleaned limit switches, and heater inside of switch cover was re-wired to prevent condensation	4 Hr.
"A" and "B" Condensate Pump Discharge Temperature Indication Wells	Corrective	None	Faulty joints	Leakage around wells	Tightened wells and calibrated temperature switches	8 Hr.
Loop 1 Protection ΔT Indicator	Corrective	None	Faulty capacitor	Indication pegged at full scale	Replaced the capacitor	2 Hr.
Turbine Redundant Overspeed Trip System (TROTS)	Corrective	None	Defective solenoid valve coil	Valve 1-1-L did not close when a trip occurred	Replaced the solenoid coil	2½ Hr.
Auxiliary Feedwater Discharge Valve V2-14A	Corrective	None	Defective body to bonnet seal ring	Body to bonnet leakage	Replaced the seal ring	8 Hr.
Feedwater Heaters "6A" and "6B" Drain Valves	Corrective	None	Valve positioners were out of adjustment	"6A" valve failed shut and "6B" valve failed open	A section of bent tubing in the air supply to the valves was replaced and the positioners were adjusted	16 Hr.
Feedwater Heater "5A" Gage Glass	Corrective	None	Defective upper isolation valve and union	Excessive leakage around gage glass	Replaced the valve and union	4 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Hotwell Level Controller	Corrective	None	Air line to controller was broken	Improper controls	Replaced the broken air line	4 Hr.
South Buss Voltage Computer Input	Corrective	None	Defective transducer	Erroneous input	Replaced the transducer	3 Hr.
Shutdown Bank "A" Rod Position Indicator N-7	Corrective	None	Defective operational amplifier	Erroneous indication	Replaced the amplifier	4 Hr.
Feedwater Heaters "1A" and "6A" Gage Glasses	Corrective	None	Faulty glass	Excessive leakage	Replaced the glass	1½ Hr.
Condensate Pump Recirculation Valve No. 1446	Corrective	None	Valve operator bent and and yoke broken	Valve was inoperative	Installed new yoke and valve actuator	6 Hr.
Water Treatment Acid Pump No. 1	Corrective	None	Defective diaphram	Pump malfunctioned	Installed a new diaphram	4 Hr.
Steam Traps on Steam Heating Units No. 2 and 3	Corrective	None	Small holes in trap covers	Steam leakage	Weld repaired the holes	4 Days
Fire Hose at Waste Condensate Tank Station	Corrective	None	Defective gasket	Leaking hose	Replaced defective gasket	1 Hr.
Feedwater Heater "4A" Drain Valve No. HDV-LCV 1506B	Corrective	None	Defective packing	Stuffing box leakage	Repacked valve	3 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" Boric Acid Transfer Pump	Corrective	None	Pump shorted out	Pump was inoperative	Installed new pump and repaired existing pump	10 Hr.
Control Valve Movement Indicator and RPM Recorder	Corrective	None	Defective potentiometers	Erratic indication	Installed new potentiometers	12 Hr.
Boric Acid Filter Inlet Pressure Gage	Corrective	None	Gage out of calibration	Improper indication	Calibrated gage . .	½ Hr.
Radiation Monitor R-18	Corrective	None	Defective electrical connection	Monitor was inoperative	Resoldered connection	3 Days
"A" Diesel Generator Pyrometer	Corrective	None	Thermocouples connections were faulty	Erratic indication	Connections were scraped and cleaned	1 Hr.
Nuclear Instrumentation	Corrective	None	Bi-stable on intermediate range drawer was not set properly	Improper indication	Bi-stable was reset	1 Hr.
Lundell Annunciator System	Corrective	None	Malfunction of No. 3 AC to DC inverter	Inverter was inoperative	Repaired inverter	12 Hr.
Heater Drain Tank Emergency Drain Valve No. 1530B	Corrective	None	Valve internals were defective	Leakage past seat	Installed new valve internals	16 Hr.
Bearing Oil Low Pressure Trip Gage	Corrective	None	Gage out of calibration	Setpoints not accurate	Calibrated gage and established proper alarm and trip setpoints	8 Hr.
"A" S.G. Feedwater Regulating Valve E.P. Converter Output Gage	Corrective	None	Defective gage	Erroneous indication	Installed new gage	5 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" Feedwater Pump Thermocouples	Corrective	None	Defective thermocouple well seals	Oil leakage around thermocouples	Resealed thermocouples	8 Hr.
Loop No. 3 Hot Leg Sample Valve No. V955B	Corrective	None	Position switch operator out of adjustment	Erroneous position indication	Adjusted position switch operator	1 Hr.
Gland Steam Pressure Indicator PI-4004	Corrective	None	Gauge out of calibration	Erroneous indication	Calibrated gage	½ Hr.
"6A" Feedwater Heater High Level Alarm	Corrective	None	Micro-switch actuator out of adjustment	Alarm was inoperative	Adjusted micro-switch actuator	½ Hr.
Right Main Stop Valve	Corrective	None	Limit switch out of adjustment	Erroneous indication	Adjusted the limit switch	1 Hr.
Right Intercept Valve	Corrective	None	Limit switch out of adjustment	Erroneous position indication	Adjusted the limit switch	1 Hr.
"A" Circulating Water Pump Discharge Valve	Corrective	None	Contacts on valve operator were defective	Valve would not open	Replaced the contacts	5 Hr.
"A" Circulating Water Pump	Corrective	None	Faulty micro-switch	Pump would not start	Replaced the defective micro-switch	2 Hr.
Fire Alarm in Transformer Yard	Corrective	None	Defective micro-switch	Spurious alarms	Replaced the micro-switch	3 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" Feedwater Heater Drain Pump Recirculating Valve	Corrective	None	Faulty pipe nipple joint	Excessive leakage	Installed a new pipe nipple	4 Hr.
Isolation Valve to Pressure Gage PI-148	Corrective	None	Defective valve joint	Excessive leakage	Installed a pipe cap on the valve	½ Hr.
"1A" Moisture Separator Reheater Relief Line Drain Trap	Corrective	None	Defective union joint	Excessive leakage	Replaced the union and remade joint	5 Hr.
Seal Water Tank Level Control Valve	Corrective	None	Malfunction of valve	No level control	Cleaned valve and lapped seat	3 Hr.
Spent Fuel Pit Steam Heating Unit Drain Trap	Corrective	None	Small Hole in trap	Steam leakage	Weld repaired the hole in trap	2 Hr.
Demineralized Water System No. 2 Strong Acid Pump	Corrective	None	Defective shaft seal	Oil leakage around pump shaft	Installed a new shaft seal	3 Hr.
"B" Heater Drain Tank Gage Glass	Corrective	None	Glass was discolored	Unable to read level	Installed a new glass assembly	1 Hr.
Engine Driven Fire Pump	Corrective	None	Expansion joint failure	Expansion joint not functioning	Installed new expansion joint	8 Hr.
Waste Evaporator Level Control Valve	Corrective	None	Valve was stuck in open position	Loss of level control	Disassembled, cleaned, and reassembled valve	5 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"B" Auxiliary Boiler	Corrective	None	Defective fuel valves	Valve would not energize to fire boiler	Installed a new fuel valve	3 Hr.
Heat Tracing Boric Acid Transfer Pumps	Design Change	None	Heat tracing failure	Excessive maintenance	Replaced heat tracing with 500 watt strip heaters for increased reliability	8 Hr.
Instrument Air Compressors	Corrective	None	Pressure switches out of adjustment	"A" and "B" compressors could not be run simultaneously in different operating modes	Calibrated the pressure switches	3½ Hr.
Heat Tracing Circuit P-51	Corrective	None	Circuit failed open	Loss of heat control	Replaced defective circuit	11 Hr.
Instrument Buss Inverter "B"	Corrective	None	Defective filter capacitor	Loss of inverter control	Replaced the capacitor	5 Hr.
"A" Instrument Air Compressor	Corrective	None	Worn rod bushings	Knocking sound from crank case warning of imminent rod failure	Installed new rod bushings	5 Hr.
"B" Auxiliary Boiler	Preventive	None	Boiler tubes required cleaning	Excessive stack temperature	Rodded out tubes and cleaned boiler. Also repaired cracked air diffuser	7 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Residual Heat Removal System Low Flow Alarm	Corrective	None	Defective Alarm comparator	Erratic alarm operation	Installed new alarm comparator FC-605A	2 Hr.
"C" Phosphate Pump	Corrective	None	Defective diaphram	Oil leakage	Installed new diaphram	2½ Hr.
"C" Feedwater Regulator Bypass Control Valve FCV-499	Corrective	None	E1P converter out of adjustment	Valve would not close completely	Adjusted converter	½ Hr.
Heater Drip Regulating Valve No. 1530-A	Corrective	None	Worn valve internals	Leakage through valve	Replaced upper and lower seats, bushings, stem and packing	32 Hr.
Pressurizer Valves No. 455A, 455C, and 456	Corrective	None	Defective valve seals	Body to bonnet leakage	Installed new cage and body gaskets and lapped valve cage and plug assemblies	27 Hr.
Gland Steam Supply Regulator	Corrective	None	Regulator malfunctioned	Regulator would not supply steam seal	Regulator was disassembled, cleaned, and adjusted	1 Hr.
Portal Radiation Monitor	Corrective	None	Detector malfunctioned	No. 6 detector would not alarm	Cleaned the detector and returned it to service	½ Hr.
Feedwater Heater "4A" Isolation Valve	Corrective	None	Packing failure	Leakage around stuffing box	Repacked valve	-----
Feedwater Heater "6A" and "6B" Tap Root Valves	Corrective	None	Packing failure	Leakage around stuffing box	Repacked valve	-----

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Feedwater Heater "6A"	Corrective	None	Defective gasket	Leakage around main flange	Replaced gasket	-----
Feedwater Heater "6A"	Corrective	None	Manway diaphram failure	Steam leak at manway	Repaired diaphram	-----
Feedwater Regulator Valves "A" and "C"	Corrective	None	Packing failure	Stuffing box leakage	Repacked valves	-----
Steam Generator No. 1 Root Isolation Blowdown Valve	Corrective	None	Defective packing	Stuffing box leakage	Repacked valve	-----
Low Pressure Turbine No. 1 Steam Inlet Line Vent	Corrective	None	Valve not seating properly	Leakage past seat	Installed pipe cap on valve	-----
Main Steam Vent Valve Downstream of Valve MS-33	Corrective	None	Defective valve internals	Excessive leakage	Replaced entire valve	-----
Main Steam Isolation Valves to Steam Analyzer - Valve Nos. MS-12B and MS-12C	Corrective	None	Defective valve internals	Excessive leakage	Replaced valves	-----
No. 2 Steam Header Isolation Valve and Isolation Valves on Warm-Up Lines to Steam Driven Feed Pump	Corrective	None	Faulty packing	Stuffing box leakage	Repacked valves	-----

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" Heater Drain Pump	Corrective	None	Faulty flange gasket	Excessive leakage	Installed new gasket	-----
Moisture Separator Reheater Vent Valve No. 1333B	Corrective	None	Defective packing	Excessive stuffing box leakage	Repacked valves	-----
"B" Accumulator Pressure and Level Sensor Root Valve No. 51 881F	Corrective	None	Defective packing	Excessive stuffing box leakage	Repacked valves	-----
Chemical and Volume Control Valve No. FT-122	Corrective	None	Defective packing	Excessive stuffing box leakage	Repacked valves	-----
"6A" Moisture Separator Drain Tank Lower Sight Glass Valve	Corrective	None	Defective packing	Excessive stuffing box leakage	Repacked valves	-----
Reactor Coolant Valve 556A	Corrective	None	Defective packing	Excessive stuffing box leakage	Repacked valves	-----
"1A" Moisture Separator Vent Valve	Corrective	None	Defective valve internals	Leakage through valve	Installed new valve	-----
"1A" Moisture Separator Vent Line to "6A" Heater	Corrective	None	Faulty weld joint	Leakage at welded joint	Ground out old weld and rewelded joint	-----
Accumulator Nitrogen Bottle Supply Line	Corrective	None	Cracked tubing	Nitrogen leakage	Cut out leaking section of tube and soldered back to fitting	-----

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OU OF SERVICE
			CAUSE	RESULT		
Radiation Monitor R-18	Corrective	None	Defective check source switches & alarm set switches	Monitor pegged low and would not source check	Repaired the switches	4 Hr.
"A" Boric Acid Evaporator	Corrective	None	Low level alarm in need of adjustment	Erroneous alarm	Adjusted low level alarm setpoint	1 Hr.
Purge Valve on 2A Moisture Separator Reheater	Corrective	None	Defective packing	Packing leakage	Repacked valve	1½ Hr
"A" Instrument Air Compressor	Corrective	None	Manual switch out of adjustment	Compressor would not unload properly	Adjusted manual switch	½ Hr.
Engine Driven Fire Pump	Design Change (Mod. & Setpoint Rev. Approval No. 57)	None	----------	Modification prevents pressure drop spikes from starting engine	Added a 10 second time delay to engine start signal	4 Hr
Waste Disposal System - Spent Resin Disposal	Design Chg. (Mod. & Setpoint Rev. Approval No. 61)	None	Resins required drumming under original arrangement	Modification in order to have capability of transferring spent resins as a liquid slurry	A 2 inch tee with diaphram isolation valve was added to the system	----

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Primary Water System	Design Chg. (Mod. & Set-point Rev. Approval No. 62)	None	Original arrangement required a temporary hose to be used for flushing	Provides a source of water for flushing waste evaporator	Installed a run of piping from primary water line in boric acid evaporator room to the waste evaporator room	------
Safety Platforms and Ladders for Secondary System	Design Chg. (Mod & Set-point Rev. Approval No. 64)	None	----------	Provides safer working conditions for access to main steam piping and turbine	Installed walkway over main steam headers, platform over main steam drain lines, and ladder & safety platform for H.P. turbine No. 2 bearing	------
Chemical and Volume Control System Boric Acid Storage Tanks	Design Chg. (Mod & Set-point Rev. Approval No. 65)	None	Possible blockage of line by solidified boric acid	This modification permits flushing of concentrates holding tank discharge line to prevent the line from being blocked by boric acid	Installed piping from concentrates holding tank discharge and boric acid storage tank to the closed floor drain system	------
Spent Fuel Cask Crane	Design Chg. (Mod & Set-point Rev. Approval No. 66)	None	Original cable was not sufficient length	Lengthened tagline cable to provide effective triggering device for safety cable system	Replaced original tagline drum and tagline with larger capacity drum and and longer cable	------

CAROLINA POWER & LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT

REPORT FOR JUNE, 1972

The major work accomplished this month was the completion of the steam generator repairs initiated in May. A detailed account of this repair is included in Appendix II of this report. The subject work was completed, and the plant returned to full power service on June 10.

Two abnormal conditions occurred during the month. On June 7, a routine equipment check revealed that "A" containment spray pump would not rotate freely when turned by hand. This condition was noted during the time the reactor was shut down for the steam generator repairs. The pump was disassembled and inspected. It was discovered that the pump impeller alignment ring had galled and was binding on the casing alignment seal ring. Subsequently, these parts were removed, and a new impeller, impeller alignment seal ring, and casing alignment ring were installed. The pump was next reassembled and successfully tested for satisfactory operation. This item is listed in the monthly maintenance report.

The second abnormal condition occurred on June 20. At that time, the plant was being operated at 98% reactor power when a reactor runback was experienced. This runback was a result of control rods H-4, H-8, and H-12 in group "2" of control bank "D" dropping into the core. Action was taken to borate the reactor to approximately 8% power with simultaneous reduction of turbine load. Load was then removed, and the reactor was manually tripped and placed in hot shutdown. Investigation revealed that the cause of malfunction was the failure of a multiplexing thyristor of the moveable gripper coil circuit located in power cabinet

2BD. The thyristor was replaced, and the reactor returned to power on June 20. The subject incidents were reported in accordance with section 6.6 of the H. B. Robinson Technical Specifications.

The major work accomplished this month, other than the steam generator repairs, was the completion of the addition of polishing demineralizers to the waste disposal system. This system consists of two 30 cubic foot mixed-bed ion exchangers with a 35 gpm filter downstream of the ion exchangers to pick up resin particles. The intent of the modification is improvement of the decontaminating performance of the waste processing system. The polishing demineralizers will be used in the normal mode of operation to further "clean up" the waste evaporator condensate by recirculating the contents of one of the waste condensate tanks. They may also be aligned to process waste water directly from the holdup tank. Decontamination factors of 100 were anticipated, but factors of only 20 have been attained.

The only other design change performed this month was the temporary recalibration of the comparators and summators in the Δ T overpower, overtemperature protection circuits. This change was based on the variation in the margin to trip and reduction in full power delta-T reflected in previous test data. The recalibration was performed to provide sufficient safety limits in the reactor protection system until more data could be taken to determine new set points and/or problem areas. Additional data was taken and revealed that no problems existed. Therefore the set points were returned to 55°F delta-T at 100% power.

A maximum plant thermal output of 2180.2 megawatts was achieved on June 30.

June, 1972

CAROLINA POWER AND LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT
UNIT NO. 2

OPERATING SUMMARY

I. Nuclear

A. Number of hours the plant was operated. 505.01

B. Number of times the reactor was made critical. 12

C. Gross thermal power generated (MWH). 990,897.6

D. Equivalent full power hours. 450.408

II. Electrical

A. Gross power generated (MWH). 313,979

B. Net power generated (MWH). 296.056

C. Length of time generator was on line (Hours). 494.19

III. Radioactive Liquid Waste Discharged on Site

A. Total curie activity discharged (excluding Tritium) (Curies). 0.05859

B. Total curies of Tritium discharged (Curies). 19.72452

C. Total volume of liquid waste discharged (Gallons). 387,057.7

D. Total volume of dilution water used (Gallons). 3,633,330,000

E. Average concentration at discharge canal outfall (uc/cc). 4.27176×10^{-12}

F. Time and date of the maximum concentration released (for any consecutive 24 hours during the reporting period).

Time 12:00 P.M. Date June 10, 1972

G. MPC used 1×10^{-7} uci/ml Basis Technical Specifications for Unidentified Activity

IV. Radioactive Liquid Waste Shipped off Site

A. Total curie activity shipped (excluding Tritium) (Curies) 1.30797

B. Total curies of Tritium shipped (Curies). 4.450

Operating Summary Cont'd.

C. Total volume of liquid waste shipped (Gallons). 14,800.0

D. Average concentration of liquid waste shipped (uc/cc). 7.95×10^{-2}

E. Time and date of the maximum concentration shipped (for any consecutive 24 hours during the reporting period).

Time -- Date June 10, 1972

V. Gaseous Waste

A. Total curie activity discharged (Curies). 0.21914

B. Time and date of maximum activity released (for any consecutive 24 hours during the report period).

Time 4:33 P.M. Date June 27, 1972

C. The MPC used, if greater than:

1. $3X10^{-8}$ uc/cc for noble and activation gas. --

2. $1.43X10^{-13}$ for halogens with greater than an eight day half-life, and for particulates with greater than an eight day half-life. --

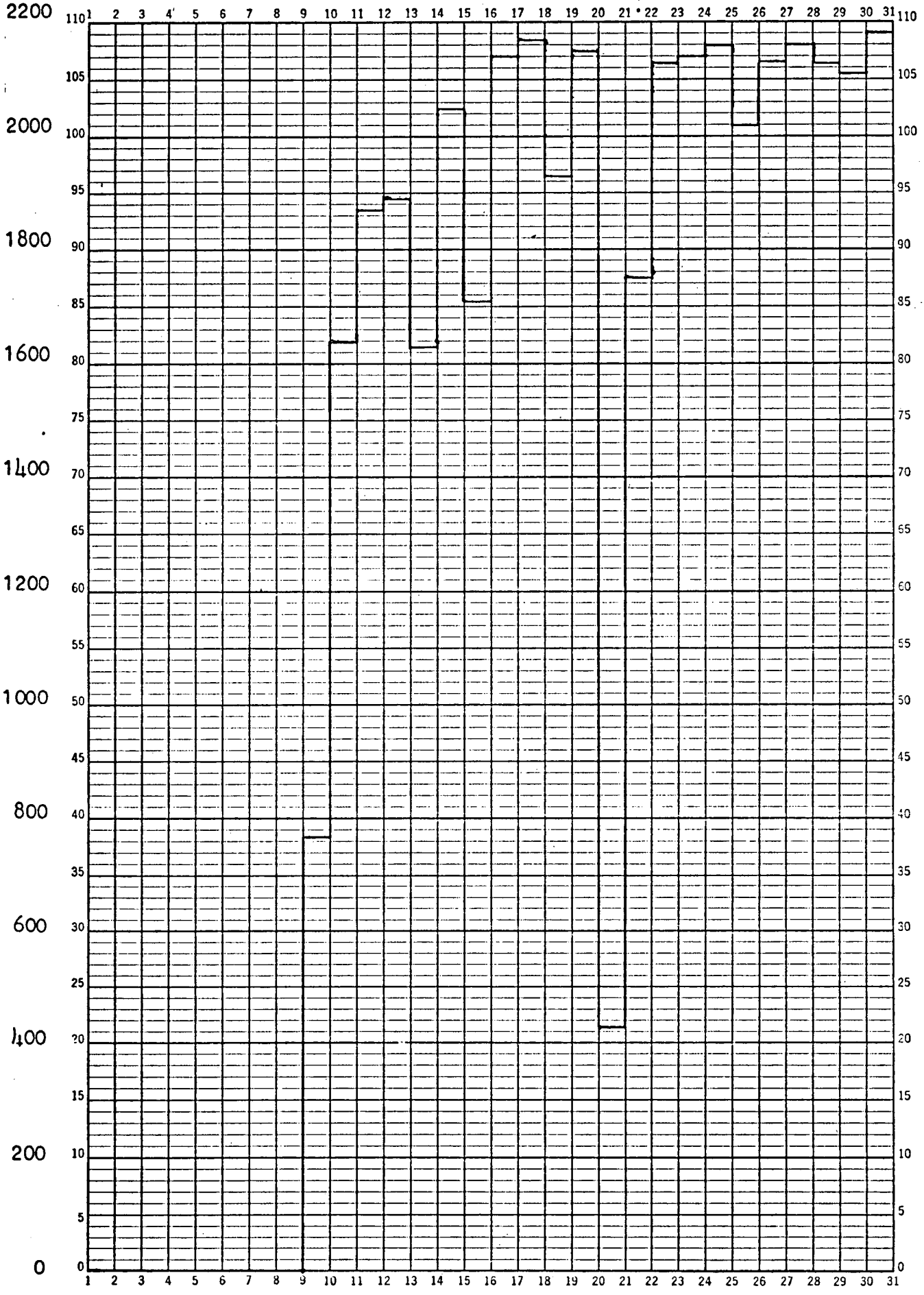
VI. Solid Radioactive Waste

A. Total volume of solid waste generated (Cubic Feet). 762.5

B. Gross curie activity involved (Curie). 1.699

C. Disposition of materials shipped off site.

Quantity	Shipped to
$762.5\ Ft^3$	Chem-Nuclear Services, Inc.



Month June 19 72

OUTAGE REPORT FOR JUNE, 1972

NUMBER	DATE	TYPE	PLANT CONDITION	REASON	DURATION
1	7	Trip	Power Level - 900 CPS Electrical Load - 0	Maintenance work in ΔT protection system initiated erroneous over temperature ΔT Trip	--
2	8	Trip	Power Level - 0 Electrical Load - 0	Reconnection of RTD's caused erroneous signal to initiate over temperature ΔT Trip	--
3	8	Shutdown	--	Shutdown for training startups	36 Min.
4	8	Shutdown	--	Shutdown for training startups	41 Min.
5	8	Shutdown	--	Shutdown for training startups	35 Min.
6	8	Shutdown	--	Shutdown for training startups	37 Min.
7	8	Shutdown	--	Shutdown for training startups	1 Hr., 3 Min.
8	8	Shutdown	--	Shutdown for AEC Licensing startups	1 Hr.
9	8	Trip	Power Level - 0 Electrical Load - 0	Manual Trip for AEC Licensing Startups	1 Hr.
10	8	Shutdown	--	Shutdown for training startups	51 Min.
11	9	Shutdown	--	Shutdown for training startups	10 Min.
12	13	Trip	Power Level - 98% Electrical Load - 675MW	Instrumentation spike initiated ΔT over temperature trip	1 Hr., 29 Min.
13	20	Trip	Power Level - 8% Electrical Load - 25 MW	Malfunction resulted in three dropped control rods and manual trip was initiated	7 Hr., 23 Min.
14	20	Trip	Power Level - 4000 CPS Electrical Load - 0	Manual trip initiated to perform maintenance on control rod drive system	--

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Component Cooling Heat Exchangers	Corrective	None	Defective piping joints	Leakage from discharge lines	Weld repaired leaking pipes	8 Hr.
Station Air Drain Trap	Corrective	None	Defective trap seating surface	Trap wouldn't drain properly	Lapped the ball seat	3 Hr.
Radiation Monitor R-18	Corrective	None	Defective switch and transistor	Alarm set & operate switch were inoperative	Repaired switch and replaced transistor	6 Hr.
Turbine Cross under Pipe	Corrective	None	Faulty gage glass joints	Steam leak at gage glass	Installed new gage glass	2 Hr.
Drain Valve on "A" Feedwater Line	Corrective	None	Defective seating surface	Leakage by valve seat	Installed cap on valve outlet	1 Hr.
Boric Acid Charging Pump Piping	Corrective	None	Defective gaskets	Leakage at suction to boric acid charging pump	Installed new gaskets and remade joint	3 Hr.
Water System Strong Acid Pump	Corrective	None	Faulty joint at suction flange	Leakage of acid	Installed new flange bolts and retorqued joint	1 Hr.
Boric Acid Filter Inlet Pressure Gage PI-113A	Corrective	None	Gage in need of calibration	Erroneous indication	Gage was calibrated	½ Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Feedwater Flow Indicators	Corrective	None	Flow indicators out of calibration	Erroneous indication	Calibrated flow indicators	2 Hr.
RTGB Alarm Acknowledge Switch	Corrective	None	Acknowledge switch was defective	Would not clear alarms	Replaced switch	3 Hr.
Loop 2 ΔT Protection Setpoints	Corrective	None	NM 306 amplifier in NIS Channel 42 was out of calibration	Overpower/over temperature ΔT setpoints decreased	Calibrated amplifier	3 Hr.
Radiation Monitor R-19	Corrective	None	Two switches failed	Monitor would not indicate	Replaced defective switches	1 Hr.
Moisture Separator Reheater Purge Valves	Corrective	None	Defective operators	Limitorque valve operators would not function	Replaced defective operator parts	16 Hr.
Sample Line from Pressurizer Water Space	Corrective	None	Defective fitting at isolation valve	Leakage around valve	Replaced valve and fitting	4 Hr.
"A" Gas Stripper	Corrective	None	Temperature controller and steam flow controller were out of adjustment	Controllers were not providing adequate control	Reset controller	3 Hr.
Demineralized Water System No. 1 Cation Conductivity Alarm	Corrective	None	Timing cams were out of adjustment	Spurious alarms	Adjusted alarm timing cams	5 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Seismic Alarm Annunciator	Corrective	None	Moisture had entered pull box	Alarm annunciator would not function	Installed a new gasket on pull box cover to keep out moisture	1 Hr.
"A" Steam Generator Feedwater Auxiliary Oil Pump	Corrective	None	Pressure actuated start up switch was out of adjustment	Oil pump would not start properly	Adjusted the pressure switch	-----
Feedwater Flow Transmitters	Corrective	None	Transmitters were out of calibration	Erroneous indication	Transmitters were calibrated	2 Hr.
Demineralized Water Acid Percent Meter	Corrective	None	Potentiometer was in need of calibration	Erroneous indications	Potentiometer was calibrated	4 Hr.
Pressurizer Spray Line Low Temperature Alarm	Corrective	None	Signal comparator was out of calibration	Erroneous indication	Calibrated comparator	1 Hr.
Waste Evaporator Feed Pump Flow Indicator	Corrective	None	Build up of boric acid in sensing line	Erroneous indication	The sensing line was cleared	1½ Hr.
"A" Boric Acid Transfer Pump Discharge Pressure Gage	Corrective	None	Gage in need of calibration	Erroneous indication	Gage was calibrated	½ Hr.
Condensate Pump Recirculation Valve	Corrective	None	Faulty valve internals	Valve malfunction	Overhauled valve internals and reset valve indication limit switches	8 Days
"A" Waste Gas Compressor Moisture Separator Level Indication	Corrective	None	Pressure transmitter zero point had shifted	Erroneous indication	Transmitter was zeroed	3 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Sample System Valve No. 953	Corrective	None	Faulty body to bonnet joint	Leakage at the joint	Replaced gasket and remade the joint	4 Hr.
Instrument Air Lines to SG Blow-down Air Operated Valves 1930 A & B	Corrective	None	Air lines ruptured	Valves would not operate	Installed new air lines	2 Hr.
Level Transmitters for Laundry & Hot Shower Tanks	Corrective	None	Air regulator feeding rotometer was defective	Erroneous indication	Replaced the air regulator	4 Hr.
Main Steam Valve MS-140	Corrective	None	Defective packing	Packing leakage	Repacked the valve	1½ Hr.
Penetration Pressurization Receiver	Corrective	None	Pin hole in weld joint	Air leakage	Weld repaired joint	2 Hr.
Main Condensate Pump Recirc Valve	Corrective	None	Yoke fractured	Valve was inoperative	Weld repaired yoke and straightened valve stem	8 Hr.
Electro Hydraulic System	Corrective	None	Impulse pressure transmitter failed	Erroneous switch to manual operation	Replaced the transmitter	14 Hr.
Radiation Monitor R-14	Corrective	None	Defective detectors	Erratic indication	Replaced detectors	8 Hr.
Generator Hydrogen Pressure Alarm	Corrective	None	Low alarm relay was defective	Alarm would not clear	Replaced the relay	4 Hr.
Waste Evaporator Feed Tank Pump	Corrective	None	Stator windings burned open	Pump was inoperative	Replaced pump	10 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Containment Vessel Pressure Indication	Corrective	None	Pressure transmitter was out of calibration	Erroneous indication	Calibrated transmitter	1 Hr.
Volume Control Tank Low Pressure Alarm	Corrective	None	Pressure indicator was out of calibration	Alarm occurring at wrong setpoint	Calibrated pressure indicator	1 Hr.
Concentrates Holding Tank Pump	Corrective	None	Pressure switch was out of adjustment	Pump was cycling on and off at wrong setpoints	Adjusted switch	1 Hr.
Loop No. 1 Letdown Valves No. 460 "A" & "B"	Corrective	None	Defective body to bonnet joints	Leakage around bonnet	Replaced body to bonnet gasket and remade joints	6 Hr.
Before Seat Drain Line Serving Valve MS-10	Corrective	None	Pin hole in elbow	Leakage at elbow	Weld repaired leaking elbow	2 Hr.
Reactor Coolant Flow Transmitter	Corrective	None	Transmitter failure	Loss of flow indication in channel 1, Loop 2	Replaced defective transmitter	5 Hr.
"B" Instrument Air Compressor	Corrective	None	Faulty time delay relay	Compressor would not start in automatic mode	Replaced relay	4 Hr.
"A" Spray Pump	Corrective	None	Damaged casing ring, impeller ring, and impeller	Pump operation was "rough"	Replaced defective parts	5 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Nuclear Instrumentation Channel N-43	Corrective	None	Dropped rod bistable relay was defective	Dropped rod/ rod stop alarm would not clear	Replaced relay	3 Hr.
"A" RHR Pump Drain Line	Corrective	None	Hole in the drain line	Leakage from drain line	Weld repaired leaking line	4 Hr.
"A" Boric Acid Storage Tank Heater	Corrective	None	Heater was shorted to ground	Heater was inoperative	Replaced heater	2 Hr.
Full Length Rod Control	Corrective	None	Failure of power supply	Non-urgent alarm would not clear	Replaced power supply	4 Hr.
Reactor Coolant System Pressure Indicator	Corrective	None	Transmitter was out of calibration	Erroneous indication	Calibrated transmitter	1 Hr.
Penetration Pressurization Air Receiver Relief Valve	Corrective	None	Valve not seating properly	Leakage by valve seat	Lapped seat and disc.	4 Hr.
"A" RHR Pump	Corrective	None	Defective gasket at pump housing joint	Leakage at the joint	Installed a new gasket	4 Hr.
Nuclear Instrumentation Channel N-36	Corrective	None	Failure of differential amplifier	Erroneous indication	Replaced the amplifier and calibrated unit	6 Hr.
Nuclear Instrumentation Channels N-31 and N-35	Corrective	None	Water present in detector canister caused corrosion of terminals	No indication	Installed new source and and intermediate range detectors	23½ Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Neutral Water Pump	Corrective	None	Pump housing and discharge line had ruptured due to corrosion	Pump was leaking at discharge pipe	A new discharge pipe was installed and a temporary pump put in service until a replacement pump is received	29 Hr.
Condensate Pump Recirculation Valve Controls	Corrective	None	Failure of flow indication sensor FIS-1446	Condensate recirculation valve would not operate	Micro-switches in FIS-1446 were replaced and instrument recalibrated	11 Hr.
Main Steam Bypass Valve V1-3A	Corrective	None	Motor operator was defective	Valve would not operate	Rewound motor	1½ Hr.
No. 1 Left Reheat Stop Valve	Corrective	None	Scored plunger in test solenoid and defective o-ring in dump valve	Reheat valve would not operate	Polished solenoid plunger and replaced o-ring	8 Hr.
"4B" Feedwater Heater	Corrective	None	Defective weld joint at interface of baffle and manway cover	Leakage around manway cover	Rewelded baffle and manway cover joint	2 Hr.
"A" Vacuum Pump Seal Water Supply Float Valve	Corrective	None	Float was stuck	Valve was inoperative	Valve seat was lapped	3 Hr.
Gas Analyzer	Corrective	None	Oxygen analyzer had a defective magnet and sensor module	Analyzer was inoperative	Replaced the defective magnet and sensor	17 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" Boric Acid Tank Heater	Corrective	None	Heater controller was out of calibration	Improper heater control	Recalibrated controller	2 Hr.
Boron Injection Tank Heaters	Corrective	None	Heater controller out of calibration	Improper heater control	Recalibrated controller	3 Hr.
Pressurizer Control Group Heaters	Corrective	None	Voltage controller out of calibration	Pressure could not be maintained without back-up heaters in service	Calibrated voltage controller	9 Hr.
Generator Voltage Regulator	Corrective	None	Malfunction of 15 volt power supply in regulator limiting circuit	Operation in automatic mode was erratic	Power supply was replaced	4 Hr.
Water Treatment System Mixed Bed Demineralizer Outlet Valve	Corrective	None	Malfunction of limit switch on valve indicator	Improper indication	Switch was cleaned	½ Hr.
Auxiliary Feedwater High Temperature Alarm	Corrective	None	Alarm setpoint out of adjustment	Spurious alarms	Adjusted setpoint	1 Hr.
"A" Electro-Hydraulic Pump Discharge Pressure Gage	Corrective	None	Pointer was broken	No indication	Replaced broken pointer	½ Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Reactor Coolant Drain Tank Level Control	Corrective	None	Controller system was out of adjustment	Alarms would not actuate at correct setpoints	Zeroed transmitter and calibrated electronic pump trips and low level alarm	13 Hr.
"3B" Feedwater Heater Normal Drain Valve	Corrective	None	Defective o-rings in seal bushing	Valve would not fully open	Installed new o-rings	4 Hr.
Moisture Separator Reheater Isolation Valves	Corrective	None	Defective valve parts	Valve malfunction	Overhauled valves and reset limit switches	9 Hr.
Condensate Pump Recirc Bypass Valve	Preventive Maintenance	None	Defective valve internals	--	Installed new valve gage, stem, and disc.	3 Hr.
Δ T Overpower, Overtemperature Protection Circuits	Design Chg (Mod. & Setpoint Rev. Approval #69)	None	Previous data indicated excessive spread between operating Delta-T's and trip points	--	Temporarily recalibrated summators and comparators in overtemperature and over power circuits (See monthly summary	15 Hr.
Waste Disposal System	Design Chg (Mod & Setpoint Rev #39)	None	Present waste disposal system does not provide design decontamination factors	Large volumes of highly contaminated wastes cannot be processed rapidly	Added a polishing demineralizer system associated valves and piping to present waste disposal system in attempt to attain higher decontamination levels	--
Moisture Separator Reheater Limitorque Isolation Valves	Corrective	None	Defective valve parts	Valves were inoperative	Disassemble, replaced parts, cleaned, and reassembled valves	42 Hr.

CAROLINA POWER & LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT

REPORT FOR JULY, 1972

During the month of July, four abnormal operating conditions occurred at H. B. Robinson Unit No. 2. The first incident took place on July 7 following a reactor trip. The reactor was in hot shutdown, and the steam dump system was being regulated to dissipate decay heat when a safety injection signal was received. The safety injection was terminated and returned to normal operation. However, safety injection valves 867 "A" and "B" would not fully close. Valve operators and indicators appeared to be in good working order, and it was surmised that a small amount of boric acid had percipitated on the valve seats preventing the valves from shutting. Working from this assumption, heat tracing circuits were adjusted to their highest setting and heat was applied to the valve bodies. This action resulted in clearing the valve seats, and the valves were successfully shut. The reactor was maintained in a sub-critical condition until the valves were returned to service.

The next abnormal condition occurred on July 9 when the "B" loop Steam Line Isolation Valve failed closed while performing a test of the valve. A reactor trip resulted, and, when attempts to reopen the valve were unsuccessful, the plant was placed in a cold shutdown condition to further investigate the problem. A failed pin in the control linkage and a damaged valve operator were determined to be the cause of the malfunction. The limit switch which restricts valve stem movement apparently had failed to function properly, and excessive stem travel resulted in the damage. The valve was repaired, a new limit switch installed, and the plant returned to operation on July 12.

The third incident related to the fact that the boron concentration in the boron injection tank fell below the range of 20,000 to 22,500 ppm required by the H. B. Robinson Technical Specifications. This condition resulted while attempting to recirculate a boric acid tank with the boron injection tank. The interconnecting line was obstructed by percipitated boric acid which prevented pressurization of the boron injection tank. With valves 841 "A" and "B" open and valve 867 "A" not fully seated, the static head of the refueling water storage tank initiated a flow to the "A" boric acid storage tank and boron injection tank which led to their subsequent dilution. The diluted boric acid tank was first noted on July 13 at which time valve 867 "A" was cycled and shut, and "A" boric acid storage tank was adjusted back within specifications. At that time the boron injection tank sample line was clogged, and the concentration in the tank could not be determined. The line was cleared, and a sample taken on July 16 indicated the tank concentration was out of specification. It was then discovered that the tank recirculation line was clogged, and a temporary hose was connected from the boric acid storage tank to the boron injection tank to accomplish recirculation and adjust the boron concentration. The tank concentration was returned to the proper range on July 17. The recirculation line was cleared on July 18 by cutting and heating the line. To preclude the pipe clogging again a modification (Modification and Setpoint Approval No. 73) was performed which consisted of the addition of drain valves to the line. The line was returned to service on July 19.

The last incident occurring this month was the failure of the part length rod control system. At 5:58 P.M. on July 26 a "Part Length Rod Control

Alert" alarm was received. Investigation revealed that the alarm was of an erroneous nature and was caused by the failure of a frequency sensing relay that monitored the 60 cycle current to the part length rod control cabinet. The relay was replaced and the control system returned to service at 8:52 P.M., July 26.

All of the above incidents were reported in accordance with the H. B. Robinson Technical Specifications.

In addition to routine maintenance items, the plant was shut down for special maintenance on two occasions this month. One instance was for repair of '1B' moisture separator reheater purge valve leakage and '1B' and '2B' moisture separator reheater drain tank leaks. The second shutdown was for repairs to leaks in the secondary system. Both events were of a short term nature.

A maximum plant thermal output of 2197.8 megawatts was achieved on July 6.

July, 1972

CAROLINA POWER AND LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT
UNIT NO. 2

OPERATING SUMMARY

I. Nuclear

A.	Number of hours the plant was operated.	647.91
B.	Number of times the reactor was made critical.	7
C.	Gross thermal power generated (MWH).	1,222,900.8
D.	Equivalent full power hours.	555.864

II. Electrical

A.	Gross power generated (MWH).	388,612
B.	Net power generated (MWH).	366,767
C.	Length of time generator was on line (Hours).	612.42

III. Radioactive Liquid Waste Discharged on Site

A.	Total curie activity discharged (excluding Tritium) (Curies).	0.06420
B.	Total curies of Tritium discharged (Curies).	43.06151
C.	Total volume of liquid waste discharged (Gallons).	291,224.7
D.	Total volume of dilution water used (Gallons).	4,024,900,000
E.	Average concentration at discharge canal outfall (uc/cc).	4.214×10^{-12}
F.	Time and date of the maximum concentration released (for any consecutive 24 hours during the reporting period).	

Time 9:45 A.M. Date July 5, 1972

G. MPC used 1×10^{-7} uci/ml Basis Technical Specification for Unidentified Activity

IV. Radioactive Liquid Waste Shipped off Site

A.	Total curie activity shipped (excluding Tritium) (Curies)	--
B.	Total curies of Tritium shipped (Curies).	--

Operating Summary Cont'd.

C. Total volume of liquid waste shipped (Gallons). --

D. Average concentration of liquid waste shipped (uc/cc). --

E. Time and date of the maximum concentration shipped (for any consecutive 24 hours during the reporting period).

Time -- Date --

V. Gaseous Waste

A. Total curie activity discharged (Curies). 7.65789

B. Time and date of maximum activity released (for any consecutive 24 hours during the report period).

Time 12:29 A.M. Date July 12, 19?

C. The MPC used, if greater than:

1. $3X10^{-8}$ uc/cc for noble and activation gas. --

2. $1.43X10^{-13}$ for halogens with greater than an eight day half-life, and for particulates with greater than an eight day half-life. --

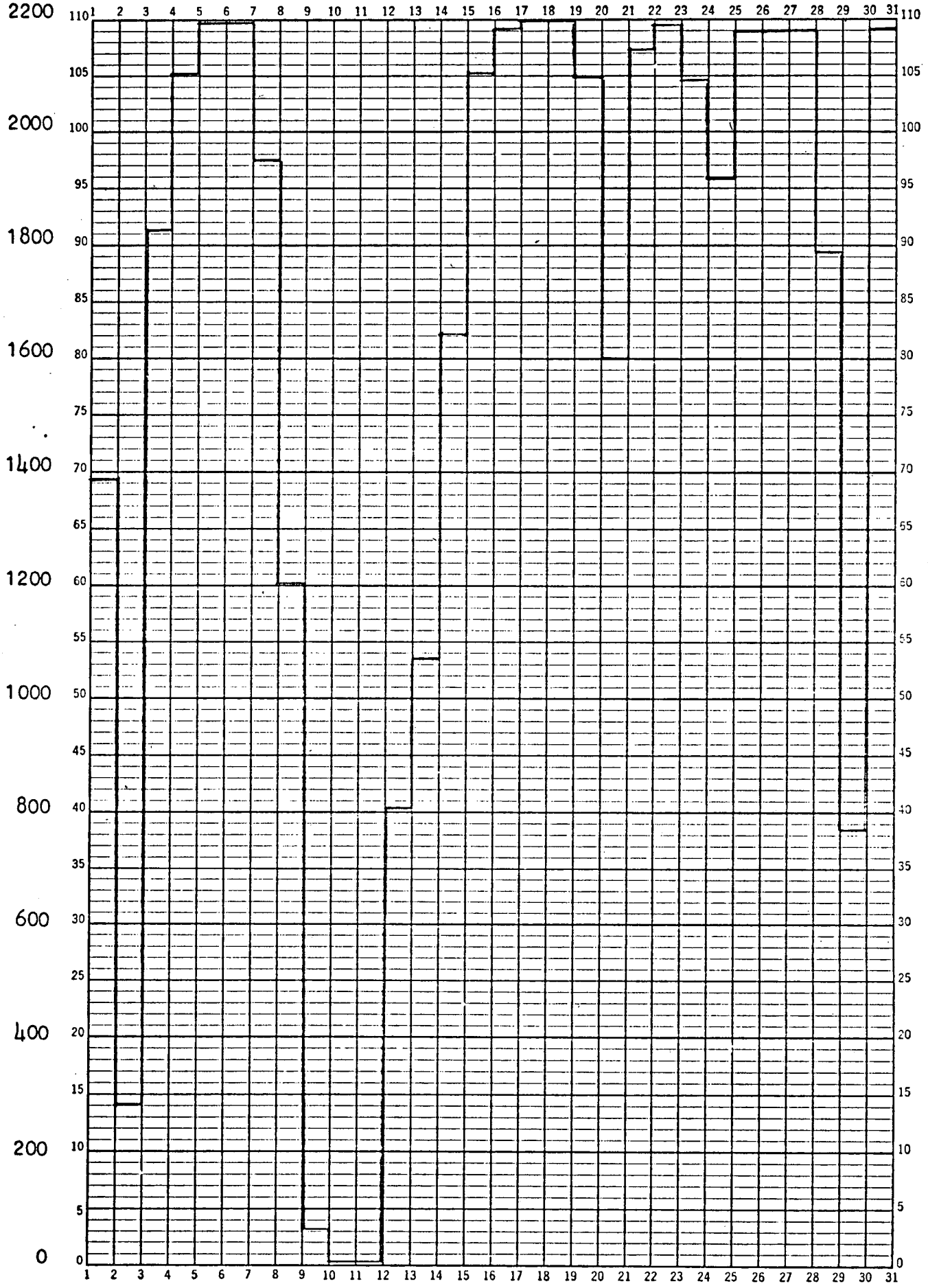
VI. Solid Radioactive Waste

A. Total volume of solid waste generated (Cubic Feet). 81.5

B. Gross curie activity involved (Curie). 0.03037

C. Disposition of materials shipped off site.

Quantity	Shipped to
81.5 Ft^3	Chem-Nuclear Services, Inc.



OUTAGE REPORT FOR JULY, 1972

NUMBER	DATE	TYPE	PLANT CONDITION	REASON	DURATION
1	1	Shutdown	--	Shutdown to repair leaks on moisture separator reheater valves	6Hr., 37 Min.
2	2	Trip	Power Level - 1.5×10^{-4} Amp. Electrical Load - 70 MW_e	Manual trip followed a turbine trip caused by loss of power supply to instrument busses 2 and 7	11Hr., 36 Min.
3	7	Trip	Power Level - 99% Electrical Load - 670 MW_e	Loss of Feedwater to steam generators was caused by blown fuse and led to lo level and steam and feedwater flow mismatch in steam generator No. 3	2 Hr., 46 Min.
4	8	Trip	Power Level - 12% Electrical Load - 50 MW_e	Failed solenoid operator prevented opening of "C" feedwater regulator valve resulting in Lo-Lo level in steam generator No. 3	1 Hr.
5	9	Trip	Power Level - 100% Electrical Load - 664 MW_e	Main steam stop isolation valve failed closed	66 Hr., 36 Min.
6	20	Trip	Power Level - 100% Electrical Load - 663 MW_e	Erroneous Lo level signal initiated while working on protection circuitry	47 Min.
7	20	Trip	Power Level - 10% Electrical Load - 15 MW_e	Operator error resulted in Lo-Lo level in steam generator "B"	29 Min.
8	24	Trip	Power Level - 100% Electrical Load - 649 MW_e	Erroneous signal initiated while working on TROTS channel	51 Min.
9	28	Shutdown	--	Shutdown to repair steam leaks on secondary system	16 Hr., 4 Min.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Spray Additive Tank	Corrective	None	Level transmitter out of calibration	Erroneous Indication	Calibrated level transmitter	1 hr.
Caustic Conductivity Indicator in Water Treatment System	Corrective	None	Conductivity meter in need of calibration	Erroneous indication	Calibrated meter	4 hr.
E.H. Pump Discharge Pressure Gage	Corrective	None	Indicator pointer was broken	No indication	A new pointer was installed	3½ hr.
Condensate Conductivity Meter	Corrective	None	Meter was out of calibration	Erroneous Indication	Calibrated meter	2 hr.
'2A' Feedwater Heater Drain Pump Recirculation Valve	Corrective	None	Motor operator square root converter out of calibration	Valve would not close at 300 MW	Calibrated converter	4 hr.
Feedwater Heaters "1B" & "2B"	Corrective	None	Controllers out of adjustment	Improper level control	Adjusted controllers	2 hr.
Waste Drumming System Valve 1799D	Corrective	None	Vacuum switch out of adjustment	Valve would not close at correct vacuum	Adjusted vacuum switch	6 hr.
Steam Generator No. 1 Pressure Gage	Corrective	None	Gage out of calibration	Erroneous indication	Calibrated gage	1 hr.
"B" Diesel voltage Regulator	Corrective	None	Potentiometer in regulating circuit was dirty	Voltage was erratic	Potentiometer was cleaned	1 hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" EH oil pump Discharge Pressure Gage	Corrective	None	Gage out of calibration	Erroneous indication	Calibrated gage	3 hr.
"6A" Feedwater Heater outlet Pressure Gage	Corrective	None	Gage pointer was binding	Gage inoperative	Pointer was freed	2 hr.
"A" Condensate Pump Discharge Pressure Gage	Corrective	None	Pointer was dislodged	No indication	Re-installed pointer	1 hr.
Outlet piping on "2A" Moisture Separator Reheater Relief Line drain Trap	Corrective	None	Hole in outlet line	Steam leakage	Removed defective line and welded in new section of pipe	6½ hr.
"A" Boric Acid Evaporator Distillate pump inlet valves (air operated)	Corrective	None	Valve diaphragms were defective	No inlet flow to distillate pumps	Installed new diaphragms	19 hr.
"6B" Feedwater Heater Gage Glass Isolation Valve	Corrective	None	Valve stem was bound	Valve was inoperative	Installed new valve	6 hr.
"A" Motor Driven Auxiliary Feedwater Pump Discharge Pressure Gage	Corrective	None	Gage out of calibration	Erroneous indication	Calibrated gage	1½ hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" Component Cooling Heat Exchanger Pressure Gage	Corrective	None	Malfunction of linkage	No indication	Installed new linkage screw and calibrated gage	1½ hr.
Chemical & Volume Control Reactor Coolant Make-up	Corrective	None	Broken wire on relay coil	Erroneous make-up deviation alarm	Repaired the coil	4 hr.
Pressurizer Letdown Isolation	Corrective	None	Malfunction of comparator LC460A	Improper control of letdown	Installed a new comparator	3 hr.
"A" Chemical & Volume Control Holdup Tank Level Indication	Corrective	None	Level indicator out of calibration	Erroneous indication	Calibrated level indicator	4½ hr.
Main Steam Isolation Valve V1-3B	Corrective	None	Broken yoke pin and damaged air cylinder	Valve was inoperative	Installed new pin and air cylinder	15 hr.
No. 1 Low Pressure Turbine Blowout Diaphragm	Corrective	None	Diaphragm failed	Diaphragm ruptured	Installed new diaphragm	2 hr.
"6A" Feedwater Heater	Corrective	None	Tubes failed	Tube to shell side leakage	Plugged and welded eleven tubes	8 hr.
Loop "C" Feedwater Control Valve	Corrective	None	Lockout solenoid failed	Loss of feedwater to steam generator "C" and subsequent reactor trip	Installed new coil in solenoid	2 hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Nuclear Instrumentation Channel N42	Corrective	None	Failure of high voltage power supply	Nuclear Instrumentation channel was inoperative	Replaced high voltage supply module	3 Hr.
Boron Analyzer	Corrective	None	Leak in detector tube	Analyzer was inoperative	Repaired leak and calibrated analyzer	--
Generator Hydrogen Regulator	Corrective	None	Regulator was dirty	Regulator was operating erratically	Cleaned regulator	3 Hr.
Waste Evaporator Hot Water Pump	Corrective	None	Failure of pump shaft seal	Excessive leakage	Installed new seal	4 Hr.
Steam Generator Level Transmitter	Corrective	None	Failure of power supply	Transmitter inoperative	Replaced power supply	1 Hr.
Heating and Ventilation Battery Room Exhaust Fan	Corrective	None	Micro-switches on discharge louvers out of alignment	RTGB indication was inoperative	Adjusted louvers and micro-switch	6 Hr.
Gas Analyzer Recorder	Corrective	None	Recorder was binding	Erroneous indication	Adjusted and calibrated recorder	4 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Heat Tracing Circuit P70	Corrective	None	Circuit failed	inoperative circuit	Circuit was removed and replaced	8 hr.
Part length rod control	Corrective	None	Defective relay	Erroneous alarm	Relay was removed & replaced	2 hr.
Annunciator Panel C-1	Corrective	None	Defective reflash & point cards	inoperative	Reflash & point cards replaced	2 hr.
"A" Sump Tank	Corrective	None	Level Switch out of calibration	Erroneous operation	Switches were calibrated to proper settings	7 hr.
Condensate Recirc. Valve EV-1446	Corrective	None	Defective controller switch	Valve inoperative	Switch was replaced	6 hr.
Pressurizer Pressure Indicator P1445	Corrective	None	Defective Power Supply	Erroneous Indication	Power Supply replaced	1 hr.
Radiation Monitor R-18	Corrective	None	Defective Photo tube	Erroneous alarms	Install new tube and calibrated	4 hr.
"B" Vacuum Pump	Corrective	None	Float valve sticking	Erroneous operation	New float valve was installed	2 hr.
Hotwell Level controller	Corrective	None	Level controller out of calibration	Improper operation	Level controller was recalibrated	3 hr.
"A" Monitor Tank Level Indicator	Corrective	None	Pressure switch out of calibration	Erroneous Alarm	Pressure Switch was recalibrated	1 hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Waste Evaporator Valve VA-4	Corrective	None	Defective diaphragm	Valve inoperative	Diaphragm was replaced	2 Hr.
Radiation Monitor R-20	Corrective	None	Broken vanes	Pump inoperative	Vanes replaced	4½ Hr.
Boric Acid Evaporator	Corrective	None	Density transmitter inoperative	Erroneous indications	Pulsed with supply air and returned to operation	2 Hr.
Heating & Ventilation System HVH-1	Corrective	None	Drain for condensate plugged	High discharge air temperature	Drain line was unplugged	1 Hr.
Vent Header Pressure Indicator on Waste Disposal & Boron Recycle Panel	Corrective	None	Transmitter out of calibration	Erroneous indications	Transmitter was recalibrated	1 Hr.
Spray Additive Tank Level Transmitter	Corrective	None	Indicator out of calibration	Erroneous indications	Transmitter was recalibrated	2 Hr.
"A" & "B" Diesels	Corrective	None	Dirty contacts	Erratic readings	Contacts were cleaned	2 Hr.
Safety Injection Valve 867 A	Corrective	None	Torque switch was out of adjustment	Valve was inoperative	Adjusted torque switch	4 Hr.
Safety Injection Valve 867 A	Corrective	None	Motor operator gear was stripped	Valve was inoperative	Repaired operator	4 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Primary Water Flow Controller FC-114	Corrective	None	Defective power supply capacitor	Flow control manual mode was inoperative	Replaced capacitor	2 Hr.
"2B" Feedwater Pump Suction Pressure Gage	Corrective	None	Gage out of calibration and over-ranged	Gage was inoperative	Calibrated gage	2 Hr.
"A" Monitor Tank High Level Alarm	Corrective	None	Pressure switch out of adjustment	Alarm occurring too late	Adjusted alarm to proper setpoint	2 Hr.
Steam Generator Blowdown Throttle Valve	Corrective	None	Position indicators out of adjustment	Loss of valve position indication	Adjusted position indicators	2 Hr.
Chemical & Volume Control Valves 460 "A" & "B"	Corrective	None	Limit switches defective	Erroneous valve position indication	Repaired limit switches	2 Hr.
Waste Gas Compressor	Corrective	None	Pressure switch was out of calibration	Compressor cycled on and off at wrong setpoints	Calibrated switch to proper setpoints	2 Hr.
Chemical & Volume Control Valve TCV-143	Corrective	None	The temperature comparator was out of adjustment	Control valve was diverting water to volume control tank at wrong setpoint	Adjusted comparator to proper setpoint	1 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" Boric Acid Evaporator	Corrective	None	Immersion heaters failed	Loss of heat to feed tank	Heater was replaced	3 hr.
"D" Flux Map Locations	Corrective	None	Detector failed	Flux map location "D" was inoperative	Replaced detector	6 hr.
"A" Battery Charger	Corrective	None	Solenoid failed and shorted to ground	Negative ground of 65 volts	Replaced solenoid	3 hr.
Reactor Protection Instrumentation System	Design change (Mod. & Setpoint Rev. Approval No. 67)	None	Original units lacked adequate reliability	-	Replaced four magnetic P/A converters with a unit incorporating all four groups	-
Waste Disposal System	Design Change (Mod. & Setpoint Rev. Approval No. 70)	None	Only temporary hoses were available for pumping waste water to truck for off site shipment	-	Permanent piping was installed for pumping waste water from waste holdup tank to truck	-
Steam Generator Blowdown System	Design Change (Mod. & Setpoint Rev. Approval No. 71)	None	The phosphate analyzer was not being utilized	-	The phosphate analyzer was removed from the system to provide space for a decontamination area	-

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Chemical & Volume Control system	Design change (Mod. & Setpoint Rev. Approval No. 73)	None	No means existed for clearing plugged recirculation line	-	Drain valves were installed in recirculation line between boric acid tanks and boron injection tank to provide flowpath for unplugging line with N_2 pressure	-

CAROLINA POWER & LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT

REPORT FOR AUGUST, 1972

The plant was operated this month without the occurrence of an incident or abnormal condition. The unit was shutdown on one occasion for repair of a leaking pressurizer spray valve. Maintenance accomplished was of a routine nature. The major modification completed was the provision of a charging pump leakage collection system and an improved design stuffing box. The plant achieved a maximum thermal output of 2197.8 megawatts on August 2 and August 8.

AUGUST, 1972

CAROLINA POWER AND LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT
UNIT NO. 2

OPERATING SUMMARY

I. Nuclear

A.	Number of hours the plant was operated.	687.59
B.	Number of times the reactor was made critical.	1
C.	Gross thermal power generated (MWH).	1,511,452.8
D.	Equivalent full power hours.	687.024

II. Electrical

A.	Gross power generated (MWH).	470,132
B.	Net power generated (MWH).	446,932
C.	Length of time generator was on line (Hours).	685.55

III. Radioactive Liquid Waste Discharged on Site

A.	Total curie activity discharged (excluding Tritium) (Curies).	0.04343
B.	Total curies of Tritium discharged (Curies).	32.21184
C.	Total volume of liquid waste discharged (Gallons).	240,499.85
D.	Total volume of dilution water used (Gallons).	3,058,000,000.0
E.	Average concentration at discharge canal outfall (uc/cc).	3.7518×10^{-12}
F.	Time and date of the maximum concentration released (for any consecutive 24 hours during the reporting period).	

Time 5:25 P.M. Date August 10, 1972

G. MPC used 1×10^{-7} uci/ml Basis Technical Specifications for Unidentified Activity

IV. Radioactive Liquid Waste Shipped off Site

A.	Total curie activity shipped (excluding Tritium) (Curies)	1.5462
B.	Total curies of Tritium shipped (Curies).	3.2620

Operating Summary Cont'd.

C. Total volume of liquid waste shipped (Gallons). 20,300.0

D. Average concentration of liquid waste shipped (uc/cc). 2.10×10^{-2}

E. Time and date of the maximum concentration shipped (for any consecutive 24 hours during the reporting period).

Time 12:00 P.M. Date August 8, '72

V. Gaseous Waste

A. Total curie activity discharged (Curies). 13.5567

B. Time and date of maximum activity released (for any consecutive 24 hours during the report period).

Time 4:53 P.M. Date August 9, 1972

C. The MPC used, if greater than:

1. $3X10^{-8}$ uc/cc for noble and activation gas. --

2. $1.43X10^{-13}$ for halogens with greater than an eight day half-life, and for particulates with greater than an eight day half-life. --

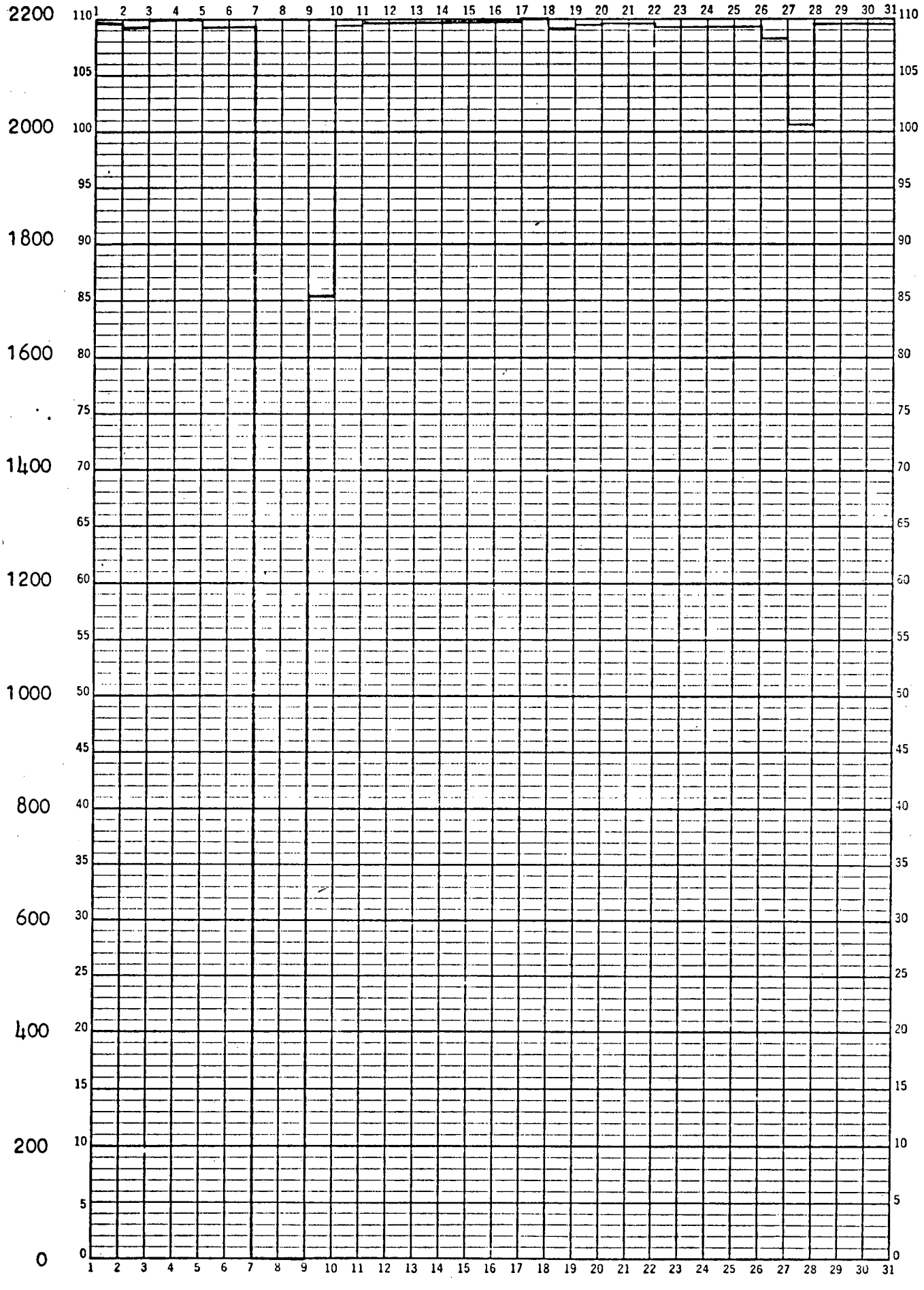
VI. Solid Radioactive Waste

A. Total volume of solid waste generated (Cubic Feet). 450.0

B. Gross curie activity involved (Curie). 1.2495

C. Disposition of materials shipped off site.

Quantity	Shipped to
450 $Ft.^3$	Chem Nuclear Services, Inc.



Month August 19 72

OUTAGE REPORT FOR AUGUST, 1972

NUMBER	DATE	TYPE	PLANT CONDITION	REASON	DURATION
1	8	Shutdown	--	Maintenance shutdown to repack valves in reactor coolant system	20 Hr., 21 Min.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" Boric Acid Tank Low Temperature Alarm	Corrective	None	Heater control out of calibration	Erratic heater control	Calibrated controller	1 Hr.
"A" and "B" Emergency Diesel Pyrometers	Corrective	None	Loose terminal connections	Erratic indication	Restored terminal connection integrity	4 Hr.
Emergency Diesel Fuel Oil Storage Tank	Corrective	None	Level indicator out of calibration	Erroneous indication	Calibrated level indicator	3 Hr.
Waste Disposal System Drumming Valves	Corrective	None	Valve actuator sensing lines were plugged with boric acid	Erratic valve operation	Sensing lines were cleared and vacuum switches were calibrated	14 Hr.
Reactor Coolant System High Δ T Alarm	Corrective	None	Defective Comparator	Erroneous alarms	Installed and calibrated new comparator	1 Hr.
"A" Instrument Inverter	Corrective	None	Defective capacitor in regulating transformer	Inverter was inoperative	Replaced defective comparator	28 Hr.
Turbine Vacuum Trip	Corrective	None	Vacuum latch rod was binding	Vacuum trip was inoperative	Freed and cleaned latch rod	2 Hr.
Loop No. 2 Protection Δ T	Corrective	None	Amplifier out of calibration	Erroneous indication	Calibrated amplifier	1 Hr.
"B" Boric Acid Evaporator Distillate Pump Suction Valves	Corrective	None	Defective valve diaphragms	Valves failed shut	Replaced diaphragms	1½ Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Lube Oil Filter Pump Discharge Pressure Gage	Corrective	None	Defective gage	No indication	Installed new gage	1 Hr.
Boron Injection Tank Recirculation Flow Meter	Corrective	None	Meter out of calibration	Erroneous flow indication	Calibrated meter	10 Hr.
Water Treatment Conductivity Recorder	Corrective	None	Defective amplifier fuse holder	Recorder would not function	Replaced fuse holder	2 Hr.
Vacuum Deaerator Alarm Circuit	Corrective	None	Circuit was wired incorrectly	Alarm would not actuate	Corrected annunciator wiring	5 Hr.
No. 2 Heat Trace Recorder	Corrective	None	Selector switch out of adjustment	Recorder was reading high on all circuits	Selector switch was adjusted	5 Hr.
Chemical and Volume control Letdown Line Pressure Gage PI-146	Corrective	None	Gage indicating pointer was broken	No indication	Installed a new pointer and calibrated gage	10 Days
No. 3 Steam Generator Blowdown Pressure Regulator Valve PRV-1936	Corrective	None	Valve out of adjustment	Low sample flow rate	Adjusted the regulator	1 Hr.
"A" Boric Acid Evaporator Level indication	Corrective	None	Density compensator out of adjustment	Erroneous indication	Adjusted compensator	2 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Containment Dew Point Recorder	Corrective	None	Defective bearing in drive gear	Recorder would not operate	Installed new bearing	4 Days
Charging Pumps	Corrective	None	Defective pump internals	Excessive leakage	Installed new throat bushings, packing, plungers, and cross head seals	4 Days
Miscellaneous Drains Collection Tank	Corrective	None	Gage glass obscured	Could not determine tank level	Installed new gage glass	1½ Hr.
Annunciator No. 18 (Steam Flow greater than Feed Flow)	Corrective	None	Faulty transistor	Annunciator would not actuate	Replaced transistor	4½ Hr.
"B" Strong Caustic Pump in Demineralized Water System	Corrective	None	Stroke adjusting rod was broken	Pump would not operate	Replaced broken rod	6 Days
Waste Evaporator Diaphragm Valve SV-1	Corrective	None	Diaphragm was ruptured	Valve would not provide isolation	Installed new diaphragm	3 Hr.
"5B" Feedwater Heater Isolation Valve SV-5	Corrective	None	Defective valve seat	Leakage by seat	Lapped valve	4 Hr.
Chemical and Volume Control System 'Make-Up' Switch	Corrective	None	Two broken switch springs	Switch malfunctioned	Installed new springs	1 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Charging Pumps	Design Chg (Mod & Set-point Rev Approval Form #30)	None	--	--	Installed new stuffing box to facilitate heat removal and lubrication and to prevent formation of boric acid crystals	--

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Waste Gas Compressors	Corrective	None	Defective pressure switch	Improper operation in automatic mode	Replaced defective switch	3 Hr.
Steam Generator "B" and "C" Level Indication	Corrective	None	Indicators out of calibration	Erroneous indication	Calibrated level indicators	1 Hr.
RTGB Annunciator	Corrective	None	Pressure switch on "B" moisture separator reheater was shorted to ground	Annunciator was receiving a ground alarm	Cleared the ground and drilled drain holes in pressure switch to preclude further shorts due to moisture accumulation	5 Hr.
"B" Boric Acid Evaporator Density Transmitter	Corrective	None	Transmitter sensing lines plugged with boric acid	Erroneous density indication	Cleared sensing lines	2 Hr.
"6A" Feedwater Heater Diaphragm	Corrective	None	Defective diaphragm	Excessive leakage	Manufactured and installed new diaphragm	14½ Hr.
"5A" and "6A" Feedwater Heater Gage Glasses	Corrective	None	Defective gage glass	Excessive leakage	Installed new glass assembly	2½ Hr.
"5B" Feedwater Heater Gage Glass Upper Isolation Valve	Corrective	None	Defective valve and union	Excessive leakage	Installed new valve and union	2 Hr.
Pure Water System Morpholine Tank Fill Tank	Corrective	None	Faulty valve seat to disc contact	Leakage past seat	Lapped valve	4 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" Boric Acid Storage Tank	Corrective	None	Failure of immersion heater	Loss of heating control	Replaced defective heater	4 Hr.
Residual Heat Removal Loop 1 Hot Leg Isolation Valve 750	Corrective	None	Defective packing	Excessive leakage	Repacked valve and replaced gland studs which were "rung off" during repacking operation	--
"6A" Feedwater Heater Normal Drip Valve	Corrective	None	Defective flapper assembly and valve plug	Erratic valve actuation	Replaced defective parts	4 Hr.
Trots System	Corrective	None	Defective magnetic speed detector	Loss of turbine speed indication	Replaced defective detector	2 Hr.
Water Treatment System Acid and Caustic Conductivity Meters	Corrective	None	Caustic meter out of calibration. Potentiometer on acid meter binding	Erroneous indication	Calibrated caustic meter and freed acid meter potentiometer	10 Hr.
Nitrogen Supply Manifold	Corrective	None	Break in tube to header fitting joint	Leakage at faulty joint	Repaired joint with silver solder	½ Hr.
Water Treatment Morpholine Pump	Corrective	None	Defective shaft seal	Oil leakage around shaft	Replaced defective seal	3 Hr.
"B" Steam Generator Blowdown Valve FCV 1931A	Corrective	None	Valve opening solenoid was defective	Valve would not open	Replaced solenoid	2½ Hr.
"B" Moisture Separator Reheater Drain Tank Pressure Gage	Corrective	None	Defective control linkage	Erroneous indication	Replaced control linkage	2 Days

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Pressurizer Spray Valve 455A	Corrective	None	Faulty Gaskets	Body to bonnet leaks	Replaced gaskets and repacked valve	13 Hr.
Volume Control Tank Low Level Alarm	Corrective	None	Failure of magnetrol level switch	Low level alarm would not actuate	Installed a dual comparator in level control circuit to provide low level sensing	12 Hr.
Mixed Bed Demineralizer Sample Valves 974B and 974E	Corrective	None	Faulty valve internals	Valves were inoperative	Removed defective valves from system and replaced with new valves	1½ Hr.
Generator Hydrogen Pressure Alarm	Corrective	None	Defective transistors	Alarm would not clear	Replaced transistors	13 Hr.
Heat Tracing Circuits on "B" Boric Acid Evaporator	Corrective	None	Circuits were shorted to ground	Circuits were inoperative	Replaced defective circuits	5 Days
"C" Main Steam Isolation Valve	Corrective	None	Defective packing	Excessive steam leak	Repacked valve and replaced corroded gland stud	3 Hr.
Pressurizer to Pressure Relief Tank Valves 535 and 536	Corrective	None	Defective packing	Excessive leakage	Repacked valve	1½ Hr.
Pressurizer Spray Valves 455B and 455C	Corrective	None	Defective packing	Excessive leakage	Repacked valve	1½ Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Primary Water Isolation Valve Serving Containment	Corrective	None	Limit switch out of adjustment	Erratic valve operation	Adjusted limit switch	3 Hr.
Primary Water Totalizer	Corrective	None	Broken wire in circuit	Totalizer malfunction	Soldered broken wire	1½ Hr.
"A" Accumulator Level Indication	Corrective	None	Defective amplifier	Erratic indication	Installed new amplifier	½ Hr.
Station Service Air Compressor	Corrective	None	Defective seals on unloader pistons	Malfunction of unloader	Installed new o-rings on unloader pistons	8 Hr.
Heating and Ventilation Unit No. 15	Corrective	None	Defective fan shaft bearings	Excessive operating noise	Installed new bearings	3 Hr.
Charging Pump Leakage Collection System	Design Chg (Mod & Set-point Rev Approval Form #38)	None	--	--	Installed required piping to provide a means of collecting stuffing box leakage and route it to boron recycle system	--
Small Tools Decontamination Area	Design Chg (Mod & Set-point Rev Approval Form #72)	None	No area was specifically established for de-con work	--	Installed sink and splatter shield	--
Chemical and Volume Control System	Design Chg (Mod & Set-point Rev Approval Form #77)	None	--		Provided a high-low alarm for volume control tank	--

CAROLINA POWER & LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT

November 21, 1972

REPORT FOR SEPTEMBER, 1972

No plant incidents occurred this month. There was one plant shutdown for a thirty-five hour period to facilitate pressurizer spray valve repair. A maximum thermal output of 2195.6 megawatts was achieved on four days during the period.

September, 1972

CAROLINA POWER AND LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT
UNIT NO. 2

OPERATING SUMMARY

I. Nuclear

A.	Number of hours the plant was operated.	683.90
B.	Number of times the reactor was made critical.	2
C.	Gross thermal power generated (MWH).	1,467,628.8
D.	Equivalent full power hours.	667.104

II. Electrical

A.	Gross power generated (MWH).	469,932
B.	Net power generated (MWH).	446,907
C.	Length of time generator was on line (Hours).	680.23

III. Radioactive Liquid Waste Discharged on Site

A.	Total curie activity discharged (excluding Tritium) (Curies).	0.04762
B.	Total curies of Tritium discharged (Curies).	39.89422
C.	Total volume of liquid waste discharged (Gallons).	130,795.9
D.	Total volume of dilution water used (Gallons).	1.8047×10^{9}
E.	Average concentration at discharge canal outfall (uc/cc).	6.97184×10^{-12}
F.	Time and date of the maximum concentration released (for any consecutive 24 hours during the reporting period).	Time 11:30 Date September 30, 19
G.	MPC used 1×10^{-7} uci/ml Basis	Technical Specifications for Unidentified Activity

IV. Radioactive Liquid Waste Shipped off Site

A.	Total curie activity shipped (excluding Tritium) (Curies)	--
B.	Total curies of Tritium shipped (Curies).	--

Operating Summary Cont'd.

C. Total volume of liquid waste shipped (Gallons). --

D. Average concentration of liquid waste shipped (uc/cc). --

E. Time and date of the maximum concentration shipped (for any consecutive 24 hours during the reporting period).

Time -- Date --

V. Gaseous Waste

A. Total curie activity discharged (Curies). 14.011

B. Time and date of maximum activity released (for any consecutive 24 hours during the report period).

Time 9:05 P.M. Date Sept. 25, '7

C. The MPC used, if greater than:

1. $3X10^{-8}$ uc/cc for noble and activation gas. --

2. $1.43X10^{-13}$ for halogens with greater than an eight day half-life, and for particulates with greater than an eight day half-life. --

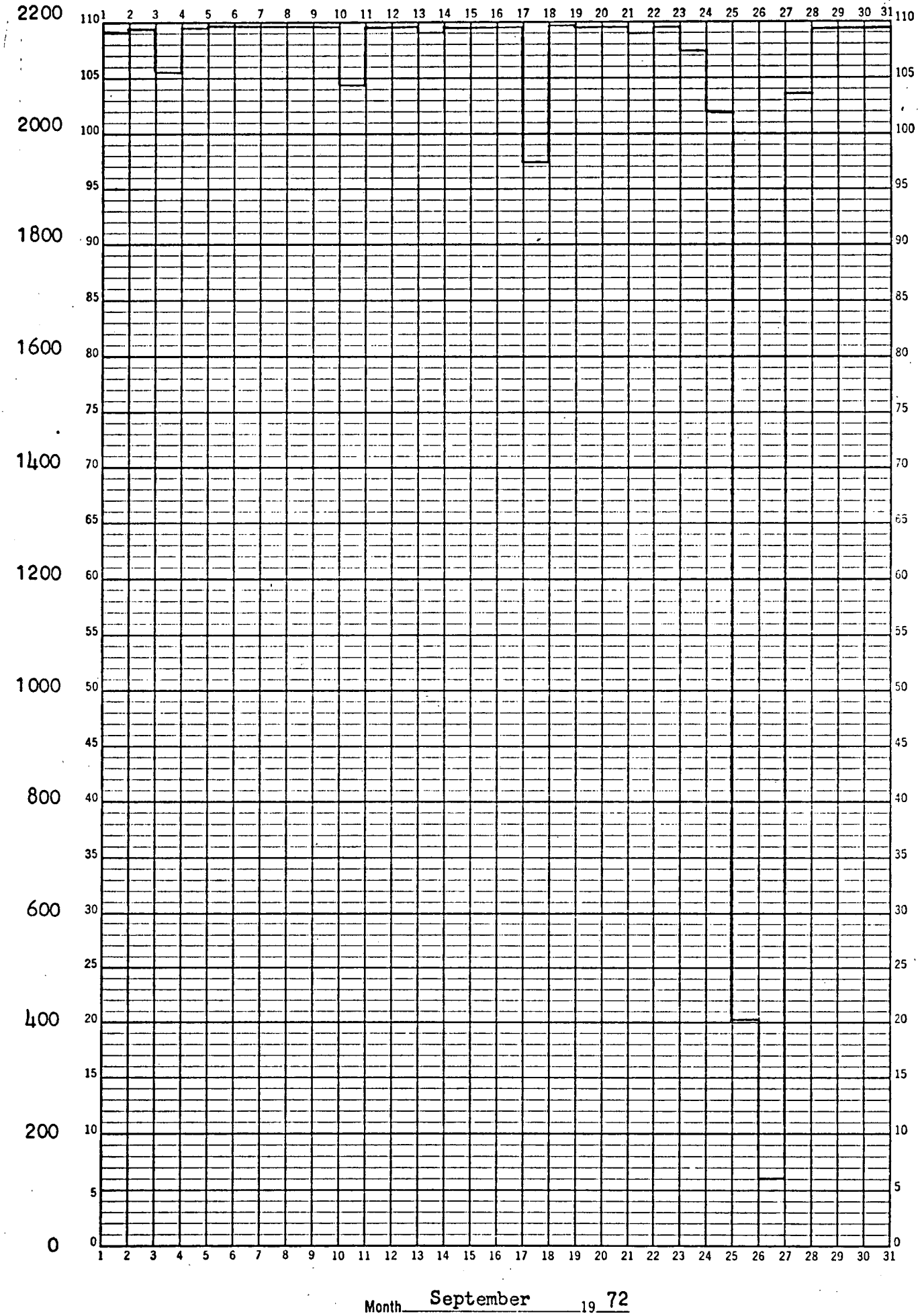
VI. Solid Radioactive Waste

A. Total volume of solid waste generated (Cubic Feet). 120

B. Gross curie activity involved (Curie). 0.252

C. Disposition of materials shipped off site.

Quantity	Shipped to
--	--



OUTAGE REPORT FOR SEPTEMBER, 1972

NUMBER	DATE	TYPE	PLANT CONDITION	REASON	DURATION
1	9-25	Shutdown	--	Maintenance shutdown for repair of pressurizer spray valve	34 Hr., 58 Min.
2	9-26	Trip	--	Low level in No. 2 steam generator due to motor operated flow control isolation valve failing to open	53 Min.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" Heater Drain Tank Gage Glass	Corrective	None	Defective gage glass	Leakage at gage joints	Installed new gage glass	2 Hr.
Emergency Generator Elapsed Time Meter	Corrective	None	There was a common connection of a D.C. and A.C. service line	Meter was inoperative	Isolated the A.C. and D.C. lines	36 Hr.
Auxiliary Steam Driven Feedwater Pump Discharge Valve (AFW-7)	Corrective	None	Pin hole in valve body	Leakage from valve body	Repair welded pin hole	8 Hr.
Nuclear Instrumentation N-31	Corrective	None	High level trip bistable out of adjustment	High level trip at wrong set-point	Adjusted bistable	1 Hr.
Residual Heat Removal Pit Sump Pumps	Corrective	None	Controller switches were wired improperly	Pumps cycled on and off sporatically	Corrected wiring	3½ Hr.
Heat Tracing	Corrective	None	Defective controller	Circuit No 68 malfunctioned	Installed new controller	4 Hr.
Waste Evaporator	Corrective	None	Distillate float out of adjustment	Unable to maintain level in concentrator	Adjusted float	6 Hr.
Accumulator Pressure Indicators PI-929 & PI-931	Corrective	None	Indicators out of calibration	Erroneous initiation of Hi/Low alarm	Calibrated pressure indicators	2 Hr.
Auxiliary Oil Pump Serving "A" Boiler Feed Pump	Corrective	None	Pressure switch out of adjustment	Pump cycled on and off	Adjusted switch	2 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OF SERVIC
			CAUSE	RESULT		
Condensate Collection System	Corrective	None	Stand pipe drain clogged	Loss of alarm at high level	Cleaned standpipe and adjusted setpoint	15
Moisture Separator Reheater Flow Control Valve FCV-1330B	Corrective	None	Stem was broken and inner valve seat damaged	Valve inoperative	Installed new valve internals	
"B" Feedwater Heater Drain Tank Level Control Valve LCV-1535A	Corrective	None	Defective gasket	Leakage around bottom cover	Installed new gasket	8 Hr
Main Steam Before Seat Drain Line Orifice	Corrective	None	Defective flange joint	Excessive leakage	Remade joint with new gaskets	2 Hr
"A" Vacuum Pump Seal Water Tank	Corrective	None	Defective float	Float would bind	Installed new float	1½ Hr
Main Steam Drain Valve	Corrective	None	Galled valve stem	Valve difficult to operate	Installed new bonnet assembly	1 Hr.
"2A" Moisture Separator Reheater Vent Valve 1333C	Corrective	None	Defective body to bonnet joint	Excessive leakage	Remade joint with new gasket	1 Hr.
Control & Protection Instrumentation	Design Chg (Mod & Setpoint Rev Approval Form #78)	None	--	Remove heat from instrumentation racks	Installed ventilation fans and filters in the instrumentation cabinets	2 Hr.
						--

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OF SERVIC
			CAUSE	RESULT		
Water Treatment Recorder	Corrective	None	Interrupter out of adjustment	Erroneous initiation of alarms	Adjusted interrupter	2 Hr
Seismic Alarm	Corrective	None	Water in seismic unit	Erroneous indication	Dried unit and sealed water tight	2 Hr
Heater Circuit Serving Feedwater System Motor of Operated Valves	Corrective	None	Short to ground	Circuit tripped out when closed	Replaced heater on Valve AFW-V2-148 and cleared short	8 Hr
Turbine Building Crane	Corrective	None	Mechanical interlock was binding	Crane breaker wouldn't latch in	Freed mechanical interlock	5 Hr
"B" Feedwater Pump Suction Line	Corrective	None	Defective union	Leakage around pressure gage union	Installed a new union	1 Hr
"6A" Feedwater Heater Level Con-Controller	Corrective	None	Ruptured diaphragm	Improper level control	Installed new diaphragm	3 Hr
"6B" Feedwater Heater Level Control	Corrective	None	Broken air supply line and a defective valve plug	Improper level control	Repaired broken line and installed new valve plug	5 Hr.
"3A" Feedwater Heater Level Control	Corrective	None	Nozzle plugged	Improper level control	Cleared nozzle	2 Hr.
Service Water Header Strainer	Corrective	None	Bound limit switch	Improper strainer operation	Freed and lubricated limit switch	4 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Containment Dew Point Recorder	Corrective	None	Broken drive strips	Recorder inoperative	Installed new drive strips	1¼ Days
"A" Electro-Hydraulic Pump Discharge Pressure Gage	Corrective	None	Indication pointer was broken	Loss of indication	Installed new pointer	3½ Hr.
Engine Driven Fire Pump	Corrective	None	Pressure switch out of adjustment	Pump actuating at incorrect setpoint	Adjusted pressure switch to proper setpoint	1 Hr.
"A" Diesel Pyrometer	Corrective	None	Dirty contacts	Erratic indication	Cleaned contacts	3/4 Hr.
Hot Leg Sample Heat Exchanger Isolation Valve 955B	Corrective	None	Limit switch out of adjustment	Erroneous indication	Adjusted limit switch	2 Hr.
Flow Control Valve FCV-499	Corrective	None	Defective SWAGE-LOC fitting	Air leakage	Installed new fitting	1½ Hr.
"1A" Feedwater Level Control	Corrective	None	Level controller out of adjustment	Control range too wide	Adjusted controller	2 Hr.
"A" Monitor Tank Level Alarm	Corrective	None	Alarm setpoint too high	Failure to alarm at required level	Adjusted alarm	2 Hr.
Demineralized Water System	Corrective	None	Contact on mixed bed program timer out of adjustment	Malfunction of No. 3 cation regeneration cycle	Adjusted contact	3 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"B" Phosphate Pump Discharge Pressure Gage	Corrective	None	Gage out of calibration	Erroneous indication	Calibrated gage	½ Hr.
Electro-Hydraulic Pump "B" Discharge Line	Corrective	None	Pin holes in line	Numerous small leaks	Weld repaired pin holes	3½ Hr.
Auxiliary Steam Condensate Collecting Tank Pump	Corrective	None	Defective gland seal	Excessive leakage	Installed new seal	2 Hr.
Chemical & Volume Control Make-Up System	Corrective	None	Defective coils in control system	Erroneous flow deviation alarm	Installed new coils	2 Hr.
"B" Condensate Pump Discharge Pressure Gage	Corrective	None	Gage out of calibration	Erroneous indication	Calibrated gage	2½ Hr.
Lube Oil Reservoir Vapor Extractor	Corrective	None	Worn shaft bearings	Excessive vibration	Installed new bearings	6 Hr.
Electro-Hydraulic Pump Discharge Pressure Gage	Corrective	None	Gage out of calibration	Erroneous indication	Calibrated gage	2 Hr.
"A" & "B" Monitor Tanks	Corrective	None	High alarm set too high	Didn't receive high level alarm	Adjusted alarm setpoint	1 Hr.
Engine Driven Fire Pump	Corrective	None	Controller out of calibration	Pump started at wrong setpoint	Calibrated controller	1 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME O OF SERVIC
			CAUSE	RESULT		
"6A" Feedwater Heater Vent Line	Corrective	None	Deteriorated piping run	Leakage from vent line	Installed a new section of piping	4 Hr
Pressurizer Spray Valve "455B"	Corrective	None	Defective packing	Excessive leakage at packing gland	Repacked valve	10 H
Feedwater Flow Transmitter FT-487	Corrective	None	Defective oscillator	Erroneous indication	Installed new oscillator	2 Hr
"B" Feedwater Pump 4160V. Breaker	Corrective	None	Defective switch operating rod	Failure to cut out closing coil	Replaced switch operating rod	3 Hr
Reheat Stop Valve	Corrective	None	Scored solenoid plunger	Valve wouldn't reopen	Polished solenoid plunger	2 Hr
Auxiliary Feedwater Isolation Valve 14A	Corrective	None	Worn seal rings	Excessive leakage	Installed new seal rings	4 Hr
Discharge Pressure Gage on Demineralized Water Pump	Corrective	None	Defective gage	No indication	Installed new gage	1 Da
Rod Bottomlight for Position J-11	Corrective	None	Dirty contact	Light wouldn't indicate	Cleaned contact	3½ H
Boron Recirculation Line Flow Indicator	Corrective	None	Sensor lines were plugged with boric acid	Loss of flow indication	Cleared lines and installed additional heat tracing	6 Hr
Nuclear Instrumentation Start-Up Rate Channel	Corrective	None	Rate meter out of calibration	Erroneous indication	Calibrated rate meter	2 Hr

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Safeguards System	Design Chg (Mod & Set-point Rev. Approval Form #80)	None	--	This change insures the proper closing of spray pump breakers independent of the safeguards bus loading sequence	Modified wiring as necessary to accomplish ECR	--

APPENDIX I

CAROLINA POWER AND LIGHT COMPANY

H. B. ROBINSON STEAM ELECTRIC PLANT

MODIFICATION TO WASTE EVAPORATOR AND BORIC ACID EVAPORATORS

MARCH 9, 1972 TO APRIL 14, 1972

WRITTEN AND COMPILED BY:

J. G. HAMMOND, PLANT ENGINEER

MODIFICATION TO WASTE EVAPORATORS AND BORIC ACID EVAPORATORS

TABLE OF CONTENTS

PART I

PROPOSED MODIFICATION

H. B. Robinson Unit 2 had been unable to achieve the design performance characteristics of its AMF waste concentration system, or its AMF boric acid concentration system. The difficulties encountered were as follows:

1. Insufficient supply of steam to hot water converter (WE)
2. Considerable foaming and carryover into distillate tank (WE)
3. Difficulty in maintaining a vacuum in concentrator (WE & BAE)
4. Inability to achieve decontamination factors (DF) on the design order of 10^6 or design flowrate of 2 GPM (WE)

NOTE: The above abbreviations indicate which concentrator system experienced the problems (i.e. - waste evaporator (WE) and boric acid evaporator (BAE).

These problems have persisted since plant testing and start-up. Efforts have been made to remedy the foaming; and, consequently, improve the DF by use of an anti-foaming agent, DOW H-10. In spite of this, decontamination factors were at best still in the range of 10^2 compared to the design level of 10^6.

Similar problems have been encountered with other AMF installations. AMF and Westinghouse representatives have evaluated these situations and have developed modifications to existing systems in an attempt to meet design criteria. The AMF modification has been performed at other plants. Based on the improved performance of these applications, the system conversion was approved for H. B. Robinson Plant.

This modification includes the following:

NOTE: Items 2 through 6 were performed only on the waste evaporator system.

1. Replacement of the mechanical vacuum pumps on the waste evaporator and both boric acid evaporators with steam ejectors.
2. Modification of the concentrator internals to relocate the reflux line, add a new moisture separator section, provide a new sieve moisture separator, and install a heater bundle shroud.

3. Deletion of the double perforated plates from between the upper and lower concentrator shells.

4. Replacement of the teflon disc in the concentrator level control valve with a 316 SS disc.

5. Installation of a new, higher-capacity steam valve serving the water converter.

6. Provision of additional connections for sampling and chemical addition.

NOTE: See figures 1 through 3 for further details, and refer to bill of materials for list of valves and major components.

Reasons for the above changes are listed below.

The replacement of the vacuum pumps with the steam ejectors upgrades the performance of the vacuum system such that a reliable vacuum can be established. Experience has indicated that a 23 to 25 inch Hg. vacuum can be drawn in about 10 minutes and readily maintained. This added stability will also provide the ability to operate at a wider range of temperature.

The modification of the concentrator internals is intended to reduce moisture carryover and improve the DF of the system. In particular, the re-routing of the reflux line from above the distillate tray prevents condensation from dripping into the tray. The new reflux location also provides better distribution of the flow back into the lower level of the concentrator. The addition of the new moisture separator sections and the sieve assembly are other means used to reduce carryover. Carryover and foaming are further diminished by enclosing the heating tube bundle in a shroud which directs the flow of the heated effluent in a circular motion.

Problems have been encountered at other installations with proper level control in the concentrator. This was attributed to malfunctioning of the level controller valve due to damage to the teflon disc. To preclude the possibility of this happening at H. B. Robinson, the teflon disc was replaced with a 316 stainless steel model.

The low unit output was improved by increasing the steam supply to the steam-water converter. This was accomplished by enlarging the supply piping and providing a new steam regulator. The supply piping was increased from $1\frac{1}{2}$" to 2" O.D.

PART II

SUPPLEMENTARY WORK TO SUPPORT FINAL MODIFICATION

The modification, as outlined in Part I, was supervised by AMF representative, Dave Martin, with work being accomplished by a crew from Metric Constructors, supervised by Earl Erickson. To support the changes being made, modification was required to the component cooling water piping in order to provide cooling water to the heat exchangers in the vacuum systems on both boric acid evaporators and the waste evaporator. These additions to the component cooling system consist of short runs of pipe tapped off of the lines feeding the cooling sections of the evaporators. The tie-ins are made on pipe 6-AC-152?-76A on the 'A' boric acid evaporator, pipe 6-AC-152?-76B on the 'B' boric acid evaporator, and pipe 3-AC-152?-110 on the waste evaporator.

The modification also required the provision of a steam supply to the steam ejectors. A flow rate of 62 lbs. per hour at a minimum pressure of 90 psig is necessary. This steam supply is obtained by tapping off of the auxiliary heating system pipe 6-S-20 upstream of valve V7-15 on the second floor of the auxiliary building. This line is reduced to 1" IPS carbon steel and constitutes a pipe run of about 150 feet through the second floor deck penetration into the boric acid evaporator rooms and across into the waste evaporator room.

When the auxiliary steam system is supplied by number 4 feedwater heater extraction, a pressure of only 60 psig is attained at 735 MWe gross electrical output. In that this does not provide steam at sufficient pressure, the auxiliary boilers must be used as a steam source. However, using the auxiliary boilers for continuous operation of the concentrators is not economically feasible nor have the boilers proved sufficiently reliable. Westinghouse has been contacted and requested to identify an acceptable steam supply for operation of the steam ejectors when the main steam system is in operation. Contingent upon provision for this new extraction point, new piping will be installed and the problem of achieving an adequate, reliable, and economical steam source will be alleviated.

In conjunction with the modification, an inspection was made of the waste evaporator distillate tank float valve. This valve was found to have a damaged plunger. Repair was not feasible and the valve was subsequently replaced.

The additional sampling point called for in Part I was made in the waste evaporator system downstream of the distillate tank. The line is tied in at the 1 X 3/4" reducer at the junction of the distillate discharge piping and pipe 1-WD-151R-17 leading to the waste condensate tanks.

A drain valve has been added to the closed loop heating system of the waste evaporator system. The valve is tapped off the closed loop piping upstream of the expansion tank. The line is reduced from 3" to 3/4" to accomodate the valve.

This work, including the modification called for in Part I was completed on April 7, 1972. No major problems were encountered in accomplishing this job.

PART III

LIST OF FIGURES

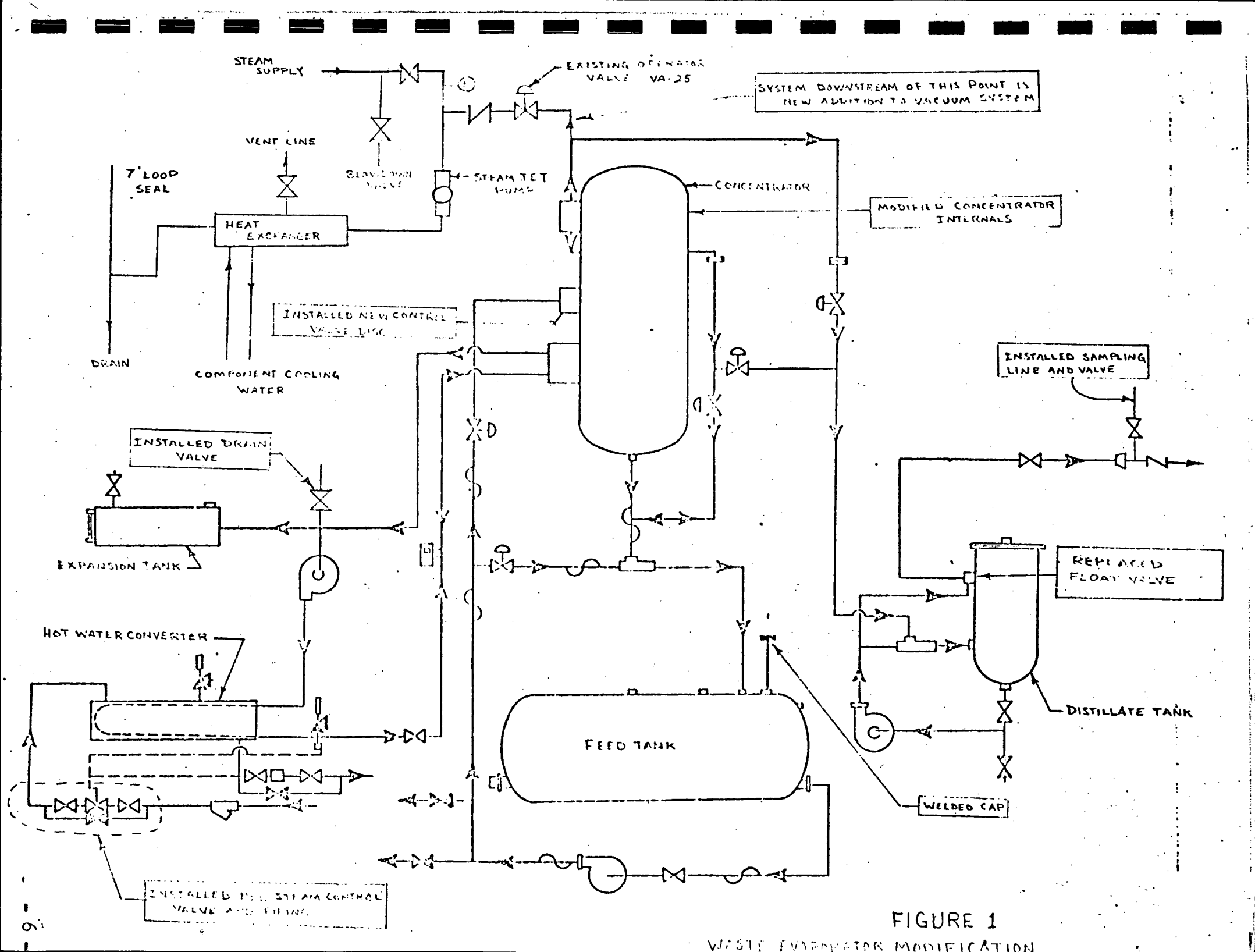


FIGURE 1

WASTE EVAPORATOR MODIFICATION

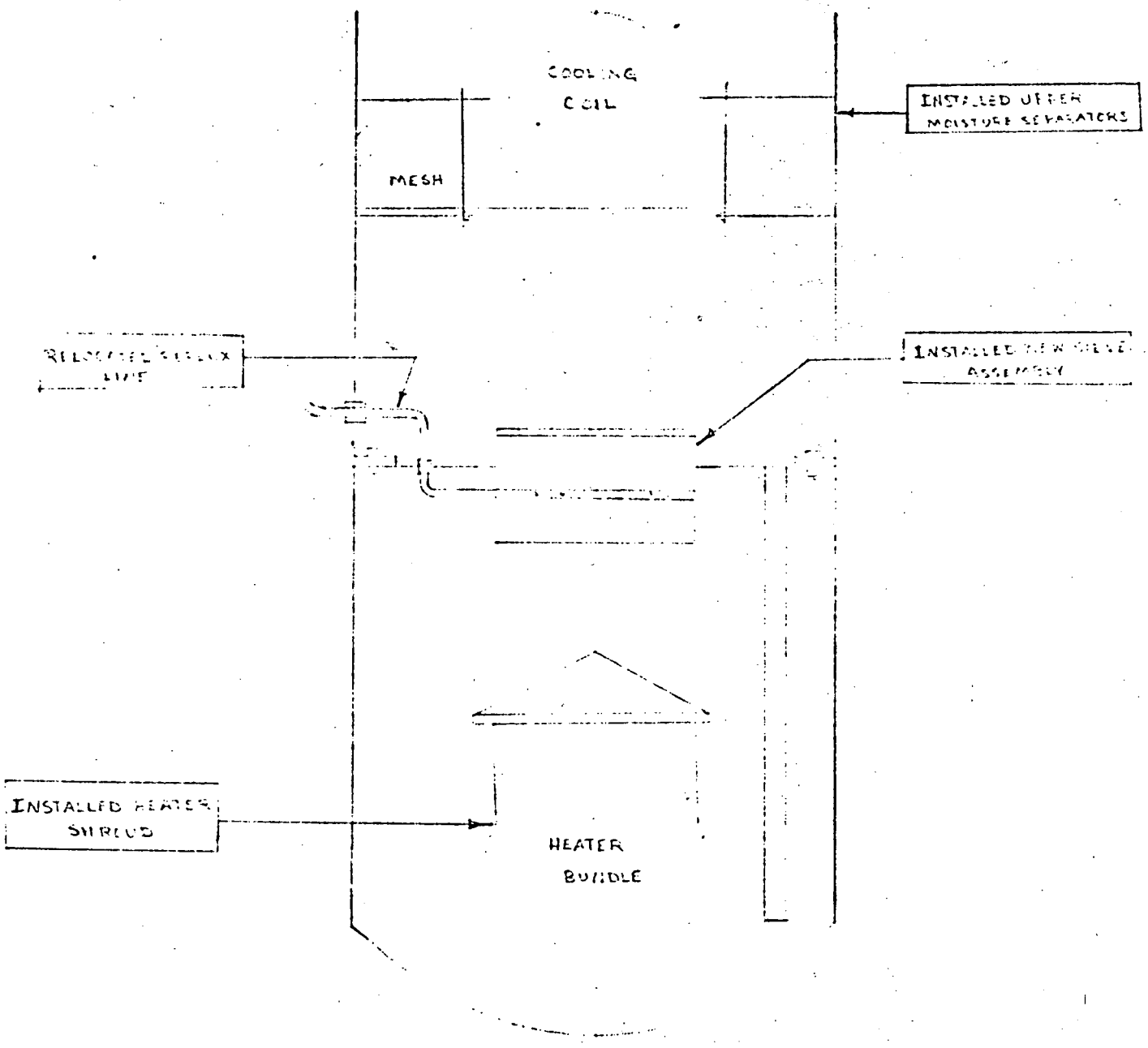


FIGURE 2

MODIFICATION OF CONDENSATOR INTERNALS

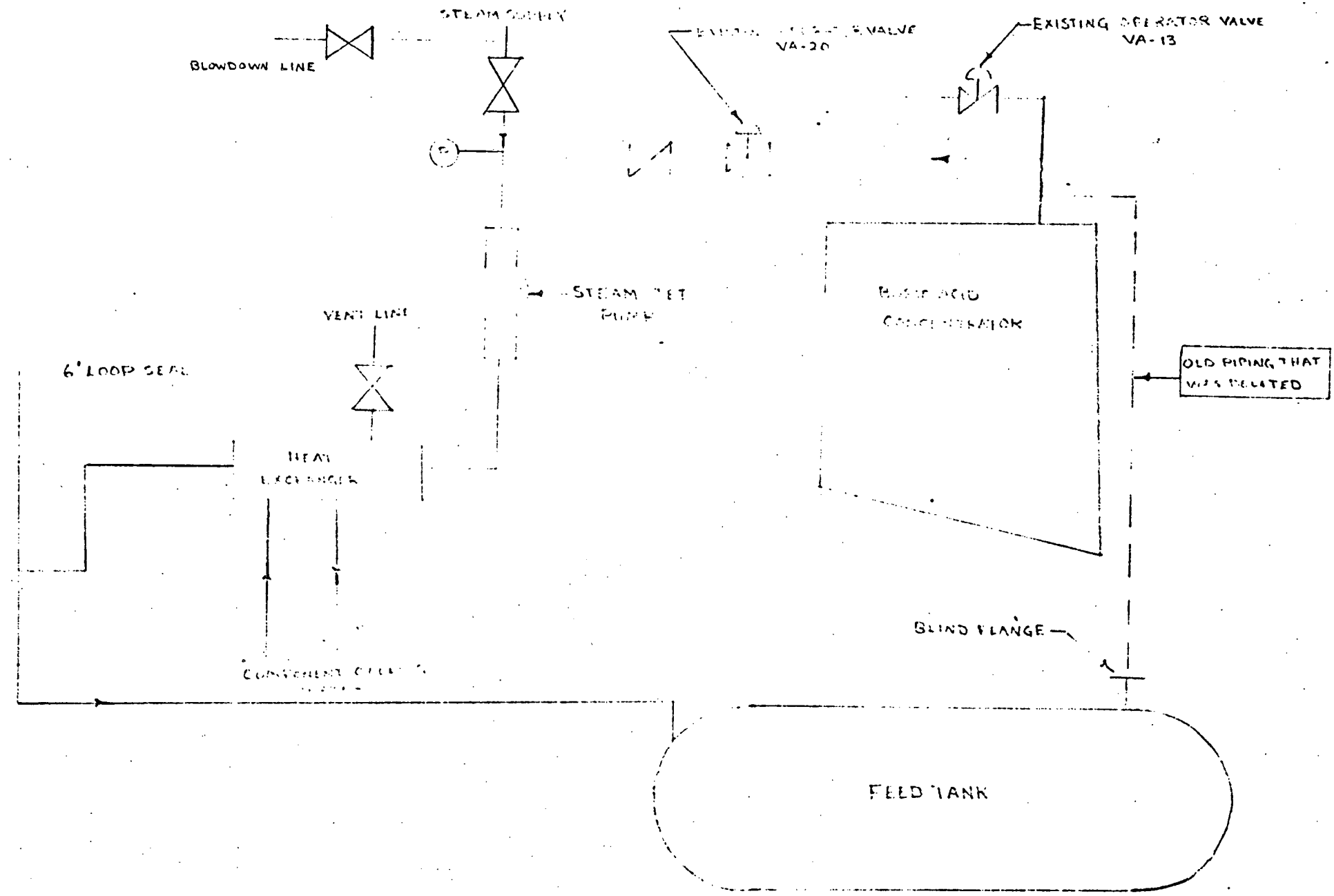

BLOWDOWN LINE
VA-20
EXISTING OPERATOR VALVE
VA-13
STEAM JET PUMP
VENT LINE
6' LOOP SEAL
HEAT EXCHANGER
OLD PIPING THAT WAS RELOCATED
BLIND FLANGE
FEED TANK

FIGURE 3

PART IV

BILL OF MATERIAL

COMPONENT	EACH	MATERIAL DESCRIPTION
Steam Blowdown Valves on Steam Ejector Supply Line	3	½" Edwards, Angle Globe, 1500#, 850° Fig. - 1048Y
Isolation Valves on Steam Ejector Supply Line	3	1" Velan, Globe Stop, 600#, Fig. W5-27ABB-2TS
Main Isolation Valve on Steam Ejector Supply Line	1	1" Edwards, Angle Globe Stop, Valve Tag No. IT36, Fig. - 848JY
Hot Water Drain Valve on Waste Evaporator	1	½" Velan, screwed, Globe, 600#, Fig. S3-27ABB-2TS
Sample Line Valve on Waste Evaporator Distillate Line	1	3/4", Grinnel, Diaphram, Saunders Model #2471-3212M with #88 Spring - 316 S.S.
Heat Exchanger Vent Line Valves	3	1" Jenkins, screwed ends, Gate Valve, No. 1300, 316 S.S.
Concentrator Vent Line Isolation Valve (Boric Acid Evaporators)	2	½", Grinnel, Diaphram, Saunders Model - #2471-3212M with #88 Spring - 316 S.S.
Check Valve Downstream of Concentrator Isolation Valve	3	1" Jenkins, screwed end, Swing Check, No. 1328-A, 316 S.S.
Concentrator Isolation Valves	3	1" Grinnel, Diaphram, Saunders Model - #2471-3212M with #88 Spring - 316 S.S.
Steam Jet Vacuum Pump	3	1", Flanged, Schutte & Koerting, Model 53A, #555
Heat Exchanger	3	Whitlock, Type AHT-4-A-C1, Model 3-W-14
Waste Evaporator Distillate Float Valve	1	McDonnell No. 27W, Max. supply pressure 100 lbs.

PART V

TEST RESULTS

Following completion of modifications, the waste evaporator was tested over a 24 hour period on April 13 and April 14, 1972. The test consisted of processing a solution of sodium hydroxide and feedwater. The ability of the evaporator to handle this solution was to be representative of waste processing and provide an indication of the evaporator efficiency.

The test was initiated at 9:00 A.M., April 13 by adding 6 gallons of sodium hydroxide (NaOH) to the evaporator feed tank. This resulted in a PH of 12.5. The evaporator was then started at 9:30 A.M. The reflux line was placed in operation at 2:30 P.M. and adjusted by "feel" to the appropriate flow rate (the flow meter is broken and is on order.). This operation was accomplished without losing vacuum. No problems were encountered with the unit start-up or operation of the equipment during the test.

Feed and distillate samples were taken at hourly intervals for the benefit of Westinghouse analysis. These samples were shipped to Westinghouse in a shielded cask. On site, samples were analyzed every two hours. Data was also recorded at two hour intervals. The sample scheduled to be taken at 8:00 A.M., April 14 was inadvertently omitted. The test was terminated at 10:00 A.M., April 14.

Trouble free operation was experienced throughout the test indicating the improved reliability of the equipment. The vacuum was readily maintained at 21-23 inches of mercury. The design flowrate of 2 GPM was achieved. In fact, a flowrate of 2.5 GPM was maintained without reflux flow and 2.17 GPM resulted with the reflux circulating.

Enclosures (2) and (3) list the analyses of the test samples as performed by C.P.&L. and Westinghouse respectively. Enclosure (1) is a summary of the recorded test data. The analytic procedures that were utilized are listed in enclosure (4). The decontamination factor (DF) referred to is defined as follows:

$$DF = \frac{\text{concentration in feed to concentrator}}{\text{concentration in distillate}}$$

The test revealed decontamination factors in the range of 10^2 to 10^5 for non-radioactive species and DF's of 10^1 to 10^4 for the radioactive species. The isotopes detected were Manganese - 54, Cobalt - 58, and Cobalt - 60. The Cobalt - 58 and Cobalt - 60 distillate levels were at or below the minimum detectable level of 3.0×10^{-8} mc/cc. The low DF valves observed for the radioactive species are

attributed to the relative low radioactivity contained in the feed. Of the non-radioactive species, the highest DF value of 10^5 was observed for sodium. The sodium DF range was consistently between 10^4 and 10^5. The boron DF's ranged from 10^3 to greater than 10^4.

Based on these test results, it was Westinghouse's opinion that the present unit was capable of DF's consistently in the 10^4 to 10^5 range. Since completion of testing, the waste evaporator has been placed in service and proved to be quite reliable. The decontamination factors have also been significantly improved. However, the DF's have only averaged around 10^3 with maximum DF's of approximately 10^4. Therefore, although the present system is markedly improved over the system initially installed, it does not appear that the maximum design DF of 10^6 can be attained.

Twelve hour operational tests were planned to determine if the new steam ejector vacuum systems installed on the boric acid evaporators functioned properly. These tests were aborted due to insufficient steam supply from the auxiliary steam system. There was also a problem with erratic flow control on the 'B' boric acid evaporator which was traced to the concentrator level controller valve. This valve had damaged internals which are on order and will be replaced before putting the unit back on the line. However, both units were operated for short periods of time and the new steam ejectors appeared to function well in achieving and maintaining a vacuum of 23 in. of Hg. Since this time, the boric acid evaporators have been returned to service and provide reliable operation.

ENCLOSURE 1

Date: 4/13/72 WASTE EVAPORATOR DATA

Time	1000	1200	1400	1600	1800	2000	2200	2400
Vacuum, In. Hg.	23.6	22.0	21.7	21.6	21.5	21.5	21.5	21.5
Concentrator Temp. °F	152	152	150	147	145	147	145	147
Hot Water In., °F	188	187	187	187	186	185	186	183
Hot Water Out, °F	172	170	170	169	168	165	163	166
Cooling Water Flow GPM	70	79	80	80	80	80	80	79.5
Cooling Water Out, °F	113	112	113	113	113	113	113	113
Reflux Flow (Open/Close)	Closed	Closed	Closed	Open	Open	Open	Open	Open
Steam Pressure, PSIG	23	23	23	23	23	23	23	24
Reg. Inlet Pressure, PSIG	10	10	10	11	10.5	11	10.5	12.5
Feed Tank Temp., °F	128	158	155	153	149	140	132	135
Steam to Air Ejector, PSIG	100	99.5	99.9	100	105	100	105	> 100
Feed Tank Level, In.	24.5	15.7	15.2	18.5	23.0	25.6	25.4	19.0
Waste Condensate Level	11%	40.3%	73%	19%	45.2%	73.8%	25.5%	60%

ENCLOSURE 1A

Date: 4/14/72	WASTE EVAPORATOR DATA				
Time	0200	0400	0600	0800	1000
Vacuum, In. Hg.	21.5	21.5	21.5	21.4	21.2
Concentrator Temp °F	145	140	147	147	151
Hot Water In, °F	181	182	185	185	186
Hot Water Out, °F	167	168	167	167	170
Cooling Water Flow GPM	79	79.5	80	80	80
Cooling Water Out. °F	117	118	114	114	115
Reflux Flow (Open/Close)	Open	Open	Open	Open	Open
Steam Pressure, PSIG	24	24	24	24	24
Reg. Inlet Pressure, PSIG	12.5	12.5	12.5	12.5	12.5
Feed Tank Temp., °F	135	155	146	144	160
Steam to Air Ejector. PSIG	>100	>100	>100	>100	>100
Feed Tank Level, In.	22.5	18	24.3	25	9
Waste Condensate Level	83	35	59	89	40

ENCLOSURE 2

CP&L ANALYSIS

Date: 4/13/72 WASTE EVAPORATOR CHEMICAL ANALYSIS

Time		1000	1200	1400	1600	1800	2000	2200	2400
γ - Gross Activity	Feed	1.29×10^{-5}	4.39×10^{-5}	2.5×10^{-4}	4.97×10^{-4}	5.69×10^{-4}	5.1×10^{-4}	5.63×10^{-4}	7.1×10^{-5}
	Dist.	2.73×10^{-5}	9.21×10^{-7}	6.25×10^{-6}	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$
Sodium (PPM)	Feed	----	----	----	----	----	----	----	----
	Dist.	1.0	0.17	0.27	0.28	0.09	0.07	0.10	0.0
PH	Feed	12.5	----	12.5	----	----	11.5	----	----
	Dist.	----	----	----	----	----	9.2	----	8.9
Conductivity (MHOS)	Dist.	14	2.45	1.54	2.8	3.1	3.5	5.5	5.
Gross Activity D.F.		0.47	4.76×10^{1}	4.0×10^{1}	$> 6.5 \times 10^{1}$	$> 7.5 \times 10^{1}$	$> 76.6 \times 10^{1}$	$> 7.7 \times 10^{1}$	$> 9 \times 10^{1}$

Date: 4/14/72

Time		0200	0400	0600	0800	1000
γ - Gross Activity	Feed	9.71×10^{-4}	9.04×10^{-4}	8.24×10^{-4}	5.31×10^{-4}	1.15×10^{-3}
	Dist	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$	$< 7.6 \times 10^{-6}$
Sodium (PPM)	Feed	----	----	----	----	----
	Dist	0.0	0.08	0.02	0.0	0.01
PH	Feed	----	----	----	----	10.3
	Dist	8.8	8.2	7.6	7.4	8.3
Conductivity (MHOS)	Dist	6.0	4.5	4.5	5.0	4.5
Gross Activity D.F.		$> 1.28 \times 10^{2}$	$> 1.19 \times 10^{2}$	$> 1.08 \times 10^{2}$	$> 7.0 \times 10^{1}$	$> 1.52 \times 10^{2}$

ENCLOSURE 3

WESTINGHOUSE ANALYSIS OF WASTE EVAPORATOR DATA

TIME		April 13 1000	1200	1400	1600	1800	2000	2200	2400	April 14 0200	0400	0600	1000
Sodium (PPM)	Feed	2933	4633	5660	4025	4127	3233	3163	4051	5027	4134	3438	3374
	Dist	3.22	0.10	0.18	0.32	0.02	0.02	0.03	0.02	0.11	0.12	0.06	0.15
	DF	9.10×10^{2}	4.68×10^{4}	3.14×10^{4}	1.26×10^{4}	2.06×10^{5}	1.61×10^{5}	1.05×10^{5}	2.03×10^{5}	4.57×10^{4}	3.45×10^{4}	5.73×10^{4}	5.58×10^{4}
Boron (PPM)	Feed	250	477	892	946	1114	1125	1223	1545	2250	2128	1988	2086
	Dist	0.2	0.4	0.5	<0.1	0.2	<0.1	0.3	<0.1	<0.1	0.6	0.5	0.5
	DF	1.25×10^{3}	1.19×10^{3}	1.78×10^{3}	$>9.46\times10^{3}$	5.57×10^{3}	$>1.12\times10^{4}$	4.07×10^{3}	$>1.55\times10^{4}$	$>2.25\times10^{4}$	3.55×10^{3}	3.98×10^{3}	1.02×10^{3}
MN 54	Feed	1.11×10^{-5}	----	----	3.24×10^{-5}	----	----	----	6.50×10^{-5}	1.11×10^{-5}	----	8.78×10^{-5}	2.27×10^{-4}
Activity	Dist	$>3.0\times10^{-8}$	----	----	$>3.0\times10^{-8}$	----	----	----	$<3.0\times10^{-8}$	$<3.0\times10^{-8}$	----	$<4.0\times10^{-8}$	$<3.0\times10^{-8}$
(μC/CC)	DF	$>3.7\times10^{2}$	----	----	$>1.08\times10^{3}$	----	----	----	$>2.13\times10^{3}$	$>3.01\times10^{3}$	----	$>2.19\times10^{3}$	$>7.57\times10^{3}$
CO 58	Feed	2.54×10^{-5}	----	----	9.76×10^{-5}	----	----	----	1.64×10^{-4}	2.24×10^{-4}	----	2.09×10^{-4}	5.13×10^{-4}
Activity	Dist	4.53×10^{-7}	----	----	3.1×10^{-8}	----	----	----	$<3.0\times10^{-8}$	$<3.0\times10^{-8}$	----	$<4.0\times10^{-8}$	7.6×10^{-8}
(μC/CC)	DF	5.6×10^{1}	----	----	3.14×10^{3}	----	----	----	$>5.47\times10^{3}$	$>7.46\times10^{3}$	----	$>5.22\times10^{3}$	6.75×10^{3}
CO 60	Feed	4.92×10^{-5}	----	----	1.18×10^{-4}	----	----	----	1.97×10^{-4}	2.85×10^{-4}	----	2.55×10^{-4}	6.43×10^{-4}
Activity	Dist	1.46×10^{-6}	----	----	8.73×10^{-8}	----	----	----	$<3.0\times10^{-8}$	$<3.0\times10^{-8}$	----	$<6.0\times10^{-8}$	2.82×10^{-7}
(μC/CC)	DF	3.37×10^{1}	----	----	1.35×10^{3}	----	----	----	$>6.56\times10^{3}$	$>9.5\times10^{3}$	----	$>4.25\times10^{3}$	2.28×10^{3}
PH	Feed	12.9	12.9	13.0	13.0	13.0	12.7	11.7	10.75	10.6	10.2	9.9	10.0
	Dist	5.7	7.1	7.1	7.3	7.8	7.8	7.7	7.3	7.0	6.9	6.6	4.5
Gross B	Feed	1.86×10^{-5}	7.57×10^{-5}	1.20×10^{-4}	1.25×10^{-4}	1.42×10^{-4}	1.19×10^{-4}	1.45×10^{-4}	1.88×10^{-4}	2.53×10^{-4}	2.42×10^{-4}	2.50×10^{-4}	4.04×10^{-4}
Activity	Dist	----	1.10×10^{-7}	5.58×10^{-8}	----	2.56×10^{-8}	1.12×10^{-8}	6.20×10^{-9}	4.22×10^{-8}	$<1.7\times10^{-8}$	5.21×10^{-8}	1.36×10^{-8}	2.50×10^{-7}
(μC/CC)	DF	----	6.88×10^{2}	2.15×10^{3}	----	5.54×10^{3}	1.06×10^{4}	2.33×10^{4}	1.45×10^{3}	$>1.4\times10^{4}$	4.64×10^{3}	1.84×10^{4}	1.62×10^{3}

Enclosure 4

ANALYTICAL PROCEDURES

The analytical procedures use are summarized below:

Sodium Analysis

Sodium analyses were performed by flame photometry, emission spectroscopy. The feed samples and drain tank sample were diluted to less than 50 ppm sodium prior to analyses while the distillate samples were analyzed undiluted. The accuracy of this method is ± 5%.

Boron Analysis

Boron analyses were performed by using appropriate samples of feed and distillate. The pH of this solution was adjusted to 5.5 with concentrated hydrochloric acid heated to remove dissolved gases, and neutralized to pH of 7 with sodium hydroxide. 10 grams of mannitol were added to this solution and then titrated with 0.1 N sodium hydroxide to pH of 8.4. Accuracy of this method is ± 1%.

Beta Activity

Beta analyses were performed with a GM detector. A 5 ml aliquot of feed solution and a 200 ml aliquot of distillate were evaporated to dryness for analysis. It is noted that no sodium hydroxide was added to any of the solutions prior to evaporation. Gamma spectra of the feed samples showed no radioactive iodine to be present.

The gross beta analysis are reported to have various analytical accuracies which are shown in Table 1.

Manganese-54, Cobalt-58 and Cobalt-60 Activities

Gamma spectroscopy (GeLi) was used to perform the isotopic analyses. A 50 ml aliquot of the feed samples and 500 ml of the distillate samples, evaporated to 50 mls were analyzed. The accuracy of this method for each of the three isotopes is ± 20% with the limits of detection being 3.0×10^{-8} uc/cc.

APPENDIX II

CAROLINA POWER AND LIGHT COMPANY

H. B. ROBINSON STEAM ELECTRIC PLANT

STEAM GENERATOR REPAIR

UNIT NO. 2

MAY 13, 1972 - JUNE 5, 1972

Written and Compiled By: J. G. Hammond
Plant Engineer

TABLE OF CONTENTS

INTRODUCTION

This report relates the events of the twenty-two day steam generator repair outage of the H. B. Robinson Unit Number 2. The work involves repairs and modification to three 44 series Westinghouse vertical steam generators, serial numbers 16A6081-1 (SG-"A"), 16A6081-3 (SG "B"), and 16A6081-2 (SG "C"). The reader is referred to enclosed figure 11 for an isometric view of this type generator. These generators are are of the U-tube bundle design consisting of 3,260 tubes of 0.875 in outside diameter and 0.050 in. wall thickness. Tube plate material is ASME-SA-336 MN-Moly steel, clad on the primary side with Inconel. The tubes are composed of NiCrFe alloy, Inconel ASME-SB-163-61T.

The report is separated into distinct sections relating to the primary side and secondary side repairs. Figures and tables pertinent to the work are enclosed at the end of the report. Reference to tube locations is given by row and column numbers. Column numbers start at the nozzle side of the generator and number toward the manway side. The row numbers begin at the channel head divider plate and proceed outward. Exact tube locations are indicated in the enclosed figures.

Ref 16

SECTION I

HISTORY OF STEAM GENERATOR LEAKAGE

The inception of leakage problems with the steam generators at H. B. Robinson Number 2 Unit occurred on June 11, 1971. At that time cladding failure was visually and ultrasonically detected in steam generator "A" (SG-"A") and steam generator "C" (SG-"C"). Cladding repair ensued, and the two generators were returned to service on August 16, 1971. This repair work was described in the "Steam Generator Tube Plate Cladding Repair" report of September 29, 1971. This report was included as an appendix to the H. B. Robinson Unit No. 2 Routine Operating Report No. 2.

The next indication of steam generator leakage occurred on October 25, 1971. At that time, an alarm was received on the radiation monitoring system steam generator blowdown line, channel R-19. Steam generator "A" was found to be the source of activity. The indicated leakage rate was approximately one GPH with a gross iodine activity in the secondary system of 2.32×10^{-5} uc/cc determined twelve hours after the leak was detected. At that time, the cause of this primary to secondary leakage was unknown. In that the source of the leakage had been identified as steam generator "A" and the magnitude of leakage was within the requirements of section 3.1.5 of H. B. Robinson Technical Specifications, plant operation was continued with leakage being monitored daily.

These conditions prevailed through the next six months. On May 7, 1972, the unit was shutdown for repair of a pressurizer spray valve.

During the subsequent primary system leak test which followed repairs on May 13, the liquid level in steam generator "A" was observed to increase slightly. On conclusion of the test, RCS pressure was reduced and the level ceased to increase. Normal plant heat-up was then begun on May 14 while limiting the blowdown from SG-"A" to a minimum. When normal operating temperature and pressure were reached, a primary leak rate test was performed. The results of this test revealed leakage in excess of the H. B. Robinson Technical Specifications requirement. Consequently, the plant was returned to a cold shutdown condition. The source of leakage was confirmed to be SG-"A" by an increase in the count rate on steam generator blowdown radiation monitor R-19. The leakage rate was measured per periodic test 8 (PT-8) and found to be approximately 12 GPM.

The excessive leakage necessitated further investigation of the problem and repairs as necessary. Therefore, following plant shutdown and cooldown on May 17, the primary manway covers on SG-"A" were removed and preparations made for a secondary hydrostatic test. With the secondary side of the steam generator filled, a visual check was made of the tube sheet prior to pressurization. Excessive leakage of tube (Row 7 - Column 43) was noted at that time on the inlet side of the channel head. The nature of the leak was a continuous drip. Some dripping of water was evident from the tube area directly above the manway,

but leakage was not positively identified and the condition was hypothesized to be due to moisture condensing on the tube sheet. This suspect area was later revealed to be free of defects as determined by eddy current testing described in Section II of this report. No leakage was observed on the outlet side. The location of the leaking tube was marked by insertion of a rubber plug secured by a lanyard. Pressurization of the secondary side was not performed, and no other leaks were noted with the head of water on the tube sheet. The repairs and modifications that followed are related in the succeeding parts of this report.

SECTION II

PRIMARY SIDE REPAIR WORK

1. Initial Stages of Outage and Inspection

Following the detection of excessive leakage in steam generator "A" (SG-"A") on May 14, Westinghouse Electric Corporation Power Systems was notified of the situation and the impending repairs that seemed to be in order. In response to this, Westinghouse despatched R. E. Cantrell from their Tampa Division to H. B. Robinson plant to stand by for explosive plugging of the leaking tubes as the situation demanded. Cantrell and a crew of ZETEC eddy current testing personnel arrived on site on May 16. The plan at that time was to hydrostatically test SG-"A" and visually locate the source of leakage. If the leakage was solely a tube failure problem in lieu of possible cladding failure, eddy current testing was to be conducted on the suspect area of SG-"A" with explosive plugging of the leaking tubes to follow.

On May 17, the primary manway covers were removed from SG-"A", and the leakage of one tube, (Row 7, Column 43), was detected as described in Section I of this report. Following the visual inspection, the eddy current testing equipment was set up and testing of the inlet side tubes was begun. This equipment was designed for remote operation. A base plate consisting of two drive motors, rack and pinon tracks, and an eddy current probe guide were afixed to the tube plate by insertion of cam locks in the tube openings in the tube sheet. This assembly was then operated from outside the interior of the channel head and was used to guide the eddy current probe into the respective tubes. The motion of this guide could be directed in either the X or Y axis. The probe itself was also inserted within the tube remotely. The position of the probe and location of the base plate was monitored on a TV screen set up in the area of the eddy current equipment with the TV camera positioned on the bowl of the channel head. The eddy current equipment itself was set up outside of the polar crane wall about 50 to 75 feet away from the steam generators with the necessary electrical leads run into the steam generator area. The eddy current probe was inserted into the tubes for a distance of four feet. Inspection was accomplished only on the inlet side, and all data was recorded on tape.

The eddy current testing was begun at 4:00 P.M. on May 17. By 9:15 P.M. the testing had revealed eight tubes with 50 to 80% reduction in wall thickness out of a total of seventy tubes inspected. Based on this apparent imminent failure of tubes in addition to the leaking tube initially detected, it was decided to proceed with eddy current testing SG-"A" more extensively and also to run a representative inspection of tubes in SG-"B" and SG-"C". Explosive plugging was thus postponed until the eddy current testing was complete at which time all defective tubes would be plugged.

A time limitation of twelve midnight on May 21 was agreed upon by Westinghouse and C.P.&L. as a deadline for termination of testing. It was judged that this would be sufficient time to assure detection of all defective tubes, and yet minimize the time required to return the plant to safe, reliable operation.

To maintain system cleanliness of the loop piping during eddy current testing, stainless steel nozzle covers were installed on the inlet and outlet piping of SG-"A". Lack of availability of additional sets of these covers made it necessary to install wooden covers which had been wrapped with tape on the inlet and outlet nozzles of SG-"B" and SG-"C".

Eddy current testing of SG-"A" proceeded through May 18 and was concluded on the afternoon of May 19. Twenty-four tubes, including the leaker, out of a total of 2240 tubes inspected were found to be defective. This inspection was conducted on all tubes out to row 27. This encompassed the suspect area reported in Section I of this report and revealed that there were no defective tubes in that vicinity. For a listing and disposition of defective tubes, refer to enclosed figures 1 and 2 and table 1.

On May 19, eddy current testing was begun on SG-"C" and proceeded through the morning of May 21. Approximately 1200 tubes were inspected and two defective tubes located. Refer to table 3 and figure 5 and 6 for disposition of defects. In conjunction with this phase of eddy current testing, an ultrasonic inspection was made of the SG-"B" tube plate cladding. Attention was directed to this area due to previous problems with cladding failures in SG-"A" and SG-"C". The test was conducted on May 21, and no defects were found.

Eddy current testing of SG-"B" was begun about 6:00 P.M. on May 21 and completed at 4:00 A.M. on May 22. Four defects were located out of 840 tubes inspected. This inspection phase of repairs was thus completed after spanning about four and one-half days.

2. Tube Pulling Operation

In that the eddy current testing would preclude the initiation of repairs, Westinghouse proposed to use the time in an effort to remove sections of three tubes from SG-"A" for analysis in an attempt to diagnose the cause of the tube deterioration. The proposal was to remove three tubes (Row 7, Column 44, 45 and 46). The tubes represented three distinct stages of deterioration. Column 44 tube was free of defects, column 46 tube was in the early stages of deterioration with a 50% indication, and column 45 tube was approaching failure status with an 80% indication. Approval was given to pull sections of these three tubes during the time eddy current testing was in process.

The procedure to accomplish this is outlined as follows:

First, an expander was inserted up into the subject tube to the first tube support (See figure 7). The tube was then rolled to the tube support such that it would be stable once it was severed.. With the rolling process completed, a cutting tool was inserted into the tube, and the lower section of the tube from the support plate to the bottom of the tube sheet was cut free by severing the tube at the bottom of the support plate.

The next step was drilling out the tube and counterboring the tube sheet to a depth of 2 3/8" in order to free the tube from the tube sheet and tube sheet cladding to which it was rolled and welded at manufacture. Once the tube had been thus prepared, it was internally threaded on the tube sheet end, secured to a jacking device at this point, and jacked out of the generator.

The Westinghouse "tube pulling crew" arrived on site around noon on May 19. Actual work on the pulling operation was begun that evening. The preparation of the tubes for the removal operation was readily accomplished, but the process of jacking the tubes out of the tube plate proved to be a different matter. In fact, the threaded portion of the tubes was repeatedly stripped out during extraction attempts. The defect-free tube, (Row 7, Column 44), was eventually removed on May 20. Portions of the other two tubes were removed with continued difficulty. Efforts at completely removing the remaining portions of the severed sections were abandoned about 6:00 P.M. on May 21. Approximately half of each of the two tubes was removed. This left a maximum tube stub standout of 41" from the face of the tube plate to the interior of the steam generator secondary side.

The portions of the tubes that were removed showed no signs of scale buildup or of excessive galling that could have resulted when they were pulled through the tube sheet. The physical appearance of the tubes was a slight "straw" discoloration. The hypothesis was that the difficulty experienced in extracting the tubes was a result of lack of water above the tube sheet which prevented any lubricating action between the tube and tube sheet. This condition was thought to be compounded by a build up of dry granular deposits on top of the tube sheet which possibly entered the gap between the tube and tube sheet and resulted in binding of the tubes.

The portions of the two tubes extending into the steam generator primary

side were cut off flush with the tube sheet. The proposal was then made to plug these tubes on the inlet side with welded plugs 42 inches long. The full length plugs are intended to give the tube secondary side stubs rigidity and reduce the possibility of vibrational damage. The 42" length was chosen because the length of the tubes remaining in the steam generator tube sheet and secondary side was determined to be from 30 to 41 inches. A fix of this type has not been accomplished before. A similiar repair has been made in which a plug was inserted from the face of the tube sheet to the first tube support. However, this type of fix was not possible in the present instance because the tubes had sprung slightly when they were cut free, and alignment could not be achieved with the tube stubs and the portion of the tubes rolled to the first tube support.

The sections of the tubes that were removed were transported from the site in shielded casks. They left the job site at 7:30 P.M. on May 22. With this portion of work completed the next operation was commencement of repairs as described in the following sections.

3. Tube Plugging Operations

The parallel work on tube pulling attempts and eddy current testing was completed on the morning of May 22. Work was then begun on reaffirming the location of the defective tubes in all three steam generators. This was accomplished by inserting the eddy current probe into the tubes previously determined to be defective and confirming the defects. Final locations on the inlet side were then marked with red plastic caps.

With the above work completed, the next operation was initiation of the actual repairs by installing explosive plugs in the defective tubes. The procedure used for this plugging was in accordance with Westinghouse Process Specification 81019 GA. The materials used consisted of inconel explosive plugs, explosive powder (Trojan - U.S. Powder, SWP-1), detonating fuses (Reinforced Primacord), detonating caps (6 or 8 strength commercial electric blasting caps), and masking tape. The plugs were prepared by inserting a cylindrical wadding of 3/4" masking tape into the plug bore to a depth of 2.4 inches. The required amount of SWP-1 powder was placed on top of the wadding and lightly tapped in place. Then a length of primacord was wrapped with 3/4" masking tape and inserted into the tube bore. The primacord functions as the detonating fuse and the masking tape provides wadding to hold the powder charge in place. This work was done prior to entering the containment. See figure 12 for a view of a plug prepared in this manner. This figure depicts the type plug used in plugging all tubes except the one from which the tube was pulled. The plug used in that tube is the same in all respects except that the lower end has a weld prep configuration, and the plug extends full depth of the tube sheet.

The actual plugging process was accomplished by inserting the prepared plug into the defective tube and firmly seating the tapered portion of the plug solidly against the tube lip. An electric detonating cap was then taped to the end of the primacord. The area was evacuated, and the detonating cap was attached to a detonating machine and fired from a safe distance. The explosion resulted in welding the thin walled area of the plug to the tube inner diameter. This remote explosive process provides a saving of time in the actual plugging procedure and minimizes radiation exposure to workers accomplishing the plugging.

At the inception of repairs, the total number of tube ends requiring plugging was fifty-eight. The fifty-eight plugs consist of forty-six plugs in SG-"A", eight plugs in SG-"B", and four plugs in SG-"C". These numbers result from the fact that each defective tube must be plugged on the inlet and outlet sides with an explosive plug. The exceptions to this are the two tubes from which attempts to remove sections were unsuccessful. These two tubes (Row 7 Columns 45 and 46) were to have welded plugs installed on the inlet sides and explosive plugs installed on the outlet sides.

Actual explosive sealing of the tubes got underway at 3:00 P.M. on May 22. The work was conducted by a Westinghouse crew under the direction of R. E. Cantrell. This work proceeded through 6:00 A.M. on the morning of May 23. At that time there were thirty-one plugs remaining to be installed out of

the initial numbers of fifty-eight. The plugging crew took a respite at this stage of work and returned to their lodgings for a period of rest. With the explosive plugging interrupted, work was started on fitting up the welded type plugs and initiation of welding. Refer to Section II, No. 4 of this report for details of this work.

The plugging crew returned to the job site on the afternoon of May 23. Due to the fact that the welding crew had reached their allowable radiation exposure limits, welding was stopped, and the explosive plugging of tubes resumed at 4:00 P.M., May 23. Installation of fourteen more plugs was completed during this stage of work, for a total installed of forty-five out of fifty-eight required. This completed plugging of SG-"B" and SG-"C" with only thirteen tubes remaining to be plugged in SG-"A". During the plugging of tubes on SG-"A" outlet, a section of the stainless steel nozzle cover was dislodged and fell into the loop piping between SG-"A" and the "A" reactor coolant pump. Plugging was terminated at that time, and the work was once again switched to welding of plugs on the inlet side of SG-"A". Welding work proceeded until 3:15 A.M. on May 25. Refer to Section III, No. 5 for details of the recovery of the nozzle cover from the loop piping.

Following welding the stainless steel nozzle cover that was installed on the inlet side of SG-"A" was removed and installed on the SG-"A" outlet nozzle. Explosive plugging was then resumed at 4:45 A.M. on May 25. Detonation of the final plug was completed by 2:00 P.M. that afternoon. Following the plugging, confirmation that the proper tubes were plugged was made by physically counting off the tube row and column numbers on the inlet and outlet of SG-"B" and SG-"C" and the inlet side of SG-"A".

The plugs were verified, and the Westinghouse plugging crew left the site on May 25. The plugging operation thus spanned three 24-hour periods with no actual plugging being accomplished on one calendar day during this time. There were two interruptions involving the work. The first occurred when the plugging crew had to stop for a period of rest, and the second took place when a portion of the nozzle cover fell into the loop piping. No major loss of time was incurred during either of these events in that operations were, in both instances, switched to the welding phase of work.

4. Welding Repairs

The welding to be accomplished consisted of two separate operations. One aspect of the weld work was fitting up of the 42 inch long plugs in the two tube stubs (Row 7, Columns 45 and 46) and prepping these plugs, and seal welding the two plugs to the tube sheet and tube sheet cladding. The other was seal welding the explosive plug to the tube sheet cladding on the inlet side of Row 7, Column 44. The fit-up of the long plugs was consistent with the standard procedure used on welded type plugs. The plug was first inserted into its respective tube until handtight. A layout line was then scribed on the plug at the normal tube plate clad face. Next the plug was removed and scribed 3/16 inch above the first line. The plug was cut off at this point and end prepped to a 1/8 inch by 45° bevel. The final step prior to welding was to drive the plug into the tube until the 45° bevel was lined up with the end of the portion of the tube remaining in the tube sheet. Welding was then accomplished by depositing a minimum of two layers of weld metal around the plug and a final layer over the end of the plug. See figure 13 for a view of the plug welded end configuration.

In addition to the two welded plugs, a seal weld is required between the explosive plug and the tube sheet cladding on the inlet side of Row 7, Column 44 to prevent moisture from entering between the cladding and the tube sheet. This is the location from which the section of the defect free tube was removed. The explosive plug effectively seals the tube sheet preventing leakage from the primary to the secondary side, but it does not provide a tube-sheet to tube-sheet-cladding seal. Therefore the seal weld becomes necessary. For ease of welding, a small plug is inserted into the bore of the explosive plug and welded to the explosive plug. For a typical view of this configuration, see figure 14.

Welding was accomplished by welders from Westinghouse Electric Corporation, Tampa Division, under the direction of Westinghouse Welding Engineer, Paul Loch. Welders and welding procedures were qualified in accordance with ASME Boiler and Pressure Vessel Code, Section III, IX and XI. The welding procedure used for the welded plugs installed in the two tube stubs and for the seal weld on the explosive plug was Westinghouse Process Number 82127ML. Dye penetrant inspection of welds was in accordance with Westinghouse Process Specification 84350JA. Material certification was maintained on all plugs and filler material. All nondestructive testing and quality control records were in compliance with the ASME Code Sections III and XI, and were maintained and compiled by Westinghouse personnel.

Initial work on fit-up and welding was begun on the morning of May 23. Attempts at fit up of the plugs indicated that machining was required to reduce their diameter. The plugs were removed to the hot machine shop and machined to proper size. Concurrent with this, work proceeded on fillet welding of the explosive plug to the tube sheet. By 3:30 P.M. the fillet weld was 98% complete. However, the welding crew reached their permissable radiation exposure limit, and welding work was discontinued and explosive plugging resumed.

A new crew of welders was flown into Hartsville from Westinghouse, Tampa Division, on the evening of May 23. After the sequence of events in which the nozzle cover fell into the loop piping, as related in Section II, No. 3 of this report, welding of the explosive plug seal weld was resumed on the morning of May 24. This weld was completed before noon. During that time, final fit-up measurements were taken on the 42 inch long plugs. They were cut off, and prepped, and fitted up for welding. These two welded plugs were completed by 6:00 P.M., May 24. Subsequent dye penetrant inspection revealed numerous indications in all welds. Explosive plugging was thereafter once again resumed on the morning of May 25. Note that explosive plugging cannot be performed in parallel with any other work in that the containment must be evacuated for each blast.

A fresh crew of welders arrived on the morning of May 26. It was decided that moisture condensing on the tube sheet around the welding work area may have been contributory to the defective welds. Therefore, a Cappas Vane - Ventilation Blower was connected to the manway on the outlet side of SG-"A" with the discharge being directed through a hose connection to an absolute filter assembly. This resulted in drawing air through the steam generator tubes and eliminating the formation of moisture on the inlet side of SG-"A". During the time this ventilation system was being erected, work proceeded on grinding out defects in the previous welds.

Repairing of welds began on the evening of May 26. This work continued through the next day, and all welding and satisfactory dye penetrant inspection was completed by 9:00 P.M., May 27.

Welding, which was initiated on May 23, was thus completed after two interruptions. From inception to completion this phase of welding spanned five calendar days.

5. Recovery of Nozzle Cover From Loop Piping

As related in Section II, Part 3 of this report, a section of a stainless steel nozzle cover was dislodged on the night of May 23 during plugging operations and fell into the loop piping between SG-"A" and "A" reactor coolant pump. This pipe has an inside diameter of 31 inches, and the size of the cover section is 1½ inches radially and 4½ inches on the chord length. Work on explosive plugging was halted at the time the cover was dislodged, and welding work resumed.

The morning of May 24 was devoted to assembly of equipment for a recovery effort. A grappling rod, 15 feet long with a 4 inch long 90° bend at its end was manufactured to be used as a means of retrieving the cover. An underwater lighting rig was also assembled to aid in the recovery. The initial effort at recovery was made at 3:00 P.M., May 24. This attempt proved unsuccessful. The cover was physically located with the grappling rod, but a secure hold on it could not be attained, and it could not be extracted from the pipe. Visual identification of the cover was not made at that time, but it was determined that the cover was resting at the first bend in the loop piping. Refer to figure 15 for a view of the cover and the portion of loop piping in which it was located.

The next plan of action was an attempt to drain the portion of the loop piping in which the cover was located and to lower a worker into the pipe to secure a rope to the cover. The cover would then be hauled out of the loop. Draining did not prove successful, as the rate of leakage back through the reactor coolant pump was too great for the capacity of the reactor drain system to overcome without draining the entire loop.

Meanwhile, work was proceeding on explosive plugging and welding of tubes. With initial recovery efforts proving to be unsuccessful, a Westinghouse recovery team from Pittsburgh was flown into Hartsville to attempt to extract the cover from the pipe. The crew arrived on the morning of May 26. Their equipment included an underwater television camera and remote viewing monitor, underwater lights, and an air operated clamping device for gripping the cover and extracting it from the pipe.

The crew completed assembling its equipment in the area of SG-"A" on the evening of May 26. However, an actual attempt at recovery was delayed until welding on SG-"A" was completed due to the fact that access to the outlet side of SG-"A" could not be attained because of the blower rig attached to the manway. Access to the area was achieved on the evening of May 27. The cover was then visually located via the television camera. The air operated clamping device was maneuvered to the cover and latched onto it. Attempt at withdrawal of the cover then once again proved futile as the cover slipped from the jaws of the clamping device as it was drawn up the piping. Continued attempts with this device yielded the same results. The clamping force of jaws of the device and the coefficient of friction between the jaws and the cover were not sufficient to positively grip the cover, which weighed approximately 60 pounds.

On May 28, an attempt was made to retrie[illegible]e cover using a net assembly. This consisted of a net 4 feet long secu[illegible] to a ¼" O.D. stainless steel handle that was 14 feet in length. The [illegible]nfiguration was that of a dip net. The use of this device proved no more successful than previous efforts.

The next recovery plan was to drain the loop piping in which the cover was located using a supplementary pump rather than the reactor drain system. The pump used was a stainless steel 130 GPM capacity centrifugal pump which had more than adequate capacity to stay ahead of the 5 GPM leakage back through the reactor coolant pump. A length of tubing was attached to the pump suction, the tubing was lowered into the loop piping, and the loop section was successfully pumped down. This was completed by 6:00 P.M. on May 29. A worker with full anti-contamination clothing and respirator was next lowered into the pipe by means of a safety cable. He then attached the cover to a rope lowered into the pipe using shackles. The worker remained in the pipe and aided in guiding the cover up toward the SG-"A" nozzle as the rope was hauled out. As the cover neared the top of the piping run, the shackles came free, and the cover slid back into the loop. The worker, who was physically beneath the cover, attempted to stop the descent of the cover, was struck on the forehead, and received a superficial skin wound. His respirator mask was cracked, but the integrity of his anti-contamination clothing was not violated. No contamination entered the wound. The worker did not lose consciousness. He was treated at the Emergency Room of Byerly Hospital in Hartsville, S. C., and returned to work the next day. The accident occurred due to the fact the worker had engaged the shackles to the cover but had not tightened them. The shackles and pins did not fall into the piping as they were secured by lanyards to the rope.

An evaluation of the situation was made, and it was decided that the above plan of action was not at fault in the accident and did not jeopardize the safety of the worker. However, to assure that a worker would not be in a similiar position where he might be struck by the cover falling back into the pipe, it was decided that in the next attempt the worker would be pulled out of the piping prior to raising the cover. This course of action was followed and on the afternoon of May 30, the piping was pumped down and a worker lowered into it. He secured a line to the cover, cleaned up the plexiglass fragments from the respirator of the injured worker, and visually inspected the pipe for any foreign objects. After his clean up work, he was pulled out, and the cover was withdrawn. The loop cleanliness integrity was thus restored after seven days.

That the cover fell into the loop was attributed in part to the fact that the three cover sections were not bolted together to form an assembled unit. The bolting was omitted due to the holes in the bolting flanges not lining up. In subsequent use of the stainless steel covers, the sections were clasped together across their bolting flanges using C-clamps. The C-clamps and sections of the cover were also secured outside of steam generator by lanyards. No further problems were encountered after these precautions were taken.

Following recovery of the cover, the underwater television equipment was utilized to inspect the outlet nozzles and loop piping on all three steam generators to assure cleanliness. Some small pieces of insulation were found in the piping on SG-"B" and were removed with a pump eductor. Cleanliness

on the inlet side loop piping was verified via visual inspection using an underwater light. The channel heads were cleaned, and the primary side restored to the required cleanliness criteria.

With the completion of recovery of the nozzle cover and clearing operations on May 30, the work on the primary side steam generator repairs was complete, contingent upon hydrostatic tests of the repaired units. This first phase of primary side repairs encompassed nine days after completion of eddy current testing. However, hydrostatic testing would not take place until June 1 due to modifications being performed on the secondary side of the steam generators. See Section III of this report for details of these modifications.

SECTION III

MODIFICATION TO SECONDARY SIDE OF STEAM GENERATORS

Preliminary metallurgical study of the sections of the tubes removed from SG-"A" revealed intergranular cracks partially penetrating through the tube wall from the outside diameter. A review of the history of the secondary side chemistry provided no clue as to the cause of this deterioration of the tubes. However, since the leak in SG-"A" was first detected in October, 1971, steam generator blowdown had been secured to prevent the release of radioactive blowdown water. This could have contributed to the presence of free caustic in the steam generator water. Another area of consideration was the fact that the H. B. Robinson steam generators had been modified in March of 1971 to reduce moisture carry over. This modification resulted in reduction of secondary recirculation by decreasing the recirculation ratio to 2.1. It was surmised that the combination of secured blowdown and reduced recirculation flow could have led to local concentrations of caustic around the top of the tube sheet. This, in turn, was said to have been a possible cause of tube deterioration. To alleviate this possibility, another modification of the steam generator secondaries was planned.

The plan was to increase the recirculation ratio from 2.1 to 3.2. This was to be achieved by raising the flow restrictor plate 3 inches. The flow restrictor plate is composed of three sections joined together as a single unit. Each section is suspended by two 2 inch diameter rods attached by a nut to the deck plate above the swirl vane cylinders. Movement of the restrictor plate can be achieved by turning the nut on these rods. The original design provides 8 inches of movement of the restrictor plate from the fully closed to the fully open position. In conjunction with raising the restrictor plates and increasing the recirculation flow there would also be an accompanying increase in moisture carry over. To compensate for this and reduce the carry over to an acceptable level, it was decided that the best approach would be the addition of orifice plates above the swirl vane cylinders. This required grinding out the existing orifice rings and welding the orifice plates in place. The welding would consist of a fillet weld attaching the orifice flange to the deck plate. See figures 8 and 10 for a view of the secondary side and the orifice plate.

The above modification was intended to alleviate the tube deterioration with the least amount of time and effort involved in actual modification work. However, there was the possibility that the flow restrictor plate could not be moved due to the buildup of corrosion products on the support rods and plate surfaces. To provide for this contingency, three alternatives were delineated. The ideal situation would be successful raising of the restrictor plates followed by welding of the orifice plates. If the plates could not be raised, there were two routes that could be taken. Either the attempt at modification could be abandoned and the steam generator secondary sides closed up, or the recirculation flow could be increased by grinding out the segments that were welded to the flow restrictor plate as a part of the 1971

modification and then welding in the orifice plates. See the enclosed flow-chart (Figure 16) for these alternate work paths.

The decision to perform the above modification to correct the steam generator tube deterioration problem was made on May 24. At that time, work was still in progress on the primary side repairs. In order to support the additional work, Westinghouse contracted with Metric Construction, Inc. for the secondary side modification. The work was to be performed by Metric under the direction of Westinghouse. The erection of scaffolding to gain access to the secondary manways was begun on the evening of May 24. The final phase of explosive plugging of SG-"A" tubes interrupted this operation on the morning of May 25. However, draining of SG-"B" and SG-"C" secondary sides was begun, and erection of the scaffolding was finished that afternoon following the completion of plugging.

Secondary manways were removed on the evening of May 25. The temperature inside the steam generators was too high at that time to permit access for work. Temperature in SG-"B" and SG-"C" was about 140°F, and inside SG-"A", which had been drained since the inception of repairs, the temperature was 115°F. The morning of May 26 was spent making final adjustments and additions to the scaffolding. Also on that morning, a truck arrived from Westinghouse Tampa Division with the orifice plates required for the secondary modification. To cooldown the interior of the steam generators, Coppus Vane ventilator blowers were placed on the scaffolding and sections of 8 inch hoses attached to the blowers to direct cooling air flow from the blower into the steam generators. Steam generators "B" and "C" were also filled to 88% level with cool water and drained down several times in an effort to reduce their secondary side temperatures.

By 10:30 P.M., on May 27, temperature in SG-"A" had been lowered to a level adequate for access and work. Work began at that time on air arcing out the deck plate covers to gain access to the restrictor flow plate area. Plywood covers were placed over the swirl vane cylinders to prevent foreign objects from falling into the tube bundle. The deck plate covers were removed and an asbestos blanket was draped over the flow restrictor plate for cleanliness protection. This phase was completed by the afternoon of May 28 at which time work was begun on air arcing out the support and guides. There are six of these guides per steam generator, and they were removed to prevent the possibility of the support rods binding in their bores during the restrictor plate lifting operation. The guides were removed on the evening of May 28. The support rods were then cleaned and lubricated with a mixture of graphite and alcohol (neolube). "Knocker" wrenches were then placed on the support rod nuts and work begun on raising the flow restrictor plate. No difficulty was experienced with this operation, and the flow restrictor plate in SG-"A" was raised the required 3 inches by the morning of May 29. This was accomplished solely by using the "knocker" wrenches without the aid of chain falls. The success of this lifting attempt indicated that the complete modification could be accomplished without resorting to the time consuming work of air arcing out the 1971 modification or aborting the entire modification. Work was begun on the morning of May 29 on air arcing out the orifice rings from above the swirl vane cylinders in SG-"A".

Meanwhile, the temperature in SG-"B" and SG-"C" had been lowered to a level suitable for work. Workers thus entered the two steam generators at noon on

May 29 and started grinding out deck plate covers. This was completed and work on grinding out the support rod guides was initiated about 6:00 P.M. that evening. The same cleanliness precautions that were used on SG-"A" were applied to SG-"B" and SG-"C". The support rod guides were removed from SG-"B" on the evening of May 29. Work was then begun on the early morning of May 30 in lubricating the support bars and "jacking" up the flow restrictor plate. Some difficulty was experienced on this lift attempt, as the flow restrictor plate was slightly cocked within the steam generator. However, once proper alignment was attained, the lift was completed. This particular lift proved rather time consuming and was not completed until 8:30 P.M. on May 30.

All of the orifice rings were removed from SG-"A" by noon on May 30, and work was begun on welding in the new orifice plates. There are three plate assemblies for each steam generator with the plate assemblies consisting of two halves. This arrangement is necessary to provide adequate clearance for rigging the plates through the manways. Upon fitting up the plates, it was discovered that there was not adequate clearance for the drain tubes that extended through the deck plate. (See Figure 9 for drain tube location) Therefore, it was necessary to air arc out a 4½ inch circular section from the orifice plate. With this accomplished, welding proceeded, and the orifice plate installation in SG-"A" was completed by the morning of May 31. The support rod guide brackets were then welded to the support rods to form a rigid assembly. This completed the work on SG-"A". The secondary side was then cleaned up and finally inspected. This was completed by 1:45 P.M., June 1.

Work on grinding out the support rod guides of SG-"C" was completed by the morning of May 31. The lifting operation was then begun and completed by 2:15 P.M. that day. Concurrent with this, air arc removal of the old orifice rings from SG-"B" was completed, and welding of the new orifice plates was begun. This orifice plate installation was completed by the morning of June 1 and was followed by welding of the support bars to the guide brackets. Final cleaning and inspection of SG-"B" were completed by 6:00 A.M. on June 2. Removal of the old orifice rings from SG-"C" was completed by the morning of June 1, at which time welding of its new orifice plates was begun. This installation as well as welding of the support bars to the guide brackets was completed by the morning of June 2. Cleaning and final inspection were then finished up that evening.

The secondary side work was thus completed eight days after the initial decision was made to accomplish the modification. The operation took place in a radiation controlled area requiring anti-contamination clothing and air supplied face masks. The radiation levels were not high, and exposure limits did not present a problem. Once the interior of the steam generators was cooled enough to permit access, the work proceeded without major difficulty or interruption. However, some time was lost when the air supply pressure regulators were transferred to primary side work priorities.

SECTION IV

HYDROSTATIC TESTING AND SUBSEQUENT REPAIRS

1. First Hydrostatic Test of SG-"A"

Following the completion of primary side repairs and secondary side modification, the next step was hydrostatic testing to assure that the repairs were successful. This test consisted of filling the secondary, pressurizing it to 200 psig, and inspecting the primary side tube sheet area for any sign of leakage. The pressure was then to be increased to 800 psig and held for 30 minutes with inspections for leakage to be conducted during this time. Any leaks observed were then to be repaired.

The primary side repair of SG-"A" was completed on May 27, and the secondary modification finished on June 1. The secondary manway holes were then cleaned with a tap, the bolts lubricated, and the manway torqued in place on the afternoon of June 1. This was followed by filling the secondary side. Pressurization was initiated at 8:45 P.M. that evening. A leaking tube (Row 7, Column 27) was detected with pressure less than 200 psig. The leakage was on the outlet side and was a continuous stream. Pressure was increased to 800 psig and no further leaks were noted. A check of the records of the plugged tubes revealed that the tube leaking during the hydrostatic test was supposed to have been plugged during the explosive plugging repairs. The tube had been detected via eddy current testing and revealed to be 90 per cent deteriorated. Evidently the explosive plugging process had led to the rupture of the worn tube, and the leakage resulted when a head of water was placed on the defective area. The fact that the tube was supposed to have been plugged, and yet was not, was attributed to an error in locating the defective tube ends on the outlet side prior to plugging. The inlet side locations had been verified via insertion of the eddy current probe and physical counts, and tubes had been accurately plugged. Also the outlet sides on SG-"B" and SG-"C" were verified by physical counts. However, the outlet of SG-"A" had not been 100 per cent checked and and error had obviously been made in the plugging operation.

On June 2, a recount was made of all the plugged tubes in SG-"A". This revealed that three tube ends on the outlet side which were not defective had been plugged, and consequently, three tube ends requiring plugging had been omitted. The tubes that were inadvertently plugged were Row 7, Column 28; Row 8, Column 26; and Row 8, Column 31. The tube ends that had been omitted were Row 7, Column 27; Row 8, Column 25; and Row 8, Column 29. Therefore, three tubes on the outlet side and three tubes on the inlet side required explosive plugs installed to complete repairs and correct the error that had been made. See Section IV, No. 3 for details of these repairs.

3. Final Repairs to SG-"A"

A Westinghouse explosive plugging crew from the Tampa Division arrived on the afternoon of June 2 to plug the outlet tube ends of SG-"A" that had been omitted; and to plug the inlet tube ends of the tubes that had been inadvertently plugged. Following the recount of tubes plugged and final verification, the plugging operation was begun on the evening of June 2. This plugging operation was completed early on the morning of June 3. The subsequent hydrostatic test revealed a leak around the plug in tube Row 7, Column 27. This leak was noted at a pressure of 800 psig as a slight drip. The pressure was held at 800 psig for 30 minutes, and the leak developed into a continuous stream.

The steam generator was drained and an attempt made to manually pull the explosive plug, but it could not be moved. An inspection of the bore of the plug revealed that it had expanded during the explosive process, but obviously a complete bonding to the tube had not been attained. The tube, therefore, required welding of the plug to the tube and tube sheet to achieve effective sealing. Welders arrived from Westinghouse Tampa Division at 10:00 P.M. on June 3. Welding of the plug was then begun. During the welding process, a drop of water was noted on the plug. Because this moisture would prevent welding, work was halted until the moisture problem was solved. Evidently, water was present within the tube above the plug. The only means to remove the water was to drill a hole in the plug and drain the tube. A drill rig was set up and a 5/16" diameter hole was drilled longitudinally through the plug. The tube was thus drained. This work proceeded through the evening of June 4.

Prior to resuming welding, the tube sheet around the weld area was preheated to assist in evaporating any entrapped water that might remain. The weld of the plug to the tube sheet cladding was then completed, and a small plug was welded into the bore of the plug to complete the sealing operation. This welding was in accordance with Westinghouse Process Specification 82127ML. Dye penetrant inspection of the welds was successfully performed per Westinghouse Process Specification 84350JA. The welders, welding procedures, and nondestructive testing were in compliance with the ASME Boiler and Pressure Vessel Code, Sections III, IX and XI.

The hydrostatic test of SG-"A" was then satisfactorily performed with no leaks observed. This was completed about 6:00 A.M. on the morning of June 5. A final cleanliness inspection was made, and the primary manway cover installation was completed by 10:30 A.M. that morning. The steam generator repairs were complete after a span of twenty-two days. Final clean up operations were finished, and start up was initiated. Full power operation of the unit was achieved on June 10. The entire outage, since initial shutdown for pressurizer spray valve repairs until full power operation, thus encompassed thirty-five days.

SECTION V

HEALTH PHYSICS ASPECT OF REPAIRS

All the work involving steam generator repairs was conducted in a radiation controlled area within the reactor containment. The health physics operation was administered by H. B. Robinson personnel. The radiation levels on the primary side were relatively high. See the enclosed table 4 for a listing of these levels. The major time consuming work that was conducted in these areas was welding in SG-"A." The explosive plugging operation did not require much work time within the channel head, other than insertion of the plugs. The eddy current testing was also largely a remote operation with a minimum of exposure time required.

Access to the work areas was controlled and monitored on a 24 hour basis during the entire repair effort. One hundred and forty-eight workmen were involved in the repairs with a composite exposure of 145.169 man-rem. Sixty of these workers accumulated a total quarter exposure greater than 1250 mrem, and one worker received a quarterly dose greater than 2500 mrem but less than [illegible] mrem. The average exposure was 981 mrem per man.

SUMMARY

Following a seven day outage for repairs to a pressurizer spray valve, the H. B. Robinson Unit 2 was started up on May 13. A primary leak rate test was performed at that time and revealed excessive primary to secondary leakage occurring in SG-"A". Plant shutdown and cooldown ensued. A visual hydrostatic test inspection on May 17 revealed a continuous stream of water leaking from tube - Row 7, Column 43. To determine the condition of the steam generator tubes, eddy current tests were performed on a representative number of tubes on the inlet sides of all three steam generators. This inspection revealed 24 defective tubes, including the leaker, in SG-"A". Four defective tubes were found in SG-"B" and two deteriorated tubes in SG-"C". These inspections were completed on May 22.

Concurrent with eddy current testing, an attempt was made to pull sections of three tubes from SG-"A" for metallurgical examination to determine the cause of tube failures. The section of the tubes to be removed were approximately six feet long and extended from the bottom of the tube sheet to the first tube support on the inlet side. The three tubes represented advancing stages of deterioration and included a zero defect tube, a 50 per cent indication, and a 80 per cent indication. The zero defect tube was successfully removed. However, removal of the other two tubes proved to be very difficult. Therefore, in order to stay within the established time schedule, only portions of these tubes were pulled with approximately 30 to 40 inches of each tube remaining in the tube sheet and steam generator. This turn of events required a special plugging procedure using 42 inch long welded plugs in the tube stubs to provide rigidity and sealing. The tube pulling operation was completed on May 21.

Explosive tube plugging commenced on May 22. This plugging procedure was completed on May 25 after two interruptions: One interruption for the plugging crew to get some rest; and a final interruption when a portion of a stainless steel nozzle cover fell into the loop piping. The subject nozzle cover was eventually recovered on May 29 after five unsuccessful attempts. Recovery was affected by draining down a section of the 31 inch I.D. loop piping and lowering a worker into the piping to attach a rope to the cover, which was then withdrawn from the loop.

Welding of the two 42 inch long plugs in the tube stubs on the inlet of SG-"A", and welding of the explosive plug to the tube sheet cladding in the location where the tube section was successfully removed from SG-"A" was begun on May 23. This work was interrupted once when a crew of welders reached their radiation exposure limits. There was also a problem with the welds failing dye penetrant inspection, which required grinding and rewelding. Welding was completed on May 28.

Meanwhile, Westinghouse analysis of the tube sections that were removed revealed intergranular cracks partially penetrating through the tube walls from the outside surface. A study of the existing conditions led to the conjecture

that a combination of secured blowdown and reduced recirculation flow had led to concentrations of caustic on the steam generator tube sheets, and consequently, tube deterioration. Blowdown was secured on October 25, 1971, when a 1 GPH primary to secondary leak was discovered in SG-"A". The reduced recirculation flow was a result of a Westinghouse secondary side modification performed in March of 1971. The modification was intended to reduce moisture carryover but also had the affect of reducing the recirculation flow. This reduced flow permitted the crud and deposits to settle out on the tube sheet.

To counteract the adverse affects of the original modification, a second modification was performed on the steam generator secondary sides. This consisted of raising the flow restrictor plated 3 inches to increase the recirculation ratio from 2.1 to 3.2. This, in turn, would increase the moisture carryover. To preclude this possibility, the modification included welding of orifice plates above the swirl vane cylinders.

Staging for this modification was begun on May 24. Work then proceeded without major difficulty, and the secondary side operations were completed on June 2.

Hydrostatic tests of SG-"B" and SG-"C" were successfully completed on June 3. However, the test of SG-"A" revealed a leaking tube on the outlet side. It was then discovered that three tubes that were defect-free had been inadvertently plugged; and consequently, three tubes requiring plugs had been omitted. These tubes were explosively plugged on June 3. A hydrostatic test followed, and once again the tube was found leaking. This time the leak was around the explosive plug, which had not completely bonded possibly due to the presence of moisture. Welding of the plug to the tube sheet cladding then ensued; and, after some difficulty with removal of moisture in the tube, sealing was completed on June 5. The hydrostatic test of SG-"A" on the morning of June 5 was successful. Thus, from the first detection of the leak until completion of satisfactory hydrostatic testing, twenty-two days had transpired. See the enclosed chronological sequence of events and the calendar of repairs for summary of the progression of work.

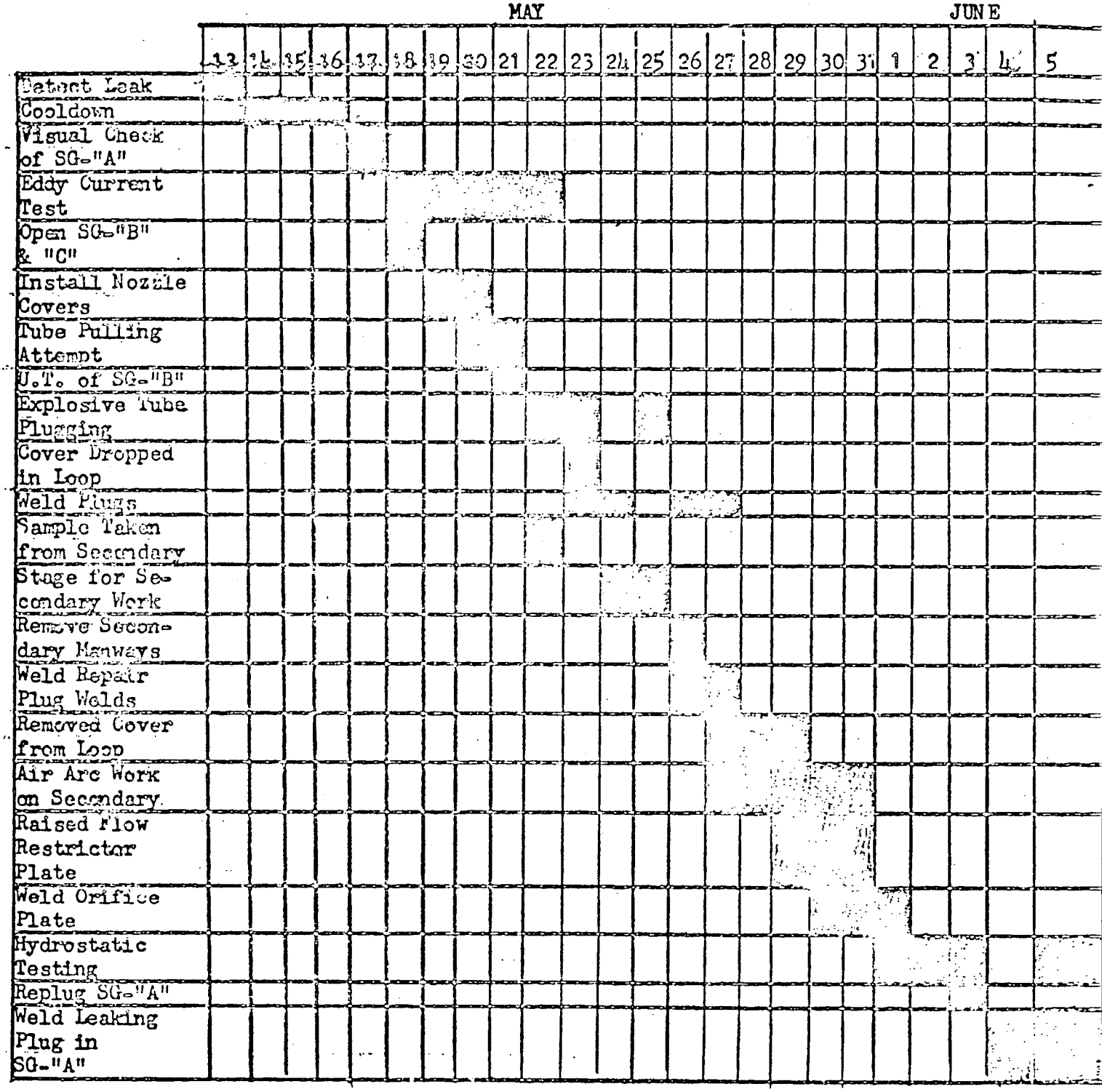
The plant was returned to full power operation on June 10. The entire outage, therefore, spanned thirty-five days from shutdown for pressurizer spray valve repairs until resumption of full service.

CHRONOLOGICAL SEQUENCE OF EVENTS

May 13	Detected excessive primary to secondary leak in SG-"A".
May 14	Indicated shutdown and cooldown.
May 17	Opened SG-"A" and found leaking tube (Row 7, Column 43). Started eddy current testing of SG-"A" which revealed other defective tubes.
May 17	Decision made to eddy current test SG's "B" and "C".
May 18	Opened SG "B" and "C".
May 19	Completed eddy current test of SG-"A" and started on SG-"C". Started attempt to pull sections of 3 tubes from SG-"A" at 6:00 P.M.
May 19	Installed covers on loop piping nozzles.
May 20	Succeeded in pulling tube (Row 7, Column 44). Ultrasonic tested SG-"B" satisfactorily.
May 21	Efforts to pull tubes (Row 7, Column 45 and Row 7, Column 46) were unsuccessful. Only half of tube sections were removed. Completed eddy current of SG-"C" and started on SG-"B".
May 22	Completed eddy current testing. Removed hand hole and took sample from secondary side. Reverified defective tube locations and started explosive plugging of tubes at 3:00 P.M.
May 23	Stopped plugging operation and commenced welding fit up and welding of plug to tube sheet. Welders received their maximum radiation exposure. Therefore, welding was stopped and plugging resumed at 4:00 P.M.
May 23	Section of stainless steel nozzle cover fell in loop during plugging process at approximately 11:00 P.M.
May 24	Unsuccessful attempt to remove nozzle cover at 3:00 P.M. Resumed welding plugs. Unsuccessful attempt to drain portion of loop to remove nozzle cover. Received word that secondary side of SG's were to be modified to alleviate tube erroaion problem.
May 25	Resumed plugging at 4:45 A.M. and completed at 2:00 P.M. Dye penetrant check of welds was unsatisfactory. Completed erection of scaffolding for secondary modification and removed secondary manway covers.

May 26	Installed blowers to cool secondary side for personnel access. Started grinding welded plugs in preparation for rewelding.
May 27	Completed welding with satisfactory dye penetrant check. Work begun on grinding out cover plates on SG-"A".
May 28	Unsuccessful attempt to remove nozzle cover from loop using air-operated clamping device. Completed grinding and lubrication of tie rods on SG-"A".
May 29	Successfully raised flow restrictor plate on SG-"A". Began grinding on SG-"B" and "C" secondary side. Unsuccessful attempt to remove nozzle cover from loop by pumping out water and sending worker in to attach rope to cover. Worker received minor injury during attempt.
May 29	Completed grinding of SG-"B".
May 30	Raised SG-"B" flow restrictor plate. Began welding orifice plates in SG-"A". Removed nozzle cover from loop.
May 31	Completed welding orifice plates in SG-"A". Completed raising flow restrictor plate in SG-"C". Commenced welding orifice plates in SG-"B".
June 1	Completed welding SG-"B" orifice plates. Inspected portion of loop piping between SG's and RCP's with underwater T.V. and cleaned, using an eductor pump. Completed work on SG-"A" secondary and installed manway. Started welding orifice plates in SG-"C". Hydrostatic tested SG-"A" and found tube (Row 7, Column 27) leaking.
June 2	Completed work on SG-"B" and installed secondary manway. Satisfactorily hydrostatic tested SG-"B" and closed primary side. Completed work on SG-"C" and installed secondary manway.
June 3	Satisfactorily hydrostatic tested SG-"C" and closed primary side. Explosively plugged final tubes in SG-"A". Hydrostatic tested SG-"A" and found tube (Row 7, Column 27) leaking around plug.
June 4	Seal welded leaking plug in SG-"A".
June 5	Completed welding on SG-"A", successfully hydrostatic tested the unit, and closed primary side.

CALENDAR OF EVENTS FOR STEAM GENERATOR REPAIRS



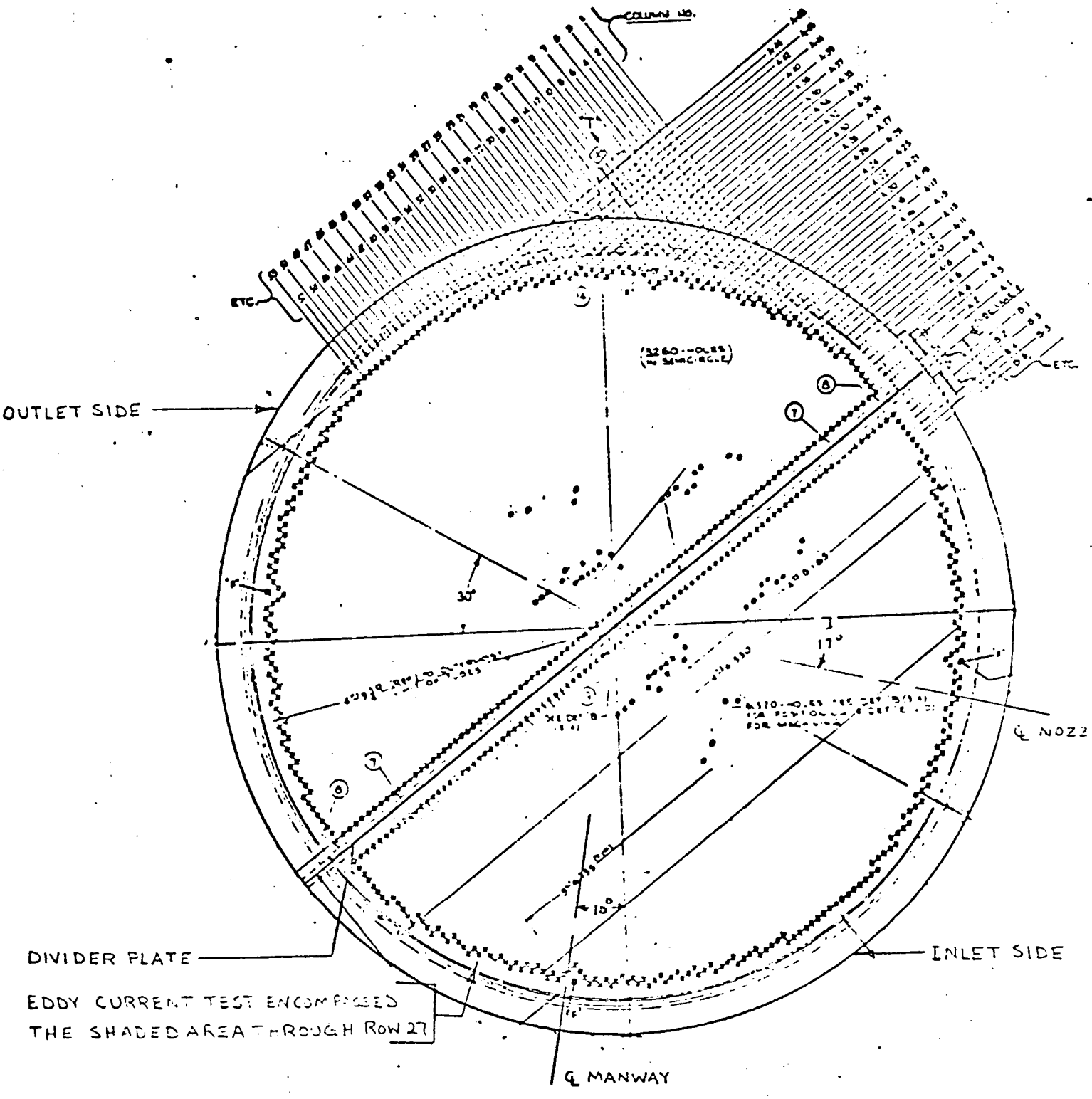
LIST OF FIGURES

AND TABLES

TABLE 1

LOCATION OF PLUGGED TUBES IN SG-"A"

ROW	COLUMN	PENETRATION(%)	REMARKS
5	41	50	
6	20	90	
7	21	90	
7	27	90	
7	28	--	Inadvertently Plugged
7	41	60	
7	43	100	Leaking Tube
7	44	--	Pulled this Tube
7	45	85	Attempted to Pull These
7	46	50	Tubes
7	47	90	
8	25	80	
8	26	--	Inadvertently Plugged
8	29	85	
8	30	85	
8	31	--	Inadvertently Plugged
8	42	75	
8	45	85	
8	48	75	
8	50	75	
8	51	90	
8	52	60	
9	47	80	
15	41	50	
16	40	75	
18	46	90	
19	48	50	



LOCATION OF PLUGGED TUBES IN SG "A"

VIEW IS LOOKING UPWARD AT TUBE SHEET
FROM CHANNEL HEAD

FIGURE 1

EXPLODED VIEW OF PLUGGED TUBES IN SG "A"

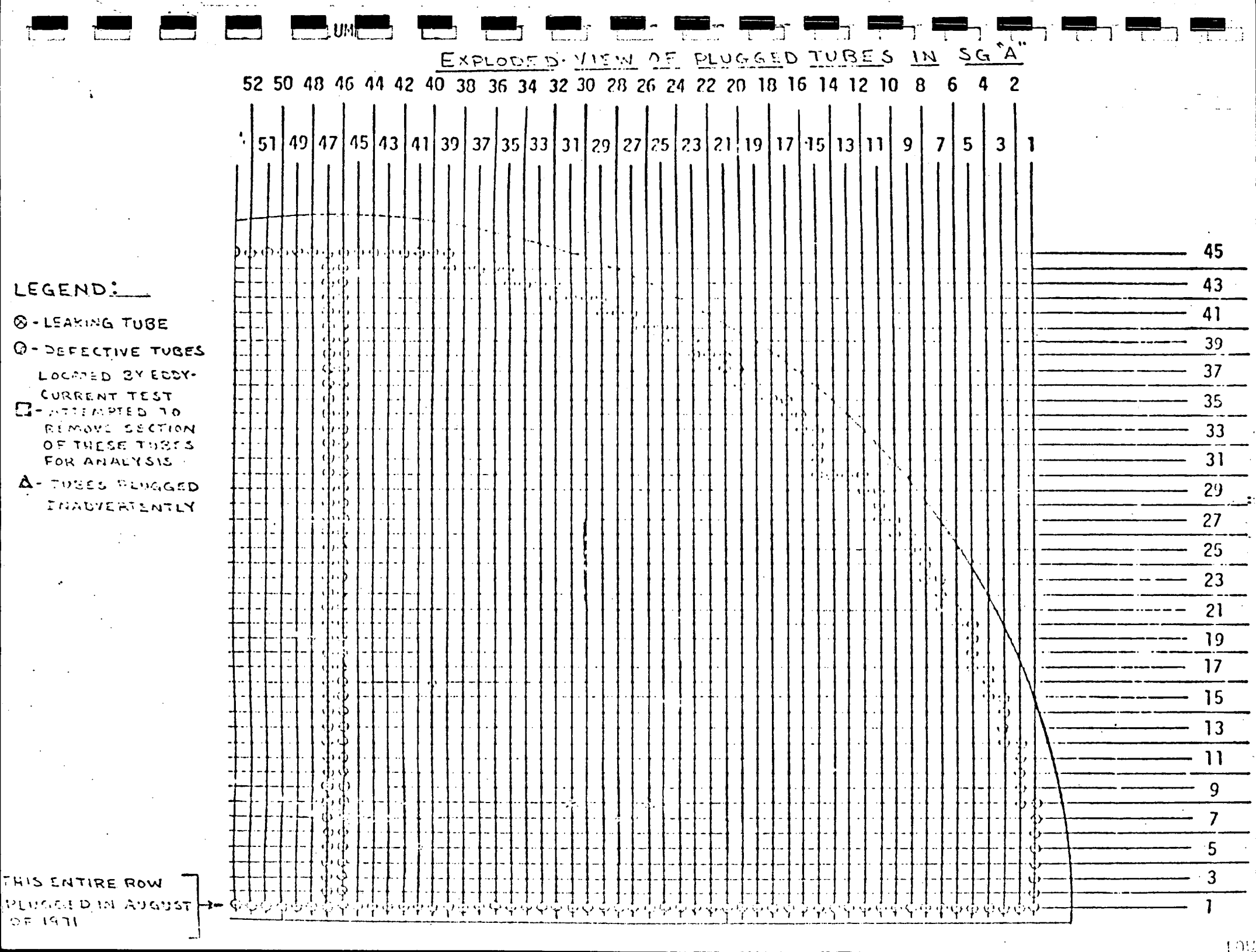
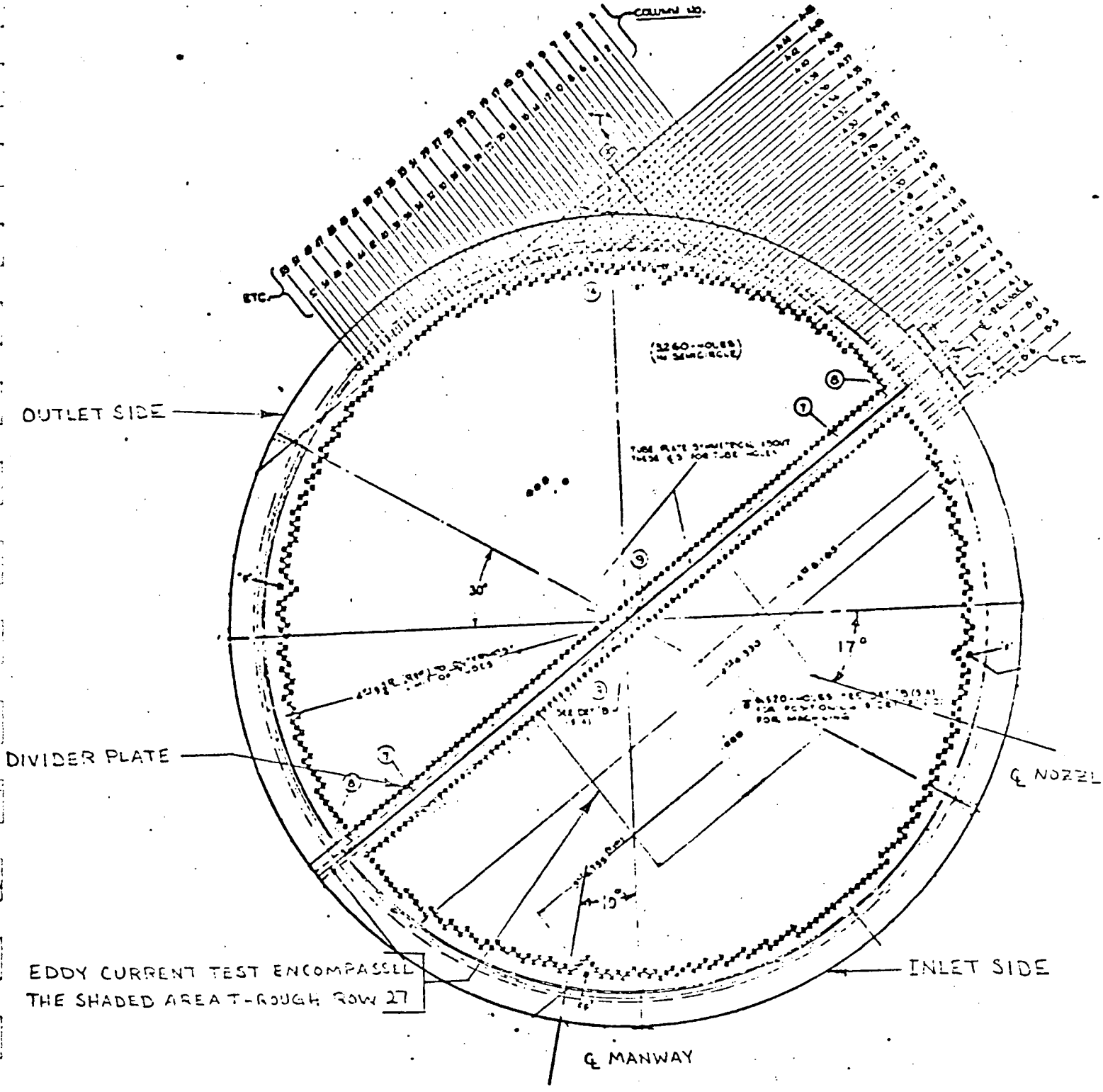


TABLE 2

LOCATION OF PLUGGED TUBES IN SG-"B"

ROW	COLUMN	PENETRATION (%)	REMARKS
18	41	75	All These Tubes
20	44	60	were Plugged
20	45	85	using explosive
20	46	75	welding plug

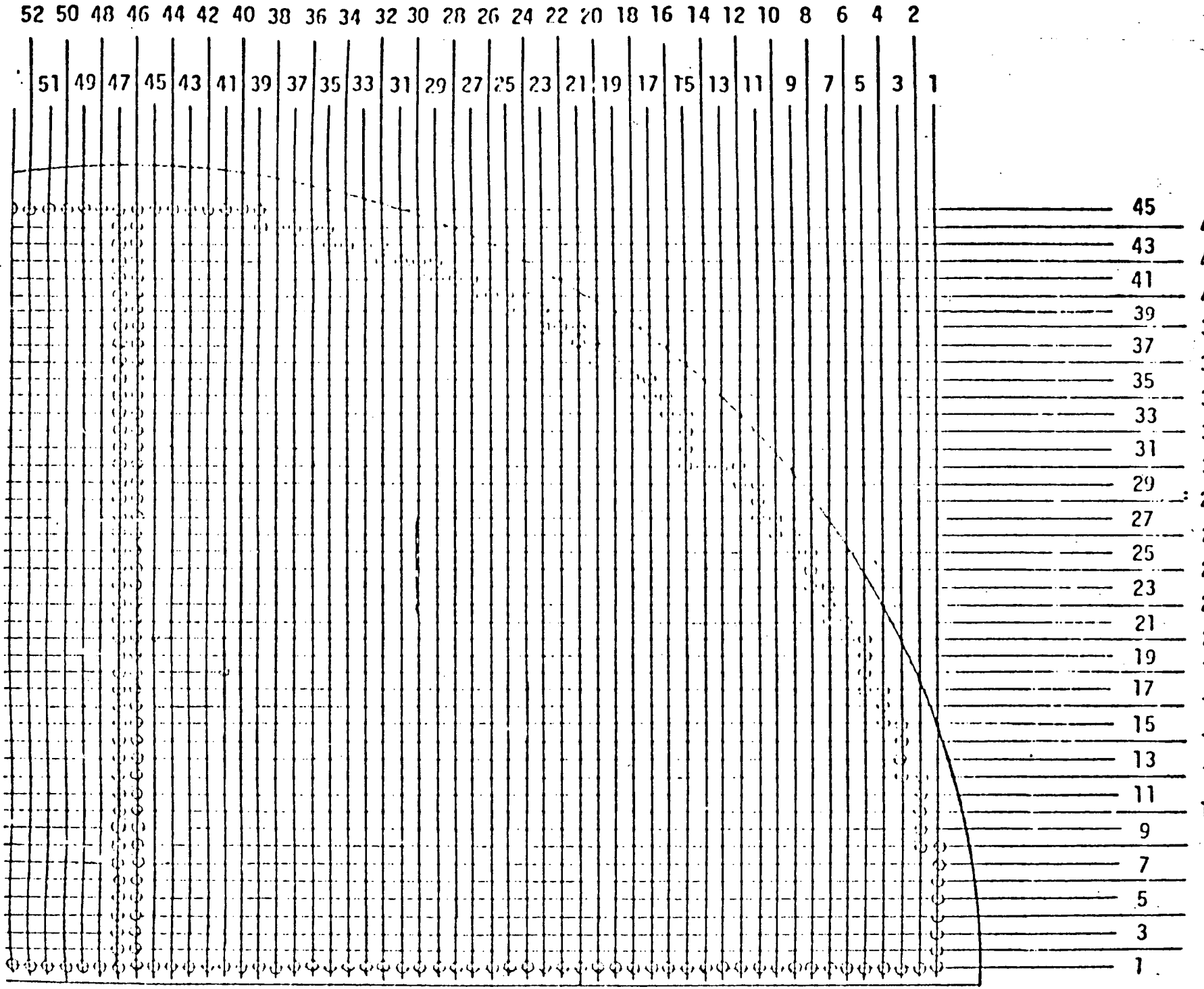


LOCATION OF PLUGGED TUBES IN SG "B"

VIEW IS LOOKING UPWARD AT TUBE SHEET FROM CHANNEL HEAD

FIGURE 3.

EXPLODED VIEW OF PLUGGED TUBES IN SG "B"



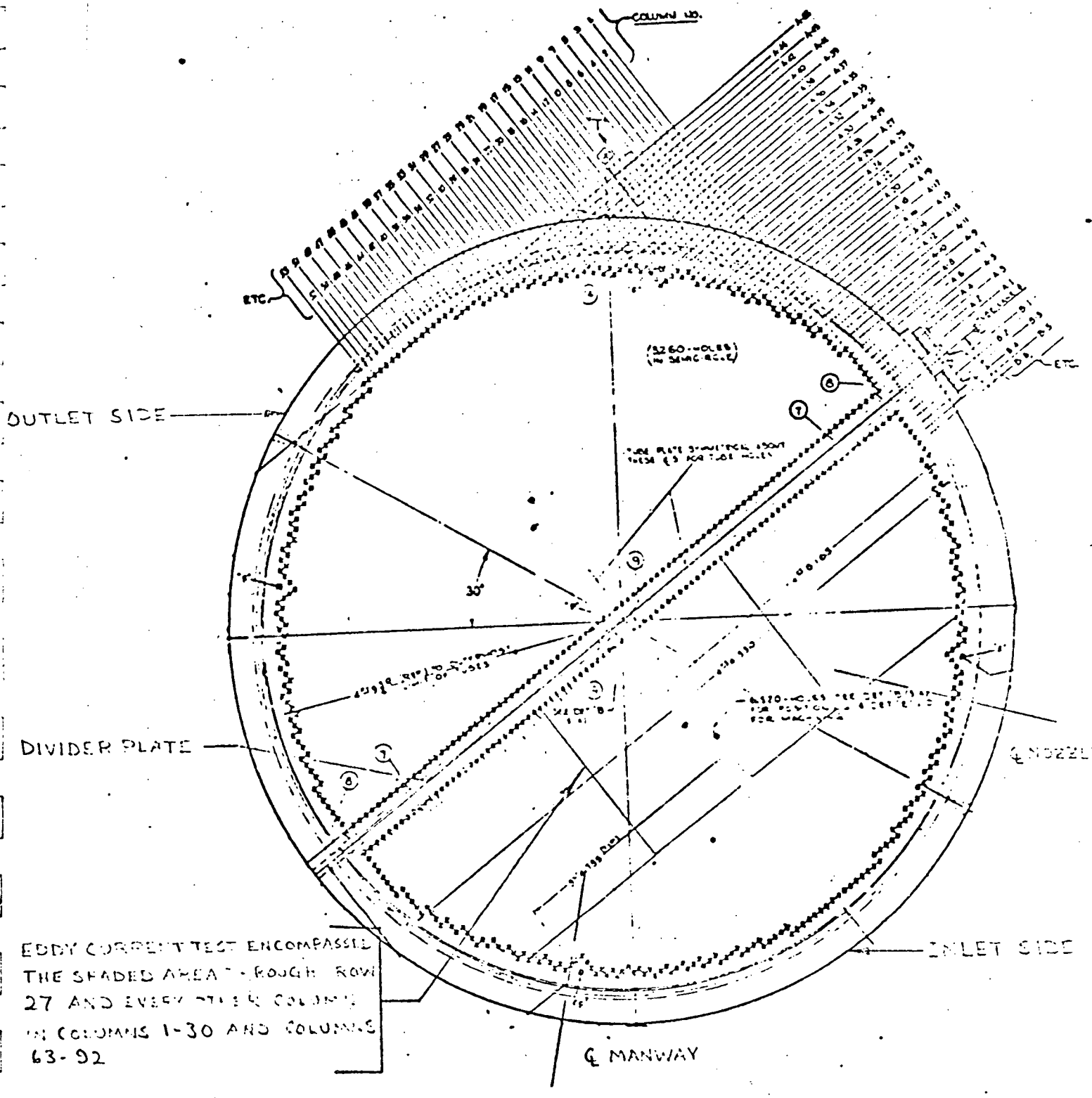
LEGEND:

⊗ - DEFECTIVE TUBES LOCATED BY EDDY-CURRENT TEST

TABLE 3

LOCATION OF PLUGGED TUBES IN SG-"C"

ROW	COLUMN	PENETRATION (%)	REMARKS
15	48	75	These tubes were plugged using explosive welding plugs
19	45	75	

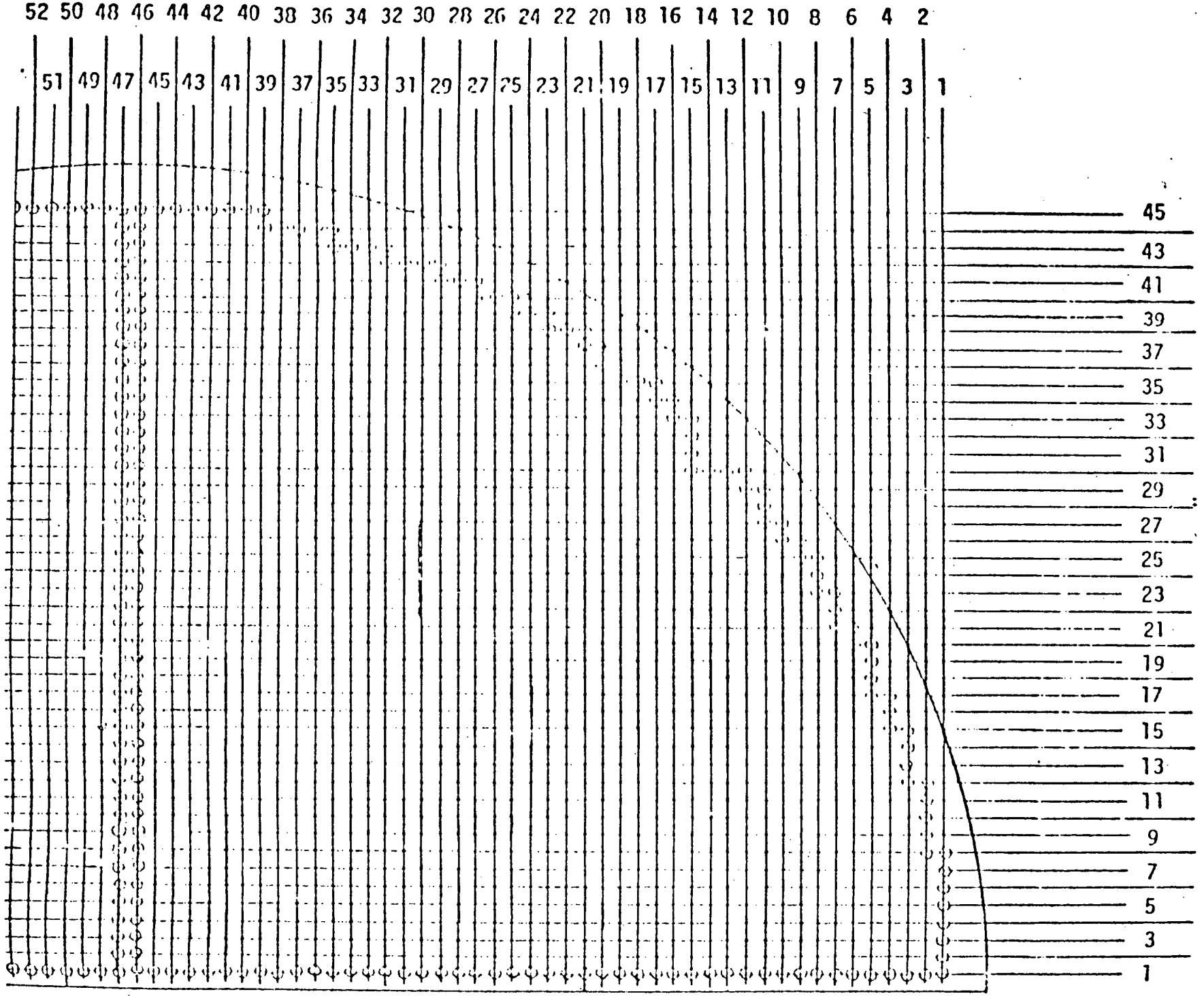


LOCATION OF PLUGGED TUBES IN SG "C"

VIEW IS LOOKING UPWARD AT TUBE SHEET FROM CHANNEL HEAD

FIGURE 5

EXPLODED VIEW OF PLUGGED TUBES IN SG "C"

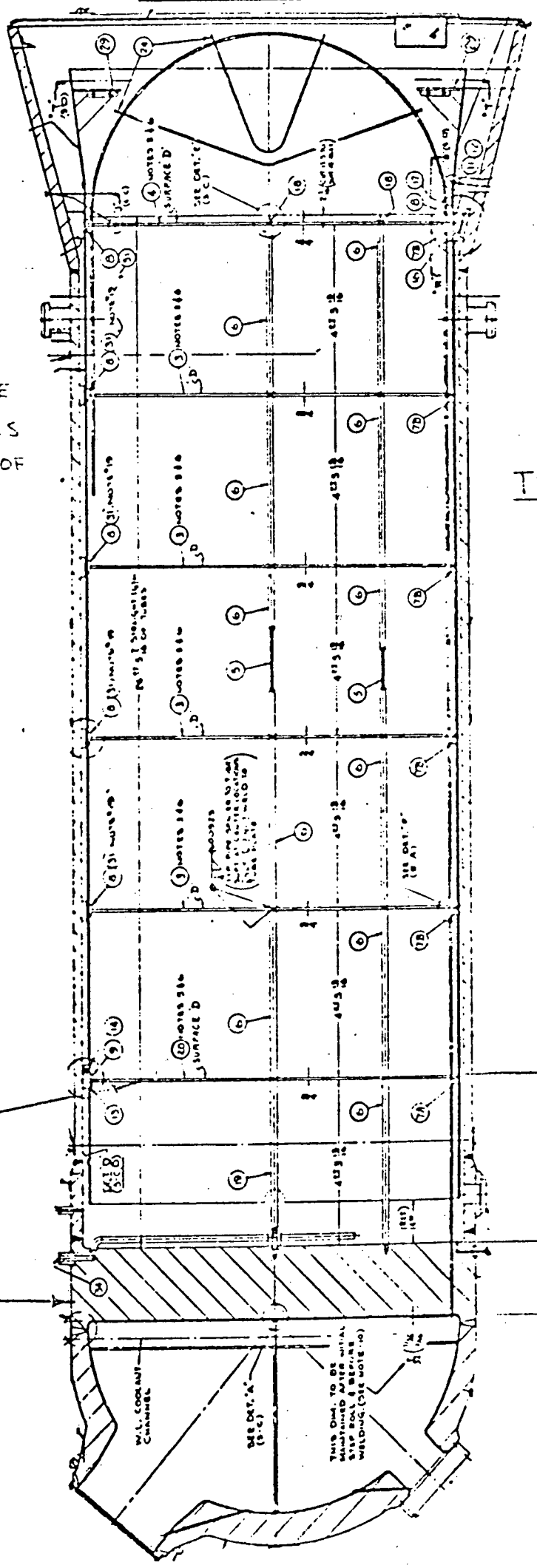


LEGEND:

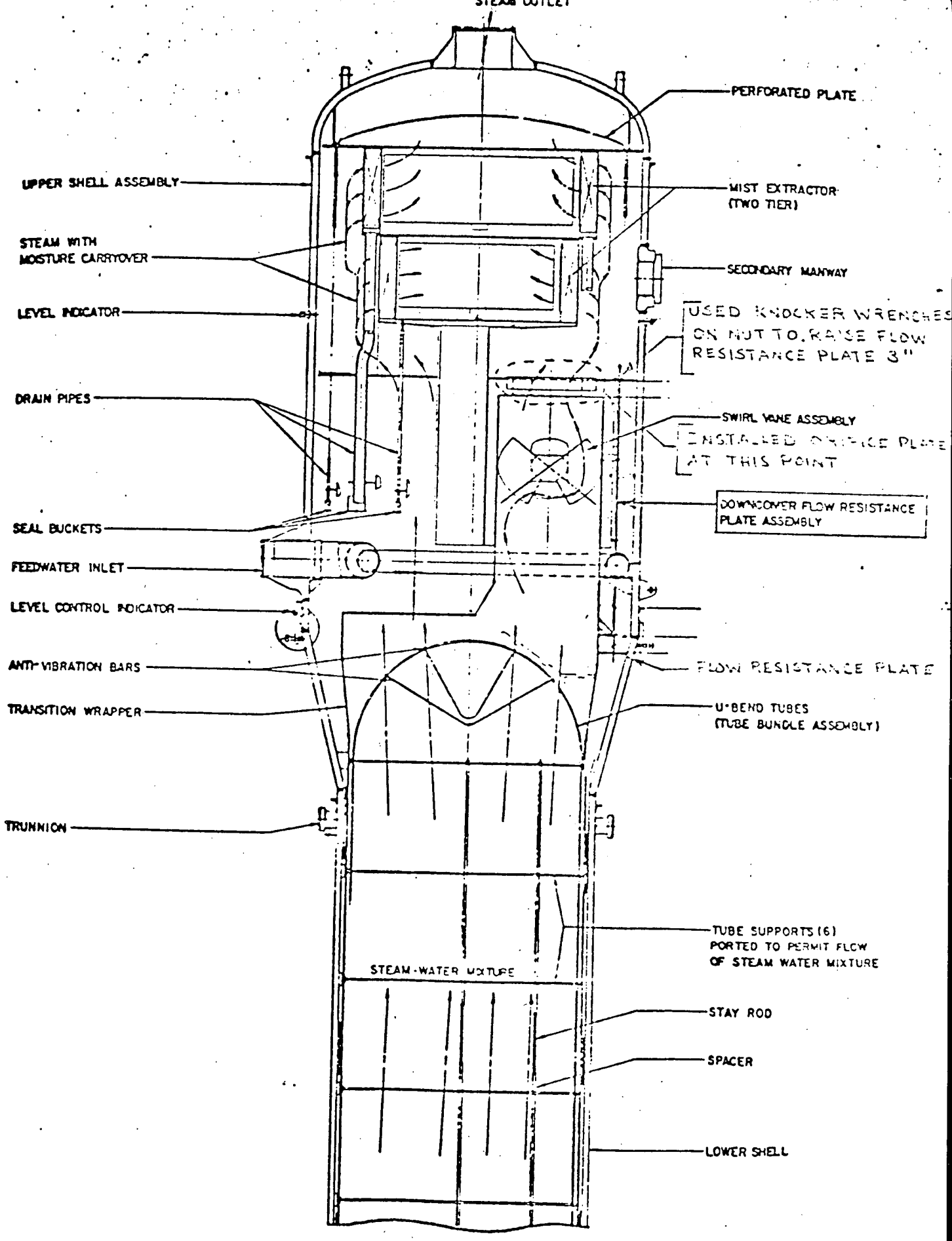
⊙ – DEFECTIVE TUBES LOCATED BY EDDY CURRENT TEST

FIGURE 7

ATTEMPTED TO REMOVE SECTION OF THREE TUBES EXTENDING FROM FACE OF TUBE SHEET TO 1ST SUPPORT PLATE



TUBE BUNDLE ASSEMBLY



VIEW SHOWING SECONDARY SIDE MODIFICATION

FIGURE 8

STEAM GENERATOR UPPER SHELL

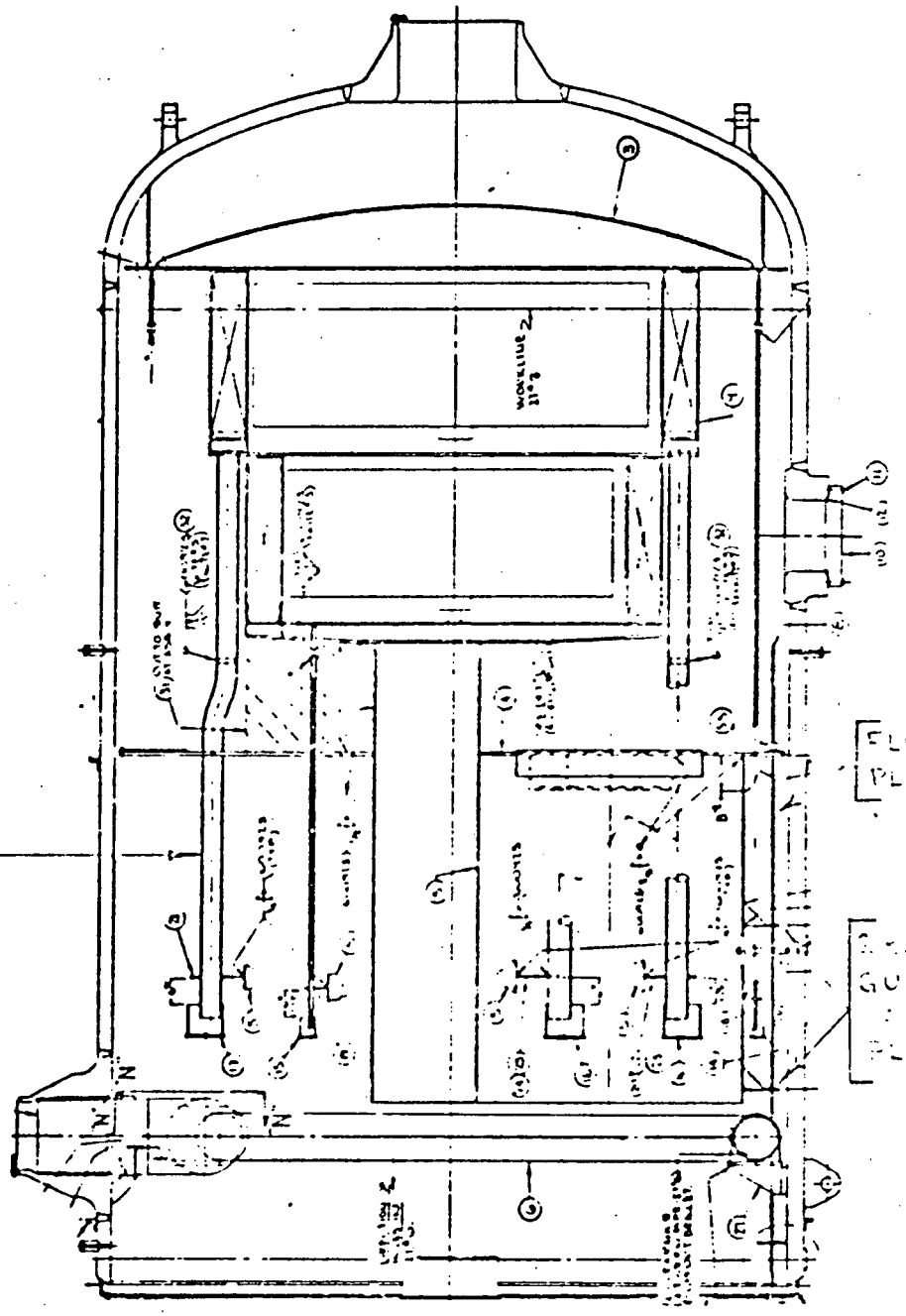


FIGURE 9

ORIFICE PLATE

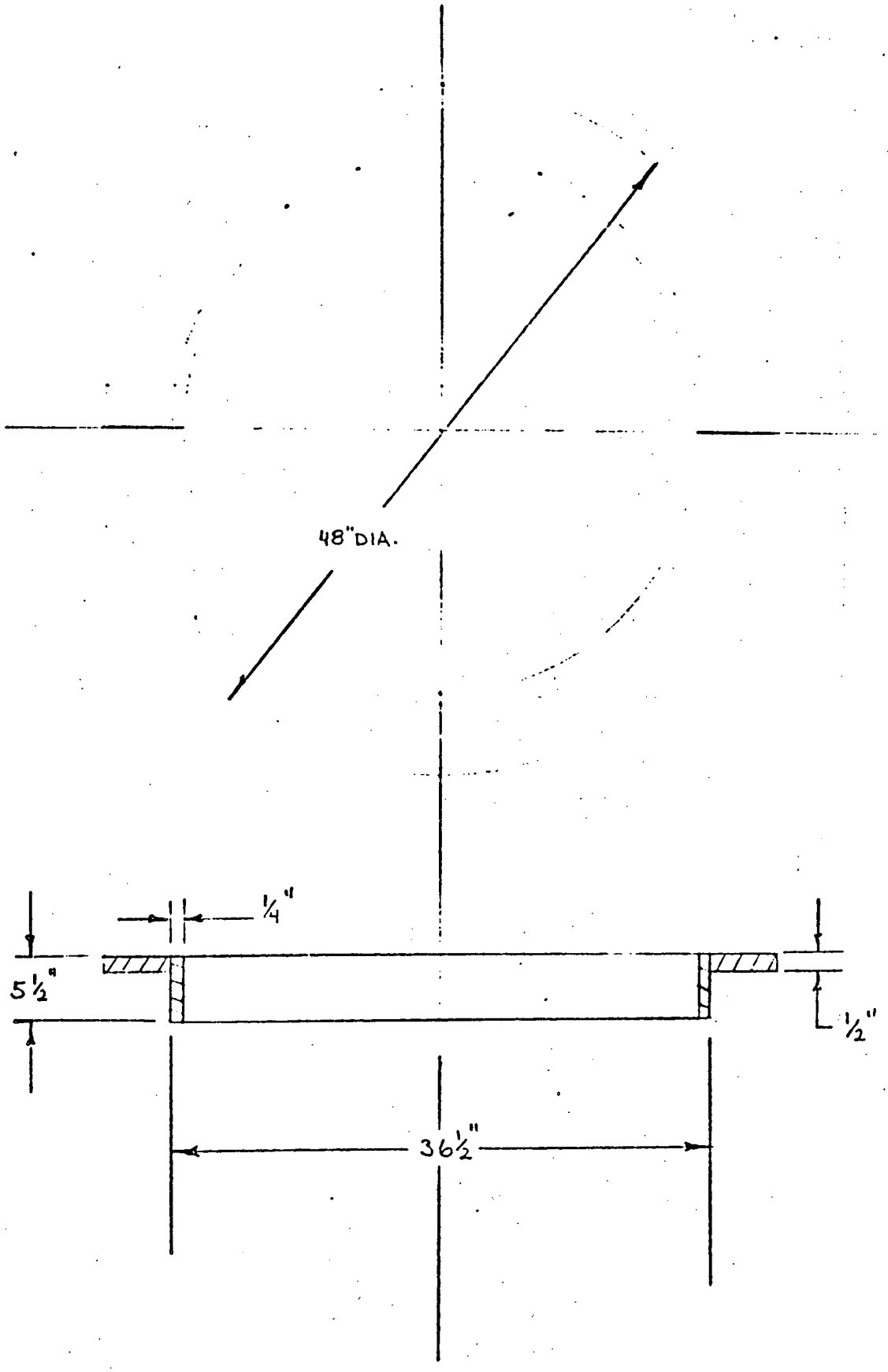
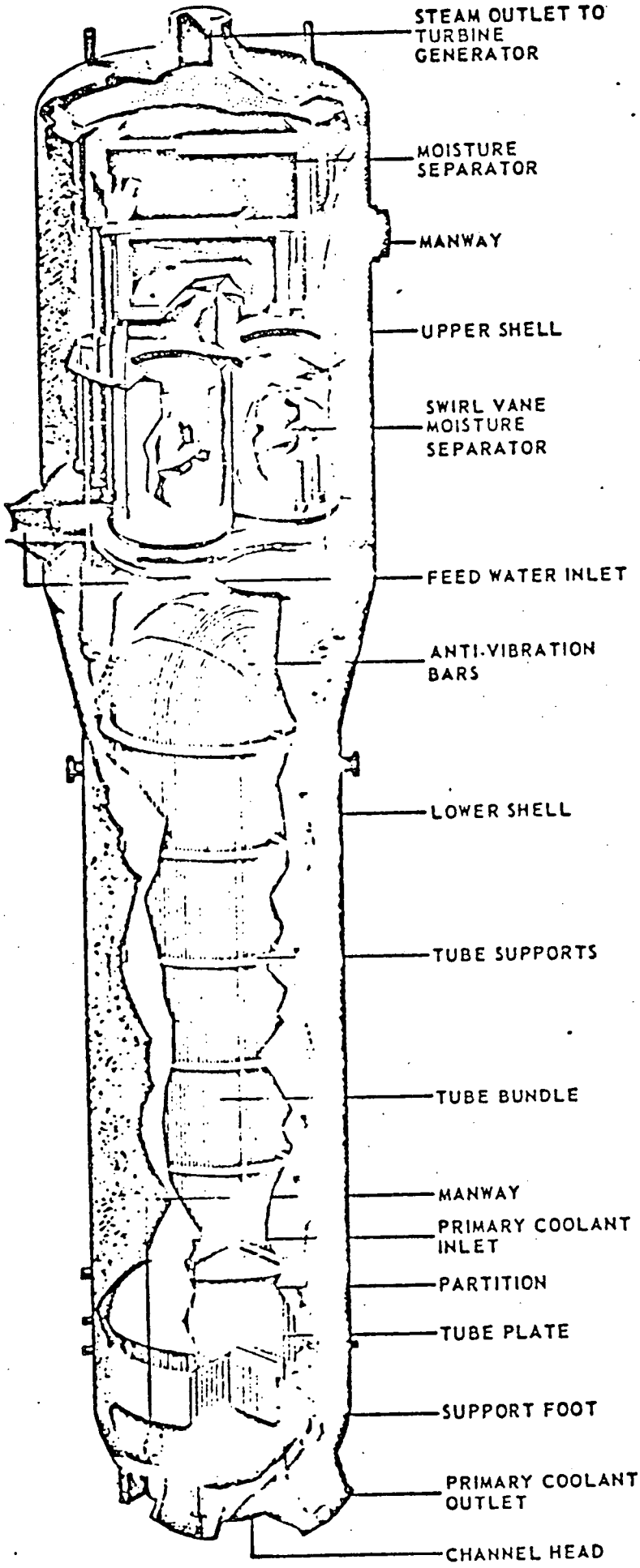


FIGURE 10

FIGURE 11



STEAM GENERATOR

FIGURE 12

EXPLOSIVE WELDING PLUG
(Actual size)

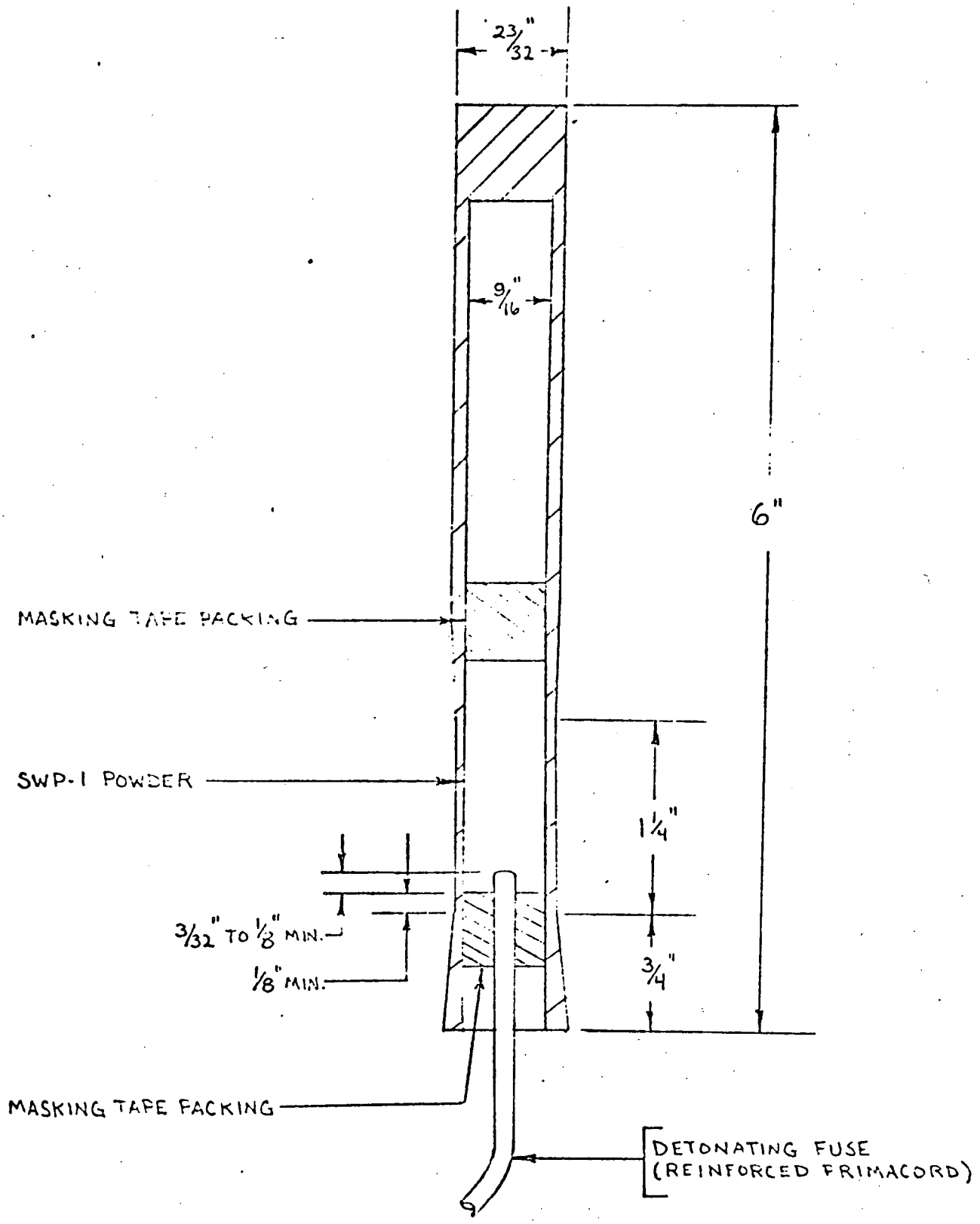
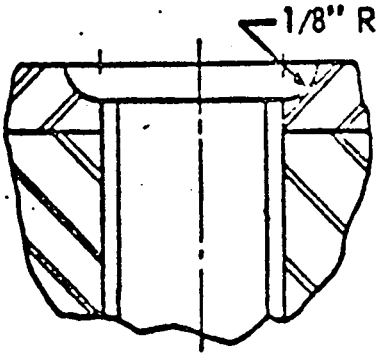
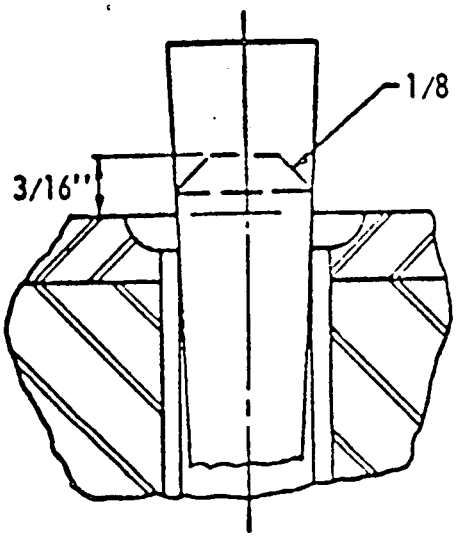


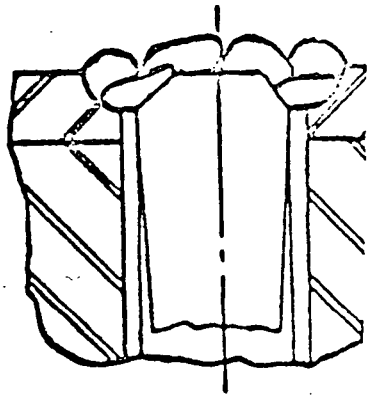
FIGURE 13



STEP 1



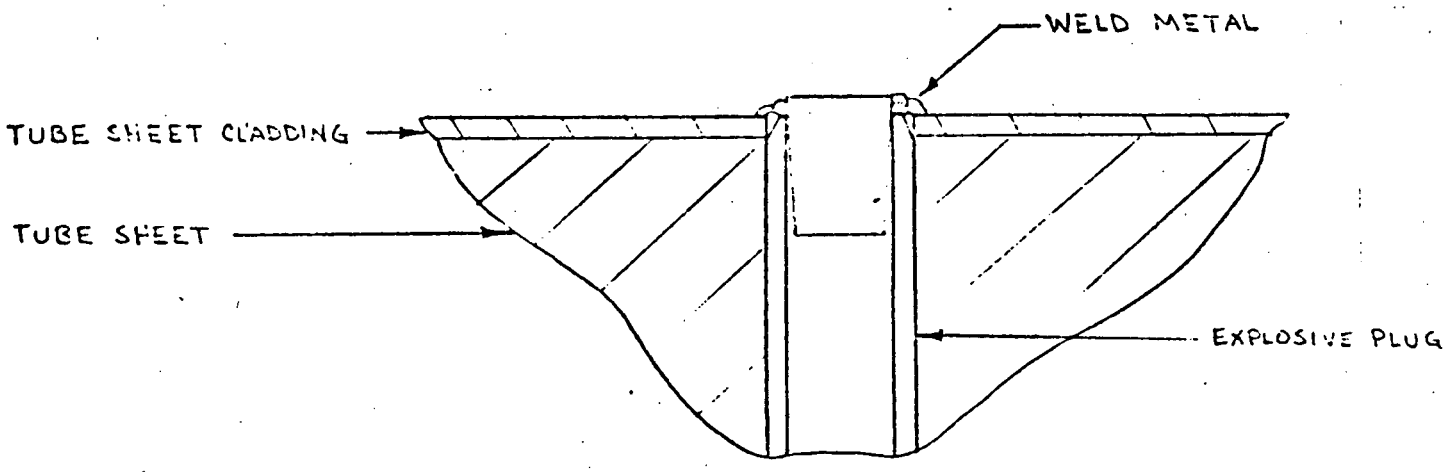
STEP 2



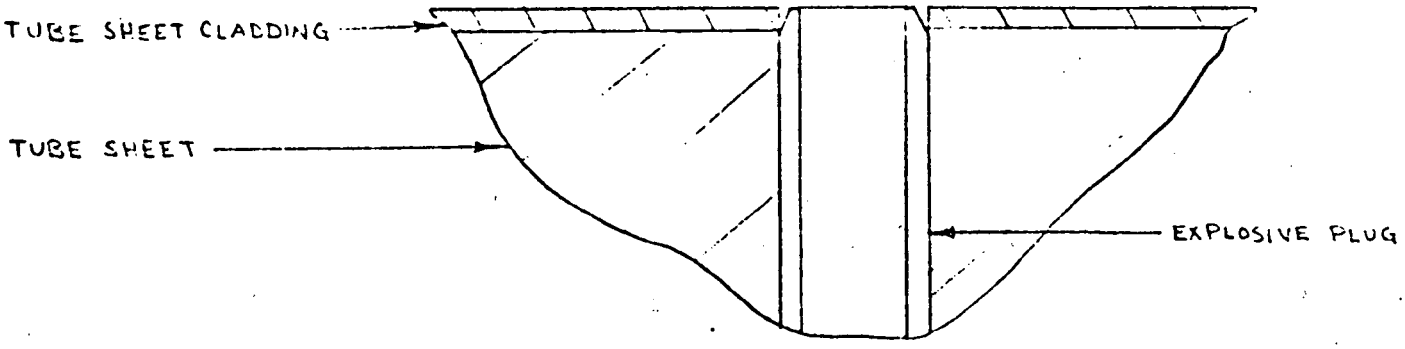
STEP 3

WELDED PLUG CONFIGURATION

FIGURE 14



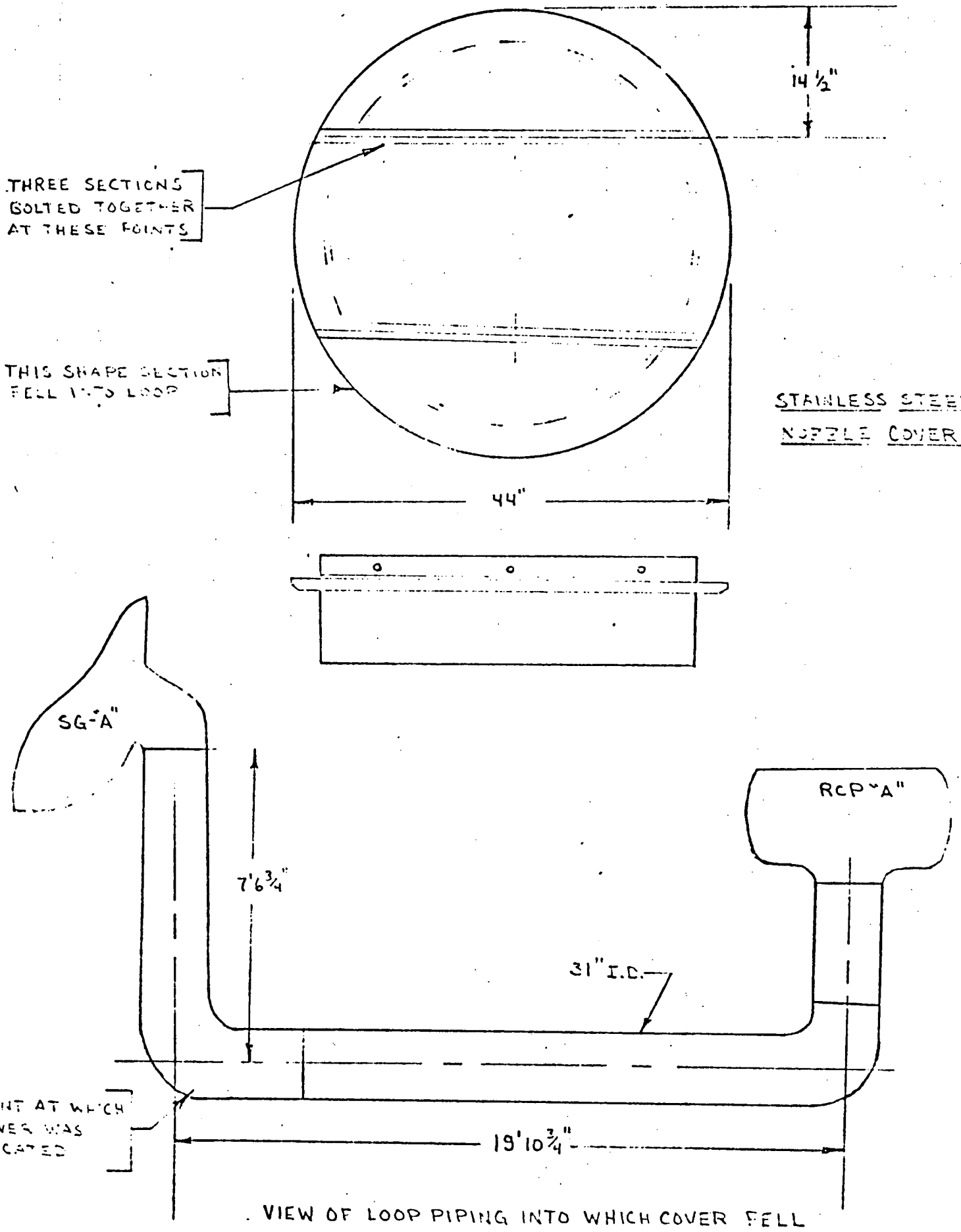
WELDED CONFIGURATION



PLUGGED TUBE SHEET PRIOR TO WELDING

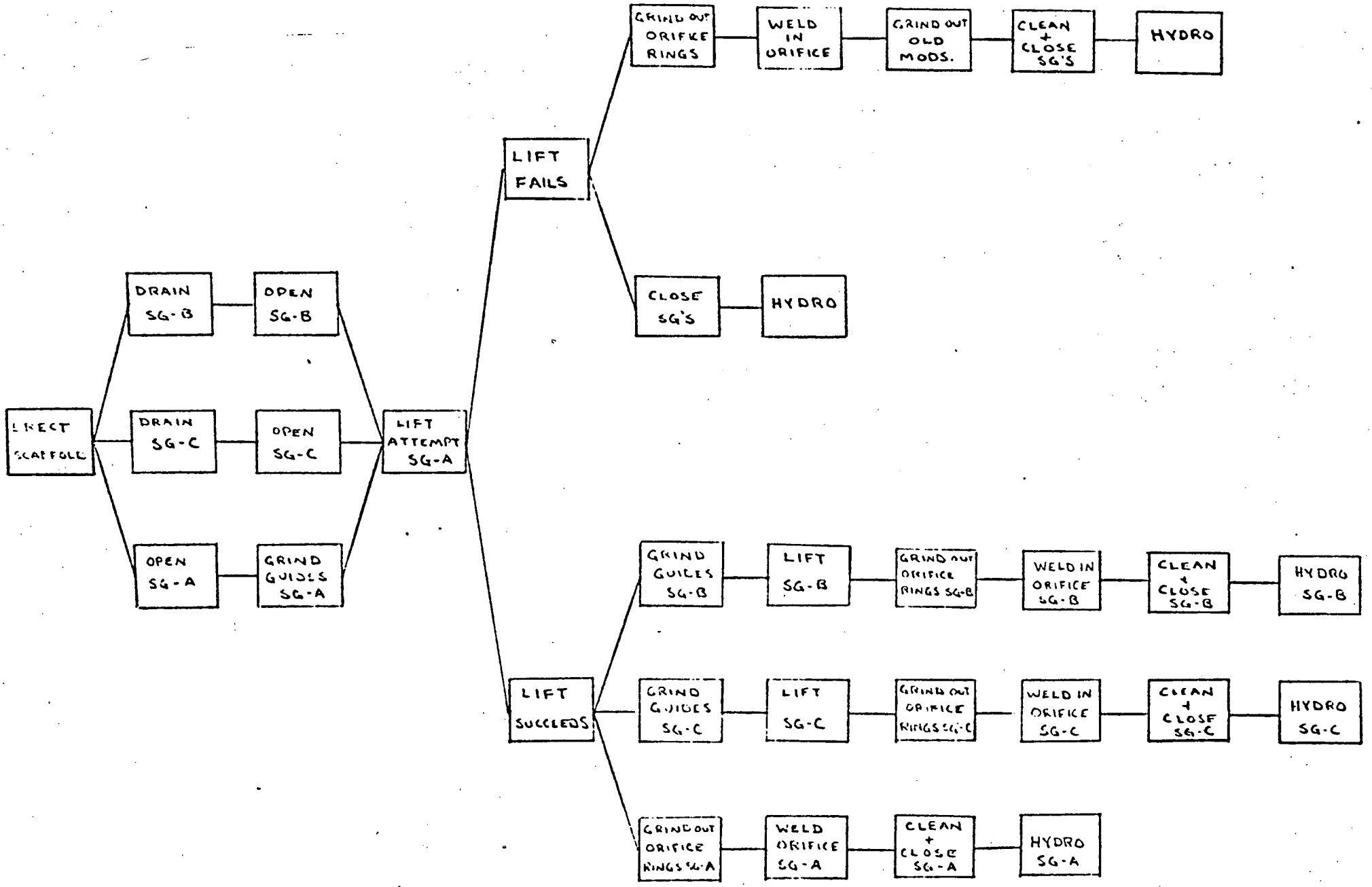
PLUG TO TUBE SHEET WELD

FIGURE 15



VIEW OF LOOP PIPING INTO WHICH COVER FELL

FIGURE 16

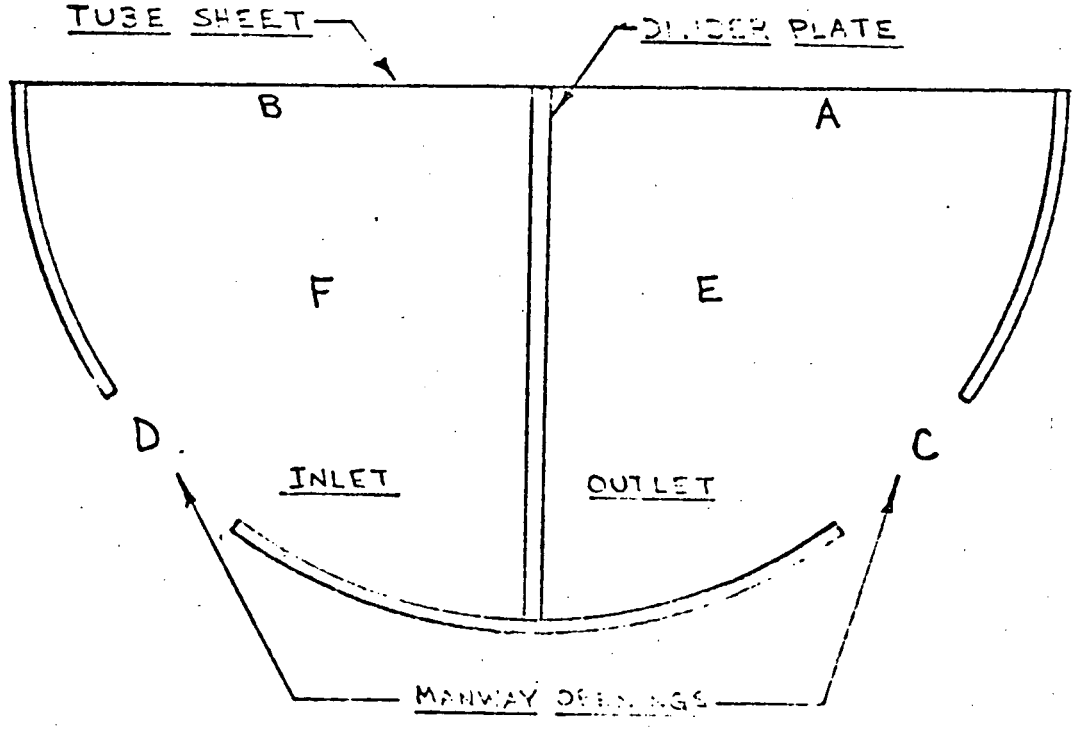


SECONDARY SIDE MODIFICATION WORK FLOWCHART

TABLE 4

RADIATION LEVELS DURING REPAIRS

STEAM GENERATOR CHANNEL HEAD



	RADIATION LEVELS (REM/HR)					
	SG-"A"		SG-"B"		SG-"C"	
SURVEY POSITION	INLET	OUTLET	INLET	OUTLET	INLET	OUTLET
POSITION A - TUBE SHEET	-	13	-	12	-	5
POSITION B - TUBE SHEET	10	-	13	-	7	-
POSITION C - MANWAY	-	4	-	6	-	11
POSITION D - MANWAY	4	-	7	-	12	-
POSITION E - INTERIOR	-	10	-	10	-	10
POSITION F - INTERIOR	10	-	11	-	10	-