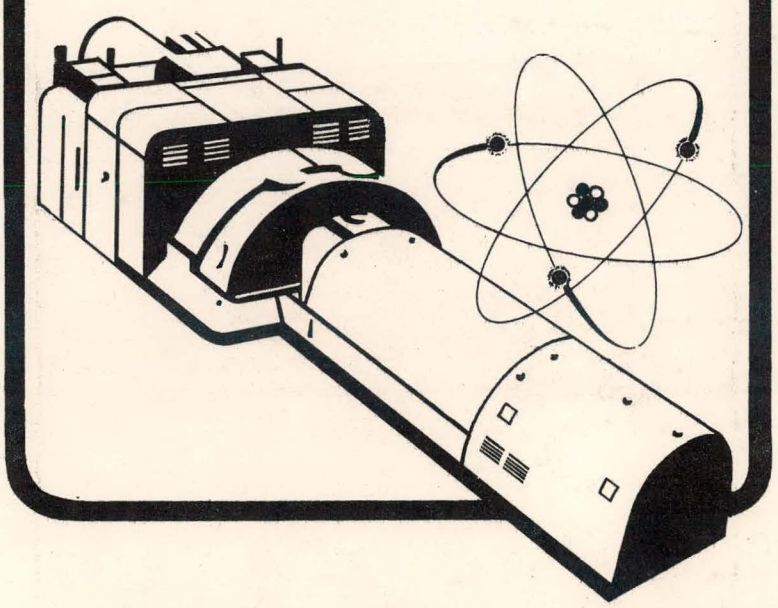
DLCS 5000372

DUQUESNE LIGHT COMPANY

Shippingport Atomic Power Station

Quantenly

OPERATING REPORT



Third Quarter 1972

Contract AT-11-1-292

United States Atomic Energy Commission

DISCLAIMER

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

January 29, 1973

C. W. Flynn, PWR Project Officer
Pittsburgh Naval Reactors Office
THRU: Director, Division of Naval Reactors

DOCUMENT FOR DTIE PROGRAM - DUQUESNE LIGHT COMPANY
SHIPPINGPORT ATOMIC POWER STATION QUARTERLY OPERATING REPORT

Reference is made to your memorandum of January 18, 1973 (PWR:CWF: 2522) subject as above, forwarding a copy of the following Duquesne Light Company Quarterly Operating Report:

DLCS 5000372, for the Third Quarter 1972.

Please be advised there is no objection from a patent viewpoint to release for publication of the above report of the Duquesne Light Company.

Roland A. Anderson
Assistant General Counsel
for Patents

cc: T. L. Foster, NR
T. W. Laughlin, DTIE, OR

UNITED STATES
ATOMIC ENERGY COMMISSION
PITTSBURGH NAVAL REACTORS OFFICE
P.O. BOX 109
WEST MIFFLIN, PENNSYLVANIA 15122

January 18, 1973

Roland A. Anderson, Assistant General Counsel
for Patents, Headquarters
THRU: Director, Division of Naval Reactors

DOCUMENT FOR DTIE PROGRAM - DUQUESNE LIGHT COMPANY
SHIPPINGPORT ATOMIC POWER STATION QUARTERLY OPERATING REPORT

Forwarded for review is the Duquesne Light Company, Shippingport Atomic Power Station Quarterly Operating Report, DLCS 5000372, for the Third Quarter 1972.

It is requested that the results of your review be forwarded to this office with a carbon copy to DTIE, Oak Ridge.

By copy of this memorandum, DTIE is requested to make the attached report available for distribution upon notification that patent review has been completed.

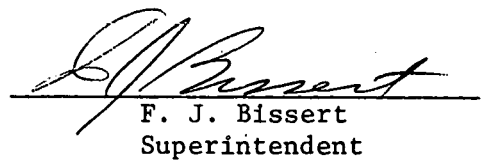
C. W. Flynn
PWR Project Officer

PWR:CWF:2522

Enclosure:
DLCS 5000372

cc: T. L. Foster, NR, w/o encl
T. W. Laughlin, DTIE, OR
w/3 cys encl and Form AEC-426

QUARTERLY OPERATING REPORT
Third Quarter 1972
DLCS 5000372

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. Any one desirous of obtaining advice 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, Office of Technical Information Extension at Oak Ridge, Tennessee, where this information is readily available.

1. SUMMARY OF OPERATIONS

During the third quarter of 1972, the Shippingport Atomic Power Station was operated as required for DLCO system load demand, testing, and maintenance. The 1A reactor coolant loop remained isolated and drained until the heat exchanger leak repairs were completed. One unintentional reactor shutdown occurred during the quarter as well as two schedule training shutdowns and start-ups for recertification of personnel. The scheduled semi-annual fall shutdown for testing, maintenance, training and operational checks was performed on September 22, 1972.

A reactor shutdown occurred on July 22, 1972 when the turbine gland steam regulator failed closed, causing a low vacuum turbine throttle trip. The faulty gland steam regulator was corrected, and the main unit generator was returned to service on July 23.

The Component Cooling Water cooler was cleaned and returned to service on August 24, 1972, using the Canal Water cooler during the interim. Component cooling water data on all system components was obtained on August 31 and September 1.

Repairs to the 1A loop heat exchanger tube leaks were completed on September 12. The loop will be returned to service during the plant shutdown in October.

On September 16, a training shutdown and start-up were performed with the reactor taken to a full scram condition and then taken critical. The Main Unit was off the line from 0623 until 2019 when the Main Unit generator was synchronized and placed back in service.

On September 17, another training shutdown and start-up was performed similar to the one on September 16, except the reactor was only taken to a partial scram condition and then taken critical at 1238. The main unit generator was out of service from 0826 until 1409 when it was again synchronized and placed back in service.

On Friday, September 22 at 2200, the Main Unit Generator was shutdown for the semi-annual fall scheduled shutdown for testing, training, operational checks, and maintenance. The reactor was shutdown at 1648 on September 24, after performing xenon transient tests.

A station cooldown was initiated on September 25 at 0434. Supervisor recertification and certification training was performed on the Pressurizer and Reactor Plant Cooldown Heat Exchanger Systems during cooldown. The Core Removal Cooling System was placed in service on September 27 when further cooling was continued to approximately 100° F. on the Reactor Coolant System.

The reactor coolant system leak rate continued to average 7-8 gallons per hour.

During the period of the third quarter, 329 drums of radioactive waste material, weighing 69,747 pounds and containing 544.52 millicuries of activity were shipped off-site for burial.

2. SUMMARY OF CORE 2 STATION PERFORMANCE

Electrical output(Gross) to date	kwhr	3,109,227,300
EFPH to date (Blanket operating time)	hr	21,375.3
EFPH to date (Seed 2 operating time)	hr	7,723.3
EFPH for the quarterly period	hr	371.3
Hours reactor critical to date	hr	52,662.7
Hours reactor critical for the quarterly period . . .	hr	2,029.1
No. 1 main unit service hours (quarterly period) . . .	hr	1,982.7
Net Station output (quarterly period)	kwhr	35,757,000
No. of forced outages*		1

* Interruption of electrical output due to protective relay action and/or operator action as required to protect the Station.

3. CHEMISTRY

During the third quarter of 1972 the chemistry section maintained specifications in the various plant systems and fulfilled station manual requirements.

Reactor Plant

During the entire third quarter the station operated with the 1B, 1C, and 1D reactor coolant loops and the BD purification demineralizer in service. The 1A reactor coolant loop was filled in September and remained isolated in either a hot or a cold lay-up condition throughout the remainder of the quarter. There were no out of specification reactor coolant conditions during this period. See Tables I and II for a summary of reactor coolant conditions.

The reactor plant auxiliary systems were maintained within chemical specifications except for the canal water system. Chromated water in the canal water cooler was inadvertently introduced into the reactor pit (0.3 ppm $CrO_4^{=}$) and this resulted in a low pH (less than 6.00). The out of specification condition lasted approximately 24 hours and was remedied by passing the reactor pit water through the canal water demineralizer. See Table III for further information.

The Cs^{138} activity of the reactor coolant remained relatively constant during this quarter. 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. Tave operation.

Average Cs^{138} Activity

Month	dpm/ml	µCi/ml	No. of Observations
July	666	3.03×10^{-4}	8
August	697	3.17×10^{-4}	10
September	579	2.63×10^{-4}	6

The gross non-volatile gamma activity of the reactor coolant after a 15 minute decay ranged from 7,164 cpm/ml at 9% reactor power to 59,939 cpm/ml at 67% reactor power. The D.F. (decontamination factor) across the demineralizer ranged from 46 to 553 after a 15 minute decay.

Turbine Plant

During the entire third quarter the station operated on volatile heat exchanger chemistry. The 1B, 1C, and 1D heat exchangers were in service throughout the quarter. The 1A heat exchanger was in either a hot or a cold lay-up condition for most of the quarter. There were two out of specification operating heat exchanger conditions. One condition was a high specific conductivity (above 10 µmho) in the 1B, 1C, and 1D heat exchangers. This condition was remedied by "blowing down" the heat exchangers. The other

out of specification condition was a low pH on the 1C heat exchanger which was also remedied by blowing down the heat exchanger and increasing the morpholine addition to the boiler feed.

Out of specification conditions for the 1A heat exchanger during lay-up were quite common. While on cold lay-up the hydrazine (N_2H_4) specification of 50 ppm to 100 ppm could not be met from day to day. This resulted in daily treatment of the 1A heat exchanger with hydrazine. Also during this quarter a maximum specific conductivity limit of 30 µmho for cold lay-up was instituted. Because of the decomposition of hydrazine to form ammonia the specific conductivity limit could not be met. A constant drain down and fill ("bleed and feed") was attempted to remedy this high specific conductivity situation but was ineffective. The 1A heat exchanger when put under hot lay-up conditions remained within specifications after "steaming off" the ammonia.

The 1B, 1C, and 1D heat exchangers also experienced out of specification conditions during lay-up. The maximum specific conductivity specification of 30 µmho was exceeded during cold lay-up treatment with hydrazine. Also the hydrazine concentration dropped below the minimum specification of 50 ppm. This condition was remedied by treating the heat exchanger with hydrazine. See Tables IV and V for a summary of heat exchanger water conditions.

Radioactive Waste Disposal System

The radioactive waste disposal system continued to operate using a series of fixed ion exchange media which was initiated during the first quarter of 1971. The Xe^{133} activity for the quarter ranged from 19.8 dpm/cc to 29.8 dpm/cc (9.01×10^{-6} µCi/cc to 1.36×10^{-5} µCi/cc).

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	10.14	10.30	126	92.6
2. Specific Conductivity umhos	- - - - - -	33	51		
3. Total Gas - cc/kg	125 Maximum	56	103		
4. Hydrogen - cc/kg	10 - 60	22	51		

TABLE II

Reactor Coolant System

Water Conditions and Chemical Adjustments

Shutdown Conditions

Chemical Conditions	Temp.	Specifications	Analytical Results Min.	Max.	NH_4OH Additions Liters	Degassification Hours
1. pH @ 25° C.	> 200°F	10.10 - 10.30	10.20	10.27		13 1/2
	< 200°F	6.0 - 10.50	9.33	10.15		
2. Total Gas - cc/kg	> 200°F	80 Max	53	71		
	< 200°F	25 Max*	19	40		
3. Hydrogen - cc/kg	> 200°F	10 - 60	19	32		
	< 200°F		10	17		
4. Oxygen - ppm	> 200°F	< 0.14	0.010	0.030		
	< 200°F	< 0.3				
5. Chloride - ppm	> 200°F	< 0.1				
	< 200°F	< 0.1	< 0.05			

* Degassification to 25 cc/kg 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	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	1200-1760	8.85- 9.47	611- 906	< 0.05-0.10	-	3.5
Coolant Charging Water						
Specifications	2.50 max.	6.00- 8.00	none	0.1 ppm max.	none**	none
Observed	0.99-2.20	6.40- 7.96	-	< 0.05	6.1-8.3	-
Canal Water						
Specifications	5.00 max.	6.00- 8.00	none	none	none	none***
Observed	1.00-1.40	5.60***-6.68	0.30****	-	-	0.07-0.58

* Multiply tabular value by $4.55 * 10^{-7}$ to obtain μc/ml
** Should be < 0.14 ppm for reactor plant cold shutdown
*** Normally near background
**** See Reactor Plant section of Q.O.R.

TABLE IV

Operating Heat Exchanger Chemistry

Volatile Water Chemistry

Water Conditions	Specifications	Heat Exchangers 1A	1B	1C	1C
1. Cond - µmho	Min. ---- Max. 10		5.6 10.5*	5.1 10.2*	5.5 10.4*
2. Phosphate - ppm	Min. ---- Max. 2		- -	- -	- -
3. Chlorides - ppm	Min. ---- Max. 0.5		0.09 0.47	0.09 0.50	0.10 0.40
4. Hydrazine - ppm	(residual)		0.037 0.092	0.029 0.083	0.030 0.075
5. Silica - ppm	Min. ---- Max. 25		1.5 3.4	1.2 3.3	1.8 4.1
6. pH at 25° C	Min. 8.0 Max. ----		8.03 9.18	7.94* 9.14	8.00 9.02
7. Chemicals Used					
Na_3PO_4		-	-	-	-
Na_2HPO_4		-	-	-	-
NaH_2PO_4		-	-	-	-
N_2H_4					

* 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					
(Hot Lay-up)	Min. ---	9.1	6.1	6.2	6.6
	Max. 10	74*	8.6	8.7	9.3
(Cold Lay-up)	Min. ---	15	19	16	18
	Max. 30	102*	83*	65*	67*
2. pH					
(Hot Lay-up)	Min. 8.00	9.22	8.70	8.65	8.62
	Max. ---	10.30	8.80	8.80	8.78
(Cold Lay-up)	Min. 8.00	9.55	9.55	9.55	9.55
	Max. ---	10.68	10.30	10.28	10.28
3. Chloride - ppm	Min. ---	< 0.05	0.10	0.10	< 0.05
	Max. 0.50	0.30	0.17	0.20	0.20
4. Hydrazine - ppm					
(Hot Lay-up)	Min. Residual	0.001	0.016	0.008	0.010
	Max. ---	35	0.049	0.110	0.070
(Cold Lay-up)	Min. 50	0.40	21*	13*	15*
	Max. 100	100	111**	89	72
5. Chemicals Used (Pounds)					
Na_3PO_4					
Na_2HPO_4					
N_2H_4		625	56	41	33

* See Turbine Plant section of Q.O.R.
** Sample taken before complete mixing

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 which were attended to during this report period are summarized as follows:

1A Steam Generator

Repair of the 1A Reactor Coolant Loop Steam Generator which had been undertaken during the second quarter of 1971 was completed. The Loop was ready to be returned to service at the end of the quarter.

1A Reactor Coolant Pump

The 1A Reactor Coolant Pump was reassembled and ready for service at the end of the quarter.

1A Test Tank

The 1A Test Tank was cleaned and remounted on its foundation.

Refueling Equipment Inventory

The inventory of refueling equipment stored at SAPS continued during the report period.

Station Service Air Compressor

A new high pressure cylinder was installed on the Station Service Air Compressor and the unit was returned to service.

PWR Test Head

The associated equipment and tools for the PWR Test Head were prepared for shipment to a vendor to be incorporated in the LWBR program.

1A Traveling Intake Screen

The 1A Traveling Intake Screen was removed from service and disassembled. The rebuilding of the screen was in progress at the end of the report period.

1B Service Boiler Feed Pump

The 1B Service Boiler Feed Pump was overhauled during the report period.

Fall Station Shutdown

The following Fall Shutdown Items were in progress at the end of the period:

1. Turbine Plant
   a. Repair of Main Unit Turbine Governor
   b. Repair of miscellaneous valve leaks
   c. Cleaning of Main Unit Condenser
2. Reactor Plant
   a. Cleaning of #1 Valve Operating System (VOS Air Compressor)
   b. Inspection of Component Cooling Water Strainers
   c. Repair of miscellaneous valve leaks

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, flow, and pressure instrumentation. Radiation surveys were taken on the reactor coolant loops, reactor vessel head, and the purification demineralizers. The reactor plant container integrity was checked at the butterfly valves. Special tests performed during this period included a resin level determination of the RWD Resin Storage Tanks and a heat load determination of the Component Cooling Water System.

Fourteen tests were performed during the report period. Ten tests were completed and four 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) was started on September 24, 1972. The test was continued on September 27-30 and remains in progress. The fifteenth performance of the Periodic Calibration of Reactor Plant Flow Instrumentation (DLCS 61301) includes the calibration of all four coolant loop flows. Calibrations were done on September 7, 28, and 29 and the test is still in progress. On September 30 the 1A Coolant Loop pressure was calibrated as the twelfth performance of the Periodic Calibration of Pressure Instrumentation (DLCS 61001).

The core axial flux was measured for power range, equilibrium xenon conditions (DLCS 63502) on September 22. Iron-Manganese wires were irradiated for twelve minutes at 33 percent reactor power. On September 23, zircaloy wires were irradiated for twenty minutes at both peak xenon and the return time for measurement of the axial flux during the xenon transient (DLCS 63503). The first performance of the Xenon Transient Test (DLCS 63303) utilizing the IKS for reactivity measurements was done on September 23 and 24.

On September 25, radiation surveys of the reactor vessel head (DLCS 58601) and the AC and BD Heat Exchangers and Demineralizers and the 1B, 1C, and 1D Reactor Coolant Loops (DLCS 58501) were taken.

The reactor plant container integrity was checked at the butterfly valves (DLCS 56802) on September 29 and 30 completing the sixteenth performance of this test. Acceptable response times and leak rates were obtained for both the supply and exhaust valves.

The FEDAL System (Operation During Station Start-Up) Test (DLCS 58302) was performed monitoring Seed Assembly E-10, which corresponds to Port 9. Performances 86 and 87 were completed during this report period.

Special tests included a heat load determination of the Component Cooling Water System (DLCS 57501) on August 31 and September 1 and a resin level determination for the RWD Resin Storage Tanks (DLCS 59801) on August 11.

TABLE VI

Tests Performed During Third Quarter of 1972

DLCS	5680216	Reactor Plant Container Integrity Test (Butterfly Valve Test)
DLCS	5750103	Component Cooling Water System (Heat Load Determination)
DLCS	5830286-87	FEDAL System (Operation During Station Start-Up)
DLCS	5850135	External Radiation Levels of Reactor Coolant System Piping and Components and Purification System Demineralizers and Heat Exchangers
DLCS	5860118	Periodic Radiation Survey of the Reactor Vessel Head
DLCS	5980103	RWD Resin Storage Tanks (Resin Level Determination)
DLCS	6100112	Periodic Calibration of Pressure Instrumentation
DLCS	6330301	Xenon Transient Test (IKS Method)
DLCS	6350226	Axial Flux Measurement Test (Power Range - Equilibrium Xenon)
DLCS	6350312	Axial Flux Measurement Test (Xenon Transient)

Tests Remaining in Progress at End of Report Period

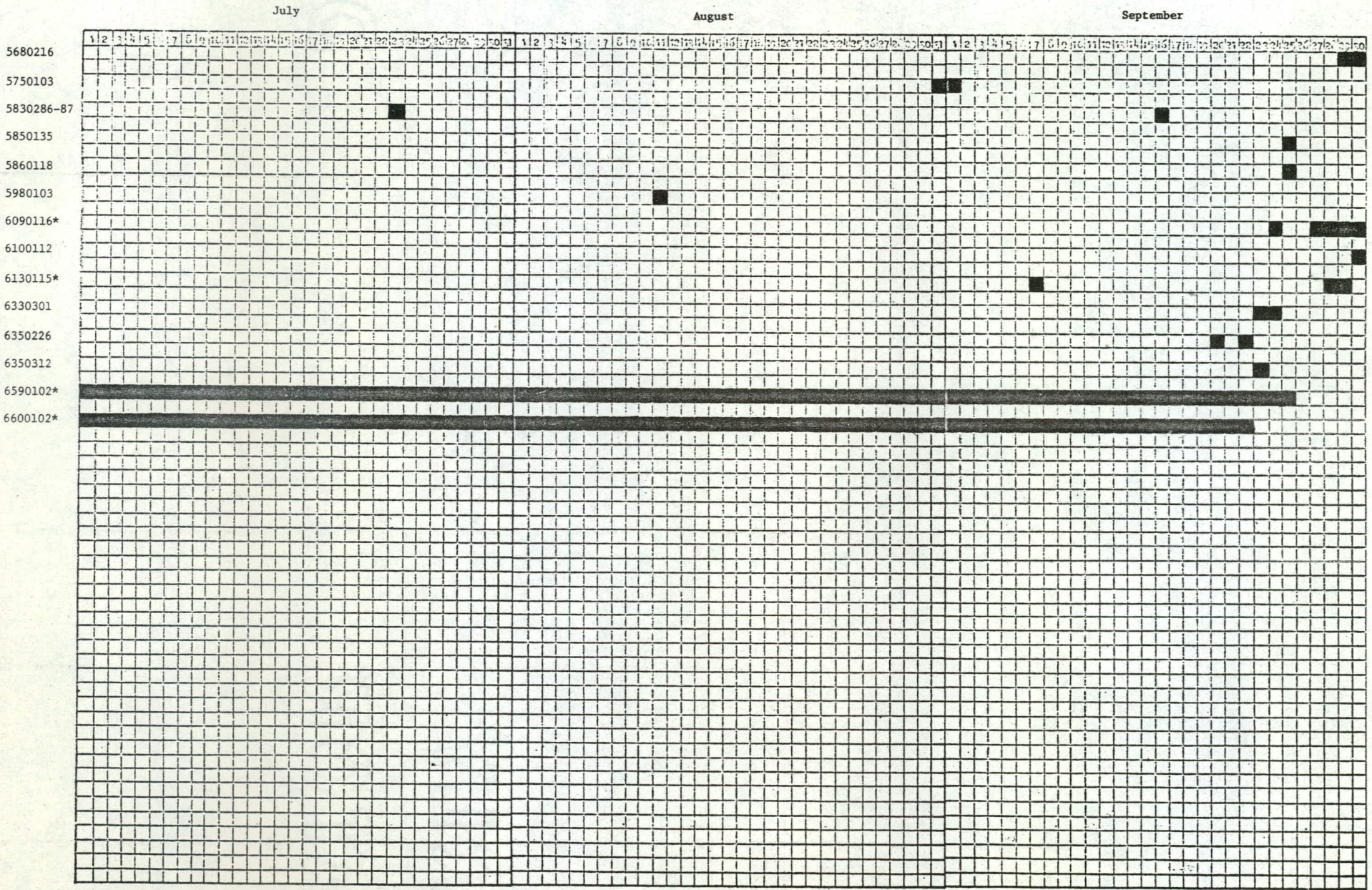
DLCS	6090116	Periodic Intercalibration of Temperature Sensing Elements
DLCS	6130115	Periodic Calibration of Reactor Plant Flow Instrumentation
DLCS	6590102	Reactor Pressure Drop and Coolant Flow Characteristics
DLCS	6600102	Reactivity Lifetime Test

FIGURE 2

Performance Dates

of

Tests Performed During Third Quarter of 1972



* Performance incomplete at end of the report period.

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	Pressurizer 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 coolant inlet temperature
Th	reactor coolant outlet temperature
Ts	time of sample isolation
v/o	percent by volume
VOS	Valve Operating System