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H. B. ROBINSON UNIT NO. 2

SEMI-ANNUAL OPERATING REPORT NO. 6

FOR PERIOD

JANUARY 1, 1973 THROUGH JUNE 30, 1973

Submitted: _____
Benny J. Furr, Plant Manager
H. B. Robinson SEG Plant

Approved: _____
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Nuclear Generation

TABLE OF CONTENTS

	PAGE NUMBER
Summary	ii
Report for January	1
Report for February	18
Report for March	30
Report for April	44
Report for May	59
Report for June	80
Radioactive Effluent Releases	90
Occupational Personnel Radiation Exposure	93
Environmental Monitoring	96
Appendix I H. B. Robinson Initial Refueling Outage Report	98

Jan - June 73

Preface:

This sixth Semi-Annual Operating Report is submitted in accordance with Section 6.6.1 of the H. B. Robinson Unit No. 2 Technical Specifications. The report relates plant operations during the period of January 1, 1973, to June 30, 1973.

Summary:

The major task accomplished during this reporting period was the completion of the first plant refueling outage. Refer to Appendix I of this report for details of the work involved. Plant operation for January through March was spent in a coastdown mode to extend core life. The outage was initiated on March 16, and completed by May 14. The following is an account of the activities occurring during the subject sixth month period.

REPORT FOR JANUARY 1973

PLANT OPERATIONS

The plant was shutdown on two occasions this month to perform maintenance. The first shutdown was on January 4 to weld repair an auxiliary feedwater to main feedwater weld joint leak. This repair consisted of grinding out the original welds and rewelding the full penetration joints on "A" and "B" feedwater headers. This work and the initial repair were recorded in plant Incident Report No. 53 and reported via letter of February 9, 1973.

The second shutdown was initiated in order to repair a cracked control block in the turbine electro-hydraulic control system. The damaged aluminum block was replaced with an upgraded stainless steel model. This work was accomplished on January 9.

In addition to the above feedwater system repair, a second incident occurring this month was a violation of the 300 mRem/week administrative radiation exposure limit by two mechanics changing a charging line filter. This incident was duly reported per plant Incident Report Number 52 and via letter of January 30, 1973.

A maximum plant thermal output of 1694 megawatts was achieved on January 13. The reactor was maintained critical for 638.10 hours during the month.

PLANT MODIFICATIONS

The only plant modification (Mod. No. 88) accomplished this month was changing of the overcurrent trip adjustment on heating and ventilation unit HVH-6B. This change had no affect on Plant safety.

OPERATING PROCEDURES

There were two operating procedure revisions accomplished this month. They were as follows:

OP-6 was changed to indicate that service water pumps may be started under any condition with no interlocks to defeat their operation.

OP-34 was expanded to include instructions for discharging and refilling the polishing demineralizers. This change provided a procedure for the first resin change out of the subject demineralizers.

PERIODIC TESTS

All tests and inspections required for this month by the plant Technical Specifications were duly performed. Discrepancies revealed by these tests are listed below.

Performance of PT 8.0, Reactor Coolant System Leakage Evaluation, indicated greater than normal leakage on January 10 and January 31. This leakage was traced to pressurizer spray valve 455B in both instances. The leak was not greater than acceptable limits and was not corrected until the following month.

On January 22 performance of PT 17.0, Turbine Bearing Oil System and E-H Control System Test, revealed low pressure in the E-H accumulators. The accumulators were subsequently charged to the required pressure.

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

I. Nuclear Generation

A. Number of times the reactor was made critical. 3

B. Gross thermal power generated (MWH). 873,259.2

II. Electrical Generation

A. Gross power generated (MWH). 290,753

B. Net power generated (MWH). 271,838

C. Length of time generator was on line (Hours). 621.51

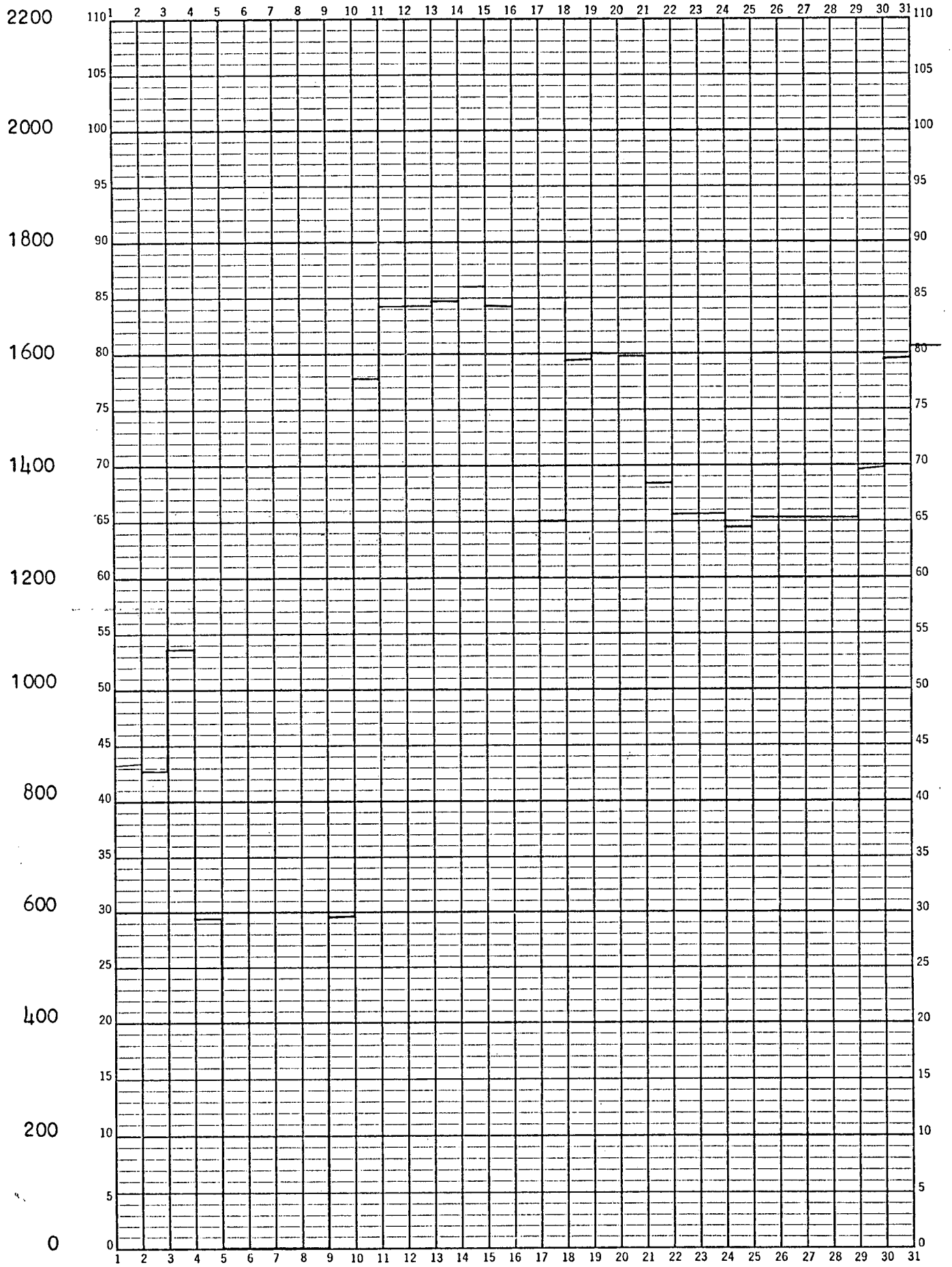
III. Solid Radioactive Waste

A. Total volume of solid waste shipped (Cubic Feet). 0

B. Total estimated Radioactivity involved (Curies). 0

C. Disposition of materials shipped.

Date	Quantity (Ft^3)	Destination
-	-	-



Month January 19 73

January 1973

OUTAGE REPORT

NUMBER	DATE	TYPE	PLANT STATUS DURING SHUTDOWN	CAUSE	CORRECTIVE ACTION	DURATION
1	1/4	Shutdown	Cold Shutdown	Shutdown to repair auxiliary feedwater leak	-	111 Hr. 2 Min.
2	1/9	Manual Trip	Hot Shutdown	Loss of EH turbine control due to leakage from cracked control block	-	4 Hr. 12 Min.
3	1/16	Shutdown	Hot Shutdown	Shutdown to replace cracked EH control block	-	7 Hr. 16 Min.

JANUARY 1973

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Heat tracing circuit #P-36	Corrective	None	Defective circuit	Failure of the circuit	The circuit and its controller were replaced	8 hrs.
"A" boric acid evaporator pressure gauge	Corrective	None	Gauge was out of calibration	Improper indication	Gauge has been recalibrated	1½ hrs.
Heat trace circuit #47	Corrective	None	Defective circuit	Received a low reading	The circuit was renewed	7 hrs.
Incore moveable "B" detector	Corrective	None	The output cable was grounded	Detector not responding properly to quick flux changes	The cable was repaired	4 hrs.
Heat trace Circuit #17	Corrective	None	Defective Circuit	Inoperative	The circuit was renewed	6 hrs.
Heat tracing alarms	Corrective	None	Relay switch out of adjustment	Circuit #65 alarming and resetting erratically	The switch was adjusted	1 hr.
Reactor coolant pump vibration meter	Corrective	None	Defective meter	Improper indication	The meter was replaced	1 hr.
Heat tracing recorder #2	Corrective	None	Relay switch out of adjustment	Erratic indication	The switch was adjusted	2 hrs.
Laundry and hot shower tank level instruments	Corrective	None	Defective level indicator	Improper indication	The indicator was repaired	5 hrs.

Jan. Cont'd.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Feedwater heater drain Tank "A"	Corrective	None	Broken connection in gauge glass	leakage	Replaced connection	2 hrs.
"B" vacuum pump control valve	Corrective	None	Broken sensing line	Loss of control function	Replaced elbow in line	1 hr.
"B" main feed water pump suction line	Corrective	None	Pin hole in line	Leakage	Weld repaired	2 hrs.
Steam generator "C' narrow range level transmitter FT-496	Corrective	None	Failure of strip heater	Transmitter frozen	Replaced strip heater	2 hrs.
North side "A" condenser steam dump valve	Corrective	None	Defective body to bonnet joint	Leakage	Replaced gasket and remade joint	3 hrs.
Heating and ventilation system HVH-10	Corrective	None	Defective exhaust fan motor	Loss of HVH-10	Replaced motor	8 hrs.

Jan. Cont'd.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"B" boric acid evaporator	Corrective	None	PS-6 fill valve control was out of calibration	Feed to evaporator picks up too low	The control was recalibrated	2 hrs.
"A" steam generator ring header	Corrective	None	Damaged elbow on the ring header	Excessive leakage	The elbow was renewed	2 hrs.
Northwest Steam dump bypass valve	Corrective	None	Deteriorated packing	Excessive leakage	The valve was repacked	2 hrs.
Warm up line isolation valve to "A" steam dump valve	Corrective	None	Defective gasket and packing	Excessive leakage	A new "body to bonnet" gasket and new packing were installed	3 hrs.
"6A" feedwater heater	Corrective	None	Defective diaphragm in the manway	Manway cover leaks	A new diaphragm was welded to the manway.	8 hrs.
Incore moveable detector system	Corrective	None	Defective encoder on "C" detector	Erroneous indication	A new encoder was installed on "C" detector	14 hrs.
Condensate measuring system transmitter LT-HVH-2	Corrective	None	Dirty sensing lines	Not responding to standpipe level increase	The sensing lines were cleaned	3 hrs.
"A" seal water injection filter	Corrective	None	Defect in weld in the vent line	Excessive leakge	The line was rewelded	7½ hrs.

Jan. Cont'd.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Relief valve on main steam line (RV1-1)	Corrective	None	The Taylor controller was out of calibration	RV1-1 valve was opening at 980 psi	The Taylor controller was recalibrated	3 hrs.
Steam dump valves	Corrective	None	Coils for the solenoid valves were open	Dump valves to condenser would not open when given a signal	The coils were replaced	3½ hrs.
Exciter air cooler	Corrective	None	The controller was in need of calibration	Controller was not holding setpoint	The temperature controller was calibrated	7 hours
Pressurizer pressure channel	Corrective	None	Recorder and indicator were out of calibration	The recorder and indicator had a difference of 15 psi	The indicator was zeroed to agree with the recorder	1 hr.
Incore moveable detector system	Corrective	None	"D" detector was found open	Erroneous indication	New detector was installed	12 hrs.
Safety injection	Corrective	None	SI Pump discharge pressure gauges out of calibration	Erroneous indication	The gauges were recalibrated	6 hrs.
"B" Main steam drain valve MS-41	Corrective	None	Damaged valve seat	Excessive leakage	Valve MS-41 was renewed	1 hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"C" demineralizer inlet sample valve	Corrective	None	Defective sample valves	Excessive leakage	The valves were renewed	3½ hrs.
Charging line flow element 122 sensing line	Corrective	None	Faulty weld	Excessive leakage	The line was rewelded	3 hrs.
"A" boric acid evaporator	Corrective	None	Float valve stem had broken	Loss of feed tank level control	Float valve stem was reworked and installed	3 hrs.
Drain collecting tank pump	Corrective	None	Shaft seal water deflector out of adjustment	Excessive noise	The deflector was adjusted	1 hr.
"1A" & "2A" moisture separator reheater pressure gauge	Corrective	None	Pressure gauge out of calibration	Erroneous indication	Gauge was recalibrated	2 hrs.
Heat tracing circuit	Corrective	None	Circuit 34 was found to have a defect	Circuits 34 & 36 would not maintain temperature on primary	The circuit was renewed	5 hours

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Condenser	Corrective	None	Deteriorated tubes	Excessive leakage	The tubes were plugged	3 hrs.
"B" boric acid transfer pump	Corrective	None	Pump motor failed	Loss of pump service	The pump was renewed	5 hrs.
"A" chemical volume control holdup tank level indication	Corrective	None	Pressure switch out of adjustment	Holdup tank high level alarm was coming on at 99% instead of 90%	Pressure switch was adjusted for 90%	2 hrs.
Heat tracing circuit 35	Corrective	None	The ohmitrol pot was checked and found to be defective	Circuit 35 failed	Ohmitrol pot was renewed	2 hrs.
Waste evaporator feed pump	Corrective	None	Defective pump	Pump failure	New pump was installed	3 hrs.
Waste evaporator feed tank pump	Corrective	None	Stator failure	Causing a 480 volt ground	The motor was renewed	3 hrs.
Heat tracing circuit P-63	Corrective	None	Faulty controller	Circuit pulling too much current	The controller was renewed	1½ hrs.

Jan. Cont'd.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Steam driven feed pump discharge pressure transmitter 1426	Corrective	None	The power fuse for pressure transmitter 1426 was blown	No indication when pump is running	The fuse was renewed and a new valve installed	4 hours
"B" boric acid evaporator	Corrective	None	Defective inner spring in pressure regulator	Would not maintain a constant pressure	A new spring was installed and the regulator was cleaned	12 hour
R-14 Radiation monitoring channel	Corrective	None	Bad log pump circuit board	Indicating too high	The log pump was replaced.	8 hrs.
Heat tracing circuit E-1	Corrective	None	A bad print program assembly motor	The recorder was found not printing	The motor was renewed	5 hrs.
Charging flow transmitter FI-122A	Corrective	None	Transmitter out of calibration	Reading too high	The transmitter was recalibrated	1½ hrs.
Boron injection tank recirculation flow indicator 934	Corrective	None	Root valves plugged with boric acid	Flow indicator 934 not operating	Strip heaters were added at the root valves to free lines	9 hrs.

Jan. Cont'd.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" gas stripper valve CV-9	Corrective	None	CV-9 has a ruptured diaphragm	Valve inoperative	A new diaphragm was installed	4 hrs.
Boric acid filter gauge PI-113B	Corrective	None	PI-113B was out of calibration	Erroneous indication	Gauge PI-113B was recalibrated	1 hr.
"A" monitor tank	Corrective	None	Pressure switch out of adjustment	Low level alarm gives alarm at wrong level	Pressure switch was readjusted	1 hr.
"B" monitor tank	Corrective	None	Pressure switch out of adjustment	High level alarm comes on at wrong level	Pressure switch was readjusted	1 hr.
"B" phosphate pump relief valve	Corrective	None	The ball check, ball guide, and the ball seat were defective	Excessive leakage	The ball check, ball guide, and the ball seat were renewed	5 hrs.
LI #2 steam generator wide range level indicator	Corrective	None	Defective meter	No indication	The meter was replaced	2 hrs.
E-H turbine control	Corrective	None	Defective E-H oil block	Excessive leakage	A new stainless block was installed	6 hrs.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"B" Instrument air dryer	Corrective	None	Moisture indicator was broken	Improper indication	The indicator was renewed	5 hrs.
Automatic rod control circuit	Corrective	None	Defective signal summator QM-408p in turbine impulse to the rod control circuit	Rods stepped in or out at will when Tave was constant	The summator was replaced	18 hrs.
Condensate collection tank pump	Corrective	None	Defective mechanical seal	Failure while in service	A new mechanical seal was installed	4½ hrs.
"A" charging pump	Corrective	None	Defective relief valve on "A" charging pump	Excessive leakage	The seating surfaces were repaired and new gaskets installed	7 hrs.
Feed tank pump on "B" boric acid evaporator	Corrective	None	Received 480V ground	Pump failure	A new pump was installed	4½ hrs.
Dropped rod-rod stop bistable	Corrective	None	Bistable trip point out of calibration	Improper indication	The bistable trip point was reset to 5%	1 hr.
Reactor coolant pump temperature recorder	Corrective	None	Defective synchronizer switch	Erroneous indication	The switch was replaced	5½ hrs.
Waste holdup tank level indication	Corrective	None	Level indicator was out of calibration	Improper indication	The indicator was recalibrated	1 hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Neutral water tank	Corrective	None	Defective weld	Excessive leakage	The tank level control probe was rewelded	9 hrs.
"A" component cooling water pump discharge check valve	Corrective	None	Retaining pin in the disc shaft came out	Excessive leakage	A new pin was installed	8 hrs.
Miscellaneous drain collecting tank	Corrective	None	Defective steam trap	Excessive leakage	A new seat and disk were installed	7 hrs.
Heating and ventilation system HVE #9	Corrective	None	Defective motor	Inoperative	A new motor was installed	6 hrs.
Engine driven fire pump	Corrective	None	Mercoid control was out of calibration	Pump would not start at the designated pressure	The Mercoid control was recalibrated	2 hrs.
"5B" feedwater heater	Corrective	None	Defective resistance temperature detector bridge block	Improper indication	The resistance temperature detector bridge block was renewed	2 hrs.
Penetration pressurization "D" header alarm	Corrective	None	Alarm point out of calibration	Giving alarm at normal level	The alarm was reset to alarm at proper level	1 hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Audio count rate channel selector switch	Corrective	None	Switch was dirty and needed lubricating	Channel selector switch was frozen	The switch was cleaned and lubricated	1 hr.
"B" boric acid evaporator	Corrective	None	PS-8 switch out of calibration	Feed valve opens at too high tank level	The PS-8 switch was recalibrated	2 hrs.
"A" feedwater pump discharge drain valve	Corrective	None	Defective valve	Excessive leakage	New 1500 lb. valve was installed	2 hrs.
"A" steam generator level transmitter LT-475	Corrective	None	Transmitter out of calibration	Improper indication	The transmitter was calibrated	5 hrs.
R-14 radiation monitor	Corrective	None	The check source, operate alarm had a broken wafer	Defective check source	The wafer was replaced	2 hrs.
Gland steam condenser	Corrective	None	Defective gasket	Excessive leakage	A new gasket was installed	4 hrs.
Freeze Panel #26	Corrective	None	The freeze protection circuit #12 on panel #26 had a broken cable	Loss of freeze protection	The cable was repaired	4½ hrs.

REPORT FOR FEBRUARY 1973

PLANT OPERATIONS

The plant was shutdown on one occasion this month to perform necessary maintenance. The shutdown was on February 12, and the work consisted of repacking the pressurizer mini-spray valves to terminate excessive leakage.

Major work for the month was directed toward preparations of the spent fuel pit, modification of the spent fuel pit heat exchanger, addition of high efficiency and charcoal filters servicing the spent fuel pit, and general preparations for the refueling effort and the turbine generator work.

Maximum monthly thermal output of 2103.2 megawatts was achieved on February 10. The reactor was maintained critical for 577.35 hours.

PLANT MODIFICATIONS

The only plant design change completed during the month was the spent fuel pit heat exchanger modification (Mod. No. 117) referred to above. This change provided tube bundle U-bend support to preclude the possibility of vibration induced tube failures.

PERIODIC TESTS

Tests and inspections required for this month by the plant Technical Specifications were performed as scheduled. The deficiencies noted as a result of these tests are summarized below.

The above normal reactor coolant leakage rate detected last month was again noted on six occasions this month as indicated by PT 8.0, Reactor Coolant System Leakage Evaluation. The leak increased beyond acceptable limits, and the plant was shutdown to correct the leakage.

The performance of PT 12.1, Radiation Monitoring System Test, indicated no response on radiation monitor R-18, liquid waste disposal effluents monitor, on February 16. On February 20, this lack of response was noted again as was a no response condition on R-11, containment air particulate monitor, and R-12, containment air gas monitor. These conditions were corrected.

Performance of PT 17.0, Turbine Bearing Oil System and E-H Control System Test, on February 4, indicated a low E-H header pressure, "B" E-H oil pump actuation at wrong setpoint, and low pressure on the E-H accumulators. The pressures were increased to the appropriate levels, and the pump setpoint adjusted. During performance of the test on February 25 the "B" E-H pump was again noted to start at the wrong setpoint. This condition was again corrected.

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

I. Nuclear Generation

A. Number of times the reactor was made critical. 3

B. Gross thermal power generated (MWH). 805,886.4

II. Electrical Generation

A. Gross power generated (MWH). 258,256

B. Net power generated (MWH). 241,284

C. Length of time generator was on line (Hours). 577.35

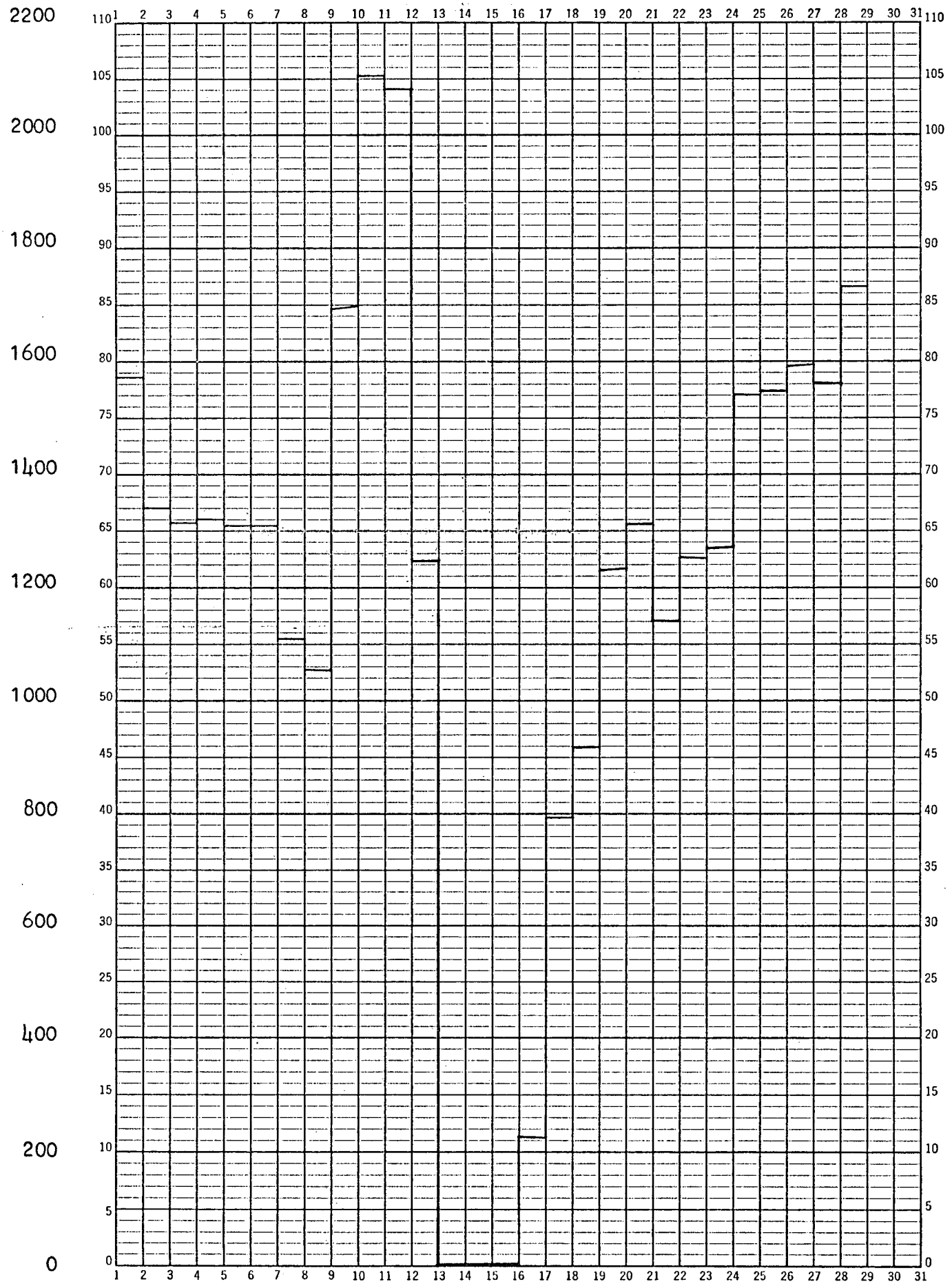
III. Solid Radioactive Waste

A. Total volume of solid waste shipped (Cubic Feet). 520.0

B. Total estimated Radioactivity involved (Curies). 9.272

C. Disposition of materials shipped.

Date	Quantity (Ft^3)	Destination
Feb. 6	360.0	Chem Nuclear Services, Inc.
Feb. 16	75	Chem Nuclear Services, Inc.
Feb. 28	85	Chem Nuclear Services, Inc.



Month February 19 73

OUTAGE REPORT

February 1973

NUMBER	DATE	TYPE	PLANT STATUS DURING SHUTDOWN	CAUSE	CORRECTIVE ACTION	DURATION
1	2/12	Shutdown	Cold Shutdown	Shutdown to repair pressurizer spray valve leakage	-	93 Hr. 57 Min.
2	2/16	Trip	Hot Shutdown	Dropped shutdown bank rod due to blown fuses	-	4 Hr. 2 Min.
3	2/19	Trip	Hot Shutdown	Turbine trip	-	1 Hr. 49 Min.

MAINTENANCE FEBRUARY 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Primary water tank level transmitter	Corrective	None	The level transmitter was out of calibration	Indicator not working	The transmitter was calibrated	11 Hr.
Transmitter for Heater drain pump "B" header flow	Corrective	None	Transmitter FT 3051 was out of calibration	Transmitter was reading too high	Transmitter FI 3051 was calibrated	8 Hr.
Heat trace Recorder #4	Corrective	None	Circuit 70 was defective	Improper indication	The circuit was repaired	9 Hr.
C.V. Personnel door	Corrective	None	Broken Roller Cam	Door would not operate	The cam was renewed	3 Hr.
Field Flashing Battery Charger	Corrective	None	Charger had two bad transistors	Charger was not regulating properly	The transistors were renewed	2 Hr.
Charging Pump Discharge Flow Transmitter	Corrective	None	Defective weld	Transmitter was leaking excessively	The transmitter was rewelded	4 Hr.
TCV 1650 Cooling Water to H_2 coolers	Corrective	None	Defect in piping to H_2 coolers	Excessive leakage	The line was welded and leakage stopped	2 Hr.
#1 Caustic Pump	Corrective	None	Defective Pump	Ran for awhile then tripped breaker	The stroke adjusting arm was repaired	8 Hr.

MAINTENANCE FEBRUARY 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Exciter Air Discharge Temperature Indication	Corrective	None	Defective capacitor in discharge temperature indicator	Gauge is erratic	The capacitor was renewed	7 hr.
"B" Phosphate Pump	Corrective	None	Defective displacement chamber	Excessive leakage	A new displacement chamber was installed	5½ hr.
C. V. Penetration Cooling Flow Indicator	Corrective	None	Flow Indicator 1977A was sticking	Improper indication	The indicator was freed	1½ hr.
Bowser Oil Filtration System	Corrective	None	Defective discharge relief valve	Causes oil to bypass filter	The valve was repaired	4 hr.
Fire Pumps	Corrective	None	Discharge Gauges and the pressure switches were out of calibration	Engine driven pump starts before the motor driven pump	The gauges were calibrated	5½ hr.
Miscellaneous drain tank pump	Corrective	None	Pump seal failed	Improper operation	A new mechanical seal was installed	3½ hr.
"C" Charging Pump	Corrective	None	#1 discharge valve seal was broken	Excessive noise	All valves, valve seats and valve guides were renewed	16 hr.
NR-41 Recorder	Corrective	None	Defective filter capacitor in #2 pen servo amplifier circuit	Improper indication	The capacitor was replaced	3½ hr.

MAINTENANCE FEBRUARY 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"2A" Moisture Separator Reheater	Corrective	None	Defective Weld	Excessive leakage	The area was ground out and rewelded	7 Hr.
Waste condensate pump flow meter	Corrective	None	Flow transmitter (FT-1064) was out of calibration	Improper Indication	Flow transmitter, FT-1064 was calibrated	3 Hr.
Residual heat removal pump discharge pressure gauges	Corrective	None	The PI-600 and PI-601 discharge pressure gauges were out of calibration	Improper Indication	The gauges were calibrated	4 Hr.
Boiler feed pump seal water strainers	Corrective	None	Trash in blowdown valves under strainers	Excessive leakage	Valves were disassembled and cleaned	2 ½ Hr.
"A" Boric Acid Evaporator	Corrective	None	Faulty Feed Tank Heater	Loss of heating capacity	Heater was renewed	3 Hr.
Caustic Pump	Corrective	None	Bad motor capacitor was found	Pump inoperative	The capacitor was renewed	7 Hr.
Nuclear instrumentation	Corrective	None	Overpower setpoints for loops "A" & "C" out of calibration	Indicating too high	Setpoints were calibrated	7 Hr.
Heat tracing Secondary circuits	Corrective	None	Circuit #29 found burned open	Would not maintain temperature	The circuit was repaired	8 Hr.

MAINTENANCE FEBRUARY 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Gas Stripper "A"	Corrective	None	Valve CV-10 had a defective diaphragm	Would not Allow Sufficient Flow	A new diaphragm was installed	3 Hr.
"A" Moisture Separator Heater Drain Tank	Corrective	None	Defect in gauge glass	Excessive leakage	New high pressure 2500 psi gauge glass with Mica-strips was installed	1½ Hr.
"B" Gas Stripper	Corrective	None	Defective diaphragm in valve CV-9	Valve CV-9 inoperative	A new diaphragm was installed	6 Hr.
Water Treatment Recorder	Corrective	None	Recorder out of calibration	Erroneous indication	The recorder was calibrated	½ Hr.
"A","B",&"C" CVCS hold up tank level indication	Corrective	None	Transmitters out of calibration	Improper Indication	The transmitters were calibrated	10 Hr.
LC-112 VCT Diversion Valve Controller	Corrective	None	Loose pin in the valve controller	Valve would not open properly on increasing level	The connector pin was repaired	5 Hr.
"B" Boric Acid Evaporator Selector Valve	Corrective	None	Defective diaphragm in suction valve	Pump could not keep up with the output of the Boric Acid Evaporator	A new diaphragm was installed	3½ Hr.
Primary Demineralizers Conductivity Meter	Corrective	None	Defective cell and no temperature compensation	Meter inoperative	The cell was renewed and the meter was wired for manual temperature compensation	14 Hr.

MAINTENANCE FEBRUARY 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
RTGB EH Low Pressure Alarm	Corrective	None	Mercoid control was out of calibration	EH System D2-10 Low Pressure Alarm would not clear	The Mercoid Control was Calibrated.	1 Hr.
"A" & "B" Heater drain tank pumps	Corrective	None	"A" and "B" pump recirculating valve controllers were out of calibration	Not controling valves properly	The controllers were calibrated	10 Hr.
Pressurizer spray valve #455A	Corrective	None	Spray valve was leaking at the bonnet	Excessive Leakage	All gaskets were renewed in the valve	17 Hr.
6A and 6B Heater drain valves	Corrective	None	Defects in 6A normal drain valve, 6B normal drain valve, and 6B Alternate drain valve	Causing 6B FW Heater level to drop	All defective parts were renewed.	5 Hr.
Pressurizer Spray Valve #455B	Corrective	None	Deteriorated packing	Excessive leakage	The valve was repacked	7 Hr.
"A" Steam generator feed, steam flow indicator	Corrective	None	FI-474 was out of calibration	B/S-478B was tripped while shutting down	FI-474 was calibrated	8 Hr.
"B" Reactor Coolant Pump oil level alarm	Corrective	None	Low oil level alarm switch was out of adjustment	Alarming at wrong level	The low oil level alarm switch was adjusted	6 Hr.

MAINTENANCE FEBRUARY 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Heat tracing secondary circuits	Corrective	None	Circuit #50 had a bad current controller and a blown fuse	Would not Maintain temperature	The controller and the fuse were renewed	
Radiation Monitor R-7	Corrective	None	Defective transistors on the log pump board (Q201 & Q202)	Failure of R-7	The transistors were replaced	6 Hr.
Heat trace Recorder #2	Corrective	None	Defective thermocouple input plug	Failure of recorder #2	The plug was renewed	2 Hr.
Waste Evaporator	Corrective	None	Defective feed pump	Failure of the pump	Waste evaporator feed pump was renewed	4 Hr.
Condensate flow transmitter	Corrective	None	Defective Transmitter	Improper indication	The force motor capacitor, detector coil, ferrite disc, & oscillator were renewed	
Neutral water discharge line	Corrective	None	Defective pipe	Excessive leakage	A new section of pipe was installed	4 Hr.
Chemical feed control panel	Corrective	None	Defective relay	Erroneous Alarms	The relay was replaced	1 Hr.
Caustic Tank Temperature gauge	Corrective	None	Temperature gauge was out of calibration	Improper indication	The gauge was calibrated	2 Hr.
Concentrates Transfer Pumps	Corrective	None	Low level cut off out of calibration	Transfer pumps would not start	Pressure switch was calibrated to actuate at 13% of tank level	3 Hr.

REPORT FOR MARCH 1973

PLANT OPERATIONS

The plant was shutdown on March 16 at 1:31 P.M. for the first refueling outage. The outage spanned some eight weeks of actual work, and the unit was back on line sixty-one days following shutdown. Major work accomplished included complete core unload, fuel inspection, region 1 fuel replacement, reactor coolant pump maintenance, steam generator inspection, turbine generator low pressure rotor replacement, generator rewedging, and numerous plant modifications. For a full account of the outage see Appendix I.

The plant operating staff was expanded this month by the inclusion of an additional Instrumentation and Control Foreman and an additional Mechanic-Electric Foreman. Mr. G. F. Bell is the new Instrumentation and Control Foreman, and Mr. C. R. Scott was promoted to the position of Mechanic-Electric Foreman. The reorganization created an opening for Stores Foreman which is now filled by Mr. W. E. Brown.

Reportable incidents occurring this month consisted of exceeding an administrative radiation exposure limit by a mechanic who entered the reactor sump following retraction of the incore thimbles, and the inadvertent spill of some 500 gallons of water from the refueling water storage tank to the plant storm drain system. These occurrences were respectively recorded in plant incident reports number 54 and 55, and reported via letters of April 26, 1973, and May 1, 1973.

A maximum plant thermal output of 1766.6 megawatts was achieved on March 4, and the reactor was maintained critical for 377.60 hours.

PLANT MODIFICATIONS

The plant modifications accomplished during the month were as follows:

TITLE	MOD. NO.
Modification of BPRA Inserts	9
Boric Acid Heat Tracing Alarms	31
Instrument Buss Inverter Synchronizing Circuit	68
Replacement of Service Water Booster Pump Motor	76
Installation of Containment Pressure Transmitter	86
Change CVCS H_2 Regulating Valve Setpoint	120
Change Instrument Air Compressor Setpoint	121
Spent Fuel Building Ventilation System	102
Containment Purge System Filter Addition	103
Pressurizer Cover Lifting Lug Modification	105
Manipulator Crane-Modification	130
Fuel Transfer System Modification	131

A brief description of each change is related below.

Modification number 9 consisted of the addition of spacers in the burnable poison rod inserts to accomodate the H. B. Robinson fuel nozzle configuration. This assured safety in handling of BPRA's during refueling operations.

Change number 31 provided for the addition of individual alarms for each recorder point on the boric acid heat tracing system. This change makes possible closer monitoring of the heat trace system to assure its proper operation in the prevention of boric acid crystalization.

The addition of the synchronizing circuit per modification number 68 assures accurate timing of recorders and clocks, and improves frequency control of inverters "A" and "B".

The replacement of service water booster pump motors per change 76 was

accomplished in order to prevent overloading and tripping that was occurring with the originally installed motors.

Modification number 86 adds a narrow range pressure transmitter to replace the containment pressure signal summator. This provides more dependable indication and alarms.

The chemical and volume control system H_2 regulating valve setpoint is changed via modification number 120. This permits greater flexibility in controlling reactor coolant chemistry and has no safety implications.

Modification number 121 increases the instrument air compressor temperature trip point to 450°F. This change was recommended by factory representatives to adjust the setpoint to a value more compatible with suction air temperatures without endangering the compressors.

The spent fuel building modification number 102 was completed this month. It consisted of the addition of charcoal and high efficiency filters to the building ventilation system.

Another ventilation modification was number 103, which added high efficiency and charcoal filters to the containment purge system. These changes were necessary in order to comply with requirements for moving spent fuel.

The final change completed this month, modification number 105, consisted of installation of lifting lugs to the pressurizer missile shield cover. This change provides a more reliable and safer method of moving the pressurizer cover.

PERIODIC TESTS

Periodic tests and inspections required during the month's generation were duly performed. Numerous periodic tests required to be performed during plant operations were not performed this month due to the plant being in a refueling shutdown condition.

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

I. Nuclear Generation

A. Number of times the reactor was made critical. 3

B. Gross thermal power generated (MWH). 605,510.4

II. Electrical Generation

A. Gross power generated (MWH). 195,739

B. Net power generated (MWH). 182,951

C. Length of time generator was on line (Hours). 373.52

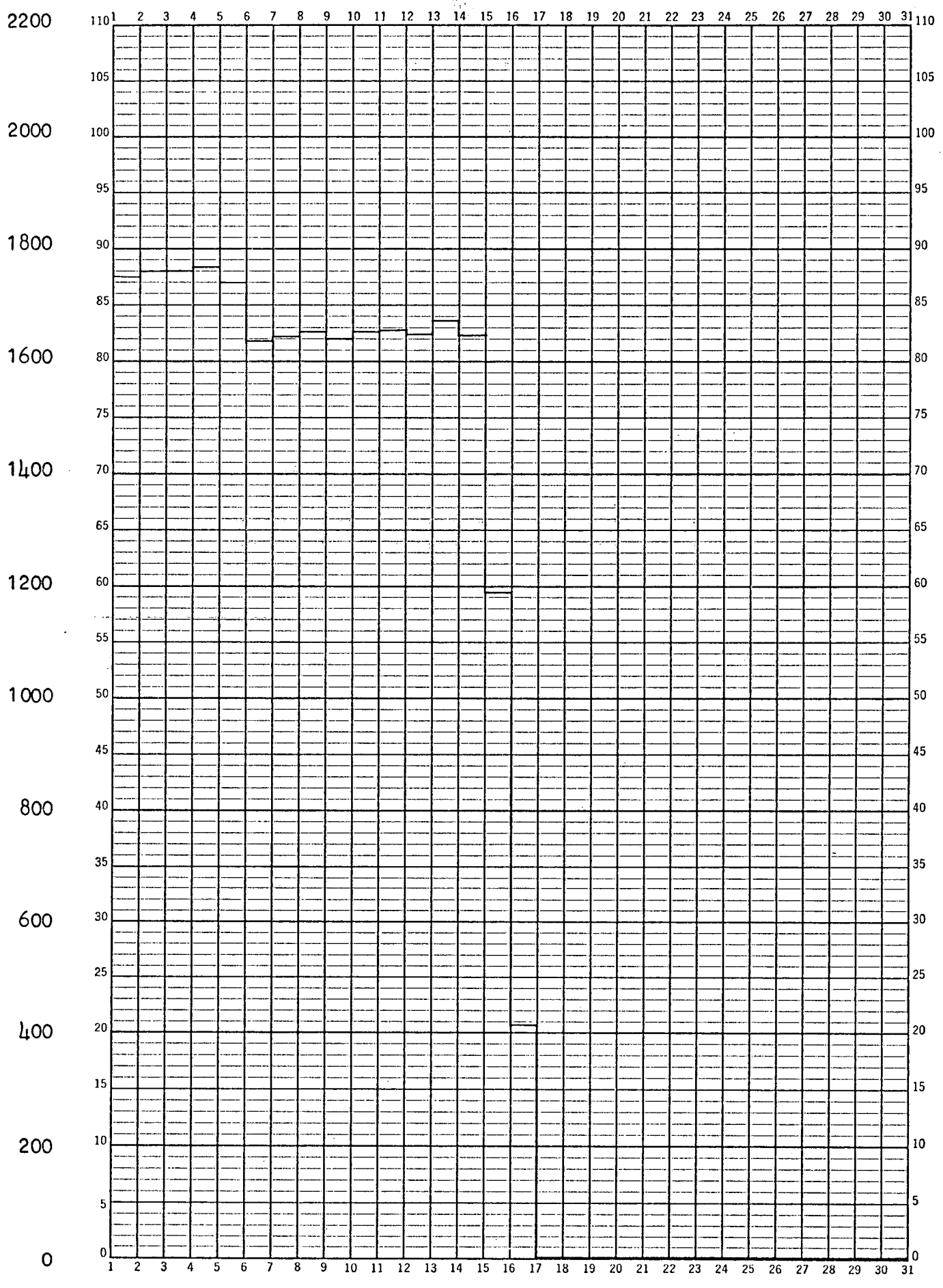
III. Solid Radioactive Waste

A. Total volume of solid waste shipped (Cubic Feet). 375

B. Total estimated Radioactivity involved (Curies). 0.643

C. Disposition of materials shipped.

Date	Quantity (Ft^3)	Destination
March 6	375	Chem Nuclear Services, Inc.



Month March 19 73

OUTAGE REPORT

March 1973

NUMBER	DATE	TYPE	PLANT STATUS DURING SHUTDOWN	CAUSE	CORRECTIVE ACTION	DURATION
1	3/16	Shutdown	Hot Shutdown	Shutdown for AEC licensing exams	-	2 Hr. 47 Min.
2	3/16	Shutdown	Hot Shutdown	Shutdown for AEC licensing exams	-	2 Hr. 5 Min.
3	3/16	Shutdown	Refueling Shutdown	Shutdown for refueling outage	-	-

MAINTENANCE MARCH 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Freeze Protection Panel # 28	Corrective	None	An opening in a condulet fitting	Circuit #2 in panel #28 inoperative	The fitting was renewed	2¼ Hr.
Concentrates holding tank transfer pump "B"	Corrective	None	Defective flange gasket	Excessive leakage	The gasket was renewed	5 Hr.
R-7 Radiation Monitoring	Corrective	None	Defective low alarm light	Would not light properly	The alarm setpoint was adjusted	½ Hr.
Moisture separator reheater	Corrective	None	Defective d/p switch on moisture separator reheater	Improper operation	Three sections of tubing were replaced	-
"A" Moisture Separator Drain Tank Level Glass	Corrective	None	Broken level gauge glass	Excessive leakage	A new level gauge glass was installed.	-
"6A" Feedwater Heater Pressure Indicator 1408	Corrective	None	Out of calibration	Improper indication	Pressure indicator 1408 was calibrated	2 Hr.
Penetration Pressurization System	Corrective	None	Flow transmitter and header pressure gauges out of calibration	Improper indication	The flow transmitters and header pressure gauges were calibrated	20 Hr.

MAINTENANCE MARCH 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Containment Phase "A" Isolation Status Panel	Corrective	None	Defective position arm	Pressurizer relief tank sample valve No. 553 indicates open when shut	The valve was repaired	1 Hr.
Channel 3 Containment Condensate Measuring system	Corrective	None	Out of adjustment	High alarm alarms at Improper level	The high alarm was adjusted	1 Hr.
"B" Acid Pump Relief Valve	Corrective	None	The valve heads were eroded	Excessive leakage	New valve heads were installed	18 Hr.
TI-430 Cold Leg Temp Loop (Low Level Amplifier)	Corrective	None	Defective solder joint	Erratic indication	The amplifier was repaired	5 Hr.
"A" Diesel Jacket H_2O Cooling System	Corrective	None	Defective valves	Leakage of fuel oil and cooling water on the starting diesel	Two new valves and related tubing were replaced	$1\frac{1}{2}$ Hr.
Heat Trace Recorder #3	Corrective	None	Heat trace circuit 17 primary and secondary were found open	Improper indication	Both circuits were replaced	$4\frac{1}{2}$ Hr.

MAINTENANCE MARCH 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"B" Circulating Water Pump Screen Motor	Corrective	None	Drive shaft shear pin was broken	The motor would run, but screen would not move	A new pin was installed	4 Hr.
Neutral Water Tank Low Level Pump Cut Off	Corrective	None	A bad capacitance probe was found	Pump did not cut off when tank was empty	Probe was repaired and the unit adjusted	8½ Hr.
Overtemperature Δ T Setpoint For Loop "C"	Corrective	None	Pressurizer pressure for loop "C" was reading high	Abnormal overtemperature setpoint	Pressurizer pressure signal was corrected and overtemperature setpoint returned to normal	8 Hr.
Bcron Analyzer	Corrective	None	Bad capacitor in chromalox solid state thermostat	Analyzer reading too low	The capacitor was renewed	4 Hr.
Heat Trace Recorder #4	Corrective	None	Bad fuse in circuit 50. Bad fuse and controller in circuit 51, circuit 49 found open, defective thermostat control on circuits 47 & 61	Circuits 49,50, 51 will not hold above low alarm on secondaries, Circuit 47 stays above high alarm and circuit 61 cycles above high alarm	Thermostat control lowered to correct circuits 47 & 61, fuses replaced incircuits 50 and 51. Controller was replaced in circuit 51, circuit 49 was repaired	5 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" Service Water Strainer	Corrective	None	Differential pressure switch out of calibration	Service water strainer would not work on automatic	The switch was calibrated	3½ Hr.
"B" Service Water Booster Pump	Corrective	None	Defective pressure switch on the suction of "B" service water booster pump	Didn't shut off at correct header pressure	The switch was renewed	2½ Hr.
Radiation Monitoring System	Corrective	None	Radiation monitors 11 and 12 have defective filter failure switches	Filter failure alarm would not reset	The switch was replaced	4 Hr.
Heat Trace Recorder	Corrective	None	CKT 41 had a bad boost transformer	Lost Temperature control	Transformer was removed and the circuit hooked into the line direct	4 Hr.
"A" Feedwater Pump	Corrective	None	Heat exchanger in the oil reservoir had a tube leak	Excessive leakage	Two tubes were plugged	8 Hr.
"B" Boric Acid Tank Heaters	Corrective	None	The heater was grounded	Loss of heating capacity	A new heater was installed	3 Hr.
"B" Boric Acid Storage Tank	Corrective	None	Heater controller out of calibration	Tank heaters would not shut off in automatic	Controller was calibrated	4½ Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OU OF SERVICE
			CAUSE	RESULT		
"A" Instrument Air Dryer	Corrective	None	Suction pressure gauge out of calibration	Improper indication	The gauge was calibrated	8½ Hr.
"B" Condenser Vacuum Pump	Corrective	None	Defective input shaft seal	Excessive leakage	A new input shaft seal was installed	30 Hr.
"A" Feedwater pump low pressure switch	Corrective	None	Defective pressure switch	Improper operation	Pressure switch was renewed	1 Hr.
"B" Steam Generator Blowdown Valve 1934B	Corrective	None	1934B had a sticking solenoid valve	Valve did not close on safety injection test	The solenoid valve was repaired	6 Hr.
Isolation Valve Seal Water Valve 1922B	Corrective	None	Limit switch on IVSW-1922B was out of adjustment	No indication in control room	The limit switch was replaced	8 Hr.
Radiation Monitor R-11 & R-12	Corrective	None	Defective switch in alarm circuit	Filter paper motor would not run	The switch was replaced	4 Hr.
Residual Heat Removal valve HCV-121	Corrective	None	A faulty remote/manual setpoint station and the I/P Pneumatic transducer was out of calibration	Valve would not open properly	The setpoint station was renewed and the pneumatic transducer was calibrated	2 Hr.
Generator H_2 Panel	Corrective	None	Generator pressure Hi/Lo alarm switch out of calibration	Low alarm comes in too soon	The switch was calibrated	1 Hr.

MAINTENANCE

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Concentrates Holding Tank Level Transmitter	Corrective	None	A leak in the high leg of the transmitter	Transmitter was operating erratically	The leak was corrected	18 Hr.
"A" & "B" Condenser Vacuum Pumps	Corrective	None	Vacuum switches, differential pressure switches, and the vacuum gauge was out of calibration	Erratic pump control	The subject instrument-ation was calibrated	14 Hr.
"A" Emergency Diesel starting Air solenoid	Corrective	None	Defective solenoid valve coil	Diesel was inoperable	The coil was replaced	1 Hr.
"A" Accumulator Isolation Valve 865A	Corrective	None	Defective operator	Valve inoperative	Repaired operator	7 Hr.
Turbine Auto-Stop Remote Latch	Corrective	None	Auto-Stop Remote latch air operator was leaking	Latch was inoperative	The operator was replaced	2 Hr.
Waste Evaporator Feed Pump	Corrective	None	Waste Evaporator pump failed	Waste evaporator was inoperative	Installed new pump	4 Hr.
Main Feedwater Header Pressure	Corrective	None	Alarm unit PSL-1420 was out of calibration	Header pressure low alarm was occurring past set point	The alarm unit PS1-1420 was calibrated	6 Hr.

MAINTENANCE MARCH 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Boric Acid Tank #2 High Level Alarm	Corrective	None	Alarm setpoint out of adjustment	Alarm acts at wrong level	The alarm setpoint was adjusted	2 Hr.
Borid Acid Tank Level Transmitter # 106	Corrective	None	Zero shift in level transmitter # 106	Transmitter #106 was reading low	The transmitter zero was adjusted	3 Hr.
Borid Acid Filter Pressure Indicators 113A & B	Corrective	None	Indicator out of calibration	Improper indication	The transmitter was calibrated	2 Hr.
Chemical Volume Control Letdown Highflow Alarm	Corrective	None	Comparator was out of calibration	Alarm would not come on at the proper setpoint	The comparator setpoint was calibrated	2 Hr.
Gas Stripper "A"	Corrective	None	Hotwell level alarm circuit switch was out of calibration	The alarm circuit was operating at the wrong level	The switch was calibrated	2 Hr.

REPORT FOR APRIL 1973

PLANT OPERATIONS

The plant was maintained at refueling shutdown conditions for the entire month. See the enclosed Appendix I for details of the outage work.

The one reportable incident occurring during the month was the inadvertent overflow of the refueling water storage tank to the plant storm drains. Some 8,925 gallons were spilled. The incident was duly reported per Technical Specification requirements. The probability of the reoccurrence of this spill has been diminished by the addition of a high level alarm on the tank as noted below and the overflow being rerouted to the waste holdup tank.

PLANT MODIFICATIONS

Plant modifications completed during the month are as follows:

TITLE	MOD. NO.
Addition of Level Alarm Switch on "5A" Feedwater Heater	48
Change of Reactor Protection System Setpoints	116
Change Reactor Coolant Pump Thermal Barrier ΔP Alarm Setpoint	135
Change Nuclear Instrumentation Hi Source Range Level Trip	132
Install Startup Rate Meter on RTGB	134
Install Surge Suppressor in Rod Position Indication Racks	136
Install a High Level Alarm on Refueling Water Storage Tank	145
Defeat of Hot Leg Safety Injection	85
Move Turbine Gear Oil Pump to Motor Control Center 6	91
Steam Break ΔP Modification	13
Addition of New Residual Heat Removal System Flow Orifice	75
Modification of Charging Pump Vents and Drains	118

TITLE	MOD. NO.
Installation of New Fixed Incore Detectors	126
Installation of New Internals in Main Steam Power Operated Relief Valves	115
Modification of Non-Regenerative Heat Exchanger	125
Circulating Water Pump Modification	124
Reactor Vessel Closure Nut Modification	154
Conversion of CCW 735 to MOV	11
Waste Gas Compressor Modification	138
Removal of Main Steam Atmospheric Dump Valves	144

A brief summary of each modification is listed below.

The addition of the level alarm on "5B" feedwater heater, per modification 48, provides a method of determining the occurrence of high levels in the heater when heater "5A" is isolated. Previously, the only alarm was on "5A" heater which provided an alarm for both heaters when they were cross connected.

Change number 116 resets the reactor trip points to values such that deviations of $\pm 1\%$ caused by instrument errors will not result in technical specification violations. The changes do not jeopardize reactor protection or safety interlocks.

As recommended by Westinghouse the normal reactor coolant pump thermal barrier ΔP was lowered. This change required resetting of the ΔP low alarm points which was accomplished per modification number 135.

The high source range level trip is changed from 2×10^5 CPS to 10^5 CPS per modification number 132. This change in a conservative direction has been

proven desirable by operating experience.

Modification number 134 consists of the addition of a startup rate meter on the RTGB. This provides the operator with more accurate core condition information during reactor startups.

The addition of a surge suppressor panel in the rod position indication system, per change 136, prevents interaction between power output relays and the pulse-to-analog converter. This change eliminates the source of spurious signals and results in a more reliable rod control system.

As described in modification 145, a high level alarm was added to the refueling water storage tank to reduce the potential of inadvertent overflow of the tank.

The automatic hot leg safety injection function was defeated due to an analysis indicating that this feature was not required to provide safe control during the initial stages of an accident condition. The remote manual capability is retained to permit the initiation of hot leg safety injection as conditions warrant. This change was documented per modification number 85.

Modification number 91 transfers the turbine turning gear motor and turning gear oil pump motor from motor control center 5 to motor control center 6. This provides for a separate turbine oil supply in case of "A" battery voltage reduction.

The steam break protection addition is outlined in modification number 13. It consists of the addition of adjustable amplifiers which are used to induce a high pressure signal into the safety injection circuitry. This assures that safety injection will be initiated if a steam break should occur upstream

of the main steam isolation valves with the valves closed.

The addition of a new residual heat removal system flow orifice is described in modification number 75. This change provides the required 4200 GPM flow for post-accident recirculation and permits use of the bypass valve HCV-758 for plant cooldown. This eliminates the locked position on valve HCV-758 which was previously employed to achieve the required flow.

Modification number 118 consists of shortening the instrumentation piping downstream of the charging pumps to eliminate vibration induced failures occurring at the natural frequency of the original piping lengths. This raises the natural frequency above the forcing frequency and eliminates the cyclic fatigue failures.

New incore fixed detectors and moveable thimbles were installed per modification number 126. Original installation consisted of eight fixed detectors. The new arrangement reduces the number of fixed detectors to four and provides four additional moveable detector locations. This increases the number of positions that can be monitored with the moveable system and improves the reliability of the fixed incore monitoring.

Per modification number 115, new internals were installed in the main steam power operated relief valves. Some galling had been experienced with the original parts, and new parts with higher hardness levels and/or stellite coatings were installed in order to eliminate the problem.

Modification 125 consists of the addition of a support in the U-bend portion of the non-regenerative heat exchanger to prevent vibration induced tube failures. A similar change, modification 133, was completed on residual heat removal heat exchanger "A". Plans are to complete the modification

on heat exchanger "B" at the next outage.

The modification of circulating water pumps "B" and "C" was accomplished per modification number 124. This change consisted of welding additional braces to the pump deflector. Problems had occurred in the past year with fracture of these deflectors, and the added support is intended to prevent any such future failures.

The reactor vessel nut washer retaining clips were removed as described in change number 154. This minor modification was accomplished in order to reinstall the nuts conveniently. The subject clips were deformed and their deletion does not affect the integrity of the closure.

Change number 138 concerns the improvement of waste gas compressor performance. The compressors' moisture separator blowdown seal-in circuit was defeated so as to prevent the separator from dropping below 50% as recommended by the manufacturer.

Another change completed this month was number 144. This consisted of removal of the main steam atmospheric dump valves and installation of blind flanges in their place. Problems have persisted with seat leakage of these valves and repair during this outage was not possible so they were thus removed.

Final change for the month was modification number 11. This modification consisted of conversion of valve CCW 735 from air operated to motor operated. The conversion assures that a supply of cooling water will be maintained to the reactor coolant pumps in the event of loss of air supply or loss of electrical power to the new valve.

OPERATING PROCEDURES

One operating procedure was revised this month. OP 28.3 was changed to delete the 1 hour requirement for boric acid batching operations. Experience has indicated that the 1 hour time limit is not realistic or necessary.

PERIODIC TESTS

In addition to the tests performed during normal operations some 34 refueling interval tests were also carried out. Deficiencies arising during the tests are described below.

Performance of PT 12.1, Radiation Monitoring System Test, on April 21 indicated no response on radiation monitor R-2, Containment Area Monitor. This condition was corrected.

Completion of refueling PT 2.6, Isolation Valve Seal Water System Test, was delayed somewhat by isolation valve leakage. Excessive seat leakage was experienced on valves 204 A and B and 870 A and B. The valve internals were replaced and/or seats lapped to correct the leakage to acceptable levels.

Problems were also encountered with accomplishment of refueling PT 23.2, Emergency Diesel Air Start with Safety Injection. Specifically, Reactor Containment Recirculating Cooling Unit HVH-3 did not start within the required time limit. A new time delay relay was installed to correct this condition, and the second test run was successfully completed.

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

I. Nuclear Generation

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

B. Gross thermal power generated (MWH). 0

II. Electrical Generation

A. Gross power generated (MWH). 0

B. Net power generated (MWH). -1736

C. Length of time generator was on line (Hours). 0

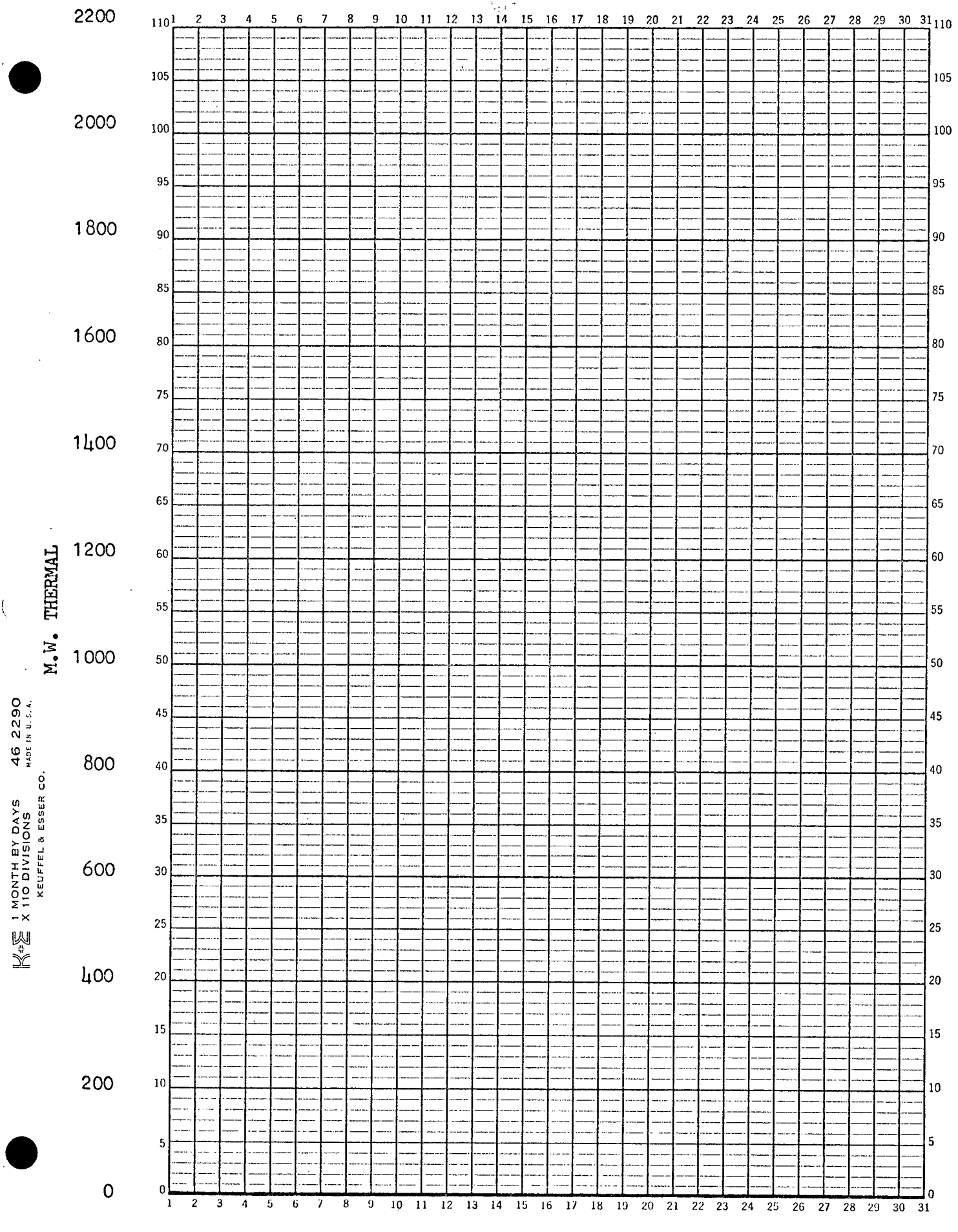
III. Solid Radioactive Waste

A. Total volume of solid waste shipped (Cubic Feet). 772.5

B. Total estimated Radioactivity involved (Curies). 5.939

C. Disposition of materials shipped.

Date	Quantity (Ft^3)	Destination
April 24	660.0	Chem Nuclear Services, Inc.
April 27	112.5	Chem Nuclear Services, Inc.


2200
2000
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M.W. THERMAL
1 MONTH BY DAYS
X 110 DIVISIONS
46 2290
MADE IN U.S.A.
KEUFFEL & ESSER CO.
Month April 19 73

April 1973

OUTAGE REPORT

NUMBER	DATE	TYPE	PLANT STATUS DURING SHUTDOWN	CAUSE	CORRECTIVE ACTION	DURATION
-	-	-	Refueling Shutdown for entire month	-	-	-

MAINTENANCE

April, 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Containment Vessel Airlock	Corrective	None	Misalignment of contact edges of door to door framing	Frequent failure of door to seal properly	The knife edges were straightened and remachined	-
Waste Evaporator Level Control	Corrective	None	Level gauge was out of calibration	Level control reading too high	The tube was cleared and gauge calibrated	5 Hr.
Heat Trace Circuit #66	Corrective	None	Several legs on the circuit were found either open or grounded	No alarm was indicated at 128°F	All defective legs were replaced	8 Hr.
Reactor Coolant Pump Motors	Corrective	None	Excessively worn shaft seals and lower oil sump gaskets	Pump vibration resulting from defective seals and gaskets was causing excessive oil leakage	New seals and gaskets were installed	-
Reactor Coolant Drain Tank Pump "A"	Corrective	None	Discharge pressure gauge had leaked down	Gauge did not indicate the pump was running	The system was refilled and gauge was calibrated	16 Hr.
Nuclear Instrumentation System	Corrective	None	P10 bistable out of adjustment	P10 bistable on N43 was tripping at 9.8% power instead of 10%	The bistable was reset to trip at 10%	1 Hr.

MAINTENANCE April, 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Motor Driven Fire Pump	Corrective	None	Fire pump start pressure switch out of calibration	Pump did not start at required pressure	The pressure switch was calibrated	2 Hr.
Radiation Monitoring System	Corrective	None	Defective output plug	Monitor R-2 was inoperative	The output plug was renewed	6 Hr.
"B" Instrument Air Compressor	Corrective	None	The head on the compressor was cracked	Low output pressure	The head was replaced. New piston rings, bearings, and valves were installed	48 Hr.
"A" Rod Drive M.G. Set	Corrective	None	Defective bearing	Excessive noise	The bearing was replaced	36 Hr.
"B" Emergency Diesel Generator	Corrective	None	Defective No. 9 lower bearing, top compression rings on No. 3 & No. 4 lower pistons, and No. 3 cylinder air start valve adapter was leaking	No detrimental effect on diesel performance	All defective parts were repaired and replaced	-
Main Steam Power Operated Relief Valves	Corrective	None	Defective valve internals	Galling of the valve & valve guide	New internals were installed	-
Auxiliary Steam Drain Collecting Tank Level Controller	Corrective	None	Defective start switch on collecting tank pump	Pump was inoperative	The switch was repaired	4 Hr.

MAINTENANCE April, 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Low Power Level Trip Bistables	Corrective	None	These bistables were activating at 25% instead of 24% power	Didn't meet acceptance criteria	The bistables were reset to trip at 24% power	1 Hr.
Refueling Water Storage Tank	Corrective	None	RWST level transmitter and the barton indicator were out of calibration	Improper indications	The transmitter and the indicator were calibrated	3 Hr.
"B" Boric Acid Evaporator Feed Tank	Corrective	None	Heater failed	Loss of heating in feed tank	Replaced heater	3 Hr.
Heat Tracing Circuit #56	Corrective	None	Circuit 56 was burned open in charging pump room	Loss of heating	The bad portion of the circuit was replaced	22 Hr.
Steam Generator Blowdown Sample Valves	Corrective	None	Three defective limit switches	Erratic valve position indication	Three new limit switches were installed	10 Hr.
Containment Vacuum Relief Valves	Corrective	None	Pressure switch PS 1722B on control circuit was out of calibration	Valves were opening too soon on an open signal	The pressure switch was calibrated	6 Hr.
Condensate Pumps	Corrective	None	Defective lower impellers and bowl	Reduced discharge pressure	Two new impellers and suction bowl were replaced	130 Hr.
Waste Evaporator	Corrective	None	Defective solenoid valve	Eductor bypass was inoperative	The solenoid valve was replaced	4 Hr.

MAINTENANCE April, 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Polar Crane	Corrective	None	Dirty contacts on the "up" safety cutout switch	Main hook on crane would not go up	The switch was cleaned	4.5 Hr.
Boron Injection Tank Return Flow Indicator-934	Corrective	None	Ruptured bellows units	Flow indicator was inoperative	The bellows unit was replaced and the flow indicator was calibrated	28 Hr.
Main Steam Power Operated Relief Valve (RV-1)	Corrective	None	Broken limit switch actuating spring	Loss of valve closing limit	The switch was renewed	2.5 Hr.
Residual Heat Removal Valve 750	Corrective	None	Defective valve disc retainer	Excessive seat leakage	New internals were installed. The gland was repacked	40 Hr.
Sampling Control Panel	Corrective	None	Panel had 3 blown fuses and several open resistors	A & B sample columns would not operate	The resistors, defective fuses and bulbs were replaced	4 Hr.
Radiation Monitor R-8	Corrective	None	Defective solder connection	Alarms spurious	The connection was repaired	3.5 Hr.
Manipulator Crane	Corrective	None	Shorted SCR in motor controls and a defective resistor	Manipulator was inoperative	The SCR and the resistor were replaced	10 Hr.
Manipulator Crane (Fuel Handling)	Corrective	None	Motor was overheated and the rotor was burned on one end	Motor on hoist failed	A new motor was installed	6 Hr.
Reactor Make-Up System	Corrective	None	Defective comparator YC 114	Sporadic make-up operation	The comparator was repaired	6 Hr.

MAINTENANCE April, 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OU OF SERVICE
			CAUSE	RESULT		
Radiation Monitoring	Corrective	None	Drive motor was burned up	Vacuum pump on monitor R-11 & R-12 was in-operative	The motor was replaced	3 Hr.
A & C Main Steam Isolation Valves	Corrective	None	Defective wiring in test controls	The valves were not testing satisfactorily	The test controls were rewired	8 Hr.
"A" Emergency Diesel Generator	Corrective	None	Three damaged thermo-couples	Loss of temperature detection	The thermocouples were replaced	-
"A" Steam Gen-erator Feed Pump	Corrective	None	Excessively worn internal gear teeth	Excessive noise	A new coupling was installed	30 Hr.
"A" Safety Injection Pump Pressure Gauge	Corrective	None	Defective stainless steel fitting and snubber valve	Discharge pressure gauge was leaking excessively	The stainless steel fitting and snubber valve were replaced	3 Hr.
Gas Analyzer	Corrective	None	Defective 118 VAC input breaker	Erratic breaker operation	The breaker was renewed	2 Hr.
Residual Heat Removal Flow Indicator	Corrective	None	I/P transducer was out of calibration	Loss of flow indication	I/P transducer was calibrated	4 Hr.

MAINTENANCE April, 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Spent Fuel Pit Skimmer Pump	Corrective	None	Defective suction valve	Improper operation	A new diaphragm was installed in the suction valve	2 Hr.
Waste Gas Compressor	Corrective	None	Defective unload solenoid valve	Solenoid valve was leaking air	The valve was repaired	3 Hr.
Heater Drain Pumps	Corrective	None	Found a faulty weld between the inlet and discharge piping on pump "A"	Recirculation inside the pump	The weld was repaired	4 Days
Post Accident Containment Water Level Detectors	Corrective	None	Defective detector switches	Loss of level indication	Replaced switches	9 Hr.

REPORT FOR MAY 1973

PLANT OPERATIONS

The refueling outage was completed this month. Initial criticality was attained at 4:27 P.M. May 14, and the unit was back on the grid at 10:12 A.M. May 16.

Major effort for the month was expended on start-up testing and final maintenance to restore the unit to service.

One incident occurred during the month and was recorded via report number 57. The occurrence involved a hydrogen explosion between the number 2 low pressure turbine bearing and the generator. The explosion was ignited by workmen removing an overhead brace with a cutting torch. No appreciable damage or injuries resulted.

The month's plant operation was limited to a maximum reactor power level of 75% until questions regarding fuel densification were resolved. A monthly maximum thermal output of 1645.6 megawatts was achieved on May 31, and the reactor was critical for 359.81 hours.

PLANT MODIFICATIONS

Modifications completed during the month were as follows:

TITLE	MOD. NO.
Modification of Containment Spray Pump Breakers	84
Installation of Residual Heat Removal Isolation Valve Limit Switches	123
Installation of Reactor Coolant RTD Restraints	127

TITLE	MOD. NO.
Addition of Auxiliary Feedwater Recirculation Line	137
Modification of Pressurizer Spray Valves	129
Addition of Feedwater Thermal Sleeves	140
Regenerative Heat Exchanger Overpressurization Modification	10
Recrimping of Control Rod Drive Mechanism Pins	153
Polar Crane Venting Modification	89
Relocation of Recorders on RTGB	150
Reactor Protection System Axial Offset Limits	151
Modification of Boric Acid Evaporator Piping	143

A summary of each of the above modifications is listed below.

Modification No. 84 consists of rewiring the containment spray pump breaker circuitry such that the breakers will not close unless there is a "P" signal coincident with safeguards bus voltage. This prevents the pumps from being locked out by the anti-pump feature on a dead safeguards bus.

Limit switches were installed of residual heat removal isolation valves 750 and 751 per Modification No. 123. This change prevents the valve lower disc retainers from bottoming out in the valve bodies thus eliminating a source of valve damage and possible leakage. Valve control torque switches are retained as a backup system.

As described in Modification No. 127, 18 restraints were added to reactor coolant RTD's to prevent the RTD's from being ejected from their respective manifolds in the event of the failure of their compression fittings. This restraint reduces the possibility of a reactor coolant system leak or depressurization.

An auxiliary feedwater recirculation line was added per Modification No. 137. This line permits routing the pump recirculation from the suction line to the condensate storage tank, thus preventing the pump from overheating when operating in the recirculation mode.

The replacement of pressurizer spray valve internals is outlined in Modification No. 129. The new internals incorporate a bellows seal design and packing box to provide a redundant stem seal. This eliminates a source of leakage and reduces forced outages required for repacking the valves.

Modification No. 140 consists of the addition of thermal sleeves at the juncture of main feedwater and auxiliary feedwater lines. This prevents thermal shock and resultant cracking of the joint. Problems with cracks at these joints occurred during the past year.

Modification No. 10 revises the method for providing overpressurization protection of the regenerative heat exchanger. This protection was originally provided by adjustment of the spring pressure on valve CVC-311, but this resulted in back leakage through the valve and poor pressurizer pressure control. The valve spring tension was increased to eliminate the leakage and a 3/4" bypass line incorporating a check valve was installed to provide the required overpressure protection.

Records indicated that the control rod drive electrical receptacle pins had been improperly crimped to the wires. This condition was corrected as described in Modification No. 153.

The polor crane venting modification, Change Number 89, consisted of cutting venting holes in each boxed girder section. This was accomplished in order to prevent possible collapse of the girders caused by differential pressure during containment integrated leak rate tests.

RTGB recorders were relocated per Modification No. 150 such that the reactor operator can more easily monitor reactor conditions when manipulating control rods.

Modification No. 151 changed the axial offset limits in a conservative direction to limit KW/FT power produced in cycle II fuel.

The final change accomplished this month, Modification No. 143, consisted of modifying suction piping on the boric acid evaporator feed and distillate pumps. This change was intended to increase available suction head to the pumps and eliminate NPSH problems, thus reducing the failure rate of the pumps.

OPERATING PROCEDURES

Fourteen operating procedures were revised this month to incorporate changes necessitated by plant modifications or to improve plant operations. These changes are listed below.

OP-33A was changed to reflect the addition of recirculation lines on the chemical and volume control holdup tanks accomplished per Modification No. 8.

The change consisted of the revision of valve lineups to indicate the new valves and to accomplish recirculation of the holdup tanks.

OP-44 was changed to close damper D-5 in the ventilation system to prevent backflow into the spent fuel building when HVE-15 and HVE-15A are not running. This revision was required as a result of connecting the spent fuel building ventilation to the plant vent system as accomplished by Modifications 102 and 103.

OP-17A and OP-14A were revised as a result of installation of new recirculation piping connecting auxiliary feedwater pumps to the condensate storage tank. The appropriate valve lineups and valve numbers were changed to reflect this modification.

OP-28A was changed to incorporate the new bypass line installed around valve CVCS 311. The line was installed per Modification No. 10 to provide regenerative heat exchanger overpressure protection. The change added the bypass isolation valve to the system valve lineup as a locked open valve.

An addition was made to OP-9A to reflect the conversion of valve CCW-735 from an air operated valve to a motor operated valve as accomplished per Modification No. 11.

OP-30 was revised to delete the reactor coolant pressurizer Delta-T limit of 200°F. This limit is no longer required per Westinghouse recommendation.

Changes were made to OP-38A, OP-38E, and OP-38F to provide for the new residual heat removal flow orifice added per Modification No. 75. The changes deleted the requirement for locking valve HCV-758 in position and indicate the proper valve lineups for normal plant operation and cooldown.

OP-13 was changed to adjust damper positions in the ventilation system. HVE-15A and HVS-4 damper positions were changes to provide proper system balance.

PERIODIC TESTS

Discrepancies noted during the periodic testing are enumerated below.

In that the monthly power level was limited to 75% the overpower trip high range was set to 84%. This was noted in PT 1.2, Nuclear Instrumentation Power Range Test.

Performance of PT 8.0, Reactor Coolant System Leakage Evaluation, revealed above normal leakage on two occasions. One leak was traced to deteriorated

packing in valve 744A, and the other leak was a defective loop 2 sample valve flange joint. The leaks were eliminated.

A defective reactor containment recirculating cooling Unit HVH-2 high level alarm was found while performing PT 8.1, HVH condensate measurement. This alarm was properly adjusted.

Performance of PT 12.1, Radiation Monitoring System Test, on May 11 indicated a no response condition on radiation monitor R-18, liquid waste disposal system effluent monitor. The monitor was repaired.

A final deficiency was noted this month during performance of PT 15.1, Turbine Valve and Trip Functional Test. It was found that the bearing oil trip was out of specification. The bearing trip was out of specification on the conservative side. In that there is no required tolerance in the plant Technical Specifications and an outage would be required to reset the trip, the adjustment was postponed until the following month.

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

I. Nuclear Generation

A. Number of times the reactor was made critical. 19

B. Gross thermal power generated (MWH). 341,985.6

II. Electrical Generation

A. Gross power generated (MWH). 104,110

B. Net power generated (MWH). 91,452

C. Length of time generator was on line (Hours). 277.03

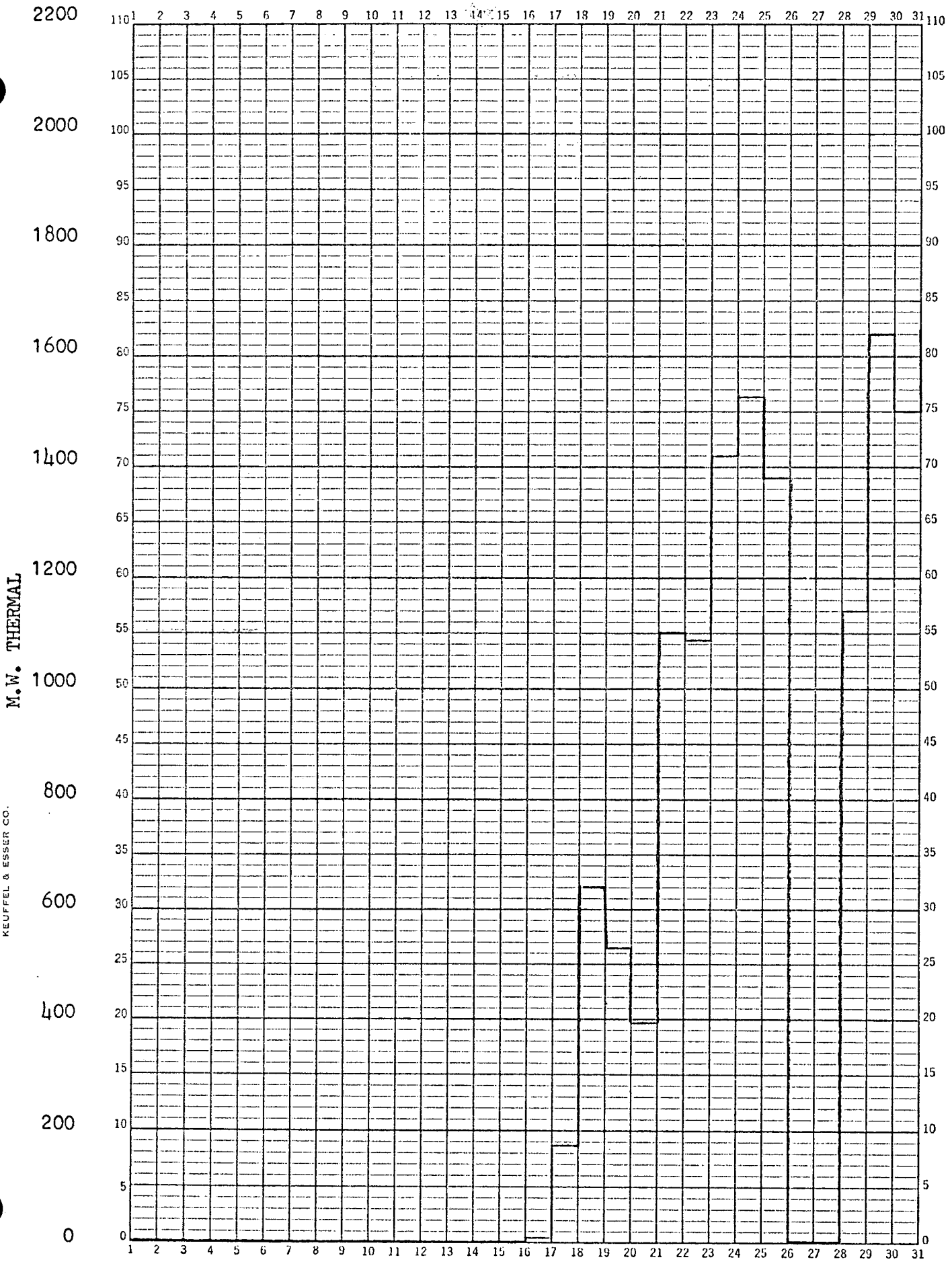
III. Solid Radioactive Waste

A. Total volume of solid waste shipped (Cubic Feet). 2071.0

B. Total estimated Radioactivity involved (Curies). 12.693

C. Disposition of materials shipped.

Date	Quantity (Ft^3)	Destination
May 4	30	Chem Nuclear Services, Inc.
May 9	825	Chem Nuclear Services, Inc.
May 16	60	Chem Nuclear Services, Inc.
May 18	450	Chem Nuclear Services, Inc.
May 23	510	Chem Nuclear Services, Inc.
May 25	487.5	Chem Nuclear Services, Inc.
May 31	682.5	Chem Nuclear Services, Inc.



Month May 1973

OUTAGE REPORT

May 1973

NUMBER	DATE	TYPE	PLANT STATUS DURING SHUTDOWN	CAUSE	CORRECTIVE ACTION	DURATION
1	5/15	Shutdown	Hot Shutdown	Shutdown for startup physics testing	-	10 Hr. 15 Min.
2	5/16	Trip	Hot Shutdown	Reactor trip occurred when turbine EH control was placed in automatic mode with governor tracking meter off of zero	EH control is now maintained in manual mode while increasing load	18 Min.
3	5/16	Trip	Hot Shutdown	High condensate temperature tripped condensate pump during turbine load test	Load test was terminated	29 Min.
4	5/17	Trip	Hot Shutdown	Due to improper tap setpoints in 4KV breaker reactor tripped when attempting to switch auxiliary power to auxiliary transformer	-	27 Min.
5	5/17	Trip	Hot Shutdown	Due to improper tap setpoints in 4KV breaker reactor tripped when attempting to switch auxiliary power to auxiliary transformer	-	22 Min.
6	5/17	Trip	Hot Shutdown	Due to improper tap setpoints in 4 KV breaker reactor tripped when attempting to switch auxiliary power to auxiliary transformer	Adjusted taps to proper setpoints	19 Min.
7	5/22	Trip	Hot Shutdown	Turbine trip due to low hydraulic oil pressure	-	48 Min.
8	5/26	Shutdown	Hot Shutdown	Training startup	-	1 Hr. 15 Min.
9	5/26	Shutdown	Hot Shutdown	Training startup	-	52 Min.

OUTAGE REPORT

May 1973

NUMBER	DATE	TYPE	PLANT STATUS DURING SHUTDOWN	CAUSE	CORRECTIVE ACTION	DURATION
10	5/26	Shutdown	Hot Shutdown	Training startup	-	38 Min.
11	5/26	Shutdown	Hot Shutdown	Training startup	-	1 Hr. 47 Min.
12	5/26	Shutdown	Hot Shutdown	Training startup	-	51 Min.
13	5/27	Shutdown	Hot Shutdown	Training startup	-	44 Min.
14	5/27	Shutdown	Hot Shutdown	Training startup	-	30 Min.
15	5/27	Trip	Hot Shutdown	Erroneous signal generated by technician working with nuclear instrumentation	Technicians were cautioned to use more care in working the system	1 Hr. 39 Min.
16	5/27	Trip	Hot Shutdown	Reactor trip caused by voltage "spike" when shifting instrument Buss No. 3 to emergency power supply	-	2 Hr. 37 Min.
17	5/27	Trip	Hot Shutdown	Trip caused by voltage surge when starting "B" feedwater pump	-	56 Min.
18	5/27	Trip	Hot Shutdown	Trip caused by voltage surge when starting "B" feedwater pump	-	55 Min.

MAINTENANCE May 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Pressurizer Spray Line Lo Temperature Alarm (Loop T-452)	Corrective	None	Loop 452 out of calibration	Lo temperature alarm was activating too high	Loop 452 was calibrated	3 Hr.
Flow Indicator 122A-Charging Pumps	Corrective	None	Indicator glass pressing against the indicator	FI 122A was indicating "0" with charging pumps running	The glass was returned to its correct position	1 Hr.
Heat Trace Circuit Z-5	Corrective	None	Primary and secondary circuits were open	Temperature is only 120° with both circuits turned on	The circuits were repaired	11 Hr.
"C" Charging Pump	Corrective	None	Defective gasket, packing adaptors, and plungers	Excessive leakage	The gasket, packing adaptors, and plungers were replaced	11 Hr.
"B" Main Steam Drain Tank	Corrective	None	Defective gaskets	Excessive leakage	New gaskets were installed	2 Hr.
Annunciator Panel A-3-6	Corrective	None	Temperature indicators 412, 422, and 432 were out of calibration	Reactor Coolant System Tavg Hi Lo Alarm was activating at wrong level	Temperature indicators 412, 422, and 432 were calibrated	3.5 Hr
"A" Charging Pump	Corrective	None	Defective plungers	Excessive packing leakage	New packing and plungers were installed	8 Hr.

MAINTENANCE May, 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Heat Tracing	Corrective	None	Defective circuit E7	Circuit would not control temperature	The circuit was repaired	5 Hr.
"A" Charging Pump	Corrective	None	Defect in discharge line at isolation valve	Excessive leakage	The valve was rewelded	4 Hr.
"A" Chemical Volume Control System Hold Up-tank Level Indicator	Corrective	None	Water in the instrument air line	Indicated "0" percent with "39" percent liquid intank	The transmitter filters were cleaned and the transmitter was re-calibrated	9 Hr.
Rod Drive MG Set "B"	Corrective	None	Defective voltage regulator	Regulator would not hold voltage	The regulator was replaced	2 Hr.
Turbine D.C. Oil Pump	Corrective	None	Pressure switch out of adjustment	Switch was closing too soon	The pressure switch was adjusted	1 Hr.
Unit 2 Hypo-chloride System	Corrective	None	Defective switch	Solution valve would not open	The switch was replaced	3 Hr.
Pressurizer Cubicle High Temperature Alarm	Corrective	None	Comparator TC 443A failed	Heaters would not cut off	TC 443A was replaced	2 Hr.
Condensate Storage Tank Conductivity Meter	Corrective	None	Defective selector switch	Meter would not calibrate	The selector switch was repaired	2 Hr.

MAINTENANCE May, 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Boric Acid Heat Tracing	Corrective	None	Defective SCR controller	A, B, and C legs of heat tracing primary circuit Z8 had burned out	The controller was replaced and the burned legs replaced	15.5H
Main Steam By-pass Valve V-1-3A	Corrective	None	Defective limitorque motor	V-1-3A would not operate from RTGB	The motor was repaired	5.5 H
Electro-Hydraulic Fluid Pressure Low Alarm	Corrective	None	Setpoint out of adjustment	Alarm activates when pump comes on	The setpoint was adjusted	2 Hr.
"B" Instrument Buss Inverter	Corrective	None	Diode "D1" was shorted and the fuses "1FU" and 2FU were blown	Spiking voltage and current	The diode and fuses were renewed	4 Hr.
"B" Mixed Bed Demineralizer	Corrective	None	Limit switches were out of adjustment	Backwash valve would not shut	The switches were adjusted	2 Hr.
Water Treatment Room	Corrective	None	Acid meter had a defective potentiometer	Conductivity meters would not operate properly	The acid meter was repaired	3.5 H
Turbine & Reheat Steam Temperature Recorder	Corrective	None	Input circuits to points 9 and 16 were open	Recorder was reading full scale	Circuits were repaired	4 Hr.

MAINTENANCE May 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" Boric Acid Tank Level Transmitter	Corrective	None	Lundell annunciator relay for the high level alarm was open	No alarm when tank level was at 53%	The relay was replaced	3 Hr.
Pressurizer Level	Corrective	None	Level recorder 459 was out of calibration on the low end	Alarming at 20% instead of 14%	The level recorder 459 was calibrated	3 Hr.
Water Treatment System Recorder	Corrective	None	Excessively worn gear on the print head	Recorder out of synchronization	The recorder was repaired	2 Hr.
Boric Acid Heat Tracing	Corrective	None	Circuits 11P and Z9P were found open	Secondaries would not maintain circuits	Circuits 11P and Z9P were repaired	15 Hr.
Valve FCV-113A Boric Acid Blender Flow Control	Corrective	None	Defective limit switch	Valve would not operate	The switch mechanism was freed and lubricated	2 Hr.
Temperature Indicator 451	Corrective	None	TI451 on loop #2 sprayline was defective	Erratic indication	TI 451 was renewed	6 Hr.
Rod Drive Motor Generator Set	Corrective	None	Defective voltage regulator	Rod drive MG set jumped from 260 to 340	New voltage regulator was installed	6 Hr.

MAINTENANCE May, 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" Circulating Water Pump Discharge Valve	Corrective	None	Defective gears	Discharge valve was inoperative	The gear box was rebuilt	8 Hr.
Rod Position Indication System	Corrective	None	Linear variable differential transformer was damaged	Rod position indicator for rod K-14 would not operate	The LVDT was replaced	7 Hr.
Aux. Boiler Condensate Pumps	Corrective	None	Defective packing	Excessive packing leakage	Pumps were repacked	7 Hr.
Full Length Rod Control System	Corrective	None	Defective regulator card	Cabinet 2AC would not move any rod	The card was repaired by replacing Q18	10 Hr.
Full Rod Control System	Corrective	None	Stationary gripper fuse was blown	Rod K-12 in cabinet 1AC would not move	The fuse was replaced	4 Hr.
"B" Motor Driven Auxiliary Feed Water Pump	Corrective	None	Defect in elbow of of recirc. line downstream of flange connection	Excessive leakage	The pump was repaired	1 Hr.
Loop #2 T/Tavg Protection	Corrective	None	Defective RTD, TE 422D, Serial No. 4310	Loop 2 T/Tavg protection T-cold was reading low	The spare T-cold RTD TE 422C was put in service	3 Hr.

MAINTENANCE May, 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Feedwater Pump "A" Thermocouples	Corrective	None	Defective thermocouples for thrust bearings	Loss of temperature detection	The thermocouples were replaced	6 Hr.
"A" Battery Charger	Corrective	None	Defective solenoids in TROTS system	Ground was indicated on battery charger	The solenoids were renewed	8 Hr.
Waste Evaporator Feed Pump	Corrective	None	Defective pump	Feed pump was inoperative	A new pump was installed	4 Hr.
Δ T/Tavg Protection Loop #1, TE 412B	Corrective	None	Loop 1 hot RTD TE412B serial no. 4327 was shorted	Loss of temperature indication	RTD serial no. 5086 was installed	7.5 Hr
Chemical Volume Control Letdown Letdown Valves 204 A & B	Corrective	None	Defective stem plugs and cages	Excessive leakage	New stem plugs and cages were installed	30 Hr.
N-42 Power Range	Corrective	None	Bistable trip set-point was out of adjustment	Low range overpower trip was activating at wrong level	The bistable trip setpoint was reset to activate at 24%	1 Hr.
Control Rod Drive Cooling Flow Meter	Corrective	None	Defective plugs in bottom of flow meter block	Excessive leakage	The plugs were retapped and replaced	1½ Hr.

MAINTENANCE

May, 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Rod Position Indicator F-12	Corrective	None	Defective indicator	Improper operation	A new indicator was installed	3 Hr.
"A" Primary Water Pump	Corrective	None	Broken pump shaft	Inoperative Pump	New pump shaft and impeller were installed	26 Hr.
Loop 3 Reactor Coolant Flow	Corrective	None	FC 436 was tripping intermittently	Loop 3 reactor coolant flow was alarming intermittently	FC 436 was replaced	1 Hr.
Waste Release Integrator	Corrective	None	Internal part was broken off and jammed	Integrator inoperative	Integrator was repaired	3 Hr.
Nuclear Instrumentation Channel 32	Corrective	None	Poor grounding	Improper indication	A new chassis ground strap was installed	19 Hr.
Pressurizer Back-up Heaters	Corrective	None	Defective summator (P 17444b)	The heaters were cycling	The summator was renewed	12 Hr.
Water Treatment System	Corrective	None	Caustic dilution water heaters temperature indicator/alarm out of calibration	Heaters would not control at correct temperature and gave high temperature alarm	The indicator alarm was calibrated	8 Hr.

MAINTENANCE May, 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"B" Main Steam Drain Tank	Corrective	None	Worn valve plug in the positioner	Abnormal operation of alternate drain valve	The valve was repaired	9 Hr.
Nuclear Instrumentation Channel-44	Corrective	None	Signal out of adjustment	Signal to recorder was reading high	The signal was adjusted	1 Hr.
Spent Fuel Pit Cooling Pump	Corrective	None	Defect in pump flange and section of pipe	Excessive leakage	The flange was adjusted and new section of pipe was installed	4 Hr.
Waste Evaporator Feed Tank Level	Corrective	None	Level transmitter out of calibration	Level was reading high	The transmitter was calibrated	6 Hr.
Part Length Rod Controls	Corrective	None	Defective stator	Pin 5 on rod F-10 measured 8.06 ohms instead of desired 17	F-10 drive was replaced with a spare from stock	-
Radiation Monitor R-14	Corrective	None	Defective transistors	R-14 was drifting up scale	A 2N1302 and two 2N1303 transistors were replaced	9 Hr.
Post Accident #2 Venting Sampling System	Corrective	None	Defective switch	Sample vacuum pump inoperative	The switch was renewed	4 Hr.
Nuclear Instrumentation Detection N44	Corrective	None	Defective NIS detector	Loss of high voltage in the NIS cabinet	A new detector was installed	10 Hr.

MAINTENANCE May, 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Radiation Monitor R-19	Corrective	None	Defective D.C. relays from R-19	Cause R-17 & R-18 to alarm	The D.C. relays were repaired	19 Hr.
Heat Trace Circuit #49	Corrective	None	Defective circuit	Circuit was inoperative	The circuit was repaired	10 Hr.
Radiation Monitor R-8	Corrective	None	Broken signal wire	R-8 would lose signal when drawer was pulled out	The signal wire was resoldered	1 Hr.
Primary System Valves Nos. 750, 751, 735, 455A, B, C, 456, and 535	Corrective	None	Defective packing	Packing box leakage	The valves were repacked	-
N41 Power Range Detector	Corrective	None	Defective cables	Detector reading low	The cables were replaced	12 Hr.
Steam Generator Wide Range Level Recorder (LR-477)	Corrective	None	Defective capacitor in one amplifier unit	Excessive noise	The capacitor was renewed	2 Hr.
Hydrogen Cold Gas Controller	Corrective	None	Controller out of calibration	Operating below the setpoint	The controller was calibrated	2 Hr.
"A" Phosphate Pump	Corrective	None	Defective ball and seat in the discharge safety valve	Pump was inoperative	The valve was repaired	4 Hr.

MAINTENANCE May, 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
2A Heater Drain Pump	Corrective	None	Worn gland sleeve	Excessive packing leak	Packing boxes on 2A & 2B drain pumps were repacked	7 Hr.
Containment Sump Level Switches	Corrective	None	Level switches (LS-1925 C & D) were deteriorated	The switches were inoperative	The switches were renewed	6 Hr.
"A" Instrument Air Dryer	Corrective	None	Defective compressor	Dryer inoperable	The compressor was replaced	10 Hr.
D.C. Seal Oil Backup Pump	Corrective	None	Differential pressure switch out of calibration	Pump ran continuously	The switch was calibrated	4 Hr.
#1 Main Feedwater Pump	Corrective	None	Defective oil cooler	Excessive leakage	One tube was plugged	7 Hr.
Turbine Electro-Hydraulic Control System	Corrective	None	Low pressure switch out of calibration	Fluid pressure Hi-Lo alarm came on	The low pressure switch was calibrated	3 Hr.
Heat Trace Circuit #49	Corrective	None	Defective strip heater and a burned wire	Circuit #49 inoperative	The heater was renewed and the wire repaired	4 Hr.
Annunciator (C1-1)	Corrective	None	The input relay to the Lundell was stuck open	SG#1 FW SF alarm is erratic	The relay was replaced	3 Hr.
Scaler-Timer Cooling Fan (Nuclear Instrumentation System)	Corrective	None	Dirty internals and lack of lubrication	The fan was inoperative	The fan was cleaned and lubricated	4 Hr.

REPORT FOR JUNE 1973

PLANT OPERATIONS

The plant operation for the month was limited to a maximum of 94.8% of licensed power while evaluations were continuing involving fuel densification. Further questions are to be resolved concerning definition of power levels at which axial power scanning becomes mandatory, when to submit results of axial mapping, and other such details. In anticipation of permission to increase power to 100% an axial power distribution monitoring system has been installed as described below.

Two reportable incidents occurred during the month's operation. The first of these was the detection of a containment integrity violation resulting from a containment penetration vent valve being left in the open position. This also constituted a procedural violation and probably rendered inoperative safety injection initiation via Hi and Hi-Hi containment pressure. The violation was reported per Incident Report No. 58 and via letter of June 14, 1973.

The second abnormal condition was the failure of the reactor to immediately trip following a turbine trip. The required TROTS (Turbine Redundant Overspeed Trip System) trip is initiated by both stop valve closure limit switches. The failure to trip was due to a malfunction of one of these switches. Approximately 7 seconds after the turbine trip, a reactor trip did result from high pressurizer pressure. Incident Report No. 59 fully documents this occurrence and the report was submitted in a letter of June 27, 1973.

The reactor was maintained critical for 718.4 hours this month and a maximum thermal output of 2079 megawatts was achieved on June 27.

PLANT MODIFICATIONS

Plant modifications accomplished during the month are as follows:

TITLE	MOD. NO.
Change Overpower Trip and Rod Stop Setpoint	157
Modification of Containment Hydrogen Venting and Pressure Relief System	122
Connection of Rod Control and Position Indication to APDMS	147

A brief summary of each change is listed below.

Modification No. 157 changes the overpower trip reset point and the overpower rod stop reset to comply with interim Technical Specification changes limiting power to 94.8%.

Test connections were added to the containment hydrogen venting and pressure relief system per Modification No. 122. This connection permits connection a portable exhaust fan for in-place tests of the system filter banks.

The final change, Modification No. 147, consists of the connection of the rod control and rod position indication system to an axial power distribution monitoring system (APDMS). The APDMS will automatically initiate an incore flux scan upon signals from rod motion. If no rod motion exists the APDMS will scan periodically. This system increases plant safety by providing current information on reactor flux and hot channel factors. Installation of the equipment was completed this month and final adjustment is in progress.

OPERATING PROCEDURES

Two operating procedures were revised this month. OP-49A was changed to include valve lineups for pressure sensing line vent valves. This was a result of the plant incident described above.

OP-38D was changed to reflect the addition of the residual heat removal flow orifice per Modification No. 75. This change indicated required valve lineups for the new arrangement.

PERIODIC TESTS

All periodic tests and inspections required to be performed during the month were successfully completed. Deficiencies detected are related below.

In that the month's power level was limited to a maximum of 94.8%, the overpower rod stop was set at 98% and the reactor trip high level set at 103%. This was noted in PT 1.2, Nuclear Instrumentation Power Range Test.

While performing PT 15.2, Turbine Valve and Trip Functional Test, on June 17, it was noted that Number 5 feedwater heaters non-return valve was operating erratically. Also, the bearing oil trip was still out of specification. These conditions were subsequently corrected.

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

I. Nuclear Generation

A. Number of times the reactor was made critical. 2

B. Gross thermal power generated (MWH). 1,342,809.6

II. Electrical Generation

A. Gross power generated (MWH). 421,172

B. Net power generated (MWH). 398,260

C. Length of time generator was on line (Hours). 708.63

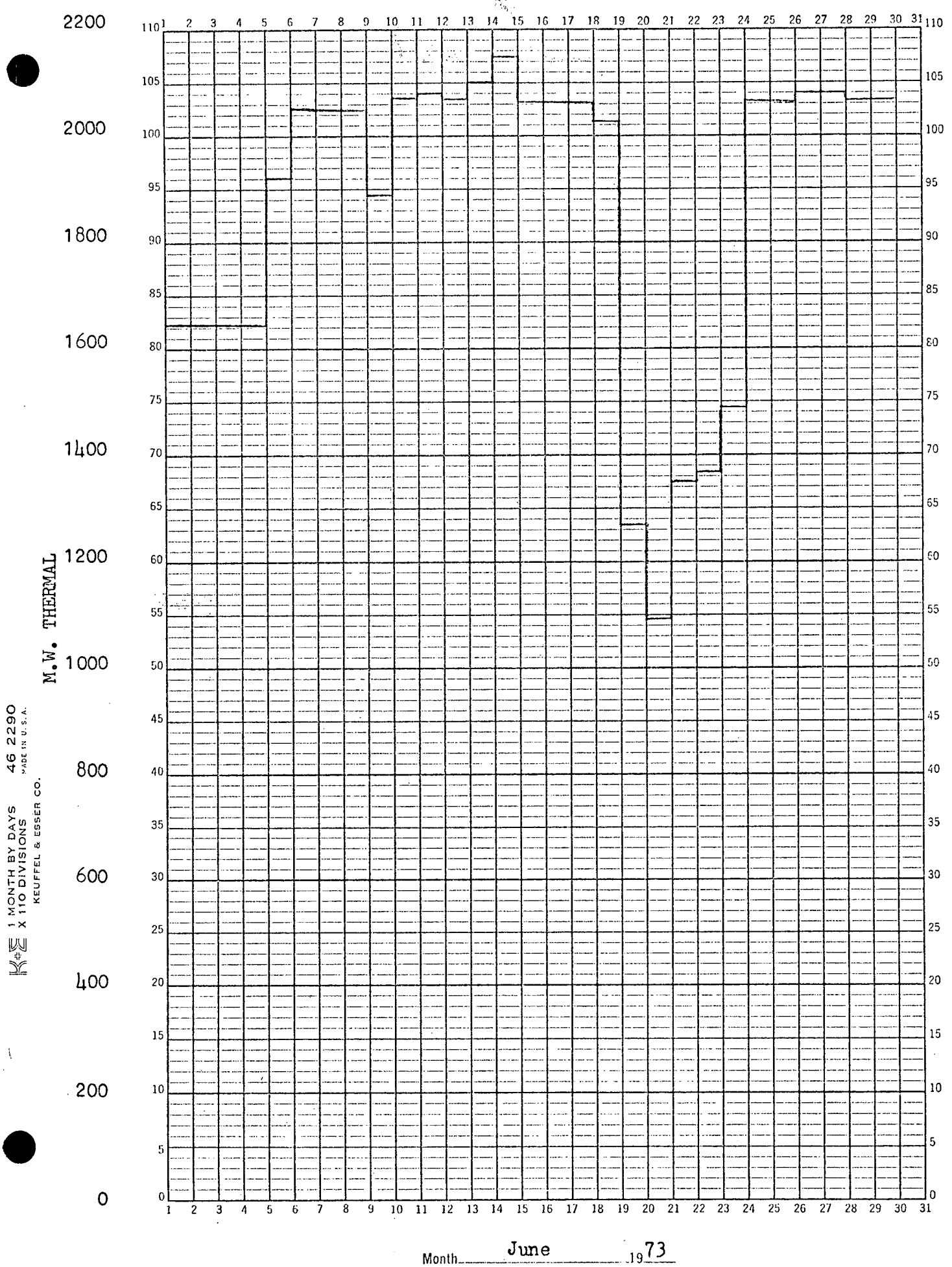
III. Solid Radioactive Waste

A. Total volume of solid waste shipped (Cubic Feet). 3053.5

B. Total estimated Radioactivity involved (Curies). 4.950

C. Disposition of materials shipped.

Date	Quantity (Ft^3)	Destination
June 1	517.5	Chem Nuclear Services, Inc.
June 5	472.5	Chem Nuclear Services, Inc.
June 8	728.5	Chem Nuclear Services, Inc.
June 12	90	Chem Nuclear Services, Inc.
June 19	375	Chem Nuclear Services, Inc.
June 22	382.5	Chem Nuclear Services, Inc.
June 25	487.5	Chem Nuclear Services, Inc.



Month June 19 73

OUTAGE REPORT

June 1973

NUMBER	DATE	TYPE	PLANT STATUS DURING SHUTDOWN	CAUSE	CORRECTIVE ACTION	DURATION
1	6/20	Trip	Hot Shutdown	Turbine trip generated by combination of test signal and defective relay	Replaced relay	7 Min.
2	6/20	Trip	Hot Shutdown	Trip caused by decrease in voltage on number 3 instrument Buss when starting "B" feedwater pump	-	25 Min.

MAINTENANCE JUNE 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
"A" service water booster pump	Corrective	None	Defective breaker	Pump breaker tripped	The breaker was replaced	5 hr
"B" instrument air dryer	Corrective	None	Leaks in the refrigerant lines	Air dryer inoperative	The leaks were repaired	4 hr
"A" instrument air compressor	Corrective	None	Defective valves, piston rings, and loading cylinders	Compressor would not maintain enough air pressure	New valves, piston rings, and loading cylinders were installed	16 hr
Boric Acid heat tracing circuits #41, 42, and 43	Corrective	None	Defective booster transformers	Circuits 41, 42, and 43 are reading low	New booster transformers were installed	8 hr
Hypochloride system	Corrective	None	Deteriorated micro switches on the valves	System inoperative	The switches were renewed	13.5 hr
Turbine steam temperature recorder	Corrective	None	Defective thermocouple	Recorder was reading full scale	The resistor was replaced Limit switches were reset	3.5 hr
Pressurizer control Hi/Lo level A3-40	Corrective	None	Level transmitter 461 was out of adjustment	Alarm A3-40 was activating erraticly	Level transmitter was adjusted	2 hr
Primary water storage tank	Corrective	None	Level transmitter 1941 was out of adjustment	Improper indication	the transmitter was adjusted	2 hr

MAINTENANCE JUNE 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Fire Pumps	Corrective	None	Out of adjustment	Fire pumps were not starting at proper set points	The pumps were adjusted to start at proper set point	20 hr
The loop 3 Reactor coolant flow transmitter	Corrective	None	Transmitter FT 436 reading lower than FT 434 and FT 435	Loop 3 low RC flow was alarming intermittently	The RC flow transmitters were calibrated for 100% flow	2 hr
Steam Generator Blowdown Sample valves FCV 1934 A & FCV 1935 B	Corrective	None	Limit switches were out of adjustment and loose	Valves were giving dual indication	The switches were adjusted and tightened	1 hr
Flow transmitter 1068	Corrective	None	Defective transmitter joint	Excessive leakage	The leak was repaired	1 hr
"B" safety injection accumulator	Corrective	None	Pressure indicators P 1925 & P 1927 were out of adjustment	Erroneous indication	The indicators were zeroed	1.5 hr
"A" boric acid evaporator	Corrective	None	Defective motor	No. 2 feed tank pump motor failed	A rebuilt pump and motor were installed	4 hr
Charging pump "B"	Corrective	None	Pilot valve of the pneumatic controller was clogged with foreign matter	Pump ran full speed constantly	The valve was cleaned	6.5 hr

MAINTENANCE JUNE 1973

EQUIPMENT	NATURE OF MAINTENANCE	EFFECT ON SAFE OPERATION	MALFUNCTION		CORRECTIVE/PREVENTIVE ACTION	TIME OUT OF SERVICE
			CAUSE	RESULT		
Valve FCV 1935 B	Corrective	None	Micro switch not working	Double indication on S/G sample panel	The switch was reset	2.5 hr
Containment vessel pressure relief valves	Corrective	None	Pressure switch out of calibration	Valves will not stay closed	The pressure switch was calibrated	2 hr
"B" reactor coolant drain tank pump	Corrective	None	Defective diaphragm on the suction valve	Not pumping properly	A new diaphragm was installed	3 hr
Discharge piping station service air compressor	Corrective	None	Defective joint in piping	Excessive leakage	The joint was rewelded	2 hr

RADIOACTIVE EFFLUENT RELEASES

REPORT OF RADIOACTIVE EFFLUENTS

Facility H. B. Robinson #2 Year 1973-1st half

I. LIQUID RELEASES

	Units	January (31)	February (28)	March* (31)	April* (30)	May* (31)	June (30)
1. Gross Radioactivity (B,γ)							
a) Total release	Curies	.048	.116	.037	.037	.072	.010
b) Average concentration released	uCi/ml	5.49E-09	1.18E-08	5.42E-09	1.38E-08	4.29E-09	1.58E-09
c) Maximum concentration released	uCi/ml	4.58E-08	4.59E-08	3.28E-08	2.72E-08	6.06E-06	8.72E-09
2. Tritium							
a) Total release	Curies	25.2	28.9	21.5	2.31	5.34	13.7
b) Average concentration released	uCi/ml	2.89E-06	2.93E-06	3.19E-06	8.60E-07	3.20E-07	2.21E-06
3. Dissolved noble gases							
a) Total release	Curies	.039	.055	.030	.0016	.0011	.0010
b) Average concentration released	uCi/ml	4.51E-09	5.60E-09	4.48E-09	5.87E-10	6.41E-11	1.67E-10
4. Gross Alpha Radioactivity							
a) Total release	Curies	No Alpha Activity Detected. MDA = 4.39E-09 uCi/ml					
b) Average concentration released	uCi/ml						
5. Volume of liquid waste to discharge canal	liters	9.03E05	3.38E05	9.30E05	4.35E05	7.84E05	4.38E05
6. Volume of dilution water	liters	8.72E09	9.87E09	6.75E09	2.68E09	1.67E10	6.21E09
7. Isotopes Released	Curies						
Ba+La-140		9.81E-04	N.D.	N.D.	N.D.	N.D.	N.D.
Sr-89		6.12E-05	N.D.	3.62E-04	1.12E-04	N.D.	N.D.
I-131		3.99E-04	3.95E-03	5.97E-04	N.D.	N.D.	N.D.
Xe-133		3.22E-02	4.99E-02	2.89E-02	6.97E-04	6.20E-04	6.91E-04
Xe-135		7.12E-03	5.35E-03	1.37E-03	8.76E-04	4.45E-04	3.43E-04
Cs-137		N.D.	7.47E-03	1.14E-02	2.91E-02	2.94E-02	2.98E-03
Cs-134		N.D.	1.34E-02	8.45E-03	5.57E-03	1.16E-02	N.D.
Co-60		N.D.	3.16E-03	9.49E-04	1.11E-02	2.99E-02	8.01E-03
Co-58		6.05E-03	N.D.	4.86E-03	2.61E-02	2.41E-02	7.05E-03
Cr-51		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Mn-54		N.D.	7.10E-03	1.07E-02	1.01E-02	1.07E-02	6.26E-03
Zn-65		N.D.	1.69E-04	N.D.	N.D.	N.D.	N.D.
Sr-90		6.88E-05	2.06E-04	1.74E-04	3.56E-05	N.D.	N.D.
Others (specify)							
8. Percent of technical specification limit for total activity released	%	1.07%	8.28%	0.957%	4.55%	8.72%	1.12%

II. AIRBORNE RELEASES

	Units	January	February	March*	April*	May*	June
1. Total noble gases	Curies	19.4	64.9	1458.1	683.Ø	869.Ø	5.19
2. Total halogens	Curies	7.69E-Ø3	1.40E-Ø2	5.51E-Ø3	6.15E-Ø4	2.Ø4E-Ø5	3.5ØE-Ø5
3. Total particulate gross radioactivity (B,γ)	Curies	5.28E-Ø6	3.Ø2E-Ø6	1.86E-Ø6	N.D.	2.24E-Ø6	3.51E-Ø5
4. Total tritium	Curies	1.44E-Ø2	1.Ø1	1.3Ø	1.11E-Ø2	7.Ø1E-Ø5	.164
5. Total particulate gross alpha radioactivity	Curies	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
6. Maximum noble gas release rate	uCi/sec	483	13Ø5	2545	423	143	47.6
7. Percent of applicable limit for:							
a. noble gases	%	0.048%	0.16%	3.6%	1.7%	2.16%	0.013%
b. halogens	%	40.2%	73.1%	28.8%	3.2%	0.11%	0.19%
c. particulates	%	0.028%	0.016%	0.0097%	0.00%	0.012%	0.19%
8. Isotope released:	Curies						
Particulates							
Cs-137		2.19E-Ø7	2.72E-Ø6	N.D.	N.D.	N.D.	N.D.
Ba-La-140		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Sr-90		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Cs-134		1.59E-Ø7	1.36E-Ø7	N.D.	N.D.	N.D.	N.D.
Sr-89		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Halogens							
I-131		7.22E-Ø3	1.33E-Ø2	5.18E-Ø3	6.15E-Ø4	2.Ø4E-Ø5	3.5ØE-Ø5
I-133		4.73E-Ø4	6.78E-Ø4	3.35E-Ø4	N.D.	N.D.	N.D.
I-135		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Gases							
Kr-85		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Xe-133		17.7	60.3	14.5Ø	682	869.0	5.059
Kr-88		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Kr-87		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Kr-85m		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Xe-138		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Xe-135m		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Xe-135		0.15	5.76	5.21	N.D.	N.D.	0.133
Ar-41		N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Others as appropriate (specify)							
		2.Ø6E-Ø6	5.45E-Ø7	6.9ØE-Ø9	N.D.	N.D.	N.D.
		2.Ø5E-Ø6	1.Ø4E-Ø6	1.46E-Ø6	N.D.	1.98E-Ø6	6.5ØE-Ø6
		5.Ø2.Ø7	N.D.	1.4ØE-Ø9	N.D.	1.24E-Ø6	3.03E-Ø5

OCCUPATIONAL PERSONNEL RADIATION EXPOSURE

For reporting period of 1 January, 1973, through 30 June, 1973, the following personnel exposures were received:

Range (mrem)	0-99	100-500	501-1250	1251-2500	Over 2500	TOTAL
Number	44	27	36	20	9	136

Individuals receiving greater than 500 mrem were in the following categories:

Category	Number
Operations	24
Maintenance-Electrical	9
Maintenance-Mechanical	15
Radiation Control	9
Janitorial	5
Contract Personnel	3
TOTAL	65

Of these 65 individuals, 53 received a summed exposure of greater than 500 mrem during refueling operations.

Category	Number
Operations	22
Maintenance-Electrical	7
Maintenance-Mechanical	7
Radiation Control	9
Janitorial	5
Contract Personnel	3
TOTAL	53

Twelve individuals received exposures of greater than 500 mrem in operations other than refueling.

Category	Number
Operations	2
Maintenance-Mechanical	8
Maintenance-Electrical	2
TOTAL	12

ENVIRONMENTAL MONITORING

1. Number of sampling locations and number of samples:

Medium	Locations	No. of Samples
air	2	52
direct radiation	22	132
water (surface)	5	106
water (ground)	1	2
bottom sediments	4	8
fish	1	2
vegetation (aquatic)	2	4
soil	2	2

No locations had levels significantly above local background.

The point of highest average concentration was Black Creek and S. C. 23. This point is immediately below the impoundment. Of the 26 samples of this point, 19 were below MDA (MDA averages for gross beta 3.5pCi/liter). The highest sample was 24 pCi/liter, with the lowest detectable 4.4pCi/liter. If the 19 badges which were less than MDA are assumed to have the MDA value of 3.5pCi/liter, the average gross beta at this would be 5.0pCi/liter.

APPENDIX I

H. B. ROBINSON INITIAL REFUELING OUTAGE REPORT

ATTACHMENT 1

TURBINE GENERATOR WORK SUMMARY

I. GENERATOR INSPECTION

Tests made on the unit included dielectric absorption, leakage voltage, maintenance overpotential and slot discharge tests on the stator windings and insulation resistance tests on the rotor and exciter windings. Insulation tests were also made on the stator RTD's. Impedance and pole balance tests were made on the rotor winding. Resistance measurements were made between adjacent stator coil ventilating tubes and also between the tube stack and the copper of each coil side. A light test was made across the 5,000 ohm resistor tying the tube stack and copper together. Pressure drop measurements were made through the ventilating tubes. The ventilation through the parallel rings, interconnecting rings, and bushings was also checked. D.C. resistance measurements were made on each phase of the stator winding and on the rotor winding for the purpose of comparison with the new machine test values. A calibration check was made on the stator temperature detectors.

A. Stator

Conditions observed in the inspection of the stator winding were as follows:

1. The general appearance of the winding was good. The winding was generally clean but there was an oil coating throughout the end windings and the bore.

2. There was no movement of slot wedges or filler strips under the wedges. There were many loose wedges throughout the bore and signs of dusting in some of the slots.

3. The rubber from approximately two-thirds of the baffle ring was missing. Pieces were found in the turbine end of the unit.

4. Exciter End

   a. All of the top diamond spacers vibrated when tapped. 27 spacers either moved or vibrated heavily.

   b. One core block moved when lightly pryed with a drift. Several sounded hollow.

   c. Four strain blocks moved slightly when pryed with a drift. All the others either vibrated or sounded hollow when tapped.

   d. Several "T" pieces showed signs of slight dusting or paint cracks.

5. Turbine End

a. All the top diamond spacers vibrated or sounded hollow when tapped. Six were hand loose. 30 moved when gently pryed. Two moved when tapped.

b. 15 of the bottom diamond spacers were hand loose or moved when pryed.

c. There were four loose core blocks. Six others at approximately the 12:00 O'Clock position showed signs of heavy dusting. All of the others showed some signs of slight dusting or paint cracks.

d. Three strain blocks moved slightly when pryed. All of the others vibrated or sounded hollow when tapped.

e. Most of the "T" pieces on the coil support brackets showed signs of dusting or paint cracks. Several could be moved by hand.

6. Other than the items mentioned in Nos. 4 and 5 above, all the end winding spacers, support blocks, brackets, supporting studs and twine lashings were tight and in good condition. The parallel ring clamping assembly was tight, however, the gap between Belleville washers was 1/16".

7. Connection taping was firm and appeared to be in good condition. This unit has bare coil connections with insulated phase leads.

8. There was no visible evidence of corona attack on end portions of the winding.

9. A very careful inspection of the winding was made for evidence of tape separation. No tape separations were observed.

10. The stator iron appears to be in good condition. The laminated end shields appear in good condition. There was no evidence of hot spots or significant mechanical damage.

11. The main lead bushings were clean and in good condition. No evidence of leakage was observed.

12. The series connections on both ends of the machine were inspected to the extent possible. The connections on the exciter end appeared in good condition and the strands were well bonded to the vent tubes. The connections on the turbine end appeared to be satisfactory with the exception of two strands on Bottom Coil 23 which were broken, one broken strand on Bottom Coil 15, four broken strands on Bottom Coil 24 and two broken strands on Top Coil 40. In several locations the strands were separated from the vent tubes. The dacron was missing from two outer transpositions and several others showed signs of dusting. This was confined to the turbine end and was located primarily from the 11:00 o'clock to 3:00 o'clock positions.

13. The phase leads were also stripped and inspected. The solder joints were subjected to an ultrasonic test and all successfully passed. The braze joints and leads were inspected to the extend possible and subjected to a dye penetrant examination. One crack was found visually on the inside of the strands next to the parallel rings on the phase lead connected to Bottom Coil 40 and physically located at the 5:00 o'clock position. A crack was also found on the inside of the top strands on the same joint. These strands also had very heavy forming tool marks. Several cracks were also found in the braze of other connections.

B. Rotor

The rotor was inspected to the extent possible and found to be in good condition. The winding was generally clean. There was a slight oil film on the winding and there were deposits of dirt located on bracing members.

1. The end winding bracing blocks appeared intact and showed no signs of movement. The turn insulation appeared intact. There was no visible end turn displacement. There were no damaged or loose insulation components.

2. The lead and stud assemblies appeared in satisfactory condition. The stud assemblies were tight. Before the unit was brought down for this outage, the Customer checked for hydrogen leaks in the area of the exciter-generator coupling and reported that none were found.

3. There was no visible evidence of heating or burning between the retaining ring fit and rotor body. There was no visible evidence of excessive heating or damage to the rotor body, wedges or retaining ring. There was no apparent evidence of movement of the rotor wedges. The wedges were tight. Balance weights were tightly in position.

C. Brushless Exciter

The diode wheel assembly appeared in good condition. The a.c. generator and PMG appeared in good condition. No fuses were blown. Capacitor and resistor assemblies appeared in good condition. Conductors and riser leads were visibly intact and in good condition. The glass banding appeared in good condition.

II. GENERATOR MAINTENANCE

1. The end windings and stator bore were sprayed with Trichloroethane and wiped with dry cloths. Oil was removed from any pockets into which it had accumulated.

2. The stator slots were completely rewedged with prestressed driving strips.

3. The phase lead connected to Bottom Coil No. 40 was replaced. The braze joint was made by using a brazing transformer and tongs. The solder joint was repoured. Any cracks in the braze alloy and any tool marks were removed from the remaining leads.

4. All loose, vibrating or hollow sounding core blocks were tightened by driving suitable thin tapered shims coated with epoxy into the split between block halves.

5. On the turbine end of the machine, the glass epoxy support blocks were jacked tightly against the bottom coil sides. Prior to jacking any loose "T" pieces were fitted with a suitable shim coated with epoxy to take up excess slack.

   All bolts, except the most inboard one, clamping the glass epoxy support block to the metal support bracket were loosened. The glass epoxy supports were jacked inwards. Insulating tapered shims, treated with epoxy, were installed between glass epoxy supports and the steel brackets. Jacking pressure was released and the bolts retightened and locked.

6. All loose diamond spacers were replaced and the top coil sides on both end turns were post-tightened. The combination of Nos. 5 and 6 also tightened up any loose strain blocks.

7. All mating surfaces between the coil support brackets, strain blocks, coil support ring and diamond spacers and the coils were liberally coated with epoxy resin.

8. The broken strands on the turbine end were repaired by brazing on pieces and remaking the solder joint. The soldering was done by using irons.

9. All broken resistors were replaced or resoldered.

10. The strands on the turbine end were bonded to the vent stacks where necessary with epoxy resin and clamped until the resin set up.

11. The strands on all of the coils were liberally coated and all the coils were liberally coated and all accessible areas filled with epoxy set up the same areas were liberally sprayed with epoxy resin.

12. The gap baffle ring was refitted with new rubber and screws and installed in the exciter end winding.

13. The parallel ring clamping assembly was tightened to reduce the gap between Belleville washers to between 5 and 10 mils.

14. All loose dacron in the outer transpositions on the turbine end were replaced where signs of dusting were noted.

15. Two erroneous reading RTD's were repaired. One with low insulation resistance was also repaired. The problem was in the cable in all cases.

16. The lead box and bushings were inspected and all oil was removed.

17. The parallel and interconnecting rings were checked for obstructions by blowing air through them. The air flow through the bushings was also checked.

18. The end windings, support blocks, parallel rings and all bracing members were painted. The stator bore was also given a light coating of paint.

III. TURBINE INSPECTION

The planned turbine work consisted of replacement of both low pressure rotors. These rotors had previously experienced problems with cracked blades in their sixth rows. Repairs had been made to the affected blading in 1971, and the turbine returned to service. The intent at that time was to manufacture new rotors, and replace the repaired items under warranty. This work was thus scheduled for the initial refueling outage.

Other inspections involving the turbine included disassembly of the high pressure turbine section, and inspection of all control valves, main stop valves, and the high pressure rotor. A selected sampling of the reheat and intercept valves was decided to be sufficient to reveal any problems in these areas.

IV. TURBINE MAINTENANCE

The low pressure rotors were replaced as scheduled. Reaming and machining of the couplings and coupling bolts were required to accomplish this work. No major fit up problems were detected during the charting of the rotors.

The inspection of the high pressure rotor revealed cracks in two tenon covers. Due to factory lead times and the unavailability of replacement parts, it was decided to repair the rotor on site. The repair consisted of grinding the peened portion of the tenons away, removing the cracked covers, under-sizing the tenons, and installing new tenon covers with under-sized tenon holes. Inspection of the other tenons on the subject blade row indicated that the gap between the tenon and cover was excessive. Therefore, in addition to replacing the cracked tenon covers all tenons in that row were repeened.

Inspection of the main control valves indicated eroded seats. The valves were subsequently lapped to provide good seating surfaces. Steam cuts were detected in the stems of both main steam stop valves. In that repair parts were not available, the stems were repaired by under-sizing the seal ring inner diameters thus reducing the clearance to provide more effective sealing. New stems were ordered and will be installed as availability permits. No problems existed with the reheat or intercept valves.

ATTACHMENT 2

Reactor Coolant Pump Maintenance

REACTOR COOLANT PUMP MAINTENANCE

DURING MARCH, 1973 OUTAGE

MARCH 16 - MAY 9, 1973

Written and Compiled By:

J. Parks
Engineering Aide

HISTORY OF REACTOR COOLANT PUMP MAINTENANCE

The initial problems with the Reactor Coolant Pumps at H. B. Robinson Unit Number 2 occurred on March 14, 1971. Reactor coolant pumps "A" and "C" were damaged when seal flow was lost during the March 14, 1971 turbine-generator trip. Reactor coolant pump "A" (RCP "A") shaft, impeller, and coupling were sent to Westinghouse in Cheswick, Pennsylvania for balancing. The shaft was replaced due to being damaged by dropping. After completion of all maintenance, the Reactor Coolant System (RCS) was pressurized and seal flow was established with no difficulty. Following repairs, the pumps' vibration was measured via the permanently installed vibrometers and recorded as follows:

RCP "A"	Point No. 1 - 0.48 mils
	Point No. 2 - 0.22 mils
RCP "B"	Point No. 3 - 0.12 mils
	Point No. 4 - 0.22 mils
RCP "C"	Point No. 5 - 0.20 mils
	Point No. 6 - 0.13 mils

The next major maintenance involving the reactor coolant pumps was to be performed during the scheduled 1973 Refueling Outage. The following is a description of the work performed at that time.

INTRODUCTION

This report relates the events of the Reactor Coolant Pump (RCP) inspection and repair during the 1973 refueling outage at H. B. Robinson Unit Number 2. The work involves repairs to three Westinghouse Reactor Coolant Pumps, model number V11001-B1. The model V11001-B1 pump is a vertical, single stage, centrifugal shaft seal pump. The reader is referred to the enclosed figure number 1 for an isometric view of this type pump. All part numbers refer to figure number 2.

INITIAL STAGES OF OUTAGE AND INSPECTION

The 1973 Refueling Outage Reactor Coolant Pump inspection and repairs were performed via the combined efforts of Carolina Power and Light (CP&L) and Westinghouse Electric Corporation, Electro-Mechanical Division.

On March 17, vibration tests were performed on the reactor coolant pumps while the unit was in a hot shutdown condition. The results of these tests are shown in Tables 2-4. This data was taken in order to reveal any overt problem areas and was to be used as base line information for measurements following any needed repairs.

CP&L mechanics began disconnection of electrical wiring to the reactor coolant pumps on March 20. Disconnection of RCP "A" was completed and RCP "C" was partially disconnected. A Westinghouse service representative arrived on site to begin work on the pumps. The polar crane necessary for major pump lifts was in use at this time. Therefore work on the RCP's was delayed until March 21.

On March 21, mechanics completed the disconnection of electrical wiring from RCP "C".

The motors of RCP's "A" and "C" were removed and placed on the operating deck. RCP "A" motor was virtually free of oil where as the entire "C" pump bay was coated with a film of oil. RCP "C" motor stand contained approximately two inches of oil. There was also a coating of oil on the main flange and casing. The oil on the casing had turned black as if it had been charred, thus there was obvious leakage prior to the time of shutdown. During the prior six months of RCP operation the oil level and the stand pipe low level alarm

for "C" pump had indicated such a problem. However, conditions were closely monitored and the safety of the plant was not jeopardized by the leak.

A swing check of "A" and "C" RCP motors was performed on March 22 with the results listed below:

RCP "A" Motor	N.S. - .024 inches
	E.W. - .037 inches
RCP "C" Motor	N.S. - .068 inches
	E.W. - .054 inches

Westinghouse was notified of these results and agreed to have a service representative on site later to repair both motors. All seals of "A" and "C" RCP's were removed for cleanup and inspection. Inspection of the number 3 seals (Pc No. - 20) on both pumps revealed that the seal nose height was zero, indicating that the seals were excessively worn. The height of the number 2 seal (Pc no. - 26) on RCP "A" was .082/.080 inches and the height of the number 2 seal on "C" was .082/.083 inches with even wear on both seals. These seals needed to be replaced. The number 1 seals (Pc. no. - 30) for RCP "A" and RCP "C" appeared to be in good condition; however, the number 1 insert (Pc no. - 29c) on both pumps required replacement. The inserts were not available on site, thus reassembly was delayed while parts were ordered. The double delta channel seal (Pc no. - 30M) and the o-ring (Pc. no. - 30L) had been damaged on both pumps and also required replacement.

On March 23, while waiting for the number 1 inserts for RCP's "A" and "C", all associated parts were cleaned and the shafts were centered. The number 1 runner (Pc. no. - 31) for "A" was cleaned and a new o-ring was installed.

Two new number 2 seals were assembled and made ready for installation.

The number 1 seal for RCP "A" was assembled and installed on the pump on March 24. The inserts were received and installed at this time. The coupling was installed and the motor stand was torqued. Reactor Coolant Pump "A" was ready for the motor to be installed. A Westinghouse representative arrived on site and performed swing checks of the RCP "A" and "C". The results of the RCP "A" check were approximately the same as found earlier (Page 2). However, it was advised that another set of readings be taken eight inches above the coupling using twenty foot-pounds of torque on the center screws.

This check was performed with the following acceptable results.

RCP "A"	N-S - .021
	E-W - .018

The swingcheck on RCP "C" revealed the same results as before (Page 2) which indicated the need for adjustment. These adjustments were made to bring the pump within specifications.

New seals for "C" RCP were assembled and installed in the coupling on March 25. New number 1 inserts were installed at this time. The coupling was placed on the pump and the motor stand was torqued. Disassembly of the lower bearing on "C" RCP revealed that the lock nuts had loosened and the lock wire had broken. No major repairs were needed.

On March 26, the advance of "C" coupling was checked and found to be incorrect. The coupling joint thus required to be remade.

Final coupling of the pumps and motors could not be made at this time due to a suggested change in lubricating oil by Westinghouse. The oil was not readily available. In order to proceed with other critical path outage work it was decided to suspend work on the pumps and proceed with flooding the loop piping. The pump technical manual states ". . . lowering of the pump shaft when the motor is uncoupled will seal off the system at the thermal barrier heat exchanger against a pressure of approximately 30 ft. of water." Even so, to assure that any possible leakage would be contained temporary piping was installed from the number 1 seal leak-offs on each pump to the Reactor Coolant Drain Tank. This was completed on March 27. The loops then were flooded for refueling operations. Work on the reactor coolant pumps was thus halted until the loops were again drained on April 22.

Following draining of the loops the hatch over RCP "B" was removed on April 23. On April 24 the hatch cover over RCP "C" was removed. RCP "B" motor was then removed and placed on the operating deck.

REASSEMBLY OF RCP "A"

A swing check was performed on RCP "A" motor which indicated no excessive clearance in the bearing shoes. The flywheel cover was removed for inspection of the flywheel. Visual inspection indicated no excessive wear. Reactor Coolant Pump "A" motor was positioned on the motor stand. A preliminary check for parallelism was made at every other hole in the coupling starting at the keyway and moving in a counter clockwise direction. The initial readings are shown below.

Key,	PT.1	.9583	PT.5	.9610
	PT.2	.9603	PT.6	.9580
	PT.3	.9605	PT.7	.9575
	PT.4	.9615		

A .010 inch shim was placed at point number 7 and the following set of readings were taken.

Key,	PT.1	.9620	PT.5	.9620
	PT.2	.9615	PT.6	.9620
	PT.3	.9615	PT.7	.9620
	PT.4	.9625		

On April 25, the motor to pump alignment on RCP "A" was completed. The final parallelism and concentricity readings were as follows:

Parallelism

Key,	PT.1	.9615	PT.5	.9615
	PT.2	.9620	PT.6	.9615
	PT.3	.9620	PT.7	.9615
	PT.4	.9620		

Concentricity

North	.0000
South	.0000
East	-.0002
West	+.0005

The RCP "A" motor and pump were thus finally coupled.

RCP "C" Reassembly

The RCP "C" coupling was removed and reinstalled obtaining an advance of .0495 inch. A swingcheck was performed on "C" RCP motor indicating excessive clearance in the bearing shoes. The shoes were adjusted to the acceptable tolerances. RCP "C" motor was positioned on the motor stand. Inspection of the flywheel indicated no deficiencies.

Alignment of RCP "C" was to be completed on April 26. The initial parallelism readings were as follows:

Parallelism			
Key, PT. 1	1.0555	PT.5	1.0510
PT.2	1.0565	PT.6	1.0510
PT.3	1.0555	PT.7	1.0540
PT.4	1.0560		

A .010 inch shim was placed at position number 6 with the following results.

Parallelism			
Key, PT.1	1.0565	PT.5	1.0555
PT.2	1.0560	PT.6	1.0560
PT.3	1.0560	PT.7	1.0560
PT.4	1.0555		

At this time the following concentricity readings on "C" were taken.

Concentricity	
North	0000
South	-0000
East	0002
West	+0003

Reactor coolant pump "C" motor and pump were coupled.

REASSEMBLY OF RCP "B"

The motor stand and coupling for RCP "B" were removed following removal of the motor. All seals on RCP "B" were then disassembled and inspected on April 27. The inspection indicated excessive damage to all seals with

the exception of the number 1 seal. However, new number 1 seal inserts and number 2 seal "O" rings did need to be installed. A complete number 3 seal assembly was necessary.

All seals for RCP "B" were reassembled on April 28. New "O" rings were used through out. The coupling was then placed on the pump shaft. RCP "B" motor stand was installed after considerable cleaning of the main flange.

On April 29 the motor for "B" RCP was positioned on the motor stand. The alignment procedures were conducted with the following results:

Initial Parallelism Check		Final Parallelism Check	
Key, PT.1	1.1410	Key, PT.1	1.1403
PT.2	1.1410	PT.2	1.1405
PT.3	1.1412	PT.3	1.1401
PT.4	1.1406	PT.4	1.1400
PT.5	1.1406	PT.5	1.1396
PT.6	1.1417	PT.6	1.395
PT.7	1.1415	PT.7	1.1396

Final Concentricity Check

North	0000
South	-.0015
East	-.002
West	0000

RCP assembly was thus completed and final adjustment was not accomplished until May 9 during plant heat-up.

FINAL ADJUSTMENTS

On May 9, RCP inspection indicated excessive leakage at the number 2 seals on RCP's "A" and "C". Adjustments on RCP "A" were accomplished without difficulty. However, it was necessary to uncouple RCP "C" to accomplish the work.

CHRONOLOGICAL SEQUENCE OF EVENTS

March 17	Performed vibration tests on three RCP's.
March 18-19	Electrically disconnected pumps.
March 20	Removal of connections from RCP "A" completed. RCP "C" partially disconnected.
March 21	Completed disconnection of RCP "C", Motors of RCP's "A" and "C" placed on the operating deck.
March 22	Swing check performed on motors of RCP's "A" and "C". Seals removed for clean up and inspection. Ordered number 1 inserts from Westinghouse.
March 23	Cleaned parts and centered the shafts. Two number 2 seals assembled and an "O" ring installed.
March 24	Number 1 seal and inserts installed on RCP "A". Coupling placed on RCP "A" shaft. Swing checks made on RCP's "A" and "C".
March 25	Seals and inserts for RCP "C" assembled and installed. Coupling was placed on shaft.
March 26	Advance on RCP"C" coupling found to be incorrect. Installed temporary piping on number 1 seal, leak-offs.
March 27 April 22	Loops flooded for refueling operations.
April 23	Hatch cover over RCP "B" was removed.
April 24	Hatch cover over RCP "C" was removed. RCP "B" motor removed. Swing check performed on RCP "A" motor. RCP "A" flywheel inspected. "A" motor positioned on motor stand. Performed alignment of RCP "A".
April 25	Continued alignment of RCP "A". RCP "A" motor and pump coupled. Corrected the advance of RCP "C" coupling. Swingcheck performed on RCP "C" motor. Bearing shoes adjusted and flywheel inspected.
April 26	Completed alignment of RCP "C" motor to pump. RCP "C" motor and pump coupled.
April 27	Inspected and assembled seals for RCP "B".
April 28	Installed seals on RCP "B". Coupling placed on pump shaft. Installed motor stand on RCP "B".

April 29	RCP "B" motor positioned on motor stand. Performed alignment of RCP "B".
	Final adjustment could not be made at this time. Waiting for plant heat-up to inspect RCP's.
May 9	Final inspection and adjustments on three RCP's.

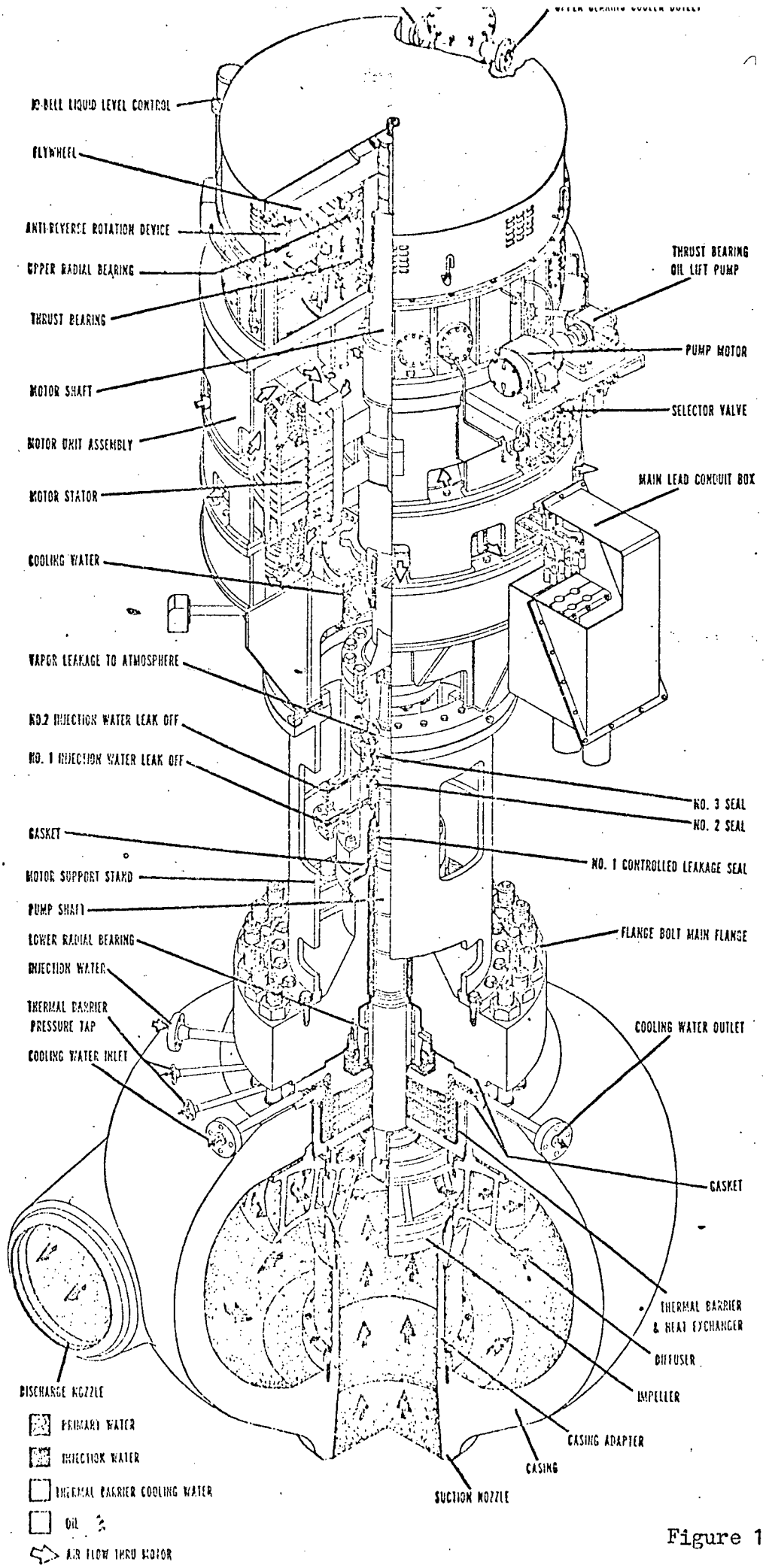

BELL LIQUID LEVEL CONTROL
FLYWHEEL
ANTI-REVERSE ROTATION DEVICE
UPPER RADIAL BEARING
THRUST BEARING
MOTOR SHAFT
MOTOR UNIT ASSEMBLY
MOTOR STATOR
COOLING WATER
VAPOR LEAKAGE TO ATMOSPHERE
NO.2 INJECTION WATER LEAK OFF
NO. 1 INJECTION WATER LEAK OFF
GASKET
MOTOR SUPPORT STAND
PUMP SHAFT
LOWER RADIAL BEARING
INJECTION WATER
THERMAL BARRIER PRESSURE TAP
COOLING WATER INLET
DISCHARGE NOZZLE
THRUST BEARING OIL LIFT PUMP
PUMP MOTOR
SELECTOR VALVE
MAIN LEAD CONDUIT BOX
NO. 3 SEAL
NO. 2 SEAL
NO. 1 CONTROLLED LEAKAGE SEAL
FLANGE BOLT MAIN FLANGE
COOLING WATER OUTLET
GASKET
THERMAL BARRIER & HEAT EXCHANGER
DIFFUSER
IMPELLER
CASING ADAPTER
CASING
SUCTION NOZZLE
PRIMARY WATER
INJECTION WATER
THERMAL BARRIER COOLING WATER
OIL
AIR FLOW THRU MOTOR

Figure 1

Refer to Table No. 1 for parts description

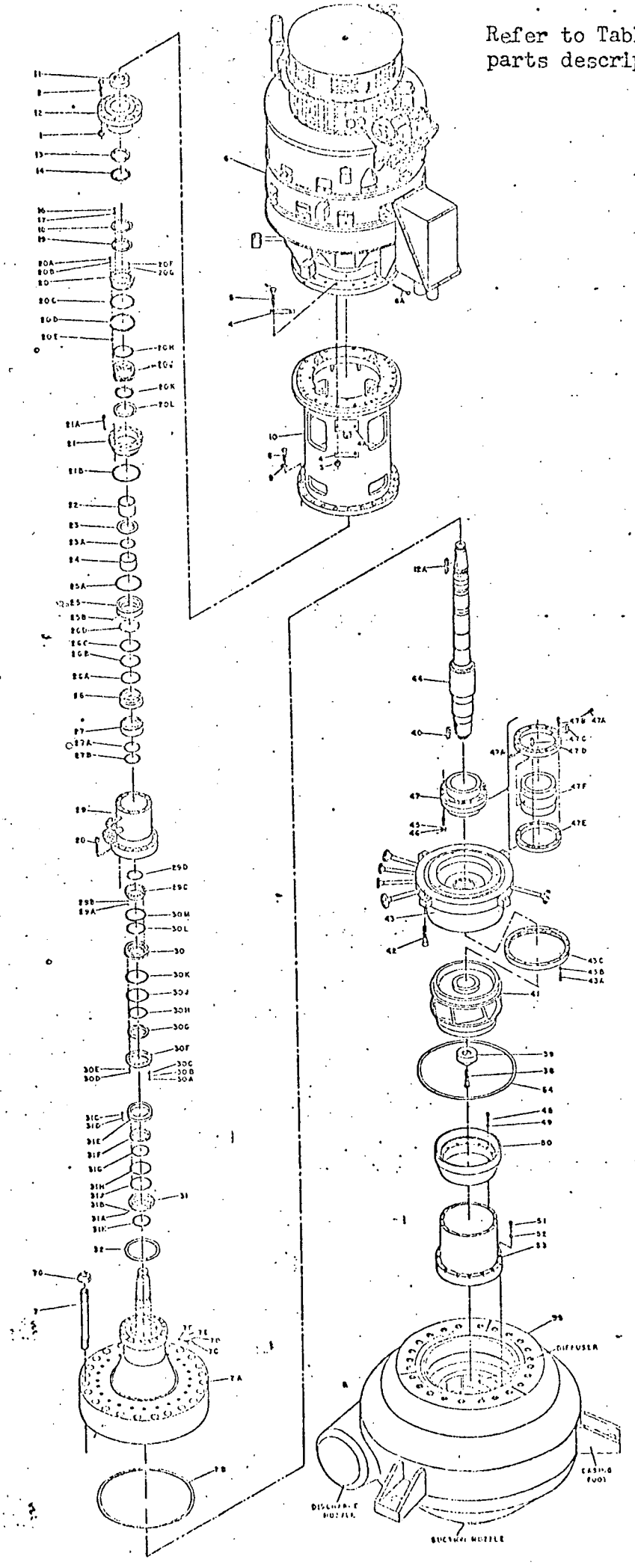


Figure 2

1. Hex Nut
2. Hex Head Bolt
3. Hex Nut
4. Lockplate

4A. Vibration Pickup
5. Hex Head Bolt
6. Motor
6A. Jacking Screw

7. Flange Stud
7A. Main Flange
7B. Flexitallic Gasket
7C. Lockwire

7D. Seal Bolt
7E. Backup Ring
7F. O-Ring
7G. Flange Stud

8. Hex Head Bolt
9. Pantleg Washer
10. Motor Support Stand
11. Coupling Nut

12. Coupling
12A. Coupling Key
13. Locknut
14. Lockwasher

15.
16. Hex Head Bolt
17. Lockplate
18. Splash Guard Retainer

19. Splash Guard
20. No. 3 Seal Ring
20A. Socket Head Cap Screw
20B. Locking Cup

20C. O-Ring
20D. Special Shims
20E. Spring
20F. Socket Head Cap Screw

20G. Locking Cup
20H. O-Ring
20J. Bellows Holder
20K. Wafer Guide Ring

20L. Wafer Assembly
21. Ring Clamp
21A. Socket Head Cap Screw
21B. O-Ring

22. No. 3 Spacer
23. No. 3 Seal Collar
23A. O-Ring
24. No. 2 Seal Spacer

25. No. 2 Seal Housing
25A. O-Ring
25B. Socket Heat Cap Screw
26. No. 2 Seal Ring

26A. Secondary Seal
26B. O-Ring
26C. Retaining Ring
26D. Retaining Wire

27. No. 2 Runner
27A. O-Ring
27B. O-Ring
28. Socket Head Cap Screw

29. Seal Housing Assembly
29A. Socket Head Cap Screw
29B. Locking Cup
29C. Insert

29D. O-Ring
30. No. 1 Seal Ring Assembly
30A. Socket Head Cap Screw
30B. Locking Cup

30C. Stop
30D. Socket Head Cap Screw
30E. Locking Cup
30F. Hydrostatic Clamp Ring

30G. Aluminum Oxide Faceplate
30H. O-Ring
30J. O-Ring
30K. O-Ring

30L. O-Ring
30M. Double Delta Channel Seal
31. No. 1 Runner Assembler
31A. Locking Screw

31B. Locking Cup
31C. Socket Head Cap Screw
31D. Locking Cup
31E. Hydrostatic Clamp Ring

31F. Aluminum Oxide Faceplate
31G. O-Ring
31H. O-Ring
31J. O-Ring

31K. O-Ring
32. Flexitallic Gasket
38. Hex Head Bolt
39. Impeller Nut

40. Impeller Key
41. Impeller
42. Socket Head Cap Screw
43. Thermal Barrier

43A. Socket Head Cap Screw
43B. Locking Cup
43C. Thermal Barrier Labyrinth Seal
44. Rotor Shaft

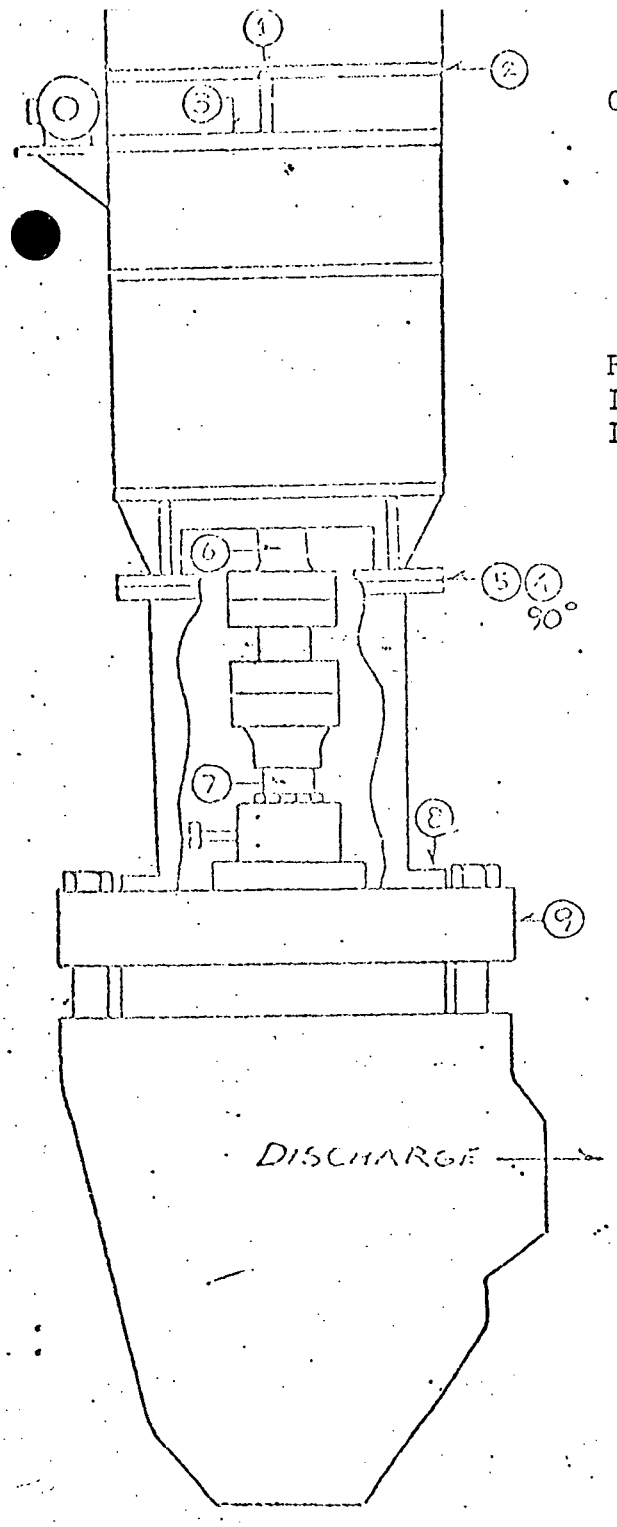
45. Lockwire
46. Hex Head Bolt
47. Radial Bearing Cartridge Assembly
47A. Cartridge Pin

47B. Socket Head Cap Screw
47C. Dowel Pin
47D. Upper Housing Half
47E. Lower Housing Half

47F. Cartridge
48. Socket Head Cap Screw
49. Locking Cup
50. Diffuser Adapter

51. Socket Head Cap Screw
52. Locking Cup
53. Casing Adapter
54. Casing

Table No. 1

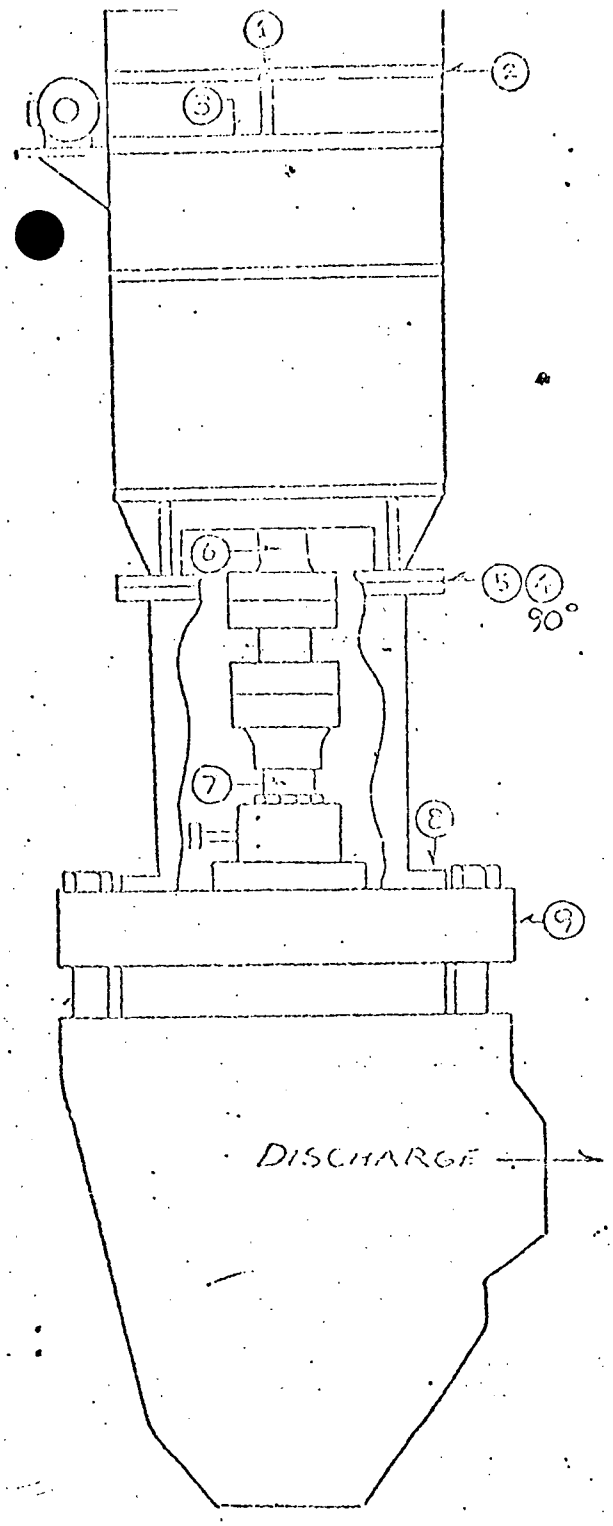


Controlled Leakage Reactor Coolant Pump Vibration Data

Reactor Coolant Pump "A"
Loop Pressure - 2200 psi
Loop Temperature - 550°F

Point	TIME	
	0545	0630
1		.75
2		.85
3		.7
4		.5
5	.7	.35
6		
7	11	8
8		.2
9		1.4

Table No. 2

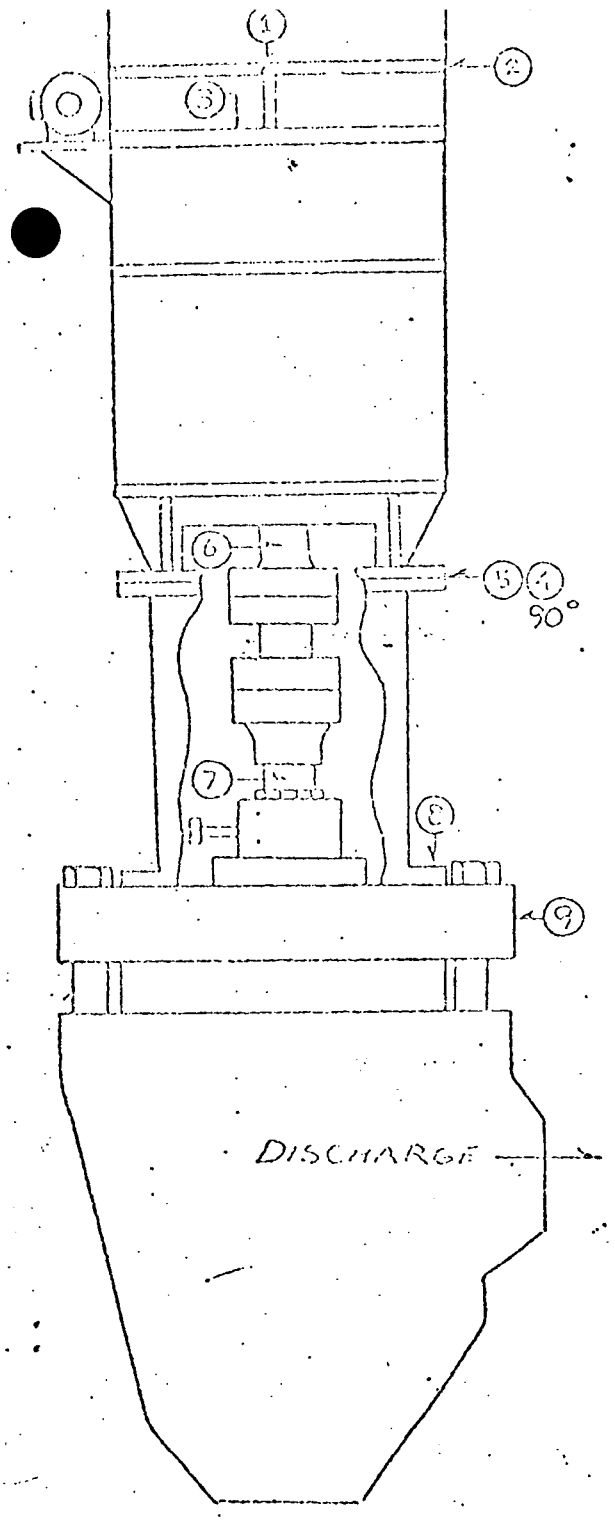


Controlled Leakage Reactor Coolant Pump
Vibration Data

Reactor Coolant Pump "B"
Loop Pressure - 2200 psi
Loop Temperature - 550°F

Point	TIME	
	0435	
1	.6	
2	1.1	
3	1.0	
4	.8	
5	1.0	
6	-	
7	11	
8	.8	
9	1.5	

Table No. 3



Controlled Leakage Reactor Coolant Pump Vibration Data

Reactor Coolant Pump "C"
Loop Pressure - 2200 psi
Loop Temperature - 550°F

Point	TIME	
	0225	0345
1	4	
2	1.6	
3	2	
4	5.6	5.4
5	1.7	1.7
6	-	-
7	8	8
8	.8	
9	7	

Table No. 4

ATTACHMENT 4

Resources Utilized During Outage

RESOURCES UTILIZED DURING OUTAGE

MANPOWER

The normal CP&L plant manpower compliment was supplemented by various outside contractors to assist with the the scheduled work. Major technical assistance was provided by Westinghouse on the following tasks.

a. Reactor Internals Inspection

b. Incore thimble replacement

c. Steam generator inspection

d. Purge modification

e. Reactor head repair

f. Inservice inspection

g. Generator rewedging

Westinghouse personnel were used in an advisory capacity on the jobs listed below.

a. Shutdown chemistry

b. Periodic test assistance

c. Fuel movement

d. Fuel inspection

e. Reactor coolant pump maintenance

f. Turbine rotor replacement

The major addition to the work force was composed of Daniel and Davis Construction personnel. Numerous service representatives were also on site for assistance in maintenance on various components. A listing of all workers on site during the outage is enumerated below.

Personnel Identification	Number of Personnel
A & M Mechanics	42
Dudley Contractors	40
Metric Constructors	26
Inservice Inspectors	22
Guy Beatty Insulators	7
S & S Sandblasters	4
Advance Security Guards	9
Magnaflux Inspectors	3
Chicago Bridge & Iron	4
Covil Insulators	4
Chem-Nuclear Services	3
Eberline (HP)	4
Fairbanks Morse	1
Stearns-Rogers	1
Filtration Technology	3
Teleflex	2
DSD, Co.	3
Byron Jackson	1

Personnel Identification Cont'd.	Number of Personnel
Carolina Crane	1
Westinghouse	141
Ze-tech	2
IRM (HP)	2
Whiting Crane	1
Biach, Ind.	1
WKM (Valves)	1
Crosby Valve	1
Copes Vulcan	1
S & K (Valves)	1
Atlas	1
CP&L (offsite)	39
Daniel Construction	164
Davis Electric	78
CP&L (onsite)	124 avg/mo.

The time individual personnel were on site varies with the task they were performing. The enclosed graph indicates the number of contract personnel on site on a daily basis.

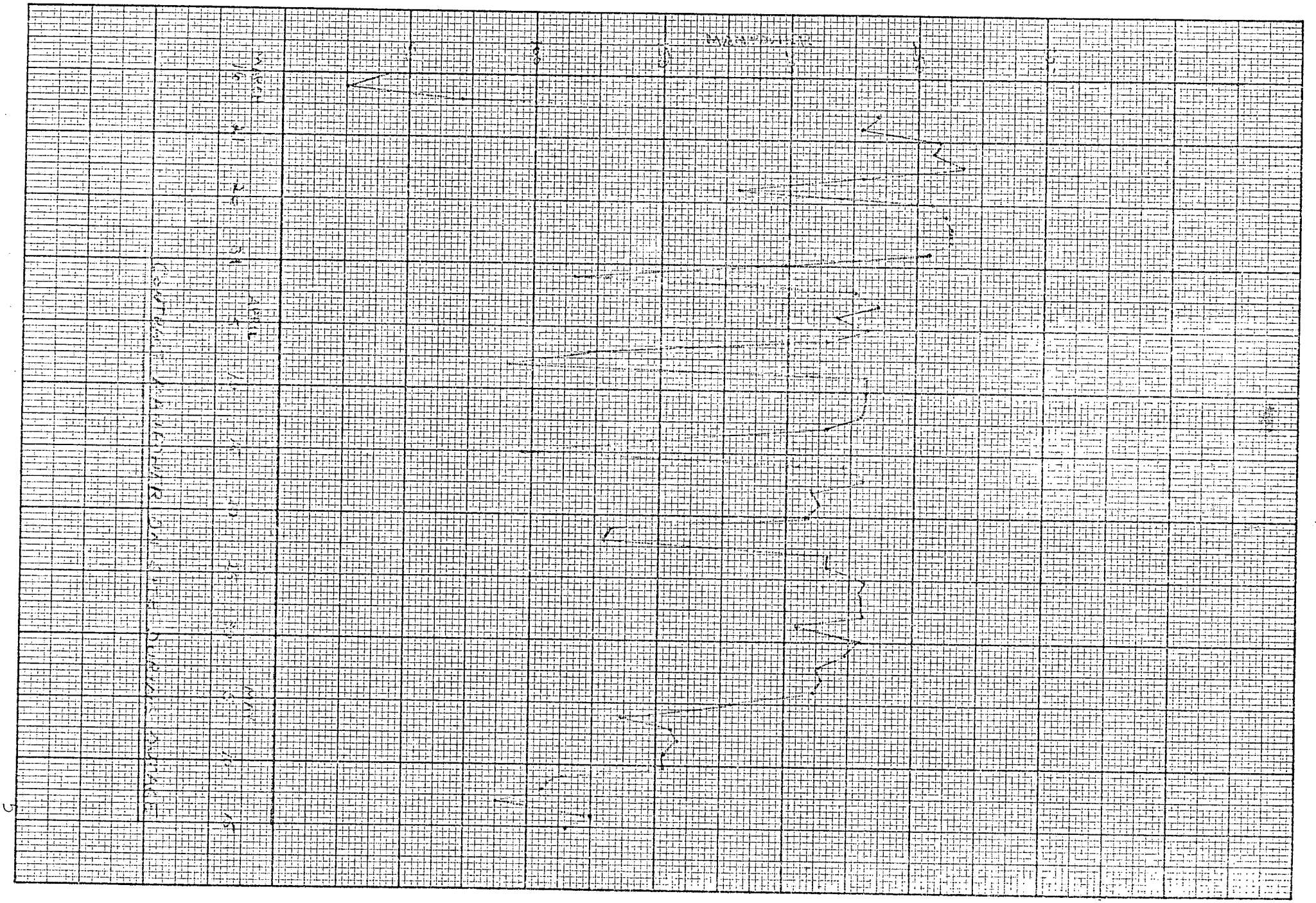
Average exposures accumulated by workers during the outage are listed below.

Month	Total Exposure	Average Exposure
March	167.5 man-rem	0.269 man-rem
April	285.2 man-rem	0.486 man-rem
May	145.5 man-rem	0.212 man-rem

Expenditures

Costs chargeable to the outage work are listed in major categories below. Note that the cost summary is not complete as some invoices are still outstanding.

Labor:	
Turbine Generator	$224,159.15
Other Labor	898,693.28
	$1,122,852.43
Materials:	
Turbine Work	$15,410.95
HP Work	28,185.69
Other Refueling Work	215,085.97
	$258,682.61
TOTAL COST	$1,381,535.04



H. B. ROBINSON INITIAL REFUELING

OUTAGE REPORT

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

TABLE OF CONTENTS

Page Number

Introduction ii

Section I Outage Work Prior To Flooding Refueling Cavity 1

Section II Work During Refueling Operations 7

Section III Work Following Draining of the Refueling Cavity 16

Summary 22

Chronological Sequence of Events 25

Figure 1 Damaged Driveshaft 34

Figure 2 Damaged RCC 35

Table 1 List of Work Accomplished During Outage 37

Table 2 Periodic Tests Performed During Outage 42

Table 3 Inspections Performed During Outage 44

Attachment 1 Turbine Generator Work Summary

Attachment 2 Reactor Coolant Pump Maintenance

Attachment 3 Steam Generator Inspection and Repairs

Attachment 4 Resources Utilized During Outage

Attachment 5 Reactor Internals and Core Components Evaluation

INTRODUCTION:

The first H. B. Robinson refueling outage was scheduled for a six week period beginning on March 16, 1973. Major work to be accomplished consisted of unloading the entire core to the spent fuel pit for TV inspection; reloading the core with 53 new fuel assemblies; inspection and repair of steam generators; inspection and maintenance of the three reactor coolant pumps; replacement of both turbine low pressure rotors; inspection of the turbine and associated systems; inspection and rewedging of the generator; performance of reactor internals inspection and inservice inspection; work on approximately 104 miscellaneous maintenance items; calibration of plant instrumentation and controls; and performance of some 34 refueling interval periodic tests.

The actual work spanned 58 days exceeding the original schedule by 13 days. There were three distinct phases of the outage: work prior to flooding the refueling cavity, the refueling operation, and work following draining of the refueling cavity. Detail of the work accomplished at these times is related in the following sections. Turbine generator operations were accomplished in parallel with refueling work and are described in Attachment 1 of this report. Refer to the chronological sequence of events and tables 1-3 for an abbreviated description of the outage.

SECTION I

OUTAGE WORK PRIOR TO FLOODING REFUELING CAVITY

In preparation for refueling, filling and boration of the spent fuel pit was begun on March 14 and completed on March 17. The boration was accomplished utilizing portable heating and mixing equipment provided by Dow Chemical Co.

The inception of the outage occurred at 1:31 P.M. on March 16 when the plant was separated from the grid. The afternoon of March 16 was expended in performing AEC licensing startup tests. Weekend activities through March 18 consisted of performance of periodic tests requiring hot shutdown conditions; modification of the pressurizer cover lifting lugs; additions of permanent reactor system level indication piping; and establishing plant refueling shutdown conditions including injection of hydrogen peroxide, cooldown, and purification. The turbine generator disassembly was begun on March 18.

All work crews were on site by Monday, March 19. At this time the primary system was drained down, and work began in earnest on the primary systems and turbine generator. Transfer of new fuel from the new fuel storage building to the spent fuel pit was also begun on March 19. This initial transfer was completed by March 22. Work accomplished during the first week of the outage, March 19 through March 25, included the following:

a. Removal of the pressurizer safety valves for inspection and testing.

b. Disassembly of reactor coolant pumps "A" and "C" for inspection-See Attachment 2 for details.

c. Eddy current inspection of steam generator "A" tubes and ultrasonic inspection of steam generator "B" cladding-See Attachment 3 for details.

d. Reactor vessel head disassembly which included removal and storage of missle shield, resistance checks of CRDM's, disconnection of reactor head wiring, installation of instrument port protective sleeves, removal of ventilation ducts, removal of reactor vessel head insulation, and relaxing and removal of reactor vessel studs.

e. Check out of the refueling transfer system, fuel handling tools, and fuel manipulator crane.

f. Disassembly of main steam relief valves for installation of new internals.

g. Installation of spare excore source range detectors.

h. Preparation of the seal table for replacement of fixed detectors and thimbles.

i. Removal of insulation for inservice inspection and valve minimum wall thickness verification and commencement of inspection.

j. Disassembly of turbine and generator including removal of exciter, removal of crossover pipes, removal of generator rotor, and removal of low pressure rotors.

The above reference to the fuel transfer system checkout consisted not only of testing the system but also performance of modifications. The fuel manipulator crane was modified by the addition of gripper up-disengage circuitry which permitted movement of the crane when the gripper was disengaged and retracted a foot into the mast. Originally the gripper had to be fully retracted prior to crane movement. Another change to the manipulator was the addition of a tape measure to the gripper assembly to provide a redundant means of verifying that a fuel assembly was in full down position. This indication is in addition to the gripper slack cable light. The manipulator was then successfully test operated. The transfer mechanism was modified by the addition of dual locking collars to hold the main drive sprockets

securely in position. A checkout of the transfer carriage revealed that the emergency retraction cable was stopping the carriage prior to it making its full travel to the spent fuel pit canal. This problem was alleviated by relocating the cable catch on the carriage some 6 inches aft of its original location. This permitted full travel and also maintained the emergency retraction function. A problem was also experienced with the upender in the spent fuel pit. The motor operation of the upender was erratic and very rough. Investigation of the problem indicated that the mechanical brake was the source of trouble. There was also a slight misalignment problem. The brake was repaired and the upender operated satisfactorily. A spare motor was also obtained in the event that the problem reoccurred. Other portions of the refueling checkout proceeded without problems.

The eddy current testing performed during the week indicated two defective tubes in steam generator "A". The ultrasonic inspection of cladding in steam generator "B" revealed no cladding separation thus eliminating the possibility of an extended outage for cladding repairs.

The preparations made at the seal table were for replacement of eight failed fixed core detectors and two plugged moveable detector thimbles. Preps consisted of retracting the thimbles to clear the bottom of the core, cutting off the retracted section, plugging the end of the severed thimble with sealant, installing a valve stuffing box at the seal table to prevent leakage when the cavity was flooded, and inserting a 20 foot long push rod into the stuffing box. The removal operation to be performed when the refueling cavity was flooded would consist of pushing the thimbles up into the empty reactor core using the push rods. The thimbles were then to be pulled out the remaining distance using air operated vise grips. They would finally be cut up under water, placed in a special transfer basket, and transferred to the spent fuel pit for storage. After the cavity draining, the push rods would be removed, and the replacement items installed.

Reactor coolant pump "A" and "C" inspection indicated that seals 1 and 3 required replacement on both pumps. Due to past problems with oil leakage, gaskets were replaced on both oil sumps. Westinghouse recommended that the oil in the pumps be replaced with a different grade lubricant. This replacement oil was not immediately available. Therefore, while the oil was on order it was decided to leave the pumps disassembled setting on their casings and route the leakoff to the reactor coolant drain tank during the time the refueling cavity was flooded.

The first phase of the outage was brought to a close during the second week, March 26 through April 1. Work accomplished during this period is listed below.

a. Setting and sealing of reactor cavity sandplugs, nuclear instrumentation covers, and seal ring.

b. Installation of stud covers and guide studs

c. Check out of RCC change fixture

d. Unlatching of part length and full length rods

e. Removal of reactor vessel head, removal of reactor internals, and refueling cavity flooding.

f. Set up of refueling television cameras, skimmer, and refueling lights.

g. Condensate pump inspection

h. Emergency diesel inspection

i. Removal of turbine blade rings, charting of low pressure turbine rotors, disassembly of turbine valves, and removal of high pressure turbine rotor

j. Removal of generator wedges and stripping of phase leads (See Attachment 1 for details of inspection and repair)

k. Completion of inservice inspection

All preparations for reactor cavity flooding were completed by Tuesday, March 27. At 9:15 A.M. that day, the reactor head was initially lifted and flooding of the cavity begun. However, the flooding was aborted when leakage was detected in the reactor sump area. There were also minor leaks at the steam generator manway covers and the incore instrumentation seal table. Attempts to repair the leaks were completed, but a second attempt at flooding the cavity on the afternoon of March 27 was again unsuccessful due to leakage around the seal ring and sand plugs. Following repairs, the next attempt at head lift took place on Wednesday morning, March 28. Leaks still persisted at the seal ring around the vessel flange.

During resetting of the reactor head, to continue leakage repairs, a loud metallic noise was heard with the head at the 9 foot elevation. The head lowering was stopped, and investigation revealed that the control rod drive shaft in core position N-7 had failed to enter the reactor head thermal sleeve guide resulting in bending both the driveshaft and thermal sleeve guide extensively. (See enclosed figure 1 for clarification). In that the reactor vessel head could not now be set back on the vessel, it was decided to remove the head to storage, unlatch the full length driveshafts, remove the upper internals to storage, reset the head on the vessel, drain the cavity down, and repair the leaks in the cavity prior to proceeding with refueling. The water level in the cavity was brought up to the 10 foot level, lead shielding installed on the floor of the manipulator, and the above plan of action carried out. The bent driveshaft was unlatched via a short handled drive-shaft tool operated from a bosun's chair. The reactor vessel head was set back in place by Thursday morning, March 29.

Reactor cavity seals were remade on the seal ring and sand plugs, and the cavity successfully flooded on the afternoon of March 30. The clarity of the water was very poor due to the pumping of water back and forth to the refueling water storage tank during initial flooding attempts. The weekend work was spent in attempts to purify and filter cavity water and in installation of additional underwater lighting. The manipulator crane was also indexed during that time.

Removal of the condensate pumps during the week revealed deterioration of the first stage sections of both pumps. One pump was shipped back to the factory for repairs, and parts were ordered to repair the other pump on site.

Turbine generator inspections during the week indicated more work than was initially planned. Numerous cracks were detected in low pressure stationary blade rings, and cracks were found in two sections of the tenon cover on the high pressure rotor. Cracks were also discovered in some generator phase leads. Repairs were started on the cracked blading during the week. Charting of the low pressure number 1 rotor was successfully completed and charting of number 2 rotor begun.

With the cavity flooding all major primary system work was terminated, and the first stage of the outage was thus completed.

SECTION II

WORK DURING REFUELING OPERATIONS

Major work during the second phase of the outage consisted of fuel movement. Attention was also directed to secondary side maintenance and work on other systems not requiring primary system access. Work for the week of April 2 through April 8 is enumerated below.

1. Unloading of reactor core.
2. Manufacture of reactor vessel "O" rings within containment.
3. Disassembly and repair of circulating water pumps "B" and "C".
4. Performance of charging pump vent and drain modification.
5. Replacement of incore detector drives and encoders.
6. Repair of reactor head damaged thermal sleeve.
7. TV inspection of fuel assemblies.
8. Weld repair of turbine stationary blading, inspection of moisture separator reheaters, charting of low pressure rotor number 2, and rewedging of generator.
9. Internals inspection.
10. Plugging of leaking feedwater heater tubes.

Fuel movement was begun at 5:30 A.M. Monday, April 2. The first thimble plug that was attempted to be transferred was partially latched and could not be reinserted in a fuel assembly. Subsequently, the thimble plug was snared via a rope, unlatched, and tied off in cavity. The thimble plug was latter removed to the spent fuel pit as scrap along with the removed incore thimbles.

The clarity of the refueling cavity water did not improve significantly until April 4. Television cameras and high intensity lights were used in an effort to speed up fuel movement, but little headway was made until the water cleared. A portable filtration system with 200 GPM flow and 25 micron filters was installed on the evening of April 4 and conditions improved.

Problems also arose with the operation of the fuel manipulator crane. The gripper assembly operation became erratic on several occasions and would not latch or unlatch. These conditions were remedied by exercising the manipulator and checking it on a dummy fuel assembly when the problem occurred. A galling of the gripper assembly on the spent fuel handling tool occurred on April 6. The tool was freed up by lubricating with neolube. Due to the erratic tool operation and poor initial water clarity only 142 fuel assemblies had been removed from the reactor core by April 8.

On April 4 while attempting to transfer an RCC (R-04) from fuel assembly A-19, it was found that a vane and two rodlets had separated from the RCC spider hub. The fuel assembly and broken rodlet were transferred to the spent fuel pit where the rodlet was later examined using air operated vise grips and TV. The broken RCC was stored in the RCC charge fixture for further inspection. As a result of this failure all other RCC hub assemblies were inspected with TV equipment. No anomalies were observed in any other RCC's. Radiation measurements of the broken rodlets indicated that they had been in the full scram position in the core for a significant time. The calculated time the separated vane was in this position was about 8000 full power hours. No anomalies were observed in the control rod guide tube or in the braze joint at the hub. There were no positive indications as to the cause of failure, but it was most likely due to less than full strength of the braze joint. There was no evidence of excessive crud buildup or debris that might have caused abnormal loadings on the rod. This RCC (R-04) and the one in initial core position N-7 (RCC R-37) where the driveshaft was bent were replaced during core reload with new RCC's. (See figure 2 for view of failure)

Work was begun on April 5 on repair of the damaged thermal sleeve in the reactor head. This repair consisted of cutting the canopy seal at the rod travel housing with a special cutting tool; removing the rod travel housing; cutting the thermal sleeve below the sleeve stop and underneath the head; removing the damaged thermal sleeve from the underside of the head; installing a new thermal sleeve and welding in position; and reinstalling and welding the rod travel housing in place. Inspection of the reactor head and thermal sleeve area during repairs revealed no extensive damage other than the bent sleeve. The repair was completed on April 15.

Manufacture of three sets of reactor vessel "O" rings was completed during the week. Due to poor accessibility to the equipment hatch and the fact that the "O" rings as manufactured cannot be carried into containment through the personnel hatch, it has become necessary to complete final manufacture of the "O" rings within containment. This process consists of coiling the "O" ring material such that it could be carried into containment, making one weld on each "O" ring, and silver plating the weld. These operations were readily completed without delay or interference.

Disassembly of the two circulating water pumps revealed sections broken out of the flow deflectors on both pumps. This same condition had existed on the other pump and had been repaired in November, 1972. New sections were rolled and welded in place to repair the deflectors on "B" and "C" pumps. Additional braces were welded on the deflectors to add more support and preclude recurrence of the failure.

Work proceeded over the week on weld repair of the turbine stationary blading. Rewedging of the generator also continued during this time. Charting of the number 2 low pressure rotor was completed on April 2. Inspection of the moisture separator reheaters (MSR) revealed cracks in the baffling in all four MSR's. Work was begun on cutting out the old baffles and welding in thicker baffling. The decision was made to repair the cracked tenon covers on the high pressure rotor by grinding down the peened sections of the tenon, removing the cover, installing a new cover with undersized tenon holes, and repeening the covers in place.

Work for the fourth week of the outage, April 9 through April 15, is listed below:

a. Completion of core unload.

b. Burnable poison change out in spent fuel pit.

c. Completion of region 2 and 3 TV inspection (see table 3).

d. Inspection and repair of feedwater heater drain pumps.

e. Inspection and repair of service water pumps.

f. Installation of new residual heat removal flow orifice.

g. Completion of internals inspection (see table 3 and attachment 5).

h. Removal of incore thimbles.

i. Modification of non-regenerative heat exchanger.

j. Inspection and repairs of main steam isolation valves.

k. Lapping and reassembly of turbine control valves.

l. Installation of new turbine low pressure rotors and repair of high pressure rotor tenon covers.

m. Generator phase lead repairs and completion of generator rewedging.

n. Inspection of condenser

Fuel movement during the first part of the week was slowed up due to problems with the fuel manipulator crane. On Monday, April 9 with only 15 assemblies left in the core

the manipulator hoist motor locked up. The trouble was located in the brake contactor and corrected. However, problems still persisted with the manipulator and the gripper failed to operate on the morning of April 10. At that time there were 9 fuel assemblies still in the core. The problem was traced to a faulty air operator cylinder. Due to the problems experienced with latching the gripper, it was decided to pull the gripper assembly up through the crane mast and replace the gripper and air cylinder. When the gripper was removed, it was found that its guide pins were galled. This galling was surmised to result from crud buildup on the fuel assembly guide holes and misalignment due to fuel bowing. To alleviate this problem the guide pins on the new gripper that was installed were turned down undersize to provide more clearance. This operation was completed and the manipulator operational by the evening of April 11. The refueling cavity was not drained for this operation.

During the lull in fuel movement, TV inspection of all region 2 and 3 fuel assemblies in the spent fuel pit was completed. Also, a special tool was assembled, and the damaged driveshaft and guide tube cover removed from the upper internals. While awaiting final core unload, the burnable poison (BPRA) tool in the spent fuel pit was checked out and a leak detected on one of the air cylinders. The tool was removed from the spent fuel pit, and the faulty cylinder replaced.

Core unload was completed by 3:00 A.M. Thursday, April 12. TV inspection of region 2 and 3 fuel was completed, and the burnable poison change out begun. Two problems were experienced with the BPRA tool. Difficulty was experienced in inserting the tool into a BPRA insert. The tool was removed from the water and a burr found on one guide pin. This burr was polished off and operation of the tool proceeded. On the morning of

April 13, the hand crank on the BPRA tool froze up and the trouble was found in an excessively galled bushing. A new bushing of brass was machined and installed in place of the stainless unit. Two BPRA's could not be inserted into their inserts and were tied off in the spent fuel pit. The BPRA change out was completed at 9:47 A.M. on April 15.

In parallel with the work in the spent fuel pit area, work proceeded on removal of the 10 incore thimbles and the reactor internals inspection. The thimbles were removed by Saturday morning, April 14. The internals inspection which had been in progress since the inception of the core unload was completed Sunday, April 16. A special borescope inspection was performed on the guide tube in core position N-7 where the driveshaft was bent and no damage was noted. During the time that no fuel was being moved in the containment, a new hoist motor was installed on the manipulator crane. Another problem arose when the manipulator drive motor failed to operate. The trouble was found in the control circuitry and a new resistor and SCR were installed to remedy the situation.

The feedwater drain pumps and the service water pumps were disassembled during the week and inspected. A defective weld was repaired in drain pump "A". A faulty bearing was replaced in the "B" service water pump.

The non-regenerative heat exchanger shell was removed on April 10 and a modification performed. This change consisted of the addition of a support in the U-bend section of the tube bundle to prevent vibration induced tube failures.

Rewedging of the generator was completed on April 12, and generator phase lead repairs begun on April 14. The turbine low pressure rotor number 2 was set in place on Wednesday, April 11 and the number 1 rotor installed on April 13. Work then proceeded on installing the low pressure inner cylinders. Work continued on MSR repairs and the high pressure tenon cover repair. Inspection of the condenser was performed during the week and a cracked thermal sleeve, cracked steam dump valve support straps, and several tubes requiring plugging were discovered.

All work critical to beginning core reload was completed by Sunday, April 15 and the final week of the second stage of the outage was begun on April 16. The work accomplished during this fifth week, April 16 through April 22, is summarized below:

a. Core reload.

b. Removal of irradiated sample.

c. Modification of residual heat removal heat exchanger.

d. Installation of loop RTD restraints.

e. Installation of upper internals.

f. Installation and latching of driveshafts.

g. Addition of feedwater thermal sleeve at junction of auxiliary feedwater line and main feed line in containment.

h. Modification to provide regenerative heat exchanger overpressure protection.

i. Installation of low pressure turbine covers and completion of high pressure rotor tenon repairs.

j. Completion of generator phase lead repairs and retying and insulation of generator.

Core reload was begun at 3:00 A.M. on Monday, April 16. Problems were experienced with the spent fuel handling tool galling again. Also, the chain drive on the manipulator crane index system broke. While the chain was being replaced, the spent fuel tool was test operated on the dummy fuel assembly and became lodged in a fuel storage rack. To extricate the tool it was required to cut the rack with remotely operated shears. The gripper assembly on the tool was subsequently replaced, and no further problems were experienced with the operation of refueling tools.

Loading of the core was slowed somewhat by bowing of some region 2 and 3 fuel assemblies. The refueling sequence was altered to set these assemblies to the side of the core, and then box their locations in with adjacent fuel assemblies prior to insertion of the bowed assemblies. The reload was completed at 6:17 P.M. Saturday, April 21. Core locations were then verified via TV.

The irradiated sample specimen was removed with difficulty on Sunday, April 22. This was followed by reinstallation of the upper internals, replacement of 5 control rod driveshafts determined to be excessively bowed during the internals inspection, and latching of the driveshafts.

During the week, the "A" residual heat removal heat exchanger shell was removed and the tube bundle modified. This change consisted of adding additional support in the U-bend area and installing stainless steel strips in the straight runs. This is intended to prevent vibration induced failures. Attempts to isolate heat exchanger "B" were unsuccessful, and due to the time involved it was not modified.

Another modification begun was the addition of thermal sleeves at the junction of the auxiliary feedwater lines and the three main feedwater lines. This change was made due to past problems with cracks developing in the joint due to thermal stresses. This modification was begun on April 16 and completed May 4.

Yet another system change accomplished during the week was the addition of a 3/4" bypass line around valve CVCS 310A to provide overpressure protection of the regenerative heat exchanger. This protection was originally provided by valve 311 which would lift when excessive pressure existed on the valve disc. This arrangement proved unsatisfactory due to excessive back leakage through the valve. This modification is intended to correct this problem.

Both low pressure turbine cover sections were set in place during the week and bolting up operations continued. Generator retying and insulating also continued. MSR repairs proceeded throughout the week, and high pressure rotor tenon machining and non-destructive testing was completed.

With the draining of the refueling cavity and setting of the reactor vessel head in place on Monday, April 23, the second phase of the outage was completed.

SECTION III

WORK FOLLOWING DRAINING OF REFUELING CAVITY

The reactor head was set in place by 8:00 A.M. Monday, April 23. Cavity decontamination was then begun in preparation for reassembly of the reactor vessel head. With the refueling cavity drained, work resumed on the final stages of maintenance involving the primary system. Some two weeks of work remained prior to beginning start up testing. Work items accomplished during this period are listed below:

a. Removal of inner containment air lock door, refurbishment, and reassembly.

b. Final eddy current and ultrasonic inspection of steam generators and explosive plugging of two tubes in steam generator "A."

c. Assembly of reactor coolant pumps "A" and "C" and inspection and required maintenance of reactor coolant pump "B."

d. Setting of high pressure turbine rotor in place and continuance of turbine assembly.

e. Completion of moisture separator reheater repairs and condenser repairs.

f. Reassembly of reactor vessel head.

g. Installation of generator rotor and reassembly of generator.

h. Completion of region "A" fuel assembly TV inspection.

i. Installation of new incore thimbles and fixed detectors.

j. Reassembly of condensate pumps.

k. Repair of residual heat removal isolation valve RHR 750.

l. Modification of pressurizer spray valves 455A and 455B.

m. Replacement of defective excore detectors.

Once the refueling operation was completed, containment integrity was no longer

required. At that time, the inner containment personnel air lock door was removed and returned to the factory for refurbishment of its contact surface. Difficulties had been experienced with proper sealing of the door, and the operating mechanism did not operate smoothly. The door was reinstalled, and the operating mechanism overhaul completed by April 29.

Removal of the reactor guide studs and stud covers, and lifting of the cavity seal ring and nuclear instrumentation excore covers proceeded without delay. However, final tensioning of the reactor studs was held up somewhat as the temperature of the reactor head was slowly raised and stabilized above the minimum required torqueing temperature of 90°F. The stud installation was finally completed by Monday, April 30. Reactor head insulation installation was also completed at that time.

While relatching part length rods, a low resistance reading was found on a part length stator in core position F-10. Rod position indicator coils were removed around the defective stator, and a new stator was installed. This replacement was completed on Tuesday, May 1. In parallel with this repair, all instrument port and part length conoseals were installed. Final head assembly including installation of ventilation and wiring and setting of the missile shield was completed by Saturday, May 5.

When the water level in the primary loop piping was lowered to the maintenance level, the steam generator manways were removed and preparations were made for resumption of the inspections. Eddy current inspection of steam generator "A" was begun on Monday, April 23, and inspection of steam generator "C" was begun in parallel on April 24. Ultrasonic inspection of the tube sheet cladding of steam generators "A" and "C" was performed on April 24, and revealed no further cladding

deterioration or failure of the repaired sections. Steam generator "B" eddy current inspection was begun on April 26. All these inspections were completed by Tuesday, May 1, and no other deteriorated tubes were detected. Essentially, 100% of the tubes on the inlet side up to the first tube bundle supports were inspected in all three steam generators. The two defective tubes in steam generator "A" that were found during the first stage of the outage were explosively plugged on Wednesday, May 2. One of these tubes (75% indication) had shown up on the eddy current inspection performed in 1972, but the data had been misinterpreted at that time. The data obtained during this outage indicated that the tube had not deteriorated any since the last inspection. This indicates that the improved control of plant chemistry and continuous blowdown has arrested the tube failures.

Other major work within containment, involved reassembly of reactor coolant pumps "A" and "C" and disassembly and inspection of reactor coolant pump "B." Seals 1 and 3 were replaced in pump "B" as they were in the other two pumps. All three pumps were reassembled and wired up by Sunday, April 29.

Turbine generator work proceeded to the final stages of assembly. A feeler blade inspection between the peened sections of the high pressure rotor tenons and tenon covers indicated that there was not a flush fit at these points. Consequently, all the tenons were repeened prior to installing the rotor. The high pressure rotor was then set in place on Tuesday, April 24. The generator rotor went back in position on Thursday, April 25. Moisture separator reheater repairs were completed on April 24, and all condenser repairs were finished by May 4.

Steam cuts were detected on the main steam stop valve stems during their inspection.

New seal rings were machined with a tighter tolerance than the stock rings in order to seal the stems. These new rings were installed and the valves assembled on May 4. New stems are on order and will be installed when available.

The installation of new incore thimbles and detectors was begun on Saturday, April 28. All connections and a check out of the system was completed on Thursday, May 3. Two power range excore detectors (N-41 and N-44) were also replaced during this time period.

The residual heat removal isolation valve, RHR 750 (14" double gate valve), presented a unique problem in isolation for maintenance purposes. The valve is located below the centerline of reactor loop piping, and there is no isolation valve between it and the loop. To work with the valve, it was necessary to drain the primary piping below the loop nozzles. This of course resulted in the loss of RHR flow, and the resultant build up of heat in the reactor core. In order to determine the decay heat build up during such an operation, a preliminary test was run while monitoring core thermocouples and source range instrumentation. It was found that the system could be isolated some 4 hours. The valve was then successfully worked while monitoring the above instrumentation. The valve disc was removed from the stem, the bonnet set back in place, and the RHR flow re-established to cool the core. The valve lower gate retainer was replaced to correct the seat leakage problem. The level was once again lowered, the valve bonnet removed, and the valve finally reassembled.

An important modification performed during the last stage of the outage was the conversion of the pressurizer spray valves, 455A and 455B to a bellows seal arrangement. Numerous packing leaks resulting in forced outages had previously

occurred with the originally installed valves. It is hoped that the addition of the bellows seal and the redundant packing will provide a more reliable valve stem seal and prevent any outages for future stem leakage repairs.

The reassembly of plant systems was drawing to an end by the weekend of May 5 and 6. During that weekend, the steam generator secondary side hydrostatic test was completed and the primary system was closed. The sandplugs over "B" reactor loop piping were removed and the insulation inspected for wetting as a result of leakage during refueling operations. A section of insulation was also removed from the reactor vessel for inspection. No residual boric acid accumulation was noted in these areas. Filling and venting of the primary system was completed early Tuesday, May 8 and leaks were detected at one instrument port connection and nine fittings at the incore instrumentation seal table. These leaks were corrected, and cold start up tests were begun on Wednesday, May 9.

The turbine generator was also proceeding concurrently with the completion of the primary side work. A turbine oil flush was completed on Monday, May 7. The generator air test was started that day and finished Wednesday, May 9. The turbine was placed on turning gear Tuesday, May 8. Final assembly of the exciter and the hydrogen cooler systems was completed by Wednesday, May 9. With the turbine on turning gear Wednesday morning, a high pitched noise developed at the governor end of the number 1 low pressure section. This noise was traced to the turbine rotor bearings. Subsequently, all low pressure turbine bearings were removed and their surfaces scraped and trued. Bearings number 3 and 5 seemed to be the source of the noise, and all repairs were completed by Saturday, May 12. The weekend of May 12 and May 13 was spent in completing work on the turbine electro-hydraulic control system.

Cold start up tests were completed Friday, May 11. A primary system hydrostatic test and boric acid leakage inspection were performed Saturday, May 12. This was followed by initiation of hot start up tests which were completed Sunday, May 13. Initial criticality was then achieved at 4:27 P.M., Monday, May 14. Then following a day of turbine telemetry tests and zero power physics testing, the plant was put on the line Wednesday, May 16. Thus the outage was officially concluded with the only remaining work being completion of power increase physics testing and final turbine balancing.

SUMMARY

The first week of the outage proceeded on schedule. There was some time lost in orienting contract workers and setting up for steam generator eddy current testing. However, the actual work was performed without delay.

Work first began to lag behind schedule in the second week. The reactor coolant pumps reassembly was not completed as originally planned due to a change in motor oil which had not been anticipated and was not readily available. This did not delay refueling operations as the pumps were left setting on their casing and seal leakage was routed via temporary hoses to the reactor coolant drain tank. Time was lost when the refueling cavity was not successfully sealed and four repair attempts were required before the leakage was controlled. An unscheduled repair developed during this period when a control rod drive shaft and reactor head thermal sleeve were bent in the process of setting the reactor head in place. The required repair was later performed off critical path. Once the refueling cavity was flooded a two day delay resulted due to poor water clarity. This condition was apparently the result of the stirring up of the refueling water supply on the several aborted flooding attempts. The condition was corrected during the following week with the addition of a portable filtration system. The turbine generator overhaul also experienced some delays during the week. Unscheduled work was required to repair cracks in the turbine stationary blading and the generator phase leads. This work was not finally completed until near the end of the outage.

The first fuel assembly was moved on Monday of the third week of the outage. The unload proceeded slowly as operators required some time to become accustomed to manipulating the refueling tools. The manipulator crane also performed erratically

and eventually required repairs prior to completing core unload. During the unload a broken control rod was detected. This rod was replaced during the core load and did not result in any significant delay. The core was finally unloaded on Thursday of the fourth week of the outage.

Further unanticipated problems developed involving the turbine generator work when two cracked tenon covers were detected on the turbine high pressure rotor. Also broken deflector plates were discovered in the moisture separator reheaters. The required repairs were made without major delays.

The work performed during the weekend of the fourth week was expedited and timely completed in order that core reload could begin on the fifth outage week. Work performed during this weekend included the burnable poison rod change out, incore thimble removal, completion of reactor head repairs, and reactor internals inspection. Work on the turbine generator also proceeded very well during this week with all repair problems being resolved and no further repair items developing. Both low pressure turbine rotors were set in place during the week.

The core reload was begun the fifth week of the outage. The operation was delayed somewhat during the initial stages due to recurrent problems with the spent fuel handling tool and manipulator crane. These items were repaired, and the reload proceeded without further delays except for problems with insertion of some bowed fuel assemblies. The reload procedure was changed to accomodate the placement of these assemblies.

During the fifth week turbine work proceeded to this reassembly stage. Also attention was concentrated on completion of secondary side work and modifications during this latter portion of the outage.

Core reload was completed on Saturday, April 21 some five weeks into the outage. The sixth and seventh weeks were then spent in major reassembly involving the turbine generator and the reactor vessel head. Also final primary plant maintenance involving reactor coolant pumps, pressurizer spray valves, steam generator inspection, and residual heat removal valve was resumed during this period.

The test program phase of the outage was initiated during the eighth week. These tests revealed certain areas requiring final adjustment or replacement of items to meet specifications. This work proceeded to the initial criticality stage on Monday, May 14, 58 days following shutdown. The plant was then back on the grid by Wednesday, May 16.

CHRONOLOGICAL SEQUENCE OF EVENTS

March 15 (Friday)	Shutdown for refueling outage
March 18 (Sunday)	Completed Spent fuel pit fill and began turbine-generator disassembly
March 19 (Monday)	Started new fuel movement to spent fuel pit, commenced head stripping, and started calibration work
March 20 (Tuesday)	Removed pressurizer safety valves for inspection & testing, removed SG "A" & "B" manways, disassembled main steam PORV, started disassembly of RCP "A" & "C", checked stud tensioners, started fuel transfer system modifications and checkout, and began preparations for inservice inspection.
March 21 (Wednesday)	Installed spare NIS source range detectors, removed exciter, removed turbine low pressure covers, and ultrasonically inspected cladding in SG "B".
March 22 (Thursday)	Disconnected CRDM's, started eddy current inspection of SG "A", ran resistance checks on CRDM's, disconnected seal table thimbles, and completed moving new fuel to SFP.
March 23 (Friday)	Installed instrument port protective sleeves, repaired up-ender in spent fuel pit, and began removal of reactor vessel studs.
March 24 (Saturday)	Prepared seal table for thimble replacement, began RCP motor inspection, removed turbine low pressure rotor No. 1, and pulled generator rotor.

March 25 (Sunday)	Completed reactor vessel stud removal, completed SG "A" eddy current inspection (found two deteriorated tubes), removed turbine low pressure rotor No. 2, retracted incore thimbles, completed partial RCP reassembly (awaiting parts for final assembly - pumps are uncoupled setting on casing and leakage through leakoff lines is channeled to reactor coolant drain tank), and pulled loop "A" sand plugs for inservice inspection.
March 26 (Monday)	Installed sand plugs, studhole covers, guide studs, and seal ring; found broken phase leads in generator; started TV installation and unlatched part length rods.
March 27 (Tuesday)	Completed fuel transfer checkout, started emergency diesel maintenance, finished closure of SG manways, started wedging of generator, started cavity flood and head lift at 9:15 A.M. and 5:00 P.M. (was aborted on both attempts to repair leaks)
March 28 (Wednesday)	Lifted reactor vessel head at 3:30 A.M. (leaks persisted), bent control rod driveshaft in position N-7 when setting head back in place, raised water level to 4 feet and removed head at 11:15 A.M. to proceed with internals removal, unlatched full length control rods (unlatched bent driveshaft using short handled tool), found cracks in turbine low pressure blade rings during their removal, and set new turbine low pressure No. 1 rotor in place to begin charting.

March 29 (Thursday)	Removed upper internals to storage, completed inservice inspection, completed turbine LP-1 charting, completed turbine valve disassembly, and set head back in place and lowered water level to continue with attempts to repair seal ring leakage.
March 30 (Friday)	Flooded cavity (still have slight leak) and removed head to storage, removed turbine high pressure rotor, set turbine LP-2 in place for charting, received AEC license to move fuel, completed refueling TV installation, and started weld repair of turbine blade rings.
March 31 (Saturday)	Cavity water clarity very poor, installed additional lighting in cavity, installed cavity skimmer, and indexed manipulator crane.
April 1 (Sunday)	Began condensate pump maintenance, started manufacture of reactor vessel "O" rings inside containment, and continued cavity water purification.
April 2 (Monday)	Moved first fuel assembly at 5:30 A.M.; had problem latching first thimble plug and tied it off in cavity with rope; had difficulty latching manipulator gripper; completed charting LP No. 2; and shipped turbine blade ring for repairs.
April 3 (Tuesday)	Started circulating water pump maintenance, detected two cracked shrouds on turbine high pressure rotor, found broken baffles in moisture separator reheaters, and began charging pump vent and drain modification.

April 4 (Wednesday) Completed disassembly of main steam stop valves, discovered two rodlets and vane broken off of control rod R-04 while making RCC change, completed condensate pump disassembly, hooked up additional filtration on refueling cavity, and began replacement of incore detector drives and encoders.

April 5 (Thursday) Completed turbine low pressure blade ring repairs, completed removal of moisture separator reheater baffles, started repairing reactor vessel head damage sustained when driveshaft was bent, and began TV inspection of fuel

April 6 (Friday) Reassembled main steam PORV, ultrasonic inspected generator phase leads, and found more cracks in LP No. 2 blade rings.

April 9 (Monday) Manipulator brake locked up and was repaired, completed circulating water pump work; started installing turbine LP No. 2 lower blade rings; started turbine HP shroud repair; and completed reactor vessel "O" ring manufacture.

April 10 (Tuesday) Completed emergency diesel work, started non-regenerative heat exchanger modification, manipulator gripper failed to operate (pulled gripper from mast and replaced gripper and air cylinder), completed incore instrumentation hardware replacement, and removed damaged driveshaft from upper internals.

April 11 (Wednesday) — Set turbine LP No. 2 in place, repaired damaged cylinder on BPRA tool, found cracked thermal sleeves & steam dump supports in condenser, completed manipulator repairs, completed non-regenerative heat exchanger modification, and started feedwater heater drain pump work.

April 12 (Thursday) — Completed core unload at 3:00 A.M., completed wedging of generator, started BPRA change out, inspected guide tube location where driveshaft was bent, and started removal of incore thimbles.

April 13 (Friday) — Replaced bushing on BPRA tool hand crank, installed new RHR flow orifice, set turbine LP No. 1 in place, started stretching bolts on turbine LP No. 2 outer cylinder, and completed all turbine weld repairs.

April 14 (Saturday) — Completed incore thimble removal, started generator phase lead repairs, turbine blade ring repaired at factory returned to site, proceeding with internals inspection, and started stretching turbine LP-1 inner cylinder bolts.

April 15 (Sunday) — Completed BPRA shuffle, completed reactor vessel head repair, installed new manipulator hoist motor, and completed internals inspection.

April 16 (Monday) — Started fuel reload at 3:00 A.M., problems with spent fuel handling tool, completed turbine HP shroud repair, chain drive on manipulator broke and was repaired, and started feedwater thermal sleeve modification.

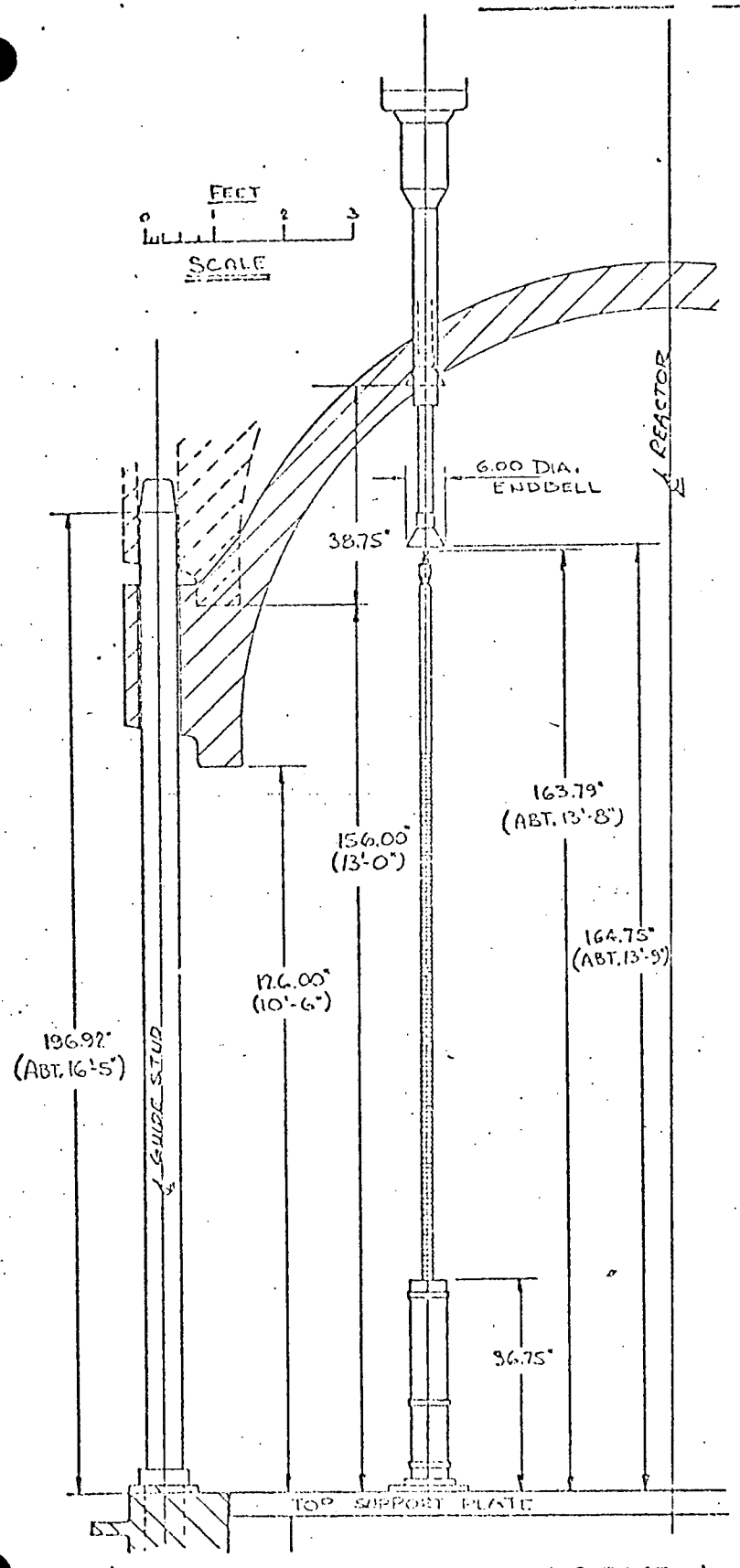
April 17 (Tuesday)	Installed new gripper head on spent fuel handling tool, removed foreign objects from fuel, and removed RHR heat exchanger shell.
April 19 (Thursday)	Set turbine low pressure covers in place, completed feedwater heater drain pump repairs, installed loop RTD restraints, received replacement RCC & inserted in new fuel assembly, and re-examined some inservice inspection areas
April 20 (Friday)	Started RHR heat exchanger modification and installed reactor vessel "O" rings.
April 21 (Saturday)	Completed core reload at 6:17 P.M. and verified core positions via TV.
April 22 (Sunday)	Removed irradiated sample, installed upper internals, replaced 5 driveshafts, and latched full length rods.
April 23 (Monday)	Drained cavity and set reactor vessel head back in place, removed inner containment air lock door for refurbishment, began cavity decon, and started eddy current inspection of S.G. "A".
April 24 (Tuesday)	Started reassembly of RCP's "A" and "C", started disassembly of RCP "B", performed regenerative heat exchanger over-pressurization modification, completed turbine HP rotor tenon repeening and set rotor in place, completed turbine control valve reassembly, completed moisture separator reheater baffle repairs, ultrasonic inspected cladding in SG's "A" and "C", started TV inspection of fuel in spent fuel pit, completed removal of stud covers & guide studs, started reactor vessel stud installation, and began eddy current of SG "C".

April 25 (Wednesday)	Completed inspection of S. G. "A", cut irradiated sample and shipped, ran HiPot on generator, completed RCP "A" reassembly, and completed RHR heat exchanger modification.
April 26 (Thursday)	Began eddy current inspection of S. G. "B", set turbine H. P. cover, installed generator rotor, and completed UT inspection of region "A" fuel.
April 27 (Friday)	Reassembled main steam stop valves, completed cavity decon, started reassembly of containment air lock, started maintenance on valve RHR 750 to correct seat leakage, and started turbine crossover installation.
April 28 (Saturday)	Completed RCP "C" assembly.
April 29 (Sunday)	Started installation of new fixed incore detectors and thimbles, completed reassembly of RCP "B", and completed RHR 750 work.
April 30 (Monday)	Completed tensioning reactor vessel studs, latched part length rods, began pressurizer spray valve modification, completed turbine crossover installation, and installed part length conoseals and insulation.
May 1 (Tuesday)	Replaced defective part length stator, completed steam generator inspection, and installed instrument port conoseals.
May 2 (Wednesday)	Explosively plugged two tubes in S. G. "A", installed transfer tube flange, replaced defective NIS detectors, and completed all turbine bolt stretching.
May 3 (Thursday)	Installed reactor ventilation, made final check of incore instruments, flushed turbine EH control system, and re-installed pressurizer safety valves.

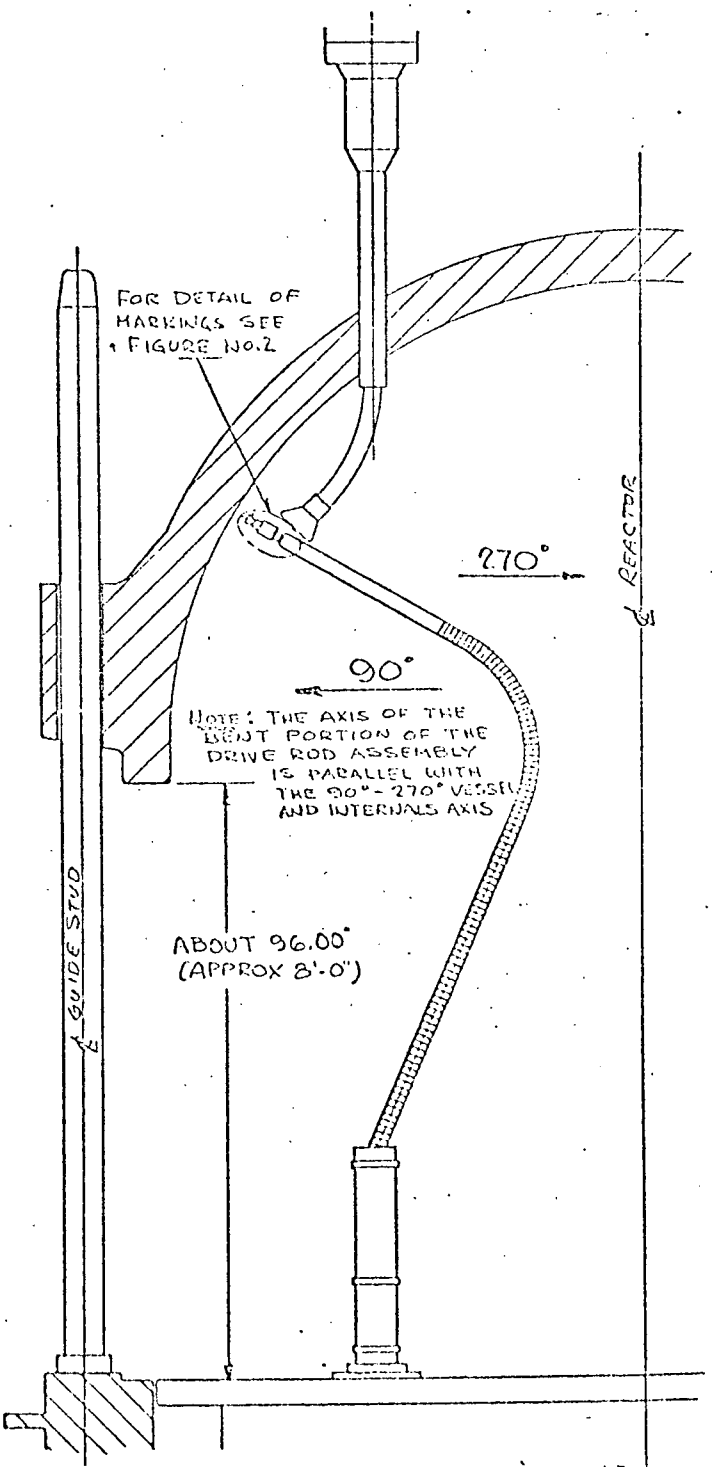
May 4 (Friday)	Installed head wiring, reassembled main steam stop check valves, completed condenser repairs, completed pressurizer spray valve modification, and completed feedwater thermal sleeve modification.
May 6 (Sunday)	Completed S. G. secondary hydrostatic test and flushed turbine lube oil system.
May 7 (Monday)	Install S. G. primary manway covers, started generator air test, coupled exciter & generator, and inspected around reactor vessel for traces of boric acid.
May 8 (Tuesday)	Filled and vented primary system, repaired small leaks, and put turbine or turning gear.
May 9 (Wednesday)	Began cold startup tests, detected noise in low pressure end of turbine, and adjusted RCP "C" to get proper seal leakoff flow.
May 10 (Thursday)	Investigated noise in turbine and found problem in bearings (bearings were inspected and their surfaces trued up)
May 11 (Friday)	Replaced defective rod position indicator coil and set reactor missile shield.
May 12 (Saturday)	Performed primary system hydrostatic test and boric acid leakage inspection, and began hot startup tests.
May 13 (Sunday)	Completed condenser tube plugging and closed condenser, performed main steam safety valve test, and completed hot startup tests.
May 14 (Monday)	Achieved initial criticality at 4:27 P.M.

FIGURES

DAMAGED DRIVESHAFT



VESSEL HEAD AND REACTOR INTERNALS RELATIONSHIPS, AT THE 10'-6" AND 13'-0" "HEAD LIFT" ELEVATIONS. (THE DRIVE LINE AT CORE LOCATION N-7 IS ILLUSTRATED)



THEORIZED RECONSTRUCTION OF THE N-7 DRIVE LINE INCIDENT, ILLUSTRATING THE DAMAGED COMPONENTS AS MEASURED BY BEST VISUAL ESTIMATE

FIGURE No. 1

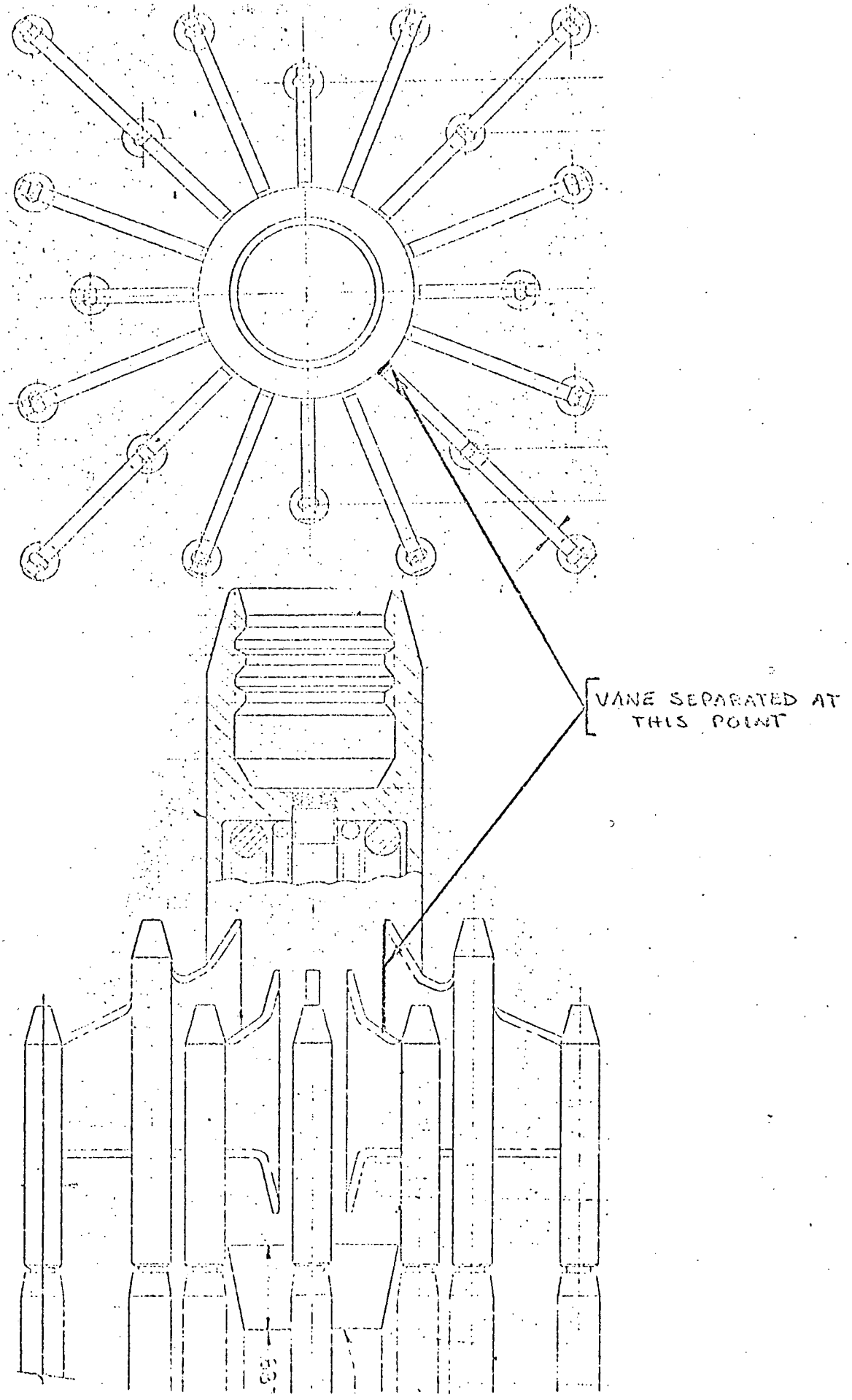


FIGURE 2

DAMAGED R.C.C

TABLES

TABLE I

LIST OF WORK ACCOMPLISHED DURING OUTAGE

PRESSURIZER

Spray Valve Modification (455A & B)

Inspect and Test Safety Valves

Packed Pressurizer Spray & Mini-spray Valves

STRUCTURES

Modify Pressurizer Cover Lifting Lugs

Polar Crane Venting Modification

Crane Checkout and Inspection

Overhauled Personnel Air Lock

General Cleaning and Painting of Containment Floors

REACTOR COOLANT SYSTEM

Reactor Coolant Pump Maintenance

Replaced Three RTD's

Installed Permanent RV Level Piping

Installed Eductor

Installed Cavity Skimmer and Filtration

Installed RTD Restraints

Repaired Damaged Reactor Vessel Head Thermal Sleeve

Replaced Five Control Rod Driveshafts

Removed Irradiated Sample from Reactor Vessel

NUCLEAR INSTRUMENTATION

Replaced Defective Incore Thimbles

Installed Spare NIS Source Range Detectors

Cleaned Thimble Conduit in Sump and Install New Hangers

Inspected Incore Thermocouple Junction Box Temperature Control

Installed New Fixed Incore Detectors

Installed New Moveable Detector Drives and Encoders

Replaced Defective Excore Detectors

SAFETY INJECTION SYSTEM

Spray Pump Undervoltage Modification

Completed SI Hot Leg Injection Modification

Steam Break ΔP Modification

Refurbished Valves 868, 869, and 870's

EMERGENCY DIESELS

Inspect Diesels & Generators

STEAM GENERATORS

Eddy Current Inspected Tubes

U. T. Inspected Cladding

U. T. Girth Weld

Plugged Two Tubes in SG "A"

Inspected SG Secondary Side Tubesheet with Fiberscope

RHR SYSTEM

Installed New Orifice

Modified Heat Exchanger "A"

Repaired Valve 750 Seat Leakage

Modified Position Switches on Valves RHR 750 and 751

MISCELLANEOUS PRIMARY SIDE ELECTRICAL WORK

Installed Containment Pressure Transmitter

Installed Fuse Block for Waste Disposal System

Modified CRDM Wiring

REFUELING SYSTEM

Modified Manipulator Crane

Modified Transfer System

Established Communications

Assembled Irradiation Tool & Provided Storage

Replaced Head of Spent Fuel Handling Tool

Replaced Gripper and Air Cylinder on Manipulator

Replaced Air Cylinder on Burnable Poison Tool

COMPONENT COOLING SYSTEM

Converted CCW 735 to MOV

Repaired CCW Inlet Flange Leakage at "B" RHR Heat Exchanger

CHEMICAL AND VOLUME CONTROL SYSTEM

Modified Charging Pump Vents & Drains

Repaired CVCS 2½ Flange Leakage

Regenerative Heat Exchanger Modification

Non-Regenerative Heat Exchanger Modification

CVCS Holdup Tank Recirc. Modification

Install BA Blender Flow Transmitter

Repaired Volume Control Tank Level Alarms

Replaced 2½ Valve Internals

SERVICE WATER SYSTEM

Repaired Leakage at "B" CCW Heat Exchanger Outlet

Replaced Service Water Booster Pump Motors

TURBINE GENERATOR

Replaced LP Rotors and Repaired Cracked Blade Rings

Inspected HP Section and Replaced Section of Shroud

Inspected & Rewedged Generator

Maintenance on Main Stop & Control Valves

Inspected Reheat & Intercept Valves

Renewed Turbine Thermocouples

Adjusted Exhaust Hood Spray

Repaired Eccentricity Pickup

Checked Turbine Low Vacuum Alarm

Checked EH Control System

Inspected Exciter Air Temperature Control

Inspected H_2 Cooling System

Repaired Cracked Phase Leads

MAIN STEAM

Installed New Internals in PORV RVI-1,2,3

Removed Atomospheric Dump Valves

Repaired Damaged Moisture Separator Reheater Baffles

Repaired Main Steam Isolation and Stop Check Valves

Began MSR Drain Tank Modification

Repaired MS Safety Valves Seats

Installed Indicator Wiring on MS Isolation Valves

FEEDWATER SYSTEM

Installed Seal On "C" Feedwater Check Valve

Repaired Leaks at Auxiliary Feedwater Pump Discharge to Main Feed Piping

Connected Auxiliary Feedwater Pump Discharge Into Condensate Storage Tank

Repaired Feedwater Pump Couplings

Plugged Leaking Tubes in Feedwater Heaters

Installed Auxiliary Feedwater Thermal Sleeves

MISCELLANEOUS SECONDARY SIDE WORK

Overhauled Heater Drain Pumps

Retubed Vacuum Pump Vacuum Switches

Packed Numerous Valves

Repair "A" Vacuum Pump Oil Leakage

Weld Repaired Circulating Water Pumps

MISCELLANEOUS ELECTRICAL WORK

Replaced Circuit Breaker on C-Phase Transformer

Inspected and Cleaned Load Centers

Instrument Bus Inverter Modification

Installed High Level Alarm on "5B" Feedwater Heater

Modified MCC-4

Changed Turbine Emergency Oil Pump From MCC-5 to MCC-6

Installed Reactivity Computer

Installed Startup Rate Meter on RTGB

Installed Rod Position Indicator Surge Suppressor

Installed Refueling Water Storage Tank High Level Alarm

CONDENSATE SYSTEM

Inspected Condenser, Repaired Cracked Internal Supports, & Plugged Leaking Tubes

Repaired Condensate Pumps

TABLE 2

PERIODIC TESTS PERFORMED DURING OUTAGE

PT NO.	TITLE
2.1	Safety Injection and Emergency Diesel Test
2.3	Accumulator Check Valve Leakage
2.4	Safety Injection Hot and Cold Leg Check Valve Leakage
2.5	Accumulator Check Valve Operability
2.6	Isolation Valve Seal Water System
3.1	Containment Spray System
4.0	Service Water System
5.0	I & C Calibration Checklist
6.1	4 KV Bus Underfrequency
7.2	Boric Acid Blending System
12.2	Radiation Monitoring System
13.0	Emergency Control Station Tests
15.1	Turbine Trip Setpoints
16.2	Containment Vessel Sensitive Leak Rate and Penetration Pressurization System
16.3	Containment Isolation Valve Tests
18.0	Chemical and Volume Control Holdup Tank and Pump Test
18.1	Waste Sump Tank and Pumps
21.1	Control Rod Drop Test
23.2	Emergency Diesel Auto Start with Safety Injection
23.3	Emergency Diesel Field Flash

PT NO.	TITLE
24.0	HVAC Fans and Filters
25.1	Pressurizer Safety Valves
25.2	Main Steam Safety Valves
25.3	Main Steam Stop Valve Test
26.0	Refueling System Interlocks
27.0	Post Accident Hydrogen Venting and Containment Sampling System

MISCELLANEOUS TESTS

1. Residual Heat Removal System Flow Measurement
2. Flow Verification of Safety Injection System
3. Steam Generator Secondary Hydrostatic Test
4. Steam Generator Differential Pressure Test
5. Primary System Hydrostatic Test
6. Inspection for Boric Acid Leakage
7. Spent Fuel Pit Alarms Test
8. Start-Up Tests
    a. Control Rod Mechanism Timing
    b. Cold Rod Drop Tests
    c. Rod Position Indication Tests
    d. Rod Control Tests
    e. Hot Rod Drops
    f. Initial Criticality
    g. Boron Dilution and Addition
    h. Design Check Tests
    i. Power Level Increase Physics Tests

TABLE 3

INSPECTIONS PERFORMED DURING OUTAGE

I. FUEL INSPECTION

1. Extent of inspection

A. Binocular inspection of all fuel during core unload

B. TV inspection of periphery of all four sides of every fuel assembly in spent fuel pit.

2. Results of Inspection

A. List of Anomalies Observed During Fuel Inspection

Assembly ID Number	Face	Rod Number(1)	Axial Location(2) (2)(Between grids ___ and ___)	Description of Anomaly
A01				None
A02	90°	1	4-5	Collapse
		3	5-6	Collapse
		6	5-6	Collapse
	180°	4	5-6	Collapse
A03				None
A04	180°	9	5-6	Collapse
A05	180°	2	5-6	Collapse
	180°	14	5-6	Collapse
A06	270°	6	5-6	Collapse
	180°	13	5-6	Collapse
	90°	13, 14, 15	5-6	Bright area, scratches
A07	270°	1	5-6	Collapse
	270°	7	6-7	Collapse
	270°	10	5-6	Collapse
A08	180°	9	4-5	Collapse
A09	270°	10	4-5	Collapse
	0°	4	5-6	Collapse
	90°	3	5-6	Collapse
A10	270°	2	5-6	Collapse
	90°	12	5-6	Collapse
	180°	7	5-6	Collapse
	270°	2	2-3	Circumferential failure
A11				None
A12	0°	4	5-6	Collapse

(1) Left to right on designated face.

Note: Horizontal lines are for reading clarity only and do not separate assemblies.

Assembly ID Number	Face	Rod Number (1)		Axial Location (2)	Description of Anomaly
	0°	4		1-2	Bowed, failed rod
	180°	14		5-6	Collapse
	180°	14		2-3	Slight deformation
A13	0°	10		6-7	Collapse
	0°	10		3-4	Bow, apparent blister
A14	0°	2		5-6	Collapse
	0°	11		4-5	Collapse
A15	270°	4		5-6	Collapse
	90°	14		5-6	Collapse
A16					None
A17	180°	2		5-6	Collapse
A18	180°	3		5-6	Collapse
	180°	8	(Second Row)	5-6	Collapse
	90°	3		4-5	Collapse
A19	90°	6		4-5	Collapse
A20	0°	12		5-6	Collapse
A21					None
A22					None
A23					None
A24					None
A25					None
A26	270°	11		5-6	Collapse
A27					None
A28	90°	4		5-6	Collapse
A29	180°	6		5-6	Collapse
A30					None
A31	180°	6-7	(Second Row)	6-7	Possible collapse
A32					None
A33					None
A34					None
A35	0°	4		5-6	Collapse
A36	270°	12		5-6	Collapse
	180°	10		5-6	Collapse
A37					None
A38					None
A39					None
A40					None
A41	180°	9		5-6	Collapse
A42					None
A43					None
A44					None
A45					None
A46					None
A47					None
A48					None
A49					None
A50					None
A51	90°	3		5-6	Collapse
A52					None
A53					Metal object on underside of bottom nozzle

Assembly ID Number	Face	Rod Number (1)	Axial Location (2)	Description of Anomaly
B01-B45				None observed
B46	0°			Top nozzle hold-down spring not full up
B47-B52				None observed
C01				None
C02				None
C03				None
C04		4-5		Machining chip on underside of bottom nozzle
C05-C17				None
C18	180°		1	Wire or 1/8" welding rod in grid
C19-C26				None
C27	0°			Top nozzle hold-down spring not full up
C28-C31				None
C32	180°			Top nozzle spring not full up
C33-C37				None
C38	180°-90°	14-15(180°)	1	Foreign matter above bottom nozzle
C39	90°			Spring not full up
C40				None
C41	90°	15	1	Small wire in grid
C42-C51				None
C52	0°			Top nozzle spring slightly depressed

II. REACTOR INTERNALS INSPECTION

1. Components Inspected

   A. Lower Internals

      a. Upper Support Flange

      b. Baffle Assembly

      c. Barrel Mid Plane Joints

      d. Upper Core Plate Guide Key

      e. Lower Core Plate

      f. Bottom Thermal Shield

B. Upper Internals

a. Thermocouple Column

b. Support Column

c. Guide Tubes

d. Orifice Plate

e. Alignment Keyways

f. Fuel Assembly Guide Pins

g. Flow Mixers

C. Control Rod Drive Lines

a. Driveshafts

b. RCC Spider

c. RCC Rods

2. Method of Inspection

A. TV inspection of RCC spiders and rods

B. Borescope inspection of upper and lower internals

C. TV inspection of internals (selected areas)

D. Measurement of baffle gaps via shim gages

3. Results of Inspection

A. Slight bowing of RCC driveshaft J-3, L-7, F-12, and E-11 (subsequently replaced subject driveshafts)

B. No other anamolies identified

III. VALVE MINIMUM WALL THICKNESS INSPECTION

1. Scope of Work

A. Verify wall thickness of reactor coolant boundary valves larger than 1" nominal pipe

B. Ultrasonic inspect 25% of the valves of each size, manufactured by same vendor, and of same material

2. Inspection Performed

A. Ultrasonic inspected 25 of a total of 76 valves within the defined boundaries

3. Results of Inspection

A. All valves were within minimum specified requirements except valve 456 (pressurizer relief valve)

B. Acceptance of valve 456

a. Measured wall thickness adjacent to the thin wall area is about 68%-73% greater than minimum value

b. Mechanical properties of material exceed minimum values by 6.29% in tensile and 35.4% in yield strength

c. Maximum fluid service temperature for the valve is 677°F for which the calculated minimum wall thickness is 6.9% below the measured thin wall area

d. Valve is within acceptable minimum wall thickness range as specified in MSS-SP-66 for butt welded valves (valve was procured to ASA B16-5 specification for flanged end valves)

IV. STEAM GENERATOR INSPECTION

1. Extent of Inspection (3260 tubes per SG)

A. Eddy current inspected inlet side tubes up to first support

a. Inspected 3091 tubes in SG "A"

b. Inspected 3202 tubes in SG "B"

c. Inspected 3116 tubes in SG "C"

B. Eddy current inspected 146 tubes in SG "A" around the U-bend section

C. Ultrasonic inspected tube sheet cladding in all steam generators

2. Results of Inspection

A. Detected one 75% indication and one 92% indication in SG "A" (tubes were subsequently explosively plugged)

B. No cladding deficiencies detected

V. INSERVICE INSPECTION

1. Scope of Work

   A. To fulfill the requirements of section XI of the ASME Boiler and Pressure Vessel Code requiring that a portion of inspections be completed by expiration of one-third of the 10 year inspection interval.

   B. It is estimated that there will be two refueling outages during the first one-third of the inspection interval and the inspections have been scheduled accordingly.

2. Inspections Performed During Outage

   A. Visual and Ultrasonic Inspections

      a. Reactor Vessel Studs & Nuts (19)

      b. Pressurizer Shell Welds (9)

      c. Pressurizer Support Skirt Weld (1)

      d. Steam Generator Channel Head to Tubesheet Weld on all 3 Generators

      e. Reactor Coolant Pipe & Welds (4)

      f. Loop "A" Accumulator Discharge Weld (1)

      g. 3 Inch Pipe Welds (12)

      h. 4 Inch Pipe Welds (8)

      i. 8 Inch Pipe Welds (5)

      j. 10 Inch Pipe Welds (4)

      k. 12 Inch Pipe Welds (1)

      l. 14 Inch Pipe Welds (1)

   * Numbers in parentheses indicate number of items inspected

   B. Visual and Dye Penetrant Inspections

      a. Safe End Welds (9)

      b. Hot Leg RTD Bypass Lines (7)

      c. Cold Leg RTD Bypass Lines (9)

      d. Loop Drain Lines (3)

e. Loop Seal Injection Lines (8)

f. Cold Leg Safety Injection Lines (3)

g. Hot Leg Safety Injection Lines (4)

h. CVCS Letdown Line (2)

i. Auxiliary Spray Line (4)

* Numbers in parentheses indicate number of items inspected

3. Inspection Results

A. Dye Penetrant Inspection

a. A linear indication ½" in length was found in pressurizer spray line elbow to safe-end weld

B. Corrective Action

a. The indication was ground out and faired into adjacent base metal

C. Ultrasonic Inspection

a. Apparent slag inclusion (0.080" diameter) detected in steam generator "A"

D. Acceptance of Slag Inclusion

a. Indication was noted in pre-service inspection and has shown no change in state due to service

b. Worst case analysis of indication shows no deterious effects

c. Defect is determined to be of no structural consequence and steam generator has full integrity

ATTACHMENTS

H. B. ROBINSON GENERATING STATION

UNIT NO. 2

APRIL, 1973 REFUELING SHUTDOWN

REACTOR INTERNALS AND CORE COMPONENTS

EVALUATION

Attachment 5

BY

J. T. BARNES

JULY, 1973

APPROVED:

H. W. Keller, Manager
Operating Plant Technology

APPROVED:

T. M. Anderson, Manager
Southern Region

Work performed under CPAN-30401

WESTINGHOUSE ELECTRIC CORPORATION
Nuclear Service Division
Nuclear Energy Systems
P. O. Box 355
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H. B. ROBINSON #2
REACTOR INTERNALS PERFORMANCE EVALUATIONS
SECTION 1
INTRODUCTION

Westinghouse, in cooperation with Carolina Power and Light Company, participated in a reactor internals and core component mechanical performance evaluation program during the first refueling shutdown in April, 1973. The program was initiated in January, 1973. This report covers the preparations and results of the program.

The H. B. Robinson #2 Reactor was the first of its generation of core and reactor internals design to be available for inspection. As a result, the opportunity was taken to perform a complete inspection in conjunction with total unloading of the core.

However, the reactor lower internals were not removed and it was therefore, not possible to inspect the reactor vessel and the outside of the lower internals.

SECTION 2
SUMMARY & CONCLUSIONS

A program was carried out during the first refuleing shutdown of the H. B. Robinson Reactor to inspect and evaluate the performance of the reactor internals and core components. The scope of the inspection was expanded to include a more detailed evaluation of the rod cluster control assembly (RCCA) drive rods and guide tubes because of an incident during defueling in which the reactor head was set down on the RCCA drive rod from core position N-7 resulting in the severe bending of the rod and damage to the vessel head thermal sleeve.

In the course of the inspection, one RCCA was found to have a separated vane. This failure occured in the RCCA from core position L-11. This control rod was not involved in any previous operating malfunctions.

A detailed inspection was carried out on the bent drive rod, thermal sleeve, guide tube, RCCA and the fuel assembly from reactor position N-7. No damage was found in the guide tube, RCCA or fuel assembly. Since it appeared that the incident was caused by an out of tolerance condition, other drive rods were inspected, and four suspected drive rods from reactor locations J-3, L-7, E-11, and F-12 were replaced.

A comprehensive inspection and study was carried out on the failed RCCA[1]. In addition, all other RCCA's were inspected for possible damage. The failed RCCA and the RCCA under the bent drive rod were replaced with new assemblies.

Areas of possible concern in the upper internals and the inside of the lower internals were inspected using the TV camera. No anomalies were

[1] "H. B. Robinson - Control Rod Failure". Letter TO-HWK-70, April, 1973. See Appendix I.

observed. Four thermal shield flexure supports were also examined with a borescope through the lower core plate and were found to be in good condition.

Copies of video tapes showing results of these inspections are enclosed with this report. Appendix II is a listing of inspection items showing the edited video tape position for each item.

SECTION 3

PROGRAM DESCRIPTION

3.1 GENERAL

A description of the scope of inspection and equipment required are included in this section. The original intention of the program was a standard inspection of the upper internals and inside of the lower internals along with a routine inspection of all RCCA spiders and a few RCCA rods. The scope of the inspection was increased to include a more detailed inspection of control rod drive shafts and the RCCA from core position L-11.

3.1.1 Scope of Inspection

Information of particular importance in the evaluation of each of the components included the following:

1. Condition of wear and alignment surfaces.
2. Integrity of wear and alignment surfaces.
3. Condition of mechanical fasteners, alignment pins, and locking devices.
4. Free movement of movable components.
5. Corrosion product formations.
6. Mechanical distortion.
7. Presence of debris.

Components included in the evaluation were as follows:

1. Reactor upper internals.
2. Reactor lower internals.
3. Drive line components.

3.1.2. Inspection Instruments

The types of inspection instruments available were as follows:

1. A portable underwater T.V. system, consisting of an underwater camera, telescoping handling fixture, video monitor, and video tape recorder.

3.1.2 Inspection Instruments (continued)

2. An underwater borescope with the capability of inspecting to a water depth of about 60 feet.
3. Binoculars for use when favorable results were possible.
4. Photographic equipment, with all of the instruments for documentation of results.

3.1.3 Preparation for Inspection

The preparation consisted of planning and coordinating Westinghouse efforts with those of the Carolina Power and Light engineering and plant personnel, preparation of written procedures, and consultations on scheduling. Layouts of the cavity area were prepared to verify that all of the equipment and procedures were compatible with the physical layout of the plant. Equipment was checked out and prepared for shipment to the plant site.

3.2 INSPECTION PLAN

The overall plan called for the inspection of the upper internals, inside of lower internals, four flexures, three RCCA drive rods, all RCCA spiders and the rods from at least six RCCA's. There was a contingency plan to remove the lower internals in the event that the inspection results deemed it necessary. Had this been done, the outside of the lower internals and the vessel would have been accessible for inspection.

The inspection was initiated with the RCCA's rods at the RCCA change fixture as RCCA change out was in progress. Next, the RCCA spiders were examined in the storage racks of the spent fuel pit.

Upon removal of all fuel from the reactor, the first step in the inspection plan was look at the flexures. This was done to determine the need for removal of the lower internals which would have required a certain amount of set up time. Four of the six flexures were inspected with the borescope.

Following the flexure exam, the borescope was used to examine the inside of two RCCA guide tubes in the upper package. The guide tubes were N-7, which had the bent drive rod, and P-6, which was replaced following the stuck RCCA incident of November 26, 1970.

3.2 INSPECTION PLAN (continued)

The underwater T.V. system was then set up in the telescoping T.V. handling tool for the inspection of the upper package and the inside of the lower internals.

Visual examinations and observations were then made on drive shafts in the upper package. The bent drive shaft from core location N-7 and the shaft from core location J-3 were removed from the pool for closer examination.

The Internals Inspection Procedure, RF-144 is contained in Appendix III.

SECTION 4

INSPECTION RESULTS

4.1 UPPER & LOWER INTERNALS BORESCOPE INSPECTION

4.1.1 Thermal Shield Flexure Supports

The borescope was set up with an overall length of 56 feet using the polar crane for assembly. The scope was then transfered to the hook on the manipulating crane and lowered through a hole in the lower core plate. In this manner, the flexures at 35°, 90°, 140° and 270° were examined and all were found to be in excellent condition.

4.1.2 RCCA Guide Tubes

The borescope was set up with an optical section which allowed straight down viewing. The borescope was then lowered into the guide tubes. By this method it was possible to view each RCCA guide plate. Guide tubes from core positions N-7 and P-6 were inspected in this manner and there were no defects.

4.2 UPPER INTERNALS T.V. INSPECTION

4.2.1 Upper Core Plate

A representative area of the upper core plate was inspected. Items of major concern included general surface condition, guide tube and support column fasteners, thermocouple runs, fuel alignment pins, orifice plate and core plate alignment pin keyways at 0° and 270°. These items were normal.

4.2.2 Guide Tubes

Several guide tubes, at core locations H-14, K-14, E-11, B-10, B-8 and B-6, were examined externally in detail with the television. All areas appeared to be in good condition.

4.2.3 Support Columns

The support columns at core locations J-14, G-14, P-13, C-12, B-9, and B-7 were examined in detail, using the television, and were normal.

4.2.4 Upper Support Plate

The upper support plate was examined and its general condition was normal. Thermocouple conduit runs were normal, as were the fasteners for the support columns and guide tubes. The top support plate alignment keyway could not be inspected due to interference of the upper internals lifting fixture.

4.3 T.V. INSPECTION INSIDE THE LOWER INTERNALS

4.3.1 Upper Support Flange

The upper support flange was inspected, with emphasis placed on the cooling nozzle welds, barrel to flange weld, and head and vessel alignment pins and the locking device welds. The results showed all components to be normal.

4.3.2 Barrel Mid-Plant Girth Weld

Approximately 50% of this weld was inspected. No anamolies were observed.

4.3.3 Lower Core Plate

Items of concern on the lower core plate were the fuel assembly, guide pins, access cover bolts, core support column bolts, and the instrument guide column bolts. All items appeared normal, however, there was a noticeable deposit on the fuel assembly guide pins that had the potential to influence the fuel assembly loading. Subsequent monitoring of fuel assembly loading revealed the condition was tolerable. The deposit is believed to be boric acid [H_3BO_3] and will return to solution during initial phases of reactor operation.

4.3.4. General Inspection

Other areas in the core barrel inspected included the baffles, baffle bolts, top former and the upper core plate guide key. There was normal surface contact on the guide keys. All other areas appeared normal.

4.4 CONTROL ROD DRIVE RODS

The drive rods from core locations M-6, P-6, and L-11 were removed from the upper internals and placed in storage racks on the cavity wall. A television examination of these shafts indicated no abnormal operational marks. However, there was light colored deposit in spots on these rods. The deposit was found to be easily removed with a slight "rubbing" action. The bent drive rod from core location N-7 was removed from the pool for visual inspection and photographs. No unusual marks were found on the drive rod, but there was a deep "gouge" on the inside diameter of the guide tube retaining cover.

A visual inspection of the drive shafts in place in the upper package indicated that some were bowed abnormally. A tool was improvised to measure the distance of the top of these bowed rods from the center line of their guide tubes. As a result of these measurements, a recommendation was made that the four rods, from core locations J-3, L-7, E-11, and F-12 be replaced.

4.5 ROD CLUSTER CONTROL ASSEMBLIES (RCCA'S)

The T.V. camera was set up at the RCC change fixture and the rods from six RCCA's were inspected. No unusual marks were found on these rods.

An inspection of all full-length and part-length RCCA's was conducted in the spent fuel pit by television, and recorded on video tape. All RCCA vanes and fingers, except the RCCA from core position L-11, were intact and in good condition.

The broken RCC from core position L-11 was examined in the RCC change fixture. The rod was lifted and viewed with the TV. No marks were found on the rods. The control rod was then removed from the assembly, leaving behind the broken vane with two rods attached. This assembly was then transferred to the spent fuel pit. There, a remote gripper suspended from

April 23, 197.
ATTACHMENT
TO-HWK-70

APPENDIX I

H. B. ROBINSON - UNIT #1

FAILED CONTROL ROD VANE

DESCRIPTION OF PROBLEM

A vane from the RCC Assembly from core position L-11 was discovered separated from the spider hub during operations in RCC change fixture in conjunction with core unloading.

SUMMARY OF INVESTIGATION

The following special inspection and evaluation was initiated immediately upon discovery of problem:

(1) Visual inspection of all RCC's in RCC change fixture during withdrawal of control rod from fuel assembly to determine if any other control rods were similarly affected with separated vane.

(2) Visual inspection of each RCC Spider Assembly in fuel assembly in spent fuel storage rack. Each vane attachment was inspected closely for indications of separation. Integrity of vane was measured by condition of tack weld at top side of each vane.

(3) Detailed visual inspection of separated vane, spider, and associated rodlets.

(4) Radiation measurements of rodlets from separated vane and main control rod assembly to determine approximately when during plant operation the separation occurred.

(5) Visual inspection using borescope inside control rod guide tube of failed control rod for anomalies resulting from failure or contributing to failure.

(6) Review plant operating history for operating irregularities that may have relationship to failure. This included CRDM and rod scram irregularities.

1 See 2

SUMMARY OF RESULTS

1. Only one RCC Assembly was involved. No anomalies were observed in inspection of remaining RCC Assemblies.

2. Radiation measurements revealed the rodlets on the separated vane three feet from top were at a level of 1.1 x 10^{1} R/hr compared with 600 mr/hr for the rodlets on the main control rod assembly. This result indicates the separated vane with the two rodlets was in the full scram position in core for a significant period of time while the remaining rodlets with spider assembly were in the normal low flux position witndrawn from the core. Calculations indicate the period of time was about 8000 full power hours of plant operation.

3. No anomalies were observed in the control rod guide tube. There were no significant marks observed on the control rod or in the guide tube that would indicate rod jamming from debris.

4. No event in plant operating history could be related to failure incident.

5. Within the limits of the inspection, no anomalies were visable in the braze joint.

DISCUSSION

The most likely failure mechanisms are:

1. Less than full strength of the braze joint on RCC Assembly.

2. Abnormal loading on RCC Assembly due to presence of debris.

There were no positive indications as to cause of failure. Since no markings indicating interference or impact were present on the failed vane, it would appear that the joint was not overstressed because of jamming from debris. On the other hand, from visual examination of the braze joint there was no indication of lack of braze.

Although there was no obvious evidence of debris jamming the control rod in question, this does not preclude the possibility since there were problems with debris during plant startup testing. In any case, the failure occurred

2 See 3

DISCUSSION (continued)

early in the first cycle as evidenced by the radiation levels measured. This result assures extensive operating cycles have been accummulated with the other control rods and any similarly affected control rods would most probably be uncovered by now.

A similar problem occurred at Conn-Yankee during first core cycle. In that case two RCC's were involved and the cause after hot cell examination of the failed joint was attributed to a manufacturing defect. The corrective action in June, 1970, was to replace the two affected RCC Assemblies. There has been no indication of any problem in Conn-Yankee since that time.

CONCLUSIONS

The failure of the vane joint on the RCC Assembly was caused by either insufficient braze strength or abnormal loading due to presence of debris. No positive indication of either anomaly could be detected. In either event, the failure did not cause any damage to the control rod guide tube. This incident is considered an isolated one and no further action beyond replacement of the failed RCC Assembly is considered necessary.

APPENDIX II

CP&L TAPE #1 A

ITEM	TAPE POSITION
RCC-R05	0 - 065
RCC-R38	065 - 126
RCC-R07	126 - 181
RCC-R36	181 - 226
PL -R202	226 - 268
RCC-R09	268 - 316
RCC-R29	316 - 363
RCC-R43	363 - 417
RCC-R45	417 - 461
RCC-R32	461 - 499
RCC-R31	499 - 540
RCC-R35	540 - 578
RCC-R33	578 - 619
RCC-R20	619 - 654
RCC-R25	654 - 686
PL -SR5	686 - 721
PL - From Ass'y C38	721 - 758
RCC-R41	758 - 790
RCC-R22	790 - 816
RCC-R06	816 - 842
RCC-R39	842 - 869
RCC-R26	869 - 895
RCC-R10	895 - 917
RCC-R18	917 - 942
RCC-R42	942 - 969
RCC-R30	969 - 996
RCC-R01	996 -1027

CP&L TAPE #2 A

ITEM	TAPE LOCATION
RCC-R11	0 - 082
RCC-R21	082 - 148
RCC-R13	148 - 205
RCC-R12	205 - 255
RCC-R40	255 - 341
RCC-R44	341 - 429
PL -SR8	429 - 495
RCC-R15	495 - 569
RCC-R16	569 - 619
RCC-R14	619 - 683
PL -SR6	683 - 732
PL -SR7	732 - 779
RCC-R27	779 - 840
RCC-R34	840 - 885
RCC-R24	885 - 928
RCC-R02	928 - 961
RCC-R23	961 - 995
PL -SR3	995 - END

CP&L TAPE #3 A

ITEM	TAPE LOCATION
RCC-R17	0 - 076
RCC-R08	076 - 140
RCC-R19	140 - 200
RCC-R37	200 - 332
Spider from Primary Source #2	332 - 387
Spider from Primary Source #1	387 - 438
PL -SR4	438 - 486
RCC-U3	486 - 521
Broken Vane from RCC-R04	521 - 600
Replacement of RCC-R04 into Ass'y A19	600 - 637
RCC Rods in Ass'y A-03	637 - 671
RCC Rods in Ass'y A-11	671 - 711
RCC Rods in Ass'y A-46	711 - 732
RCC Rods in Ass'y A-22 (Bent Drive Rod)	732 - 914
Thermocouple Column E-13	914 - 950
T/C Runs from Column E-13	950 - 960
Thermocouple Column C-12	960 - 970
Locking Cups - Base of Column E-13	970 - 985
Thermocouple Column C-5	985 - END

CP&L TAPE #4 A

ITEM	TAPE LOCATION
Guide Tube B-6	0 - 163
Support Column B-7	163 - 268
Guide Tube B-8	268 - 327
Fuel Ass'y Guide Pins - Upper Core Plate	327 - 405
Cooling Nozzles, Vessel & Head Alignment Pins and Lifting Hole	405 - 740
90° Upper Core Plate Alignment Pin	740 - 765
180° Upper Core Plate Alignment Pin	765 - 788
270° Upper Core Plate Alignment Pin	788 - 820
0° Upper Core Plate Alignment Pin	820 - 865
Upper Barrel to Core Barrel Girth Weld	865 - END

CP&L TAPE #5 A

ITEM	TAPE LOCATION
Lower Core Plate	0 - 313
270° Baffle	313 - 603
90° Baffle	603 - 770
Drive Rods M-6, P-6 and L-11	770 - 950

CP&L PROJECT
H. B. ROBINSON STATION
INTERNALS INSPECTION

RF-14.4 INTERNALS INSPECTION DURING REFUELING SHUTDOWN

NUCLEAR SERVICE DIVISION
WESTINGHOUSE NUCLEAR ENERGY SYSTEMS
P.O. BOX 355, PITTSBURGH, PA. 15230

APPROVED FOR USE	APPROVED FOR USE	APPROVED FOR USE
J Kubanesath	R.W. Keller	
W Nuclear Service Division	W Nuclear Service Division	Carolina Power & Light Co.
3/6/73	3/6/73	
Date	Date	Date

RF-14.4 INTERNALS INSPECTION DURING REFUELING SHUTDOWN

I. Purpose:

The purpose of this instruction is to specify the procedures to be followed in the inspection of the reactor internals.

II. Prerequisites:

1. The core has been unloaded in accordance with approved refueling procedures.
2. The reactor upper core internals have been placed in the storage stand.
3. The reactor internals lifting rig has been checked for proper operation for removal of lower internals per the conditions of procedure RF-9.9 B.
4. The reactor vessel flange mating surface protection ring has been placed in position.
5. RCC drive shafts B-6, L-9, and N-7 have been placed in storage stand on side of refueling pit.
6. All eight irradiation specimen access plugs removed.

III. Precautions:

1. Care must be exercised in monitoring for radiation hazard in the handling of tools and equipment withdrawn from the refueling water.
2. A minimum, predetermined depth of water over the various reactor internals, must be maintained at all times.
3. Personnel must wear special protective clothing in all radiation danger zones.
4. All handling tools must be thoroughly cleaned before insertion into the reactor vessel.

IV. *Procedure:

A. Upper Package Inspection

1. Assemble underwater TV system and handling fixture.
2. Using polar crane, transfer TV to hoist on manipulating crane.

*The sequence of this procedure may be altered to suit shutdown operating conditions.

IV. Procedure: (continued)

A. Upper Package Inspection (continued)

3. Lower TV camera to top of upper package and inspect thermocouple columns and thermocouple runs. Inspect conduits and T/C ends simultaneous with guide tubes and support columns.
4. Lower TV to bottom of upper package and inspect fuel assembly guide pins.
5. Inspect upper core plate alignment keyway.
6. Inspect support columns and guide tubes. Special emphasis will be placed on detailed inspection of the guide tube for location B-6 near the outlet nozzle.
7. Inspect top support plate alignment keyway and orifice plate.
8. Inspect RCC drive shafts located in storage stand.

B. Inspection of Inside of Lower Internals

1. With TV system in handling fixture and fixture attached to hoist on manipulating crane, lower TV camera to upper support flange.
2. Inspect upper support flange.
3. Inspect inside surface of outlet nozzles.
4. Inspect barrel mid-plane joint.
5. Inspect upper core plate guide keys.
6. Inspect baffle assembly. Emphasis will be placed on determination of existence of flow markings in baffle plates near joints.
7. Inspect lower core plate, fuel guide pins and instrument penetrations.
8. Remove TV system from pool.
9. Using polar crane, assemble borescope for a water depth of 52'.

IV. Procedure: (continued)

B. Inspection of Inside of Lower Internals (continued)

10. Transfer borescope to hoist on manipulating crane.
11. Extend borescope through lower core plate and inspect thermal shield flexures.
12. Remove borescope from pool.
13. Assemble baffle gap measuring tool.
14. Lower baffle gage with .005" shim into pool and check baffle gap at select locations.
15. Repeat step 14 with .003" shim and .0015 shim at select locations.

NOTE: Steps 14 and 15 will be performed only in baffle areas which are suspect of leakage as indicated by flow marking or fuel assembly markings.

16. Remove baffle gap measuring tool from pool.

C. Inspection of Lower Internals Exterior (Optional)

1. Lower internals to be removed from vessel and placed in storage area per RF-9.9B.
2. Manipulator crane will be located on south side of lower internals.
3. Assemble underwater TV system and handling fixture.
4. Using polar crane, transfer TV to hoist on manipulating crane.
5. Inspect irradiation specimen guides.
6. Inspect secondary core support.
7. Inspect radial supports.
8. Inspect thermal shield support pins and bottom flexures.
9. Inspect core barrel-vessel alignment pins.
10. Perform visual inspection of upper support flange.

IV. Procedure: (continued)

D. Inspection of Vessel (Optional)

1. With TV system in handling fixture and fixture attached to manipulating crane hoist, lower TV camera to bottom of vessel.
2. Inspect bottom surface for debris.
3. Inspect bottom penetrations.
4. Inspect inside vessel surface.
5. Inspect lower keyway.
6. Inspect nozzle faces.
7. Remove TV system from pool.

E. Inspection of Outside of Lower Internals and Vessel Bottom With Lower Internals in Place (In lieu of C. & D.)

1. Using polar crane, assemble borescope for a water depth of 37'.
2. Transfer borescope to hoist on manipulating crane.
3. Lower borescope through irradiation specimen access ports in flange.
4. Inspect upper thermal shield supports and top of specimen chutes.
5. Transfer borescope to polar crane and add four, 5' sections.
6. Return borescope to manipulating crane hoist.
7. Lower borescope through access holes in lower core plate, intermediate diffuser plate and bottom support plate.
8. Inspect bottom of reactor vessel.
9. Remove borescope from pool.

F. Inspection of RCC Spiders and Rods

1. Attach underwater TV system and handling fixture to hoist on spent fuel pit crane.
2. Lower TV camera to a depth just above the fuel assemblies in the fuel storage rack.

IV. Procedure: (continued)

F. Inspection of RCC Spiders and Rods (continued)

3. Inspect RCC spiders in position in assemblies by passing TV over top of units.
4. Remove TV system from spent fuel pit.
5. Set up TV camera at RCC change fixture in refueling pit. Adjust camera for height so that RCC rods can be viewed as RCC is withdrawn from fuel assembly.
6. Inspect selected sampling of RCC rods.
7. Remove TV camera from pool.

APPENDIX IV

CPL INTERNALS ASSURANCE INSPECTION PLAN

General Assembly: Upper Internals

Components	Recommended Minimum Inspection	Planned Inspection	Points Inspected	Inspector & Date	Results & Observations
1. Thermocouple Column	1	2	2	R. Kim 4/14/73	Locking Cups, Conduits & Swagelok Fitting OK
2. Thermocouple Run	1	18	18	R. Kim 4/14/73	Runs Straight & Secure. Swageloks, Uprights & Conduit to support column welds all OK
3. Top Support Plate Alignment Keyway	1	2	0		Could not inspect due to interference of lifting rig
4. Support Column	5	10	6	R. Kim 4/14/73	Column to Deep Beam interface good. Bolts & Locking Cups good. T/C Hardware good
5. Guide Tubes	2	4	6	R. Kim 4/14/73	All welds appear OK
6. Orifice Plate	1	2	1	R. Kim 4/14/73	Everything in good condition
7. Upper Core Plate Alignment Keyway	1	2	2	R. Kim 4/15/73	Bolts & Locking Cups OK. Normal wear surface Vertical shiny markings look smooth
8. Fuel Assembly Guide Pin	2	8	10	R. Kim 4/15/73	Pins appear good. Some appear to have deposits of light colored substance near tip & tapered portion.
9. Flow Mixers	1	3	3	R. Kim 4/15/73	Locking Hardware good. Welds to T/C end stops good. Thermocouple Hot Junctions appear to be sound and straight

CPL INTERNALS ASSURANCE INSPECTION PLAN

Lower Internals Interior

Components	Recommended Minimum Inspection	Planned Inspection	Points Inspected	Inspector & Date	Results & Observations
1. Upper Support Flange					
a. Cooling Nozzle Welds	2	8	Welds on (8) Nozzles 185° to 280° 0° to 90°	R. Kim 4/15/73	All welds sound No Anamolies
b. Barrel to Flange Weld	30° Two Sides	180°		R. Kim 4/15/73	Weld appears to be sound
c. Locking Device Welds	2	6	12	R. Kim 4/15/73	All Lock Bars and Welds sound
d. Head & Vessel Alignment Pin	2	4	3	R. Kim 4/15/73	All wear surfaces in good condition. Signs of contact on some surfaces
2. Baffle Assembly	2 Quadrants	4 Quadrants	2 Quadrant	J.Barnes 4/15/73	Some flow marking due to fuel assembly grids. No horrizontal flow marks. Bolts OK
3. Barrel Mid-Plant Joints	30° Two Sides	180°	0° to 140°	R. Kim 4/15/73	No anomalies in weld. Only marking was probable machine marks
4. Upper Core Plate Guide Key	2	4	4	R. Kim 4/15/73	All keys show signs of contact
5. Lower Core Plate					
a. Fuel Assembly Guide Pins	3	24	Several	R. Kim 4/15/73	Randomly Scanned Lower Core Plate and Manway Cover. Noticeable deposi on guide pins. All crimping, lock welds sou
b. Access Cover Bolts	2	4	4		
c. Core Support Column Bolts	4	16	Several		
d. Inst. Guide Column Bolts	5	20	Several		
6. Bottom Thermal Shield Flexures Inside Attachment to Core Barrel	2	4	4	J.Barnes 4/14/73	35°, 90°, 140° and 270° Flexures Inspected. All are in good condition.

CPL INTERNALS ASSURANCE INSPECTION PLAN

Control Rod Drive Line

Components	Recommended Minimum Inspection	Planned Inspection	Points Inspected	Inspector & Date	Results & Observations
1. Drive Shaft	3	3	3	J.Barnes 4/15/73	Noticeable Deposits on Rods
2. RCC Spider	26	53	53	J.Barnes 4/9/73	One Broken RCC. All others in good conditio
3. RCC Rods	3	6	6	J.Barnes 4/3/73	Some Flow Marks. Otherwise rods in good condition.

ATTACHMENT 3

Steam Generator Inspection and Repairs

CAROLINA POWER AND LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT
Hartsville, S. C.

STEAM GENERATOR INSPECTION AND REPAIR

1973 REFUELING OUTAGE

UNIT NO. 2

MARCH 16, 1973 - May 5, 1973

Written and Complied By: Jim Millen, Engineering Aide

TABLE OF CONTENTS

	PAGE
Introduction	1
Section I - History of Steam Generator Leakage	2
Section II - Inspection and Repair	4
Section III - Health Physics Aspects of Inspection	6
Summary	7
Chronological Sequence of Events	8
Calendar of Events for Steam Generator Work	10
List of Figures and Tables	11
Table 1 - Location of Plugged Tubes in S. G. "A"	12
Figure 1 - Location of Plugged Tubes in S. G. "A"	13
Figure 2 - Exploded View of Plugged Tubes in S. G. "A"	14
Table 2 - Location of all Plugged Tubes in S. G. "A"	15
Figure 3 - Exploded View of all Plugged Tubes in S. G. "A"	16
Table 3 - Location of all Plugged Tubes in S. G. "B"	17
Figure 4 - Exploded View of all Plugged Tubes in S. G. "B"	18
Table 4 - Location of all Plugged Tubes in S. G. "C"	19
Figure 5 - Exploded View of all Plugged Tubes in S. G. "C"	20
Figure 6 - Steam Generator	21
Table 5 - Location of Tubes not Inspected in S. G. "A"	22
Figure 7 - Exploded View of Tubes not Inspected in S. G. "A"	23

Table of Contents Cont'd.

		PAGE
Table 6 -	Location of Tubes not Inspected in S. G. "B"	24
Figure 8 -	Exploded View of Tubes not Inspected in S. G. "B"	25
Table 7 -	Location of Tubes not Inspected in S. G. "C"	26
Figure 9 -	Exploded View of Tubes not Inspected in S. G. "C"	27
Table 8 -	Location of U-Bend Inspected Tubes in S. G. "A"	28
Figure 10-	Exploded View of Tubes U-Bend Inspected in S. G. "A"	29
Table 9 -	Radiation Levels During Inspection of S. G. "A"	30
Table 10 -	Radiation Levels During Inspection of S. G. "B"	31
Table 11 -	Radiation Levels During Inspection of S. G. "C"	32

INTRODUCTION

This report relates the events of a steam generator inspection and repair during the 1973 refueling outage of the H. B. Robinson Unit No. 2. The inspection involves three (3) 44 series Westinghouse vertical steam generators, Serial Nos. 16A6081-1 (SG "A"), 16A6081-3 (SG "B") and 16A6081-2 (SG "C"). The reader is referred to enclosed figure 6 for a schematic drawing of this type generator. The generators are of the U-tube bundle design consisting of 3260 tubes of 0.875 inch outside diameter and 0.050 inch wall thickness. The 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.

This report contains figures and tables pertinent to the inspection and work, and these are enclosed at the end of the report. Reference to the tube location 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.

SECTION I

HISTORY OF STEAM GENERATOR LEAKAGE

The inception of steam generator leakage problems at H. B. Robinson Unit No. 2 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 27, 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 the 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} Uci/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, R.C.S. pressure was reduced, and the level ceased to increase. Normal plant heatup was then begun on May 14 while limiting the blowdown from S. G. "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. Repair ensued, and the generator was returned to service on June 10, 1972. This repair work was described in the "Steam Generator Repair Unit No. 2 May 13, 1972 - June 5, 1972" report of July, 1972.

To help prevent recurrence of tube leaks, steam generator chemistry was changed based on Westinghouse recommendations. Major changes were an increase in the phosphate specification, daily measurement of sodium/phosphate ratio, and use of continuous chemical addition and blowdown.

SECTION II

STEAM GENERATOR INSPECTION AND REPAIR

The 1973 refueling outage steam generator inspection was performed by the combined efforts of Zetech and Westinghouse personnel. The inspection included eddy current testing of all three steam generators, ultrasonic testing of all three steam generators, and a U-bend inspection of S. G. "A".

The eddy current testing was performed by remote control devices. Cross bars were installed in the channel head; one bar served as a track and the other as positioner for the probe. The probe was extended up to the first tube support. Test results were monitored by an oscilloscope and recorded on tape recordings and graphs for later analysis. Out of 3260 tubes in each steam generator, 3091 tubes were tested in S. G. "A", 3202 tubes in "B" and 3116 tubes in "C". The tubes not inspected could not be inspected by remote control devices and would therefore have to be checked by hand probe. Due to time and exposure involved it was decided not to test these tubes. See enclosed figures 7, 8 and 9 for tubes not inspected.

Out of 9409 tubes inspected only two tubes were found to have defects large enough to plug. These two tubes were in steam generator "A" and were adjacent tubes located on column 52, rows 27 and 28. The tube located on column 52, row 27 was also recorded in a 1972 inspection but not interpreted as a defect. This tube had not

deteriorated since its original detection. Its defect was determined to be 75%. The tube located at column 52, row 28 had a defect of 92%. Both tube defects were explosively plugged on both the inlet and outlet sides. This work was performed by the Tampa Division of Westinghouse.

An ultrasonic test was also performed on all three steam generators. This test was to examine the tube sheet for cladding separation. The ultrasonic test results showed no indications of cladding separation in any of the steam generators. This test was performed by Westinghouse personnel.

A U-bend inspection was performed on steam generator "A" to determine if there was any tube deterioration around the U-bends. All tubes in rows 41 through 45 were inspected totalling 146 tubes. There were no indications of tube deterioration in this area. This test was performed by Westinghouse personnel. See enclosed Figure 10 for view of tubes inspected.

SECTION III

HEALTH PHYSICS ASPECTS OF INSPECTION

All the work involved in steam generator inspection was conducted in a radiation controlled area within the reactor containment. The health physics operation was administered by Westinghouse personnel and H. B. Robinson personnel. The radiation levels on the primary side were relatively high. See the enclosed tables 8, 9 and 10 for a listing of these levels. The major time consuming work was the installation of eddy current equipment and the ultrasonic testing. The actual eddy current testing was a remote operation with a minimum of exposure time required. The ultrasonic testing required approximately 10 minutes per steam generator with a minimum of exposure received. Access to the work area was controlled and monitored on a 24 hour basis.

SUMMARY

The removal and installation of the manway covers was done by the H. B. Robinson maintenance personnel. All testing and inspection was under the supervision of Westinghouse operating plant services personnel. The tube plugging operation was under the direction of Westinghouse - Tampa Division personnel.

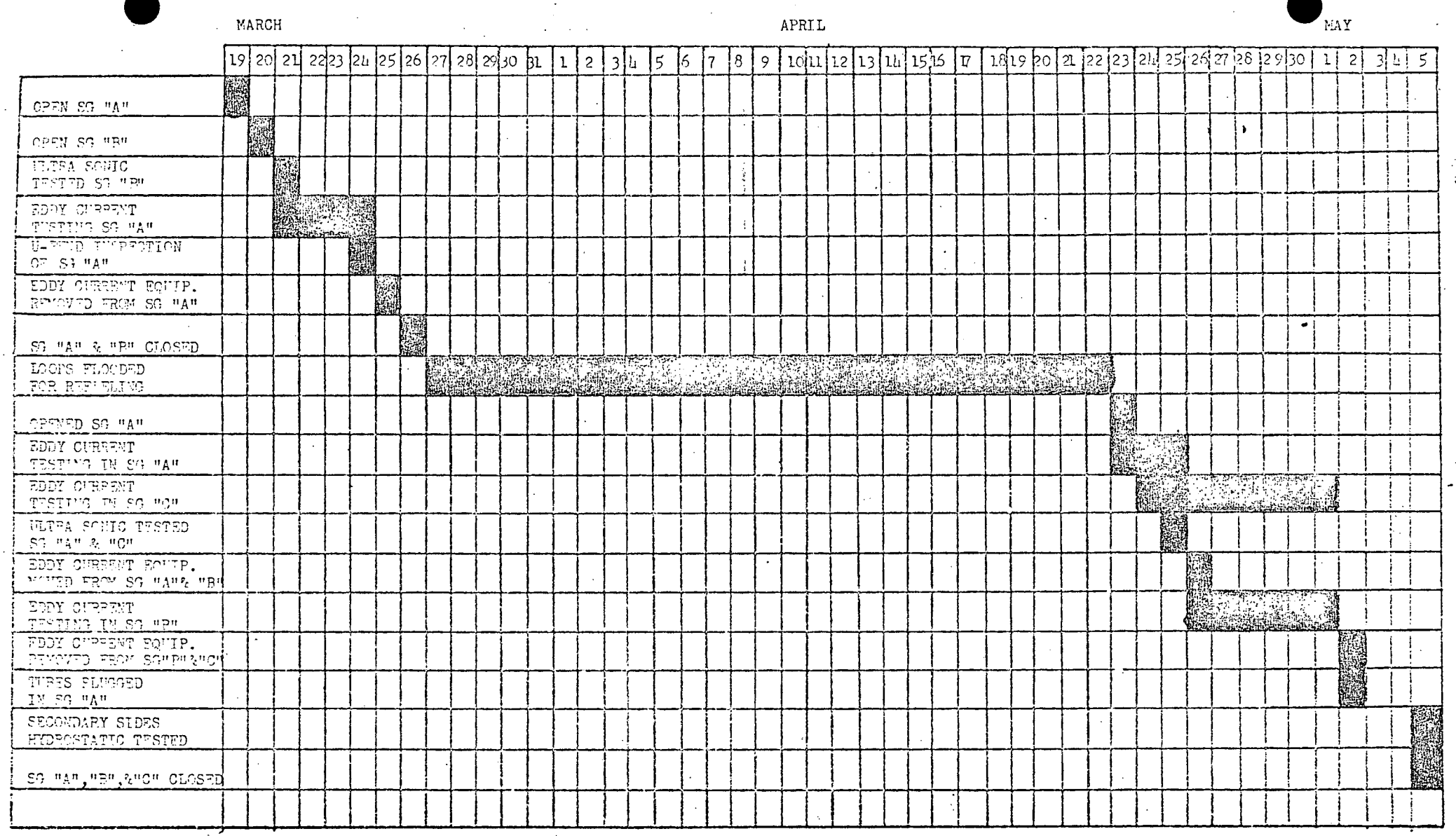
All Quality Assurance and Quality Control work was done by Westinghouse Tampa Division Quality Control personnel and inspected and verified by a CP&L engineer.

A bar chart of the time involved in this inspection and repair is enclosed in this report. See page 8 for this chart.

CHRONOLOGICAL SEQUENCE OF EVENTS

March 19	Opened S. G. "A"
March 20	Opened S. G. "B", installed blowers on "A" and "B".
March 21	Installed nozzle covers on S. G. "A" and "B". Eddy current testing of S. G. "A" begun. S. G. "B" ultrasonically tested.
March 22	Eddy current testing of S. G. "A" continued. S. G. "A" ultrasonically tested.
March 23	Eddy current testing of S. G. "A" continued. Nozzle covers removed from S. G. "B".
March 24	Eddy current testing of S. G. "A" continued. U-bend test of S. G."A" performed.
March 25	Eddy current equipment removed from S. G. "A".
March 26	Manway covers replaced on S. G. "A" & "B".
March 27 to April 22	Loops flooded for refueling.
April 23	Opened S. G. "A" and began eddy current testing of S. G. "A"
April 24	S. G. "C" opened and eddy current testing begun on "C". Eddy current testing continued on S. G. "A".
April 25	Eddy current testing continued on S. G. "A" & "C". S. G. "C" ultrasonically tested. S. G. "B" opened and nozzle covers installed.

April 26	Eddy current testing of S. G. "A" completed and test equipment moved to S. G. "B". Eddy current testing of "C" continued.
April 27 to May 1	Eddy current testing continued in S. G. "B" & "C".
May 2	Eddy current test equipment removed from S. G. "B" & "C". Tubes plugged in S. G. "A". S. G. "A" inspected.
May 5	S. G. "A", "B" and "C" secondary side hydrostatic tested. S. G. "A", "B" and "C" closed.



CALENDAR OF EVENTS FOR STEAM GENERATOR WORK

1973 REFUELING OUTAGE

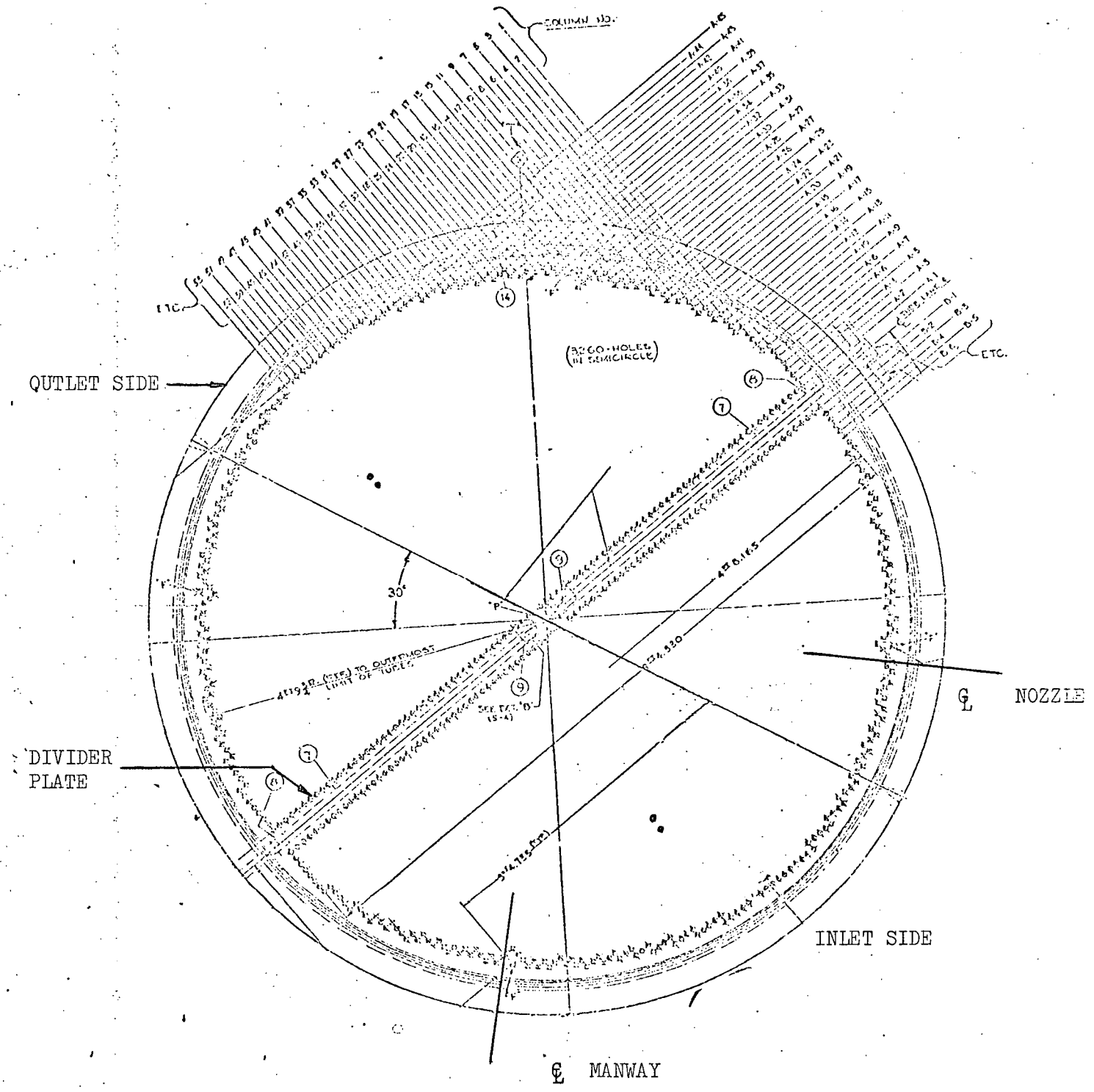
LIST OF FIGURES AND TABLES

Table 1	Location of Plugged Tubes in S. G. "A"
Figure 1	Location of Plugged Tubes in S. G. "A"
Figure 2	Exploded View of Plugged Tubes in S. G. "A"
Table 2	Location of All Tubes Plugged in S. G. "A"
Figure 3	Exploded View of All Plugged Tubes in S. G. "A"
Table 3	Location of All Plugged Tubes in S. G. "B"
Figure 4	Exploded View of All Plugged Tubes in S. G. "B"
Table 4	Location of All Plugged Tubes in S. G. "C"
Figure 5	Exploded View of All Plugged Tubes in S. G. "C"
Figure 6	Steam Generator
Table 5	Location of Tubes Not Inspected in S. G. "A"
Figure 7	Exploded View of Tubes Not Inspected in S. G. "A"
Table 6	Location of Tubes Not Inspected in S. G. "B"
Figure 8	Exploded View of Tubes Not Inspected in S. G. "B"
Table 7	Location of Tubes Not Inspected in S. G. "C"
Figure 9	Exploded View of Tubes Not Inspected in S. G. "C"
Table 8	Location of U-Bend Inspected tubes in S. G. "A"
Figure 10	Exploded View of Tubes U-Bend Inspected in S. G. "A"
Table 9	Radiation Levels During Inspection of S. G. "A"
Table 10	Radiation Levels During Inspection of S. G. "B"
Table 11	Radiation Levels During Inspection of S. G. "C"

TABLE 1

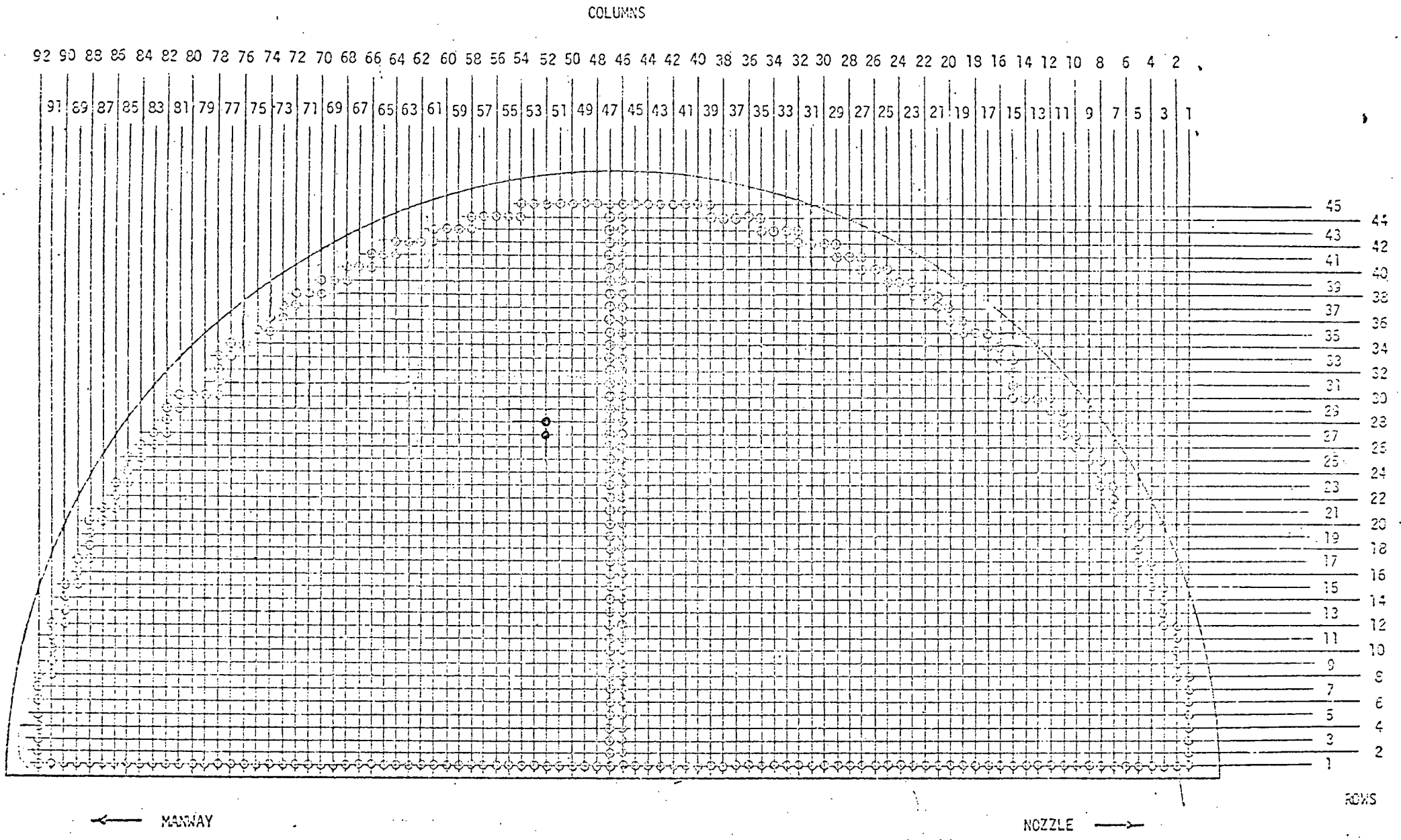
LOCATION OF PLUGGED TUBES IN S. G. "A"

ROW	COLUMN	PENETRATION %	LOCATION
28	52	92	2" Above Tube Sheet
27	52	75	2" Above Tube Sheet



LOCATION OF PLUGGED TUBES IN S. G. "A"
VIEW IS LOOKING UPWARD AT TUBE SHEET
FROM CHANNEL HEAD

FIGURE 1



● PLUGGED TUBES

'S. G. "A"

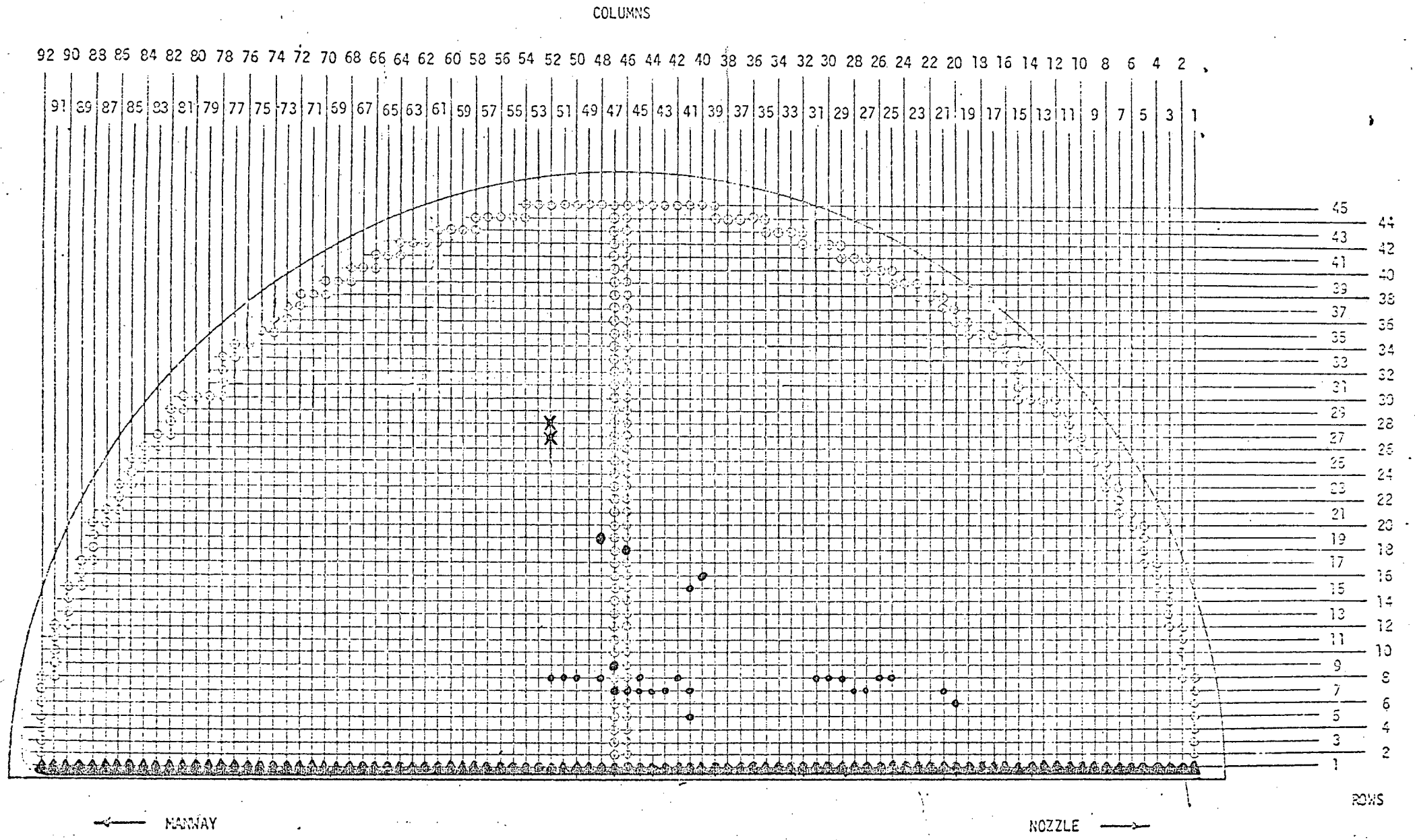
FIGURE NO. 2
EXPLODED VIEW OF PLUGGED TUBES

TABLE 2

LOCATION OF PLUGGED TUBES

S G "A"

ROW	COLUMN	REMARKS
1	1-92	PLUGGED 1971
5	41	" 1972
6	20	" 1972
7	21, 27, 28	" 1972
7	41	" 1972
7	43 - 47	" 1972
8	25, 26	" 1972
8	29, 30, 31	" 1972
8	42, 45, 48	" 1972
8	50 - 52	" 1972
9	47	" 1972
15	41	" 1972
16	40	" 1972
18	46	" 1972
19	48	" 1972
27	52	" 1973
28	52	" 1973



△ PLUGGED JULY 1971
• PLUGGED JUNE 1972
✕ PLUGGED MAY 1973

S. G. "A"

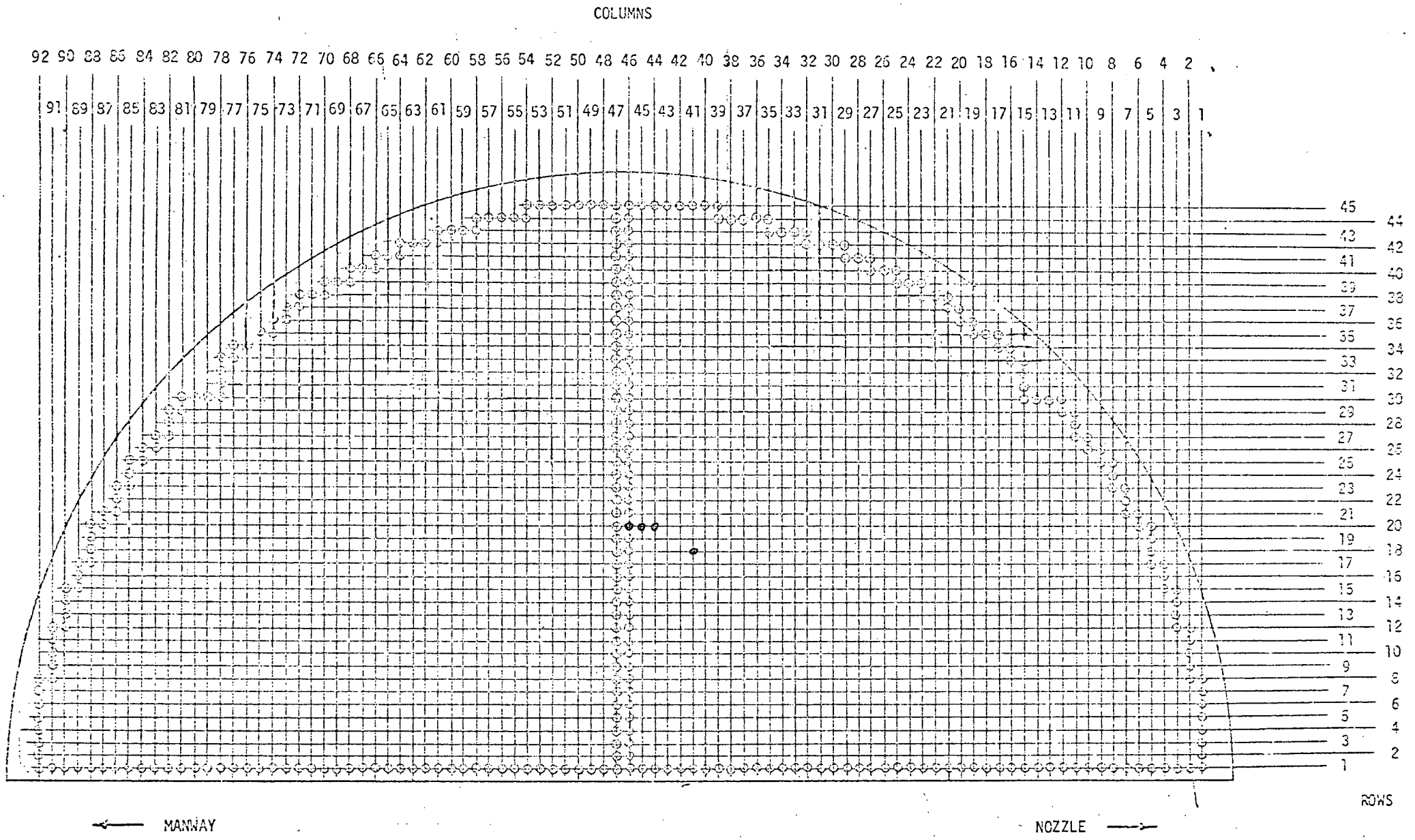
FIGURE 3
EXPLODED VIEW OF PLUGGED TUBES

TABLE 3

LOCATION OF PLUGGED TUBES

S. G. "B"

ROW	COLUMN	REMARKS
18	41	PLUGGED 1972
20	44	"
20	45	"
20	46	"



• PLUGGED JUNE 1972

S. G. "B"

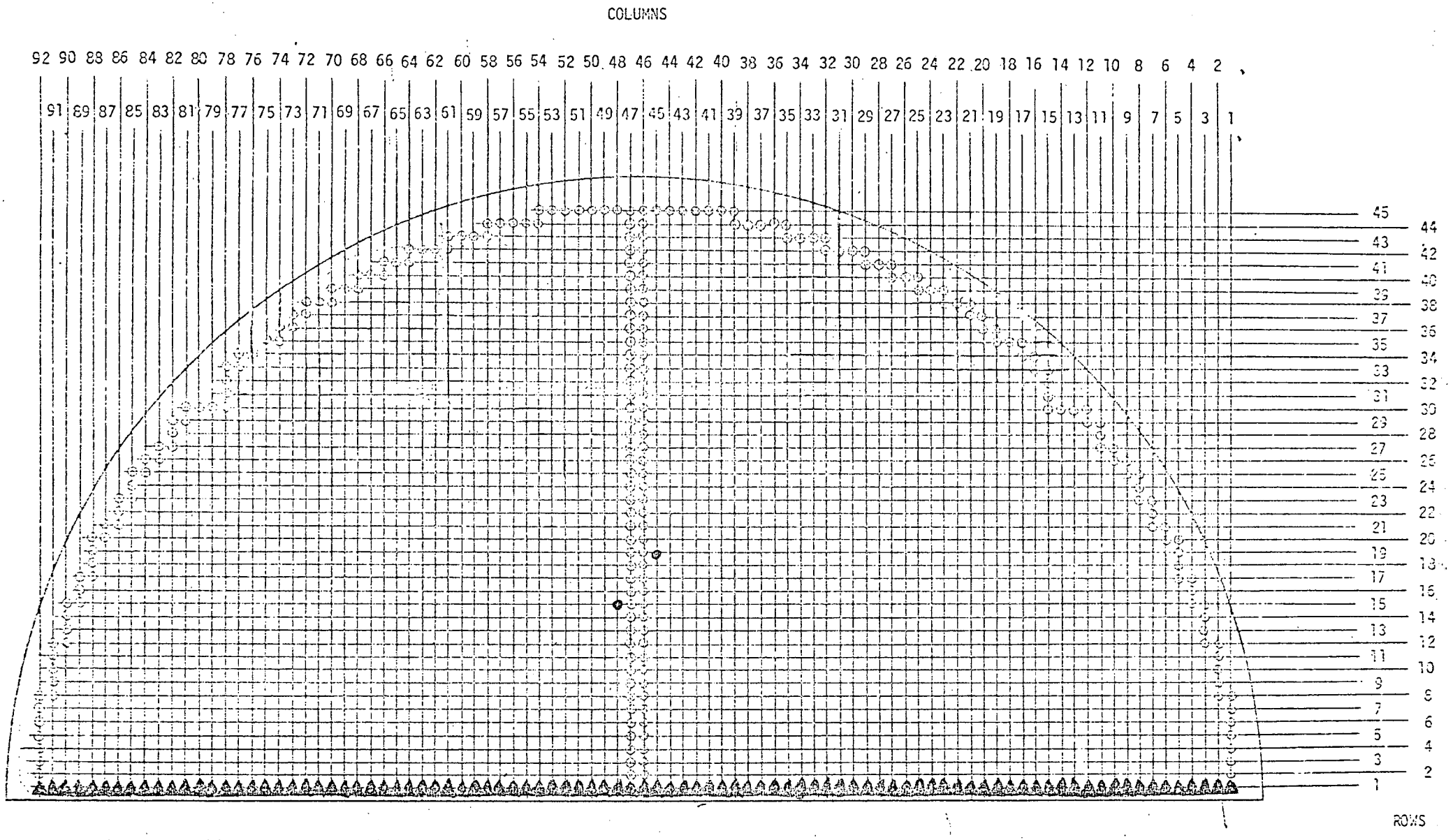
FIGURE 4
EXPLODED VIEW OF PLUGGED TUBES

TABLE 4

LOCATION OF PLUGGED TUBES

S. G. "C"

ROW	COLUMN	REMARKS
15	48	PLUGGED 1972
19	45	"
1	1-92	PLUGGED 1971

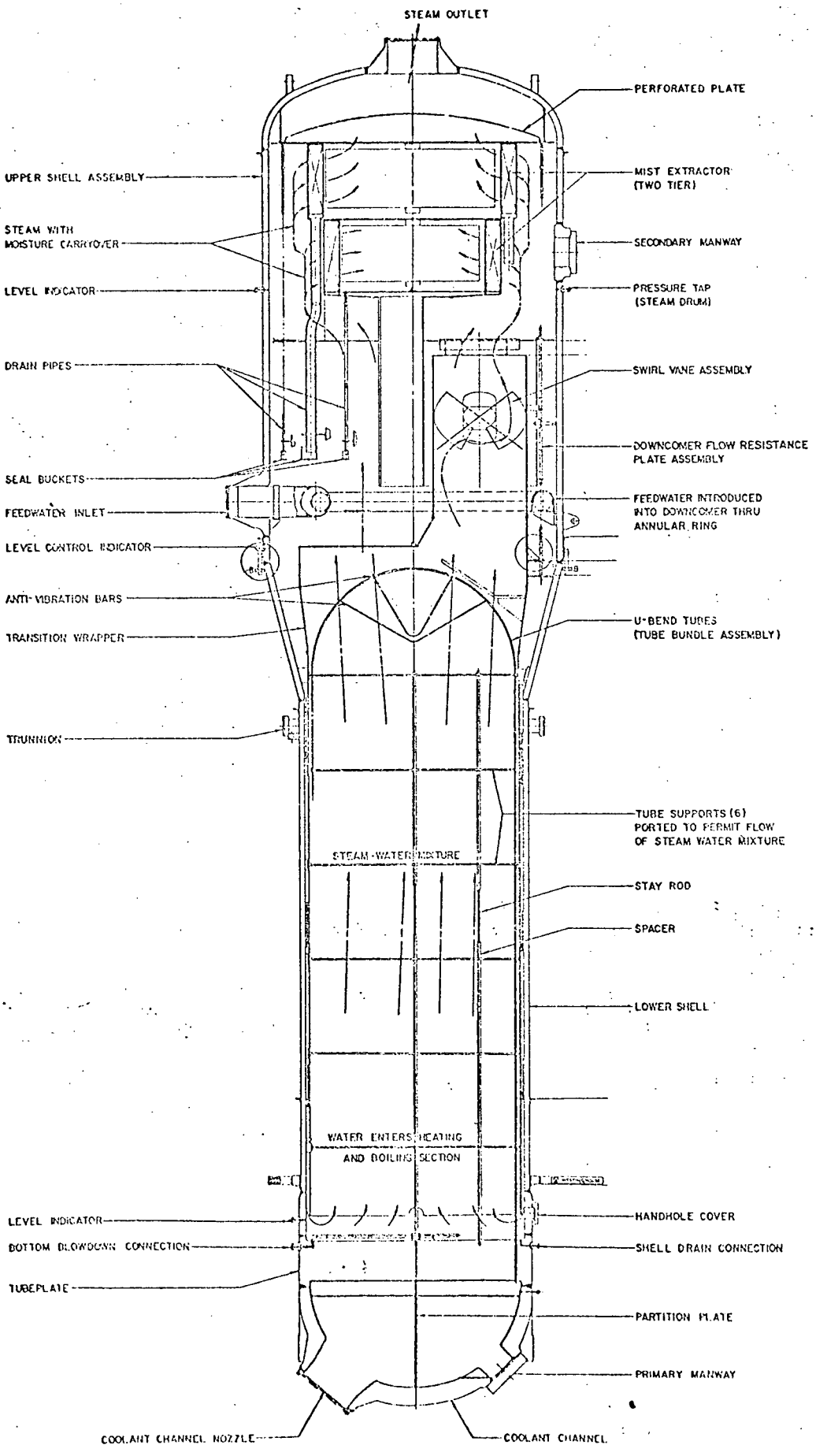


S. G. "C"

FIGURE 5

EXPLODED VIEW OF PLUGGED TUBES

FIGURE 6



STEAM GENERATOR

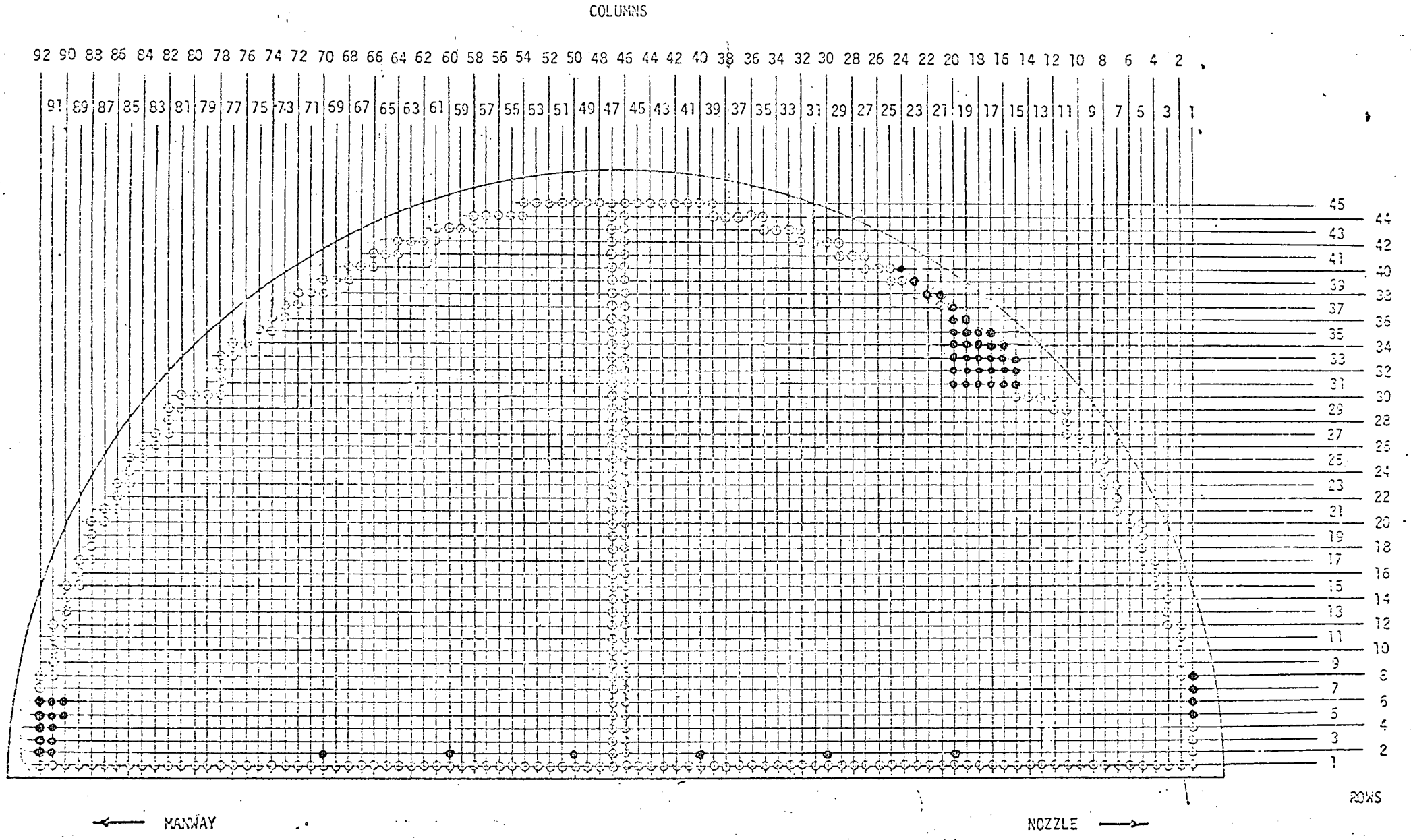
TABLE 5

LOCATION OF TUBES NOT INSPECTED

SG "A"

ROW	COLUMN	REMARKS
1	1-92	PLUGGED 1971
2	20,30,40,50	NOT ACCESSABLE WITH REMOTE EQUIPMENT
2	60,70,91,92	" " " " "
3	91 & 92	" " " " "
4	91 & 92	" " " " "
5	1	" " " " "
5	90,91,92	" " " " "
6	1	" " " " "
6	90,91,92	" " " " "
7	1	" " " " "
8	1	" " " " "
31	15-20	" " " " "
32	15-20	" " " " "
33	15-20	" " " " "
34	16-20	" " " " "
35	17-20	" " " " "
36	19,20	" " " " "
37	20	" " " " "
38	21	" " " " "
38	22	" " " " "
39	23	" " " " "
40	24	" " " " "

EXPLODED VIEW OF TUBES NOT INSPECTED



STEAM GENERATOR "A"

TUBES NOT INSPECTED

FIGURE 7

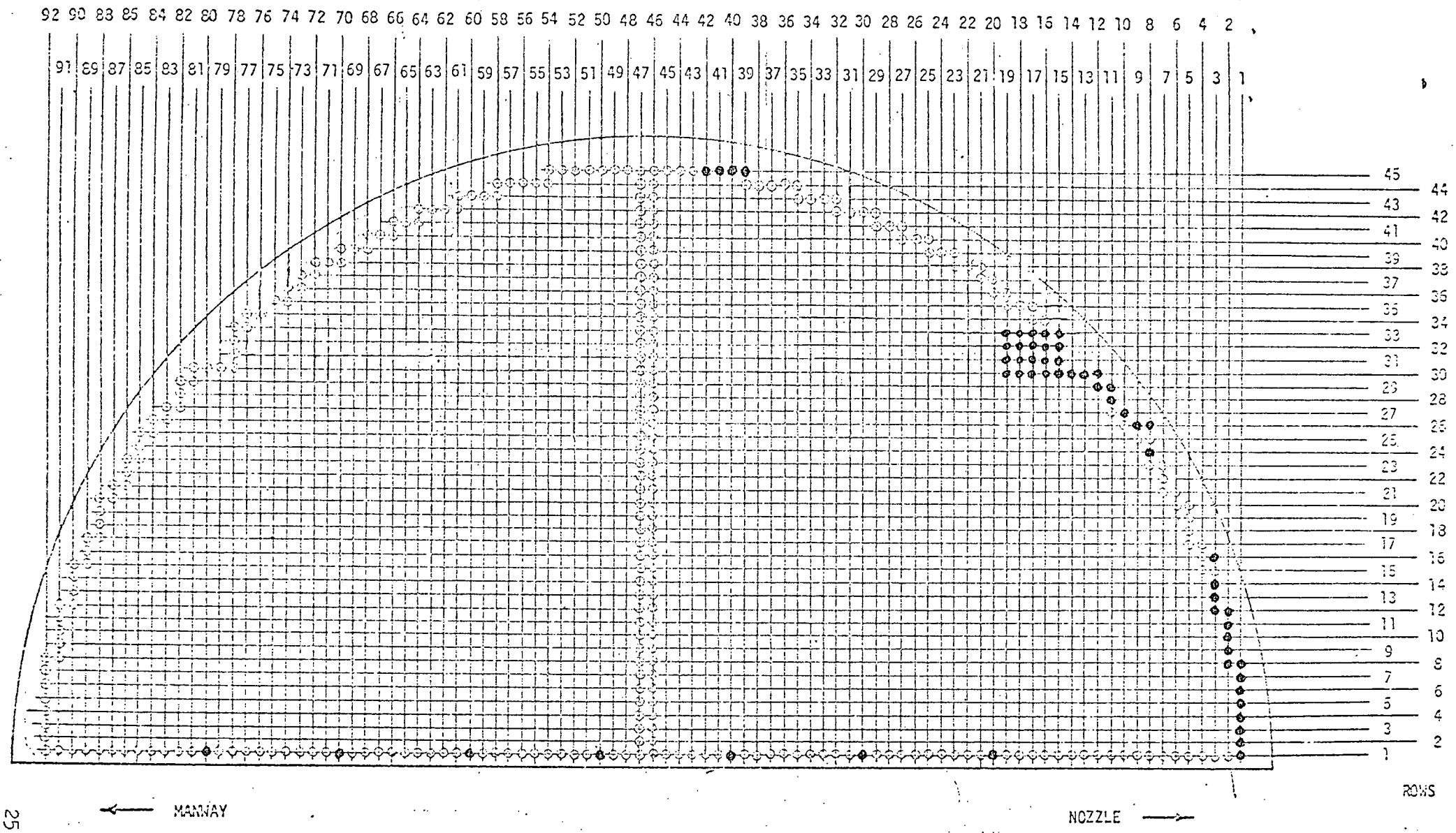
TABLE 6

LOCATION OF TUBES NOT INSPECTED

S. G. "B"

ROW	COLUMN	REMARKS
1	1, 20, 30,40	NOT ACCESSABLE WITH REMOTE EQUIPMENT
1	50, 60, 70, 80	"
2	1	"
3	1	"
4	1	"
5	1	"
6	1	"
7	1	"
8	12	"
9	2	"
10	2	"
11	2	"
12	2, 3	"
13	3	"
14	3	"
16	3	"
24	8	"
26	8, 9	"
27	10	"
28	11	"
29	11, 12	"
30	12-19	"
31	15-20	"
32	15-20	"
33	15-20	"
45	39-42	"

EXPLODED VIEW OF TUBES NOT INSPECTED



TUBES NOT INSPECTED

STEAM GENERATOR "B"

FIGURE 8

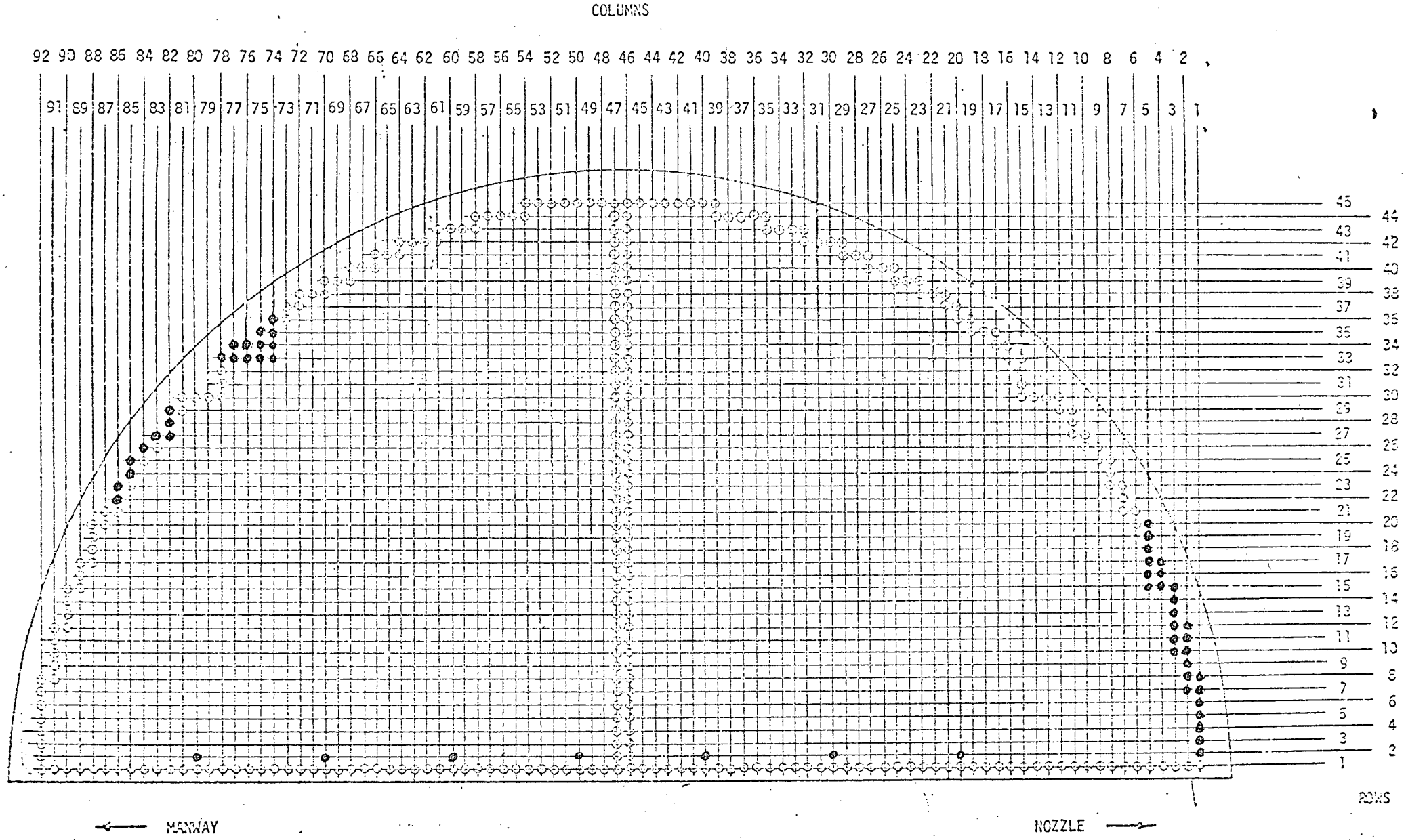
TABLE 7

LOCATION OF TUBES NOT INSPECTED

SG "C"

ROW	COLUMN	REMARKS
2	20,30,40	NOT ACCESSABLE WITH REMOTE EQUIPMENT
2	50,60,70,80	" " " " "
2	1	" " " " "
3	1	" " " " "
4	1	" " " " "
5	1	" " " " "
6	1	" " " " "
7	1,2	" " " " "
8	1,2	" " " " "
9	2	" " " " "
10	2,3	" " " " "
11	2,3	" " " " "
12	2,3	" " " " "
13	3	" " " " "
14	3	" " " " "
15	3,4,5	" " " " "
16	4,5	" " " " "
17	4,5	" " " " "
18	5	" " " " "
19	5	" " " " "
20	5	" " " " "
22	86	" " " " "
23	86	" " " " "
24	85	" " " " "
25	85	" " " " "
26	84	" " " " "
27	82,83	" " " " "
28	83	" " " " "
29	83	" " " " "
33	74-78	" " " " "
34	74-77	" " " " "
35	74-76	" " " " "
36	74	" " " " "
1	1-92	PLUGGED 1971

EXPLODED VIEW OF TUBES NOT INSPECTED



● TUBES NOT INSPECTED

STEAM GENERATOR "C"

FIGURE 9

TABLE 8

LOCATION OF U-BEND INSPECTED TUBES

SG "A"

ROW	COLUMN
41	27 - 66
42	29 - 64
43	32 - 61
44	35 - 58
45	39 - 54

EXPLODED VIEW OF TUBES U-BEND INSPECTED

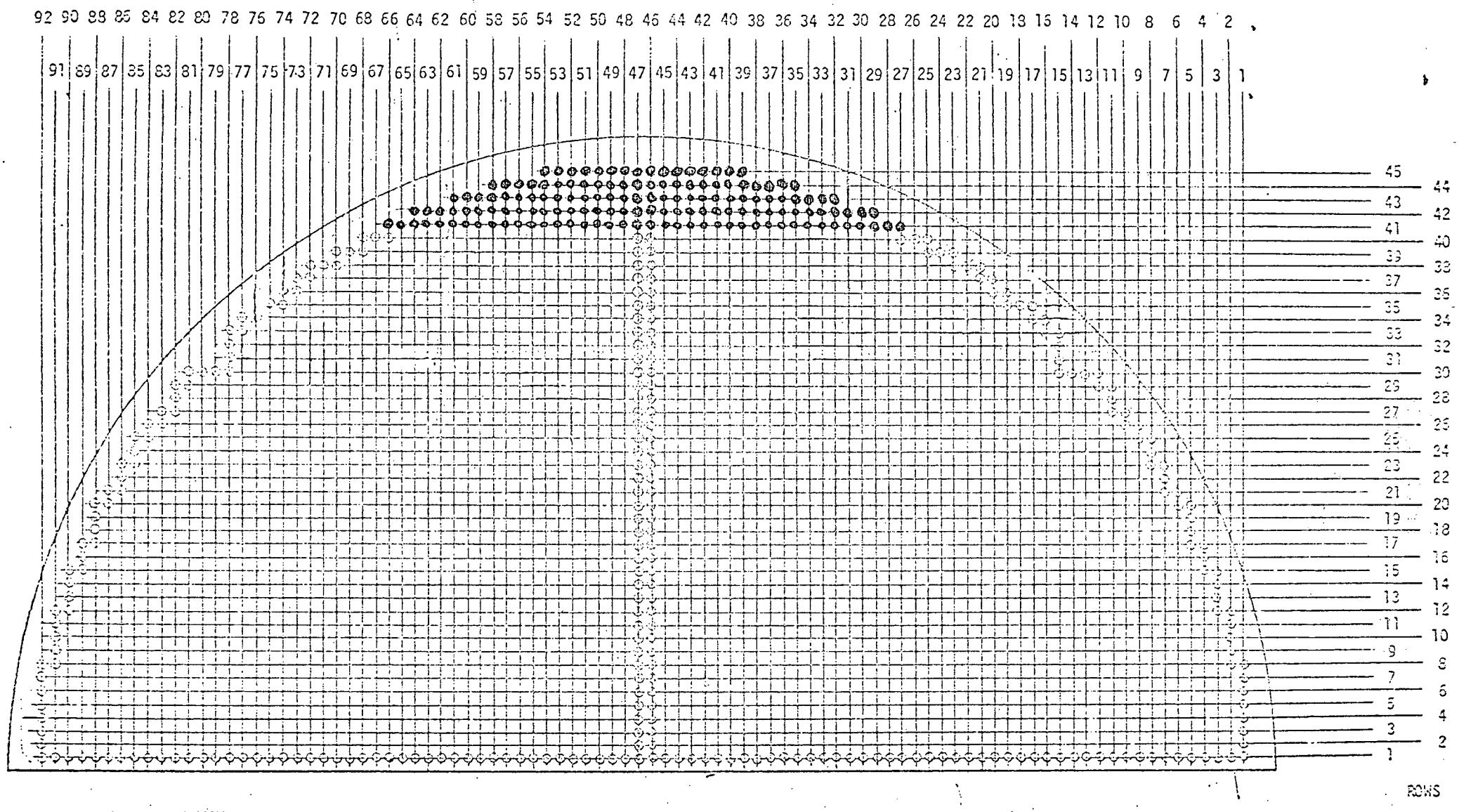


FIGURE 10

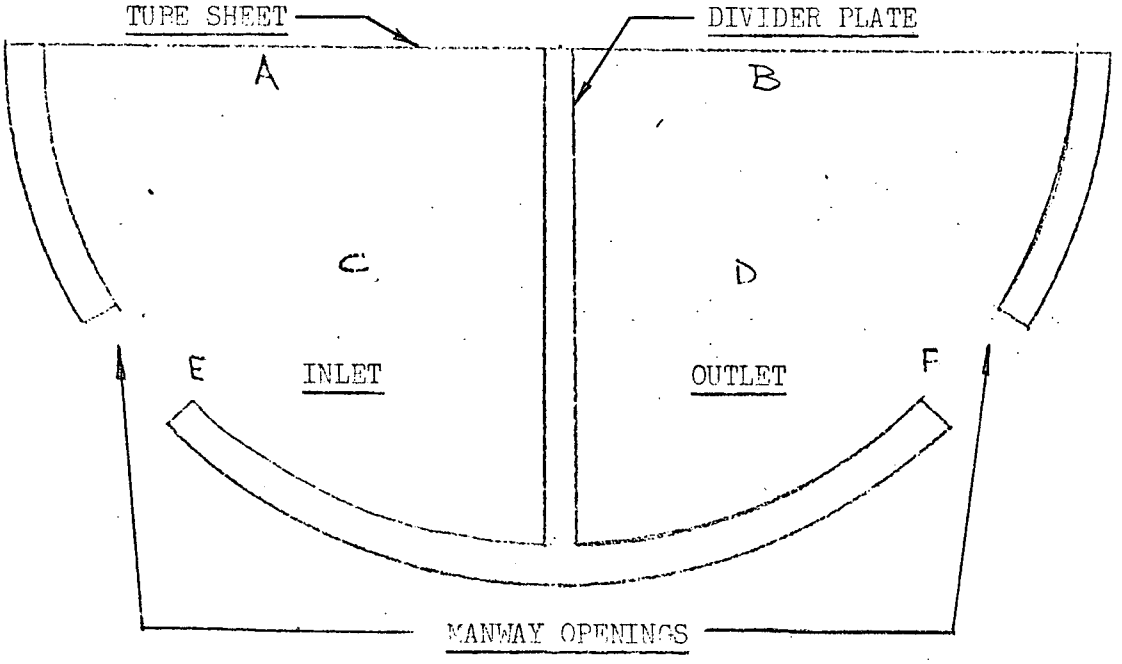
● U-BEND INSPECTED TUBES

S.G. "A"

TABLE 9

RADIATION LEVELS DURING INSPECTION

STEAM GENERATOR CHANNEL HEAD "A"

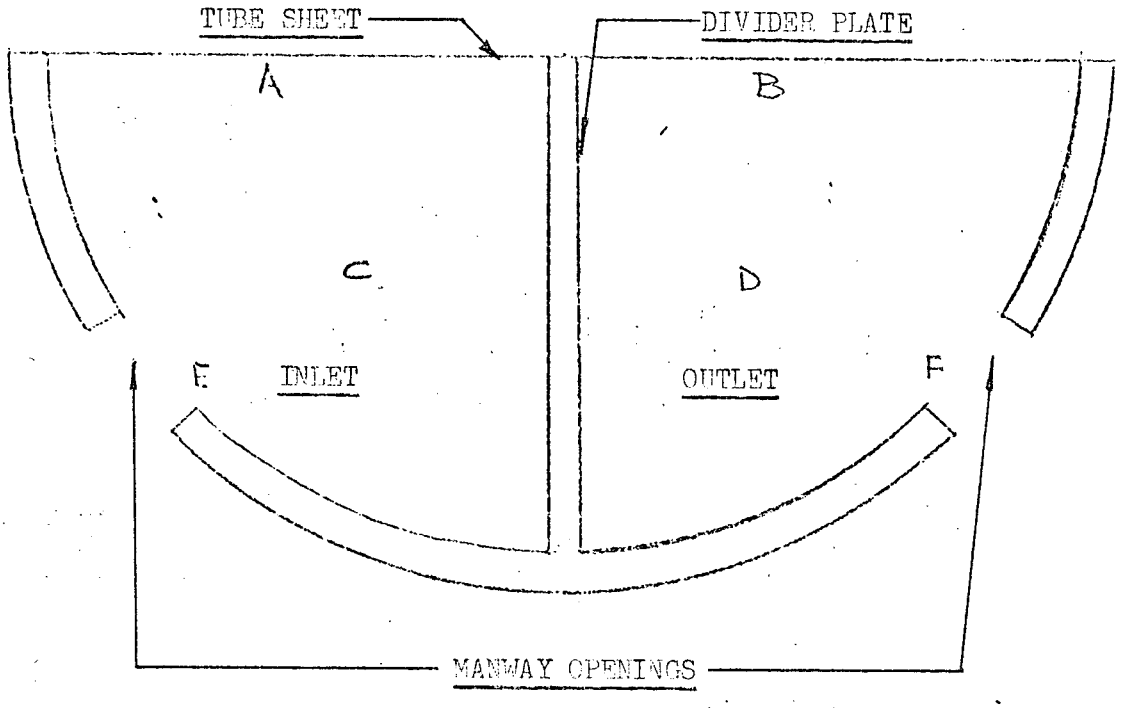


	RADIATION LEVELS	
SURVEY POSITION	INLET	OUTLET
POSITION A-TUBE SHEET	15 REM/HR	-
POSITION B-TUBE SHEET	-	20 REM/HR
POSITION C-INTERIOR	7 REM/HR	-
POSITION D-INTERIOR	-	15 REM/HR
POSITION E-MANWAY	3 REM/HR	-
POSITION D-MANWAY	-	2 REM/HR
GENERAL FIELD	7 REM/HR	15 REM/HR

TABLE 10

RADIATION LEVELS DURING INSPECTION

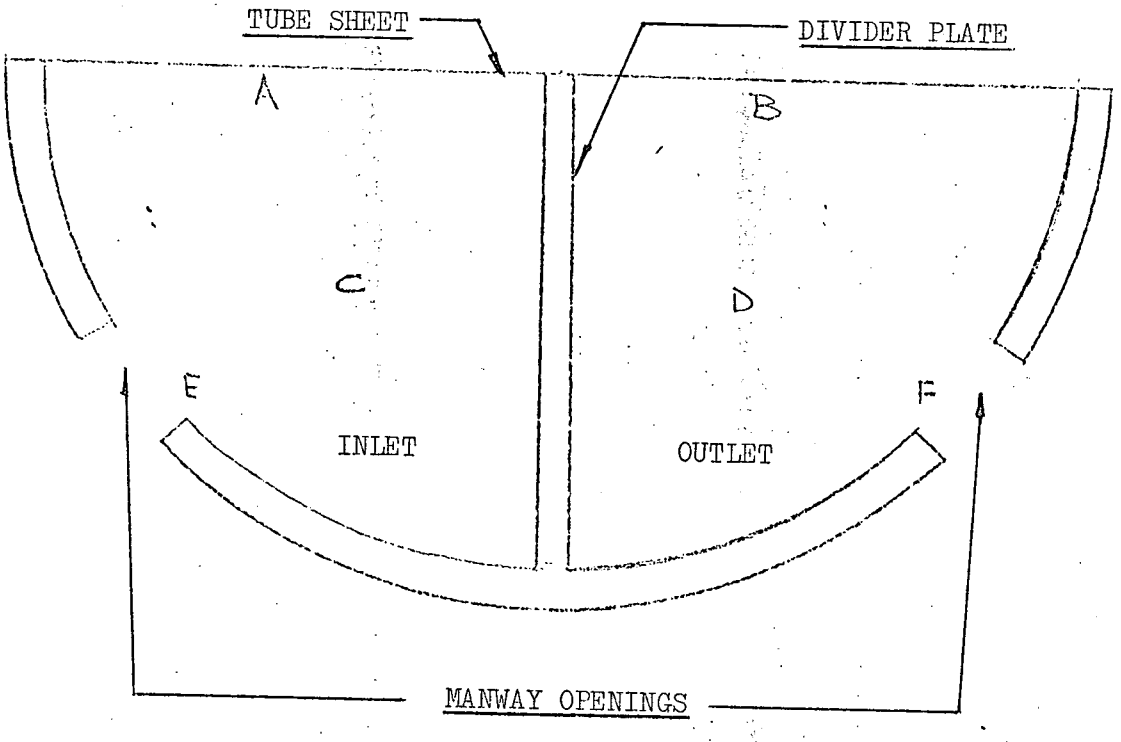
STEAM GENERATOR CHANNEL HEAD "B"



	RADIATION LEVELS	
SURVEY POSITION	INLET	OUTLET
POSITION A-TUBE SHEET	18 REM/HR	-
POSITION B-TUBE SHEET	-	25 REM/HR
POSITION C-INTERIOR	15 REM/HR	-
POSITION C-INTERIOR	-	15 REM/HR
POSITION E-MANWAY	3 REM/HR	-
POSITION F-MANWAY	-	2.5 REM/HR
GENERAL FIELD	15 REM/HR	15 REM/HR

TABLE 11

RADIATION LEVELS DURING INSPECTION
STEAM GENERATOR CHANNEL HEAD "C"



	RADIATION LEVELS	
SURVEY POSITION	INLET	OUTLET
POSITION A TUBE SHT.	15 REM/HR	-
POSITION B TUBE SHT.	-	10 REM/HR
POSITION C INTERIOR	12 REM/HR	-
POSITION D INTERIOR	-	8 REM/HR
POSITION E MANWAY	2.5 REM/HR	-
POSITION F MANWAY	-	800 MR/HR
GENERAL FIELD	12 REM/HR	8 REM/HR