3

24,083

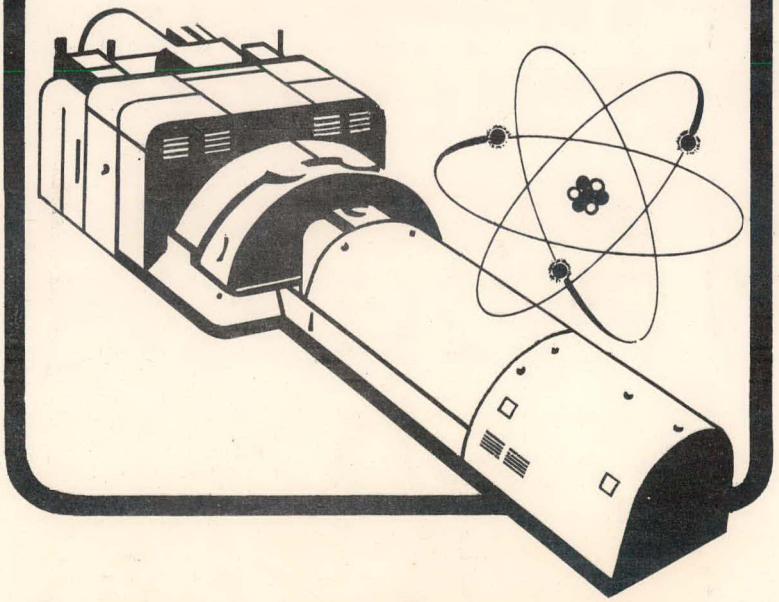
DLCS 5000273

DUQUESNE LIGHT COMPANY

Shippingport Atomic Power Station

Quarterly

OPERATING REPORT



Second Quarter 1973

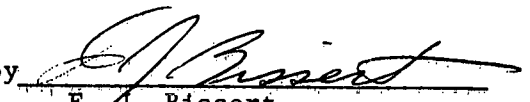
Contract AT-11-1-292

United States Atomic Energy Commission

MASTER

DISCLAIMER

QUARTERLY OPERATING REPORT
Second Quarter 1973
DLCS 5000273

Approved by 
F. J. Bissert
Superintendent

Contract AT-11-1-292
United States Atomic Energy Commission

TABLE OF CONTENTS

Preface

This Quarterly Report is prepared and issued by the Duquesne Light Company to disseminate information relative to all significant activities conducted at the Shippingport Atomic Power Station. Consistent with the premise that Shippingport was built to provide information and not power at competitive costs, this report makes no effort to analyze power production costs and makes no deductions regarding costs which might be achieved if Shippingport had been built and operated solely to produce power.

In preparation of these reports, it has been presumed that the reader has a working knowledge of nuclear reactors, reactor technology and/or electric utility generating station operations. The reader is reminded, however, that this is an operating report rather than a technical report. Anyone desirous of obtaining information on recent technical progress related to the nuclear portion of the Shippingport Atomic Power Station is therefore referred to the United States Atomic Energy Commission, Division of Technical Information Extension at Oak Ridge, Tennessee, where this information is readily available.

1. SUMMARY OF OPERATIONS

The Shippingport Atomic Power Station was operated as required for maintenance, testing, training, and Duquesne Light Company system load demand during the second quarter of 1973. The Heat Dissipation System was not operated during this period.

The semi-annual cold Station shutdown continued from the previous quarter for maintenance, testing, and training. The Station heat-up commenced on April 6 and following testing, the reactor was taken critical and the generator synchronized at 1610 hours on April 12.

The Station was shutdown, then returned to power operation on April 15 for the purpose of fault testing new 138 kv line equipment.

Two additional scheduled shutdowns were performed on May 10 and 24 for Operation Supervisor training. The Station was returned to power operation on each occasion the following day.

A reactor scram occurred on April 27 due to failure and grounding of the NPS channel 1A CIC detector positive signal lead. This lead was replaced and the generator synchronized at 2125 on April 28.

On June 13, depleted resin was flushed from the 1BD purification demineralizer. The demineralizer was recharged with 23 cubic feet of NH_4OH type resin and returned to service the following day.

During the second quarter, 3905 cubic feet of solid radioactive waste material, weighing 154,000 pounds and containing 517.000 millicuries of activity were shipped off-site for burial.

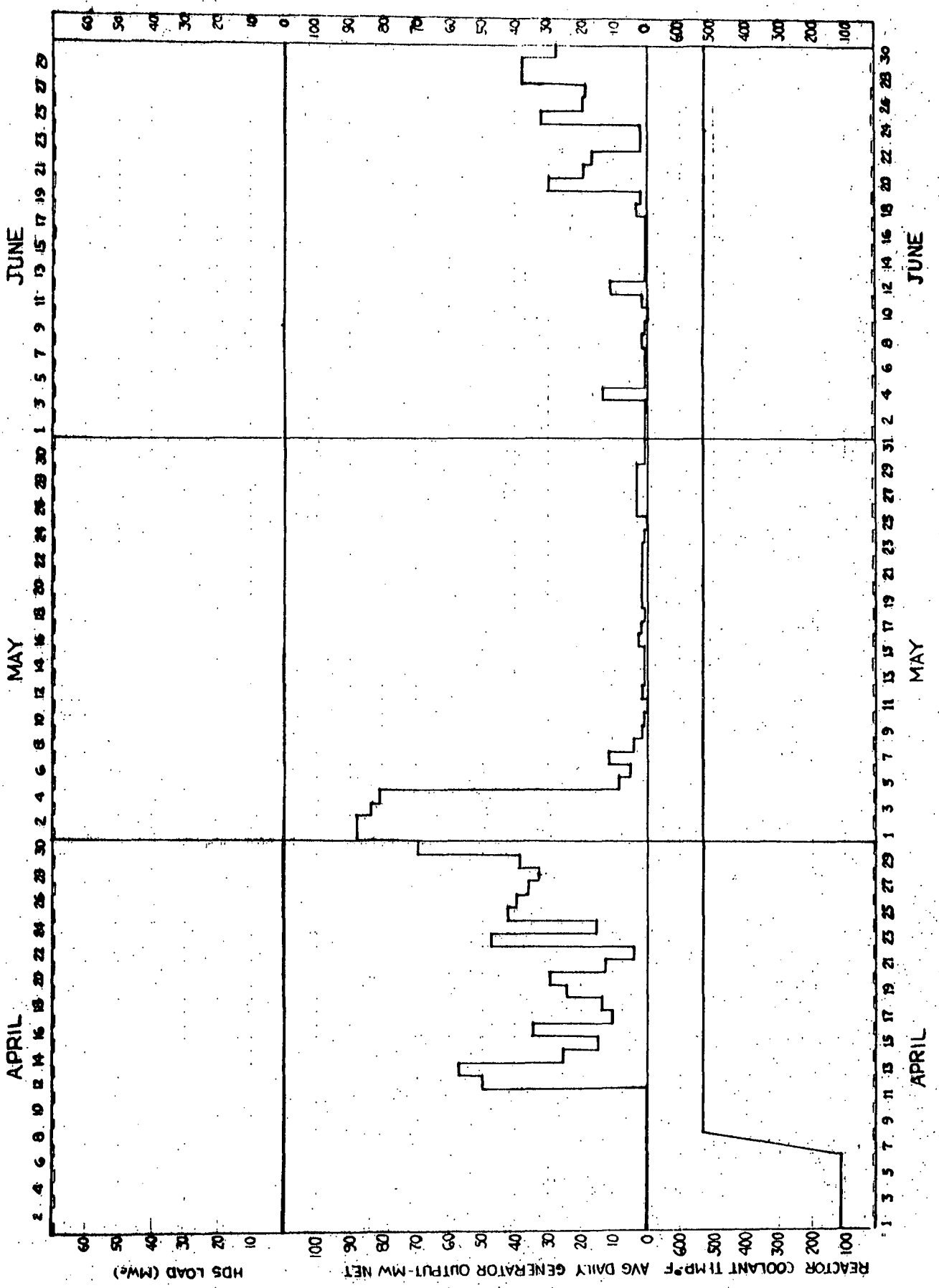


FIGURE 1
Generator Output, HDS Load and Reactor Coolant Temperature During Second Quarter Period

2. SUMMARY OF CORE 2 STATION PERFORMANCE

Electrical output (Gross) to date	kwhr	3,313,472,300
EFPH to date (Blanket operating time)	hr	22,710.9
EFPH to date (Seed 2 operating time)	hr	9,058.9
EFPH for the quarterly period	hr	332.0
Hours reactor critical to date	hr	57,949.0
Hours reactor critical for the quarterly period	hr	1,852.5
No. 1 main unit service hours (quarterly period)	hr	1,840.8
Net Station output (quarterly period)	kwhr	27,629,000
No. of forced outages*		1

*Interruption of electrical output due to protective equipment action and/or operator action.

3. CHEMISTRY

During the second quarter of 1973, the Chemistry section maintained specifications in the various plant systems and fulfilled station manual requirements.

Reactor Plant

During the second quarter, the station operated using the 1A, 1B, 1C, and 1D reactor coolant loops and the AC and BD purification demineralizers. There were no out-of-specification reactor coolant conditions during this period. See Tables I & II.

The reactor plant auxiliary systems experienced a small number of short term out-of-specification conditions during this quarter. The coolant charging water had high specific conductivity (>2.50 μmho/cm) and pH (>8.00) values. This was attributed to back leakage and recirculation following ammonium hydroxide (NH_4OH) addition to the reactor coolant system. A low pH (<6.00) in the canal water resulted from absorption of carbon dioxide (CO_2) from the air. The component cooling water system was maintained within specifications throughout the entire quarter. See Table III for further information.

The Cs^{138} activity of the reactor coolant continued at the expected levels during the quarter and indicates continued operation with no fuel element abnormalities. All values are corrected to a standard base of 67% reactor power, four reactor coolant loops in service, two purification demineralizers in service at full flow and 536°F Tavg operation.

Average Cs^{138} Activity

Month	dpm/ml	μc/ml	No. of Observations
April	671	3.02×10^{-4}	5
May	610	2.75×10^{-4}	8
June	620	2.79×10^{-4}	10

The gross non-volatile gamma activity of the reactor coolant after a 15 minute decay ranged from 3,636 cpm/ml at 9% reactor power to 49,609 cpm/ml at 67% reactor power. The D.F. (Decontamination Factor) across the demineralizer ranged from 72 to 798 after a 15 minute decay.

As required by the station manual, radiochemical analysis of reactor coolant for insoluable activity is performed each 1000 EFPH. Samples for the ninth performance of this requirement were collected from May 1, 1973 to May 2, 1973. The sample analysis has not been completed during this quarter, therefore the results will be shown in the next quarterly report.

Turbine Plant

During the entire second quarter, all boilers operated on volatile chemistry. The 1A, 1B, 1C, and 1D heat exchangers were in service throughout the quarter. At the beginning of the quarter, the station was shutdown and the heat exchangers were in cold lay-up and then hot lay-up. The only out-of-specification operating

condition consisted of high specific conductivities (>10 μmho/cm) in the 1A, 1B, 1C, and 1D heat exchangers. This high specific conductivity condition was remedied by "blowing down" the boilers. The out-of-specification conditions during lay-up periods consisted of high specific conductivities (>10 μmho/cm) in the 1A, 1B, 1C, and 1D heat exchangers during hot lay-up. The high specific conductivity values resulted from ammonia formation while "steaming" the heat exchangers in going from cold to hot lay-up. The out-of-specification conditions experienced during cold lay-up were low pH values in the 1C and 1D heat exchangers, a low hydrazine concentration in the 1A heat exchanger, and high hydrazine concentrations in the 1A, 1B, 1C, and 1D heat exchangers. Treatment with hydrazine corrected the low pH and low hydrazine concentration conditions. The high hydrazine concentrations were due to sampling the heat exchangers before complete mixing occurred after treatment with hydrazine. See Tables IV and V.

The primary to secondary leak in the 1A heat exchanger, which was discovered during the fourth quarter of 1972, remained relatively constant with a leak rate of approximately 2.5 gal/hr at 67% reactor power. The short lived fluorine-18 radioactivity of the heat exchanger also remained relatively constant at approximately 3.7×10^{-6} μCi/ml

Radioactive Waste Disposal System

The total radioactivity, exclusive of tritium and short lived Fluorine-18 discharged from Shippingport during the quarter was approximately 0.0005 curies, which is less than 0.1% of the allowable limit. The quantity of short lived radioactivity (F-18) released was 0.0013 curies. The quantity of 0.15 curie of Tritium was an insignificant 0.02% of the allowable limit No gaseous discharges were made from the gaseous waste system to the environment during the quarter. These radioactivity releases from Shippingport are far too small to have any measurable effect on the general background environmental activity outside the plant.

TABLE I

Reactor Coolant System

Water Conditions and Chemical Adjustments

Operating Conditions

Chemical Condition	Specifications	Analytical Results Min.	Max.	NH_4OH Additions Liters	Degassification Hours
1. pH @ 25° C	10.20 ± 0.10	10.11	10.30	114	60.1
2. Specific Conductivity umhos/cm	- - - -	28	49		
3. Total Gas - cc/kg	125 Maximum	60	116		
4. Hydrogen - cc/kg	10 - 60	19	48		

TABLE II

Reactor Coolant System

Water Conditions and Chemical Adjustments

Shutdown Conditions

Chemical Conditions	Temp.	Specifications	Analytical Results Min.	Analytical Results Max.	NH_4OH Additions Liters	H_2 Addition cu. ft.
1. pH @ 25° C	≥ 200°F	10.10 - 10.30	10.20	10.25	2.5	0
	< 200°F	6.0 - 10.50	9.30	9.78	0	0
2. Total Gas - cc/kg	> 200°F	80 Max	29	74		
	< 200°F	25 Max*	--	--		
3. Hydrogen - cc/kg	> 200°F	10 - 60	10	34		
	< 200°F		--	--		
4. Oxygen - ppm	> 200°F	<0.14	0.010	0.010		
	< 200°F	<0.3	0.010	0.015		
5. Chloride - ppm	> 200°F	<0.1	<0.05			
	< 200°F	<0.1	<0.05			

*Degassification to 25 cc/kg maximum must be accomplished prior to reducing reactor coolant pressure below the minimum required for reactor coolant pump operation.

TABLE III

Reactor Plant Auxiliary Systems

Water Conditions

System	Specific Conductivity umhos/cm	pH at 25° C	Conc. - ppm			Gross Gamma* Activity-dpm/ml
			CrO_4^{--}	Cl^-	Dis. O_2	
Component Cooling						
Specifications	none	8.30-10.50	500-1000	1 ppm max.	none	none
Observed	1230-1450	8.62-9.60	510-650	<0.05		BKGD - 1.1
Coolant Charging Water						
Specifications	2.50 max.	6.00-8.00	none	0.1 ppm max.	none**	none
Observed	1.80-4.30****	7.50-9.00****		<0.05	7.4-9.0	
Canal Water						
Specifications	5.00 max.	6.00-8.00	none	none	none	none***
Observed	1.28-1.30	5.56-6.03****				0.67-2.10

* Multiply tabular value by 4.50×10^{-7} to obtain uc/ml
** Should be <0.14 ppm for reactor plant cold shutdown
*** Normally near background
**** See reactor plant section of QOR

TABLE IV

Operating Heat Exchanger Chemistry

Volatile Water Chemistry

Water Conditions	Specifications	Heat Exchangers* 1A	1B	1C	1D
1. Cond - µmhos/cm	Min. ---- Max. 10	5.5 15.0***	5.0 18.0***	4.8 17.5***	5.2 14.0***
2. Phosphate - ppm	Min. ---- Max. 2	0.00 0.4	0.00 0.3	0.00 0.3	0.00 0.4
3. Chlorides - ppm	Min. ---- Max. 0.5	0.11 0.40	0.10 0.50	0.10 0.44	0.10 0.40
4. Hydrazine - ppm	(residual)	.021 .075	.021 .115	.021 .090	.021 .086
5. Silica - ppm	Min. ---- Max. 25	2.4 3.2	2.3 2.3	1.9 2.3	1.6 2.5
6. pH at 25° C	Min. 8.0 Max. ----	8.25 9.10	8.18 9.20	8.01 9.01	8.24 9.10
** 7. Chemicals Used in lbs Na_3PO_4 Na_2HPO_4 NaH_2PO_4 N_2H_4		-- --	-- --	-- --	-- --

*NOTE: Hydrazine and Morpholine are added continuously to all operating heat exchangers via the turbine plant condensate system during normal plant operations.

**NOTE: Additional treatment to boilers required in special cases.

***See Turbine Plant section of Q.O.R.

TABLE V

Non-Operating Heat Exchangers

Water Chemistry

Water Conditions	Specifications	Non-Operating Heat Exchangers 1A	1B	1C	1D
1. Specific Cond. - µmho/cm					
(Hot Lay-up)	Min. ---	5.7	5.1	5.3	4.1
	Max. 10	29.4***	17.9***	16.6***	15.5***
(Cold Lay-up)	Min. ---	13.0	14.0	16.0	8.1
	Max. 30	21.0	20.0	19.0	19.0
2. pH					
(Hot Lay-up)	Min. 8.00	8.17	8.10	8.00	8.10
	Max. ---	10.08	9.84	9.81	9.80
(Cold Lay-up)	Min. 9.50	9.58	9.52	9.39***	9.43***
	Max. ---	9.86	9.81	9.65	9.60
3. Chloride - ppm	Min. ---	<0.05	0.10	<0.05	0.10
	Max. 0.50	0.29	0.25	0.23	0.18
4. Hydrazine - ppm					
(Hot Lay-up)	Min. Residual	.002	.006	.006	.002
	Max. ---	19.8	19.8	19.8	19.8
(Cold Lay-up)	Min. 50	46***	50	60	65
	Max. 100	134***	136***	102***	104***
** 5. Chemicals Used in lbs.					
Na_3PO_4		--	--	--	--
Na_2HPO_4		--	--	--	--
N_2H_4		9.5 **	9.5 **	8 **	9 **
C_4H_9NO		--	--	--	--

**NOTE: Additional treatment to boilers required in special cases.

***See Turbine Plant section of Q.O.R.

4. MAINTENANCE

Repairs of major components, as well as routine maintenance on equipment, instruments, controls and preventive maintenance were performed during the quarterly report period. Major work items completed or in progress during this report period are summarized as follows:

Core Assembly Room Preparation for LWBR

Preparation of the core assembly room for the Light Water Breeder Reactor (LWBR) continued with the installation of a special clothing dressing room.

RWD Inspection and Cleaning

Inspection and cleaning of the 1A and 1B Non-active Waste Tanks was completed. The 1A and 1B Special Waste Tanks were also inspected with no cleaning required.

RWD Modifications

The test tank effluent filter was installed.

Demineralizer Building Modifications

Conversion of the Demineralizer Building into a clean storage area for LWBR equipment was started.

Core Vault Modifications

The PWR-2 Fuel Storage Racks were removed from the Core Vault, and the LWBR Mechanism Stator Racks were installed.

M-160 Spent Fuel Shipment

Preparations for the first shipment of PWR-2 spent fuel in the Deep Pit were started near the end of the report period.

Refueling Equipment Inventory

Inventory of refueling equipment stored at SAPS, and evaluation of their condition was about 95% complete at the end of this report period.

Load Test of 125 Ton Fuel Handling Building Crane

The 125 ton hoist on the Fuel Handling Building Crane was load tested.

1C Traveling Screen

Preventative maintenance was started on the 1C traveling screen at the Screen House.

Spring Shutdown

All items that were scheduled for inspection and repair were completed and returned to service during the first two weeks of this quarterly report.

5. TEST PROGRAM

The primary objective of the test program during the quarterly report period was to continue reactivity depletion of Core 2 Seed 2 in order to determine irradiation and reactivity lifetime properties and core power distribution as a function of lifetime. Other objectives for this period were to perform periodic calibrations of the primary plant temperature and flow instrumentation, the feedwater instrumentation, and the Data Acquisition System. The reactor plant container integrity was checked at the butterfly valves and a leak rate test was done on the Reactor Water and Pressurizer Steam Relief Valves. Tests were also performed to check the Nuclear Protection System and the Control Rod Drive Mechanisms. Special tests completed during this period included a check for leaks at Radioactive Waste Disposal and a heat load determination of the Component Cooling Water System.

Eleven tests were performed during the report period. Nine tests were completed and two remained in progress at the end of the quarter. Table VI lists these tests and Figure 2 indicates the performance dates. Information pertaining to chemistry tests may be found in the chemistry section of this report.

The Periodic Intercalibration of Temperature Sensing Elements (DLCS 60901) which was started last report period on March 16, 1973 was completed on April 11. This completed the seventeenth performance of this test. The sixteenth performance of the Periodic Calibration of Reactor Plant Flow Instrumentation (DLCS 61301) included the calibration of all four coolant loop flows and was completed on April 2. In conjunction with these instrument calibration, the Data Acquisition System Calibration Test was performed completing the seventeenth performance of DLCS 60401.

The Control Rod Drive Mechanism Periodic Test was performed on April 9 and 10 with four reactor coolant pumps operating on fast speed. All rod full travel scram times were below the allowable maximum full travel scram time of 1.80 seconds. This completed the eleventh performance of DLCS 66101.

DLCS 60802, Nuclear Protection System (Checkout of Pump Power, SLOFA and CLOFA Circuitry) was performed for the tenth time on April 11 and 12. After an adjustment to the resistor in the 1B RCP T-Relay circuit was made, all response times were within the specified limits.

The reactor plant container integrity was checked at the butterfly valves (DLCS 56802) completing the seventeenth performance of the test. The 1C and 1D supply valve seals were replaced at this time. Acceptable response times and leak rates were obtained for both the supply and exhaust valves.

On May 8, 9, and 11, the Periodic Reactor Plant Leak Rate Test (DLCS 56401) was performed for the ninth time. There were no indications of any leakage through any of the Reactor Water or Pressurizer Steam Relief Valves.

The FEDAL System (Operation during Station Start-Up) Test (DLCS 58302) was performed monitoring Seed Assembly E-10, which corresponds to Port 9 on the multiport valve. Performances 90 through 93 were executed during this report period.

The Periodic Calibration of Feedwater Instrumentation (DLCS 61801) was performed on June 19 and 26-28. For this twelfth performance, all instrumentation met the test specifications.

A special test was conducted on May 24 to determine the Component Cooling Water System heat load. This test will be repeated at different river temperatures to determine the capability of the System.

Another special test was performed on June 9 using Freon-12 to check for gas leaks at RWD. No trace of leakage was detected anywhere in the system.

TABLE VI

Tests Performed During Second Quarter of 1973

DLCS 5640109	Periodic Reactor Plant Leak Rate Test
DLCS 5680217	Reactor Plant Container Integrity Test (Butterfly Valve Test)
DLCS 5830290-93	FEDAL System (Operation during Station Start-Up)
DLCS 6040117	Data Acquisition System Calibration Test
DLCS 6080210	Nuclear Protection System (Checkout of Pump Power, SLOFA and CLOFA Circuitry)
DLCS 6090117	Periodic Intercalibration of Temperature Sensing Elements
DLCS 6130116	Periodic Calibration of Reactor Plant Flow Instrumentation
DLCS 6180112	Periodic Calibration of Feedwater Instrumentation
DLCS 6610111	Control Rod Drive Mechanism Periodic Test

Tests Remaining in Progress at End of Report Period

DLCS 6590102	Reactor Pressure Drop and Coolant Flow Characteristics
DLCS 6600102	Reactivity Lifetime Test

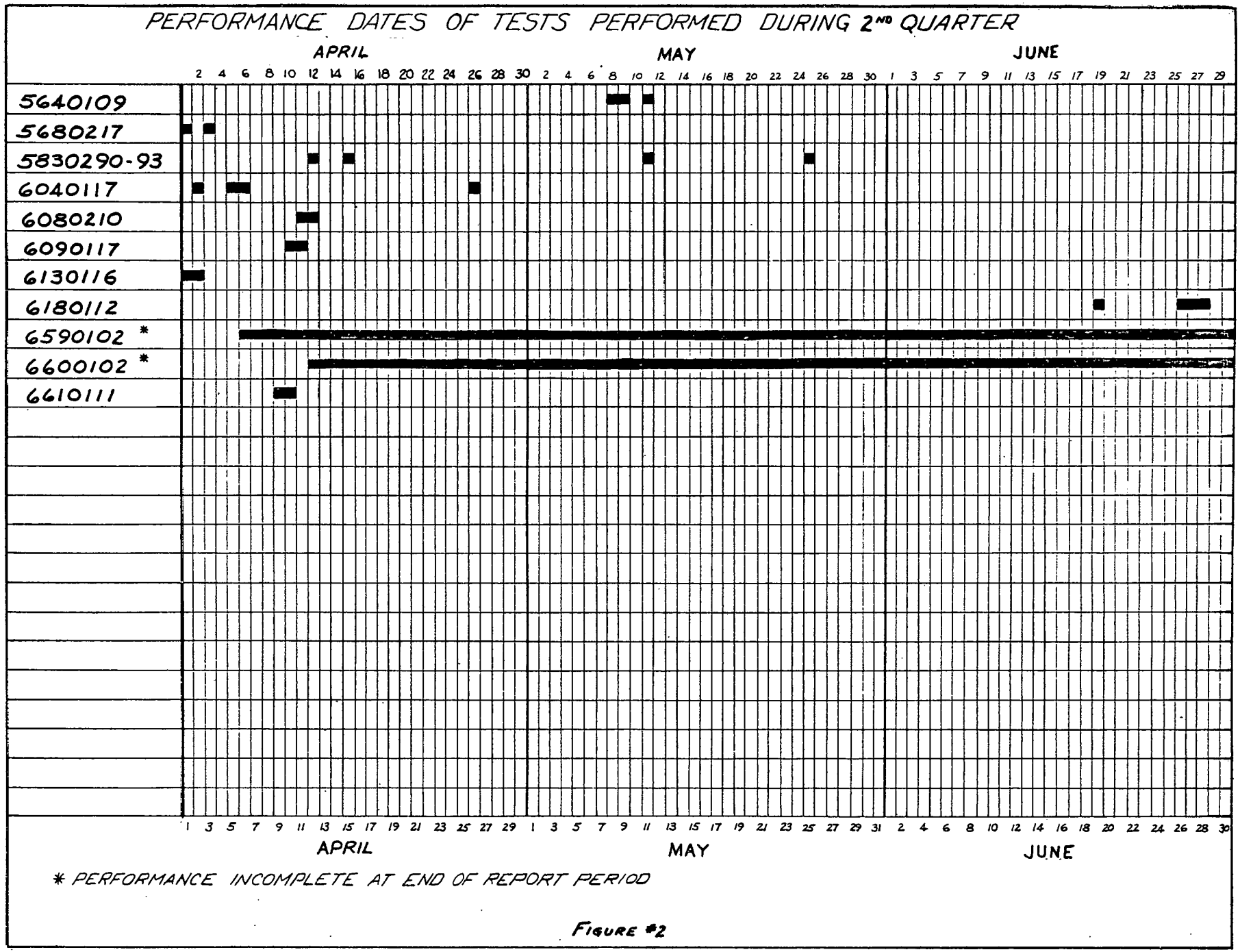

PERFORMANCE DATES OF TESTS PERFORMED DURING 2ND QUARTER
APRIL
MAY
JUNE
5640109
5680217
5830290-93
6040117
6080210
6090117
6130116
6180112
6590102 *
6600102 *
6610111
* PERFORMANCE INCOMPLETE AT END OF REPORT PERIOD

FIGURE #2

6. GLOSSARY

AEC . . . . . United States Atomic Energy Commission

AIX . . . . . after ion exchanger (outlet)

a/o . . . . . atomic percent

BAPL. . . . . Bettis Atomic Power Laboratory

BIX . . . . . before ion exchanger (inlet)

bkgd. . . . . background

CIC . . . . . compensated ionization chamber

DAS . . . . . Data Acquisition System

DE. . . . . demineralizer effluent

DF. . . . . decontamination factor

EFPH. . . . . equivalent full power hour

FEDAL . . . . . Failed Element Detection and Location System

Hc. . . . . critical height

HDS . . . . . Heat Dissipation System

magamp. . . . . magnetic amplifier

MELBA . . . . . Multipurpose Extended Life Blanket Assembly

mr. . . . . milliroentgen

mrem. . . . . milliroentgen equivalent man

NPS . . . . . Nuclear Protection System

ORMS. . . . . Operational Radiation Monitoring System

PWR . . . . . Pressurized Water Reactor

R . . . . . roentgen

RC. . . . . resistance capacitance

μc. . . . . microcuries

RCS . . . . . Reactor Coolant System

rem . . . . . roentgen equivalent man

RPC . . . . . Reactor Plant Container

RWDS . . . . . Radioactive Waste Disposal System

STP . . . . . standard temperature and pressure

su . . . . . smear unit (100 sq. cm.)

Tavg . . . . . average reactor coolant temperature

Tc . . . . . reactor inlet coolant temperature

Th . . . . . reactor outlet coolant temperature

Ts . . . . . time of sample isolation

v/o . . . . . percent by volume

VOS . . . . . Valve Operating System