DLCS 5000170

MASTER

DUQUESNE LIGHT COMPANY
Shippingport Atomic Power Station

MASTER

Quarterly
OPERATING REPORT

**First Quarter
1970**

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

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Duquesne Light Company
Shippingport Atomic Power Station
Power Stations Department

QUARTERLY OPERATING REPORT
First Quarter 1970
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Approved by

F. J. Bissert
Superintendent

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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 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 first quarter of 1970, the Shippingport Atomic Power Station was operated as required for maintenance, testing and the Duquesne Light Company System load demand. No scheduled shutdowns occurred and the Heat Dissipation System remained shutdown throughout the period.

Two operational incidents occurred during the quarter, both of which were associated with primary plant instrumentation. At 5:20 PM on January 11, the reactor scrambled because of a low pressure spike on the pressurizer pressure indicator. The cause of the spike, a foreign, adhesive-like substance within the instrument which apparently caused its sensitivity to change, was found and corrected and the station was returned to power operation at 1:32 AM on January 12.

On January 28, AC power to the reactor coolant average temperature indicator was interrupted because of an open circuit in the supply wires. Reactor coolant average temperature increased from the normal $536 \pm 1^{\circ}\text{F}$ to 542°F over approximately a 1 1/2 hour period before a high temperature alarm was initiated and the malfunction was discovered. Since the reactor operator uses the average temperature indicator for reactor temperature control, no corrective action, such as control rod movement, was undertaken until the alarm sounded. The temperature error was then discovered and corrected and back-up instrumentation used for temperature control until the faulty wiring was replaced.

No shipments of radioactive waste were made from the facility during this report period.

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FIGURE 1

Generator Output, HDS Load and Reactor Coolant Temperature During
First Quarter 1970

2. SUMMARY OF CORE 2 STATION PERFORMANCE

Electrical output (Gross) to date.	kwhr	2,372,549,700
EFPH to date (Blanket operating time).	hr	16,473.7
EFPH to date (Seed 2 operating time)	hr	2,821.7
EFPH for the quarterly period.	hr	889.8
Hours reactor critical to date	hr	34,859.9
Hours reactor critical for the quarterly period. . hr		2,153.8
No. 1 main unit service hours (quarterly period) . kwhr		2,151.8
Net Station output (quarterly period).	kwhr	116,063,000
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 first quarter of 1970, the chemistry section maintained required chemical specifications in the various plant systems and participated in the test program. Two sample collections were obtained for DLCS 59201, PWR Core 2 Reactor Coolant Crud Study (Periodic Sampling).

The following table summarizes the chemical test results for the quarter.

Reactor Plant

The 1D reactor coolant loop and the 1BD purification demineralizer remained out of service the entire quarter. Water conditions of the 1A, 1B, and 1C reactor coolant loops were maintained in accordance with the station manual. No out of specification water conditions were observed in the primary coolant system.

A summary of operating water conditions obtained during power operation is contained in Table I.

The Component Cooling Water System was maintained within chemical specifications during the report period. The Canal Water System met all chemical specifications except that the minimum pH fell to 5.68 due to the presence of dissolved carbon dioxide. Pollution of the primary charging water with ammonium hydroxide, which is used to treat the primary coolant, resulted in out of specification pH and conductivity conditions which persisted throughout the majority of the quarter. No trace of chloride contamination was detected in the primary charging water. The required chemical specifications and observed conditions of the Reactor Plant Auxiliary Systems are summarized in Table II.

A slight increase in Cesium-138 activities was noted in mid-February. Cesium-138 activity was determined on approximately a daily basis for the remainder of the quarter. Analyses obtained at low power levels yielded the highest results upon correction to standard conditions. These few numbers were not included in the monthly average. The Cesium-138 activity remains at a relatively low level. The following tabulation lists the average Cesium-138 values calculated for each month of the report period. All values are corrected to a standard base of 67 percent reactor power, four reactor coolant loops, two purification demineralizer loops in service at 33,000 pounds/hour flow through the demineralizers and 536°F Tavg operation:

Average Cesium - 138 Activity

<u>Month</u>	<u>dpm/ml</u>	<u>uc/ml</u>	<u>No. of Observations</u>
January	371	1.69×10^{-4}	9
February	411	1.87×10^{-4}	12
March	466	2.12×10^{-4}	22

On February 13, at 2445 EFPH, the reactor coolant was sampled and tritium activity was determined to be 2.3 uc/liter. The value is comparable to those previously obtained during Core 2, Seed 2 operation.

Reactor coolant crud sample collections were performed on February 13 at 2445 EFPH and on March 12 at 2684 EFPH as part of DLCS 59201, PWR Core 2 Reactor Coolant Crud Study (Periodic Sampling). Analysis of those samples was about to begin at the end of this report period.

As required by the Station Manual, radiochemical analysis of reactor coolant for soluble and insoluble activity is performed each 1000 EFPH of Core 2 operation. Table III contains the results of samples obtained on December 10 at 1690 EFPH and on February 13, 1970 at 2445 EFPH. The activities per milligram of the crud sample of February 13 are distorted due to the low crud weight involved, however the percentage recovery is considered accurate.

Throughout the first quarter, the primary plant was operated with the 1A, 1B, and 1C loops in service and 33,000 pounds/hour flow through the IAC purification demineralizer. The gross non-volatile gamma activity after 15 minutes decay at the inlet to the IAC purification demineralizer ranged from 11,520 cpm/ml at 15 percent reactor power to 69,210 cpm/ml at 67 percent reactor power. Only one 120 hour gross gamma activity indicated the presence of significant corrosion products by a higher than normal count rate. The D.F. observed across the IAC purification demineralizer ranged from 250 to 735. Eleven routine weekly crud samples ranged in specific activity from 1.67×10^7 cpm/mg to 4.93×10^7 cpm/mg after a 120 hour decay. The crud concentration of these samples ranged from 0.66 ppb to 3.00 ppb.

Turbine Plant

The 1D reactor coolant loop heat exchanger remained out of service during the entire quarter. 1A, 1B, and 1C reactor coolant loop heat exchangers were used for all power operations. There were no hot or cold lay-ups during this period. No evidence of primary to secondary leakage was detected. Chemical specifications were maintained on the heat exchangers without exception. Summaries of heat exchanger water analysis may be found in Table VI.

Waste Disposal System

During this quarter, the Radioactive Waste Disposal System was operated in the manner initiated during the fourth quarter of 1969. The liquid radioactive waste from the chemical waste tanks was processed through the evaporator and then pumped to the test tanks. Five chemical waste tanks were processed in this manner during the quarter. Three surge tanks were also processed in this period. Twelve test tanks with a tritium activity ranging from 2.28×10^{-3} uc/ml to 6.20×10^{-4} uc/ml were discharged to the Ohio River. Since these test tanks were composed of waste from both the surge and chemical waste tanks, the tritium activity cannot be considered as a measurement of either the surge or the chemical waste tanks.

The Xe^{133} activity of the vent gas system ranged from 1.7 dpm/cc (7.7×10^{-7} uc/cc) to 0.8 dpm/cc (3.6×10^{-7} uc/cc) for this quarter.

All other wastes were processed in the usual manner.

TABLE I

Reactor Coolant System

Water Conditions and Chemical Adjustments

Operating Conditions

Chemical Condition	Specifications	Analytical Results		NH ₄ OH Additions Liters	Degassification Hours
		Min.	Max.		
1. pH @ 25° C	10.20 ± 0.10	10.10	10.30	207.9	169.33
2. Specific Conductivity umhos	- - - -	28	54		
3. Ammonia - ppm	- - - -	16	50		
4. Total Gas - cc/kg	125 Maximum	64	111		
5. Hydrogen - cc/kg	10 - 60	25	60		

TABLE II

Reactor Plant Auxiliary Systems

Water Conditions

System	Specific Conductivity umhos	pH _o at 25° C	Cond. - 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	1350-1800	9.19- 9.52	588-786	<0.05	-	Bkgd. - 10 ± 8
Coolant Charging Water Specifications	2.50 max.	6.00- 8.00	none	0.1 ppm max.	none**	none
Observed	2.32-7.00	8.10- 9.45	-	<0.05	10	-
Canal Water Specifications	5.00 max.	6.00- 8.00	none	none	none	none***
Observed	1.40-4.30	5.68- 6.55	-	-	-	Bkgd. - 34 ± 10

* Multiply tabular value by 4.55×10^{-7} to obtain uc/ml

** Should be < 0.14 ppm for reactor plant cold shutdown

*** Normally near background

Primary System Resin and Crud Analysis

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** For conversion to the microcurie unit, multiply tabular value by 4.55×10^{-7}

TABLE IV

Operating Heat Exchanger Chemistry

Water Chemistry

Water Conditions	Specifications	Operating Heat Exchangers			
		1A	1B	1C	1D
1. Dis. Salts - ppm	Min. --- Max. 1000	40 162	23 170	23 168	
2. Phosphate - ppm	Min. 5 Max. 100	16 90	9 97	12 99	
3. Chloride - ppm	Min. 0 Max. 0.5	0.20 0.45	0.20 0.45	0.20 0.45	
4. Hydrazine - ppm	(residual)	0.013 0.072	0.022 0.080	0.021 0.074	
5. Silica - ppm	Min. 0 Max. 25	1.0 6.0	1.0 6.0	1.0 7.0	
6. pH at 25° C	Min. 9.50 Max. 11.00	9.82 10.68	9.51 10.70	9.52 10.69	
7. Chemicals Used, lbs. Na ₃ PO ₄ Na ₂ HPO ₄ NaH ₂ PO ₄		24.5 8.5 -	2.5 8.5 -	2.5 8.5 -	

4. MAINTENANCE

Routine repairs of major components, instruments and controls and preventive maintenance were performed during the quarterly report period. Major repairs performed are summarized as follows:

1D Heat Exchanger

Repair of the 1D reactor coolant loop heat exchanger, which had been undertaken during the last report period, continued throughout the quarter. The first support plate of the failed tube* was inspected by boroscope. Eddy current testing of 1956 tubes of the tube bundle was then begun. This testing was completed on February 6 and, including the 1094 tubes tested during the previous quarter, a total of 3050 tubes were checked. Based upon the results of the eddy current testing, it was decided to remove and inspect six defective tubes and one which had been plugged at the factory by the vendor. Work was initiated to machine and cut the tubes at the tubesheet. The factory installed plugs were removed and the ends of all seven tubes were severed at the tubesheets. Five tubes were completely removed and shipped to Bettis Atomic Power Laboratory for inspection. The removal of the two remaining tubes and machining of the tubesheets for the installation of tube plugs remained in progress at the end of the quarter.

1A and 1B Boiler Feed Pump Check Valves

The 1A and 1B boiler feed pump check valves were found to be leaking at the threaded area of the seats, resulting in reverse rotation of the pumps when they were shutdown. The two seat rings were cleaned and the crevice between the seat and valve body heliarc welded. Each seat and flapper was then checked and the high spots were machined down. The valves were then reassembled and returned to service.

1A Control Air Compressor Aftercooler

The 1A control air compressor aftercooler was found to be leaking air into the cooling water. The aftercooler was isolated and removed for inspection. It was necessary to plug ten tubes and the aftercooler was then reinstalled and returned to service.

1A Deaerator Pump

The 1A deaerator pump was overhauled during the report period. It was necessary to install stainless steel sleeves in the packing gland area. New bearings were also installed and the pump returned to service.

Refueling Cleanup

Refueling cleanup continued with the movement and storage of the shielded fuel handling tool and the cleaning of the Fuel Handling Canal dry pit.

* Note: Reported in last quarter's 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 tests were performed to check the operation of the FEDAL System and radiation surveys were taken of a purification demineralizer.

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

The FEDAL System Check-out Test (DLCS 58201) was performed on January 5 and 6 and March 10 and 11, followed by the FEDAL System Operational Test (DLCS 58401) on January 7 and 8 and March 12 and 13. These tests yielded normal results. The investigation of the high background count rate problem continued during this report period.

The seed fuel cluster at core location G-10 was monitored by the FEDAL system during station start-up on January 12 (DLCS 58301). Test results indicated no cladding failures in this cluster.

The LAC purification system demineralizer was surveyed on January 29 and again on March 31 (DLCS 58502). Both surveys indicated that the radiation level of the LAC demineralizer had reached the limit set for resin discharge.

TABLE VIII

Test Performed During First Quarter of 1970

DLCS 5820124,25	FEDAL System (Checkout Test)
DLCS 5830185	FEDAL System (Operation During Station Start-up)
DLCS 5840123,24	FEDAL System Operational Test
DLCS 5850204,05	Radiation Survey of the Demineralizers

Tests Remaining In Progress At End of Report Period

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

Figure 2
PERFORMANCE DATES
OF
TESTS PERFORMED DURING FIRST QUARTER OF 1970

* Performance incomplete at end of 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
FMI.	flow measurement instrumentation
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

Glossary

DLCS 5000170

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