DLCS 5000174

DUQUESNE LIGHT COMPANY
Shippingport Atomic Power Station

First Quarter MASTER
1974

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

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QUARTERLY OPERATING REPORT
First Quarter 1974
DLCS 5000174

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 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

During the first quarter of 1974, the Shippingport Atomic Power Station was operated as required for Duquesne Light Company system load demand, testing, and maintenance until February 4 when the station was shutdown. The 1A reactor coolant loop remained isolated during the first quarter. The primary coolant leak rate averaged 8 gph during the operational period of the first quarter.

The Station was shutdown at 1700 hours on January 28 for repair of the river water booster pump strainer. The station was returned to power operation at 1300 on January 29.

While performing the monthly overspeed trip checks on the turbine, the throttle valves inadvertently tripped closed. The generator was off the line between 0605 and 0622 on February 3 as a result of the throttle valve trip.

The station was shutdown at 0006 hours on February 4 due to severe turbine-generator vibration. Failure of the rotating blading in the turbine caused the turbine-generator to become unbalanced resulting in extensive damage to the rotating and stationary blades and bearing. In addition, the vibration caused the generator hydrogen seals to leak which resulted in an explosion and fire. No station personnel were injured. The nuclear plant portion of the station was not involved and accordingly there was no release of radioactivity.

The station was cooled down and remained in this condition for the remaining portion of the quarter. The BD core removal cooling system was placed in service to the 1B loop on February 7.

During the period of the first quarter of 1974, two off-site shipments for burial of solid radioactive waste were made. The total shipment weighed 53,800 pounds and contained 66 millicuries of activity.

FIGURE 1
Generator Output - HDS Load and Reactor Coolant Temperature During
First Quarter Period

2. SUMMARY OF CORE 2 STATION PERFORMANCE

Electrical output (Gross) to date	kwhr	3,476,592,300
EFPH to date (Blanket operating time)	hr	23,812.0
EFPH to date (Seed 2 operating time)	hr	10,160.0
EFPH for the quarterly period	hr	202.3
Hours reactor critical to date.	hr	62,232.7
Hours reactor critical for the quarterly period . . .	hr	796.5
No. 1 main unit service hours (quarterly period). .	hr	795.1
Net Station output (quarterly period)	kwhr	22,028,000
No. of forced outages*.		2

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

3. CHEMISTRY

During the first quarter of 1974, the Chemistry section maintained specifications in the various plant systems and fulfilled station manual requirements.

Reactor Plant

The 1A reactor coolant loop and the BD purification demineralizer remained out of service. There were no out-of-specification reactor coolant conditions during this quarter. See Tables I and II. The reactor plant auxiliary systems were maintained within specifications throughout the quarter. See Table III for further information.

The Cs¹³⁸ 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. Data was not obtained during February and March since the reactor was shutdown.

Average Cs¹³⁸ Activity

<u>Month</u>	<u>dpm/ml</u>	<u>µc/ml</u>	<u>No. of Observations</u>
January	736	3.31×10^{-4}	6

The gross non-volatile gamma activity of the reactor coolant after a 15 minute decay ranged from 8,466 cpm/ml at 9% reactor power to 56,988 cpm/ml at 67% reactor power. The D.F. (Decontamination Factor) across the demineralizer ranged from 47 to 687 after a 15 minute decay.

As required by the station manual, radiochemical analysis of reactor coolant for insoluble activity is performed each 1000 EFPH. Samples for the tenth performance of this requirement were collected during the last quarter. The sample analysis is still in progress, therefore the results will be shown in the next quarterly report.

Turbine Plant

The 1B, 1C, and 1D heat exchangers were in service during operating periods. The Station was shutdown on February 4. The 1B, 1C and 1D heat exchangers were placed under hot layup and then cold layup conditions where they have remained for the remainder of the quarter. The 1A heat exchanger has been on cold layup since November 5, 1973. There were no out-of-specification conditions for the 1B, 1C and 1D heat exchangers during operating periods.

The only out-of-specification conditions during hot layup consisted of high specific conductivities ($> \mu\text{mho/cm}$) in the 1B, 1C and 1D heat exchangers which occurred as a result of decomposition of hydrazine added during a plant cooldown. The out-of-specification conditions experienced during cold lay-up were high and low hydrazine concentrations in the 1B, 1C and 1D heat exchangers and high hydrazine concentration and high specific conductivity ($> \mu\text{mho/cm}$) in the 1A heat exchanger. Treatment with hydrazine corrected the low hydrazine concentration condition. The high hydrazine concentrations were due to sampling the heat exchangers before complete mixing occurred after treatment with hydrazine. The high conductivity in the 1A heat exchanger was attributed to ammonia forming from hydrazine decomposition. See Tables IV and V.

Radioactive Waste Disposal System

The total radioactivity, exclusive of tritium discharged from Shippingport during the quarter was approximately 0.0004 curies, which is less than 0.1% of the allowable limit. The quantity of 0.11 curie of Tritium was an insignificant 0.01% of the allowable limit. 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		NH ₄ OH Additions Liters	Degassification Hours
		Min.	Max.		
1. pH @ 25° C	10.20 $\pm$ 0.10	10.13	10.30	53.2	45.25
2. Specific Conductivity μmhos/cm	—	33	50		
3. Total Gas - cc/kg	125 Maximum	64	114		
4. Hydrogen - cc/kg	10 - 60	29	46		

TABLE II

Reactor Coolant System

Water Conditions and Chemical Adjustments

Shutdown Conditions

Chemical Conditions	Temperature	Specifications	Analytical Results		NH ₄ OH Additions Liters	H ₂ Addition cu. ft.	Degas. Hours
			Min.	Max.			
1. pH @ 25° C	>200°F	10.10 - 10.30	10.13	10.22	--	0	21
	<200°F	6.0 - 10.50	8.94	10.04	--	0	0
2. Total Gas - cc/kg	>200°F	80 Max	24	72			
	<200°F	25 Max*	--	--			
3. Hydrogen - cc/kg	>200°F	10 - 60	10	30			
	<200°F		--	--			
4. Oxygen - ppm	>200°F	<0.14	.005	.05			
	<200°F	<0.3	.005	.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 $\mu\text{mhos/cm}$	pH at 25°C	Conc. - ppm			Gross Gamma* Activity - dpm/ml
			CrO_4^{--}	Cl^-	Dis. O_2	
Component Cooling Specifications	none	9.30 - 10.50	500-1000	1 ppm max.	none	none
Observed	1110 - 1800	8.90 - 9.70	510-658	0.05 - 0.44		0.08 - 0.14
Coolant Charging Water Specifications	2.50 max.	6.00 - 8.00	none	0.1 ppm max.	none**	none
Observed	1.4 - 2.0	6.10 - 7.95		<0.05	6.8 - 7.8	
Canal Water Specifications	5.00 max.	6.00 - 8.00	none	none	none	none***
Observed	1.5 - 1.7	6.00 - 6.20				bkgd - 1.2

* Multiply tabular value by 4.50×10^{-7} to obtain $\mu\text{c/ml}$

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

*** Normally near background

TABLE IV
Operating Heat Exchanger Chemistry
Volatile Water Chemistry

Water Conditions	Specifications	Heat Exchangers *			
		1A	1B	1C	1D
1. Cond. - mhos/cm	Min. --- Max. 10		5.2 6.6	4.7 6.3	5.2 7.0
2. Phosphate - ppm	Min. --- Max. 2		0.00	0.00	0.00
3. Chlorides - ppm	Min. --- Max. 0.5		0.07 0.15	0.07 0.13	0.07 0.13
4. Hydrazine - ppm	(residual)		0.072 0.095	0.089 0.077	0.088 0.072
5. Silica - ppm	Min. --- Max. 25		2.8	2.2	3.1
6. pH at 25°C	Min. 8.0 Max. ---		8.60 9.04	8.65 9.03	8.50 9.07
** 7. Chemicals Used in lbs.			--	--	--
Na ₃ PO ₄			--	--	--
Na ₂ HPO ₄			--	--	--
NaH ₂ PO ₄			--	--	--
N ₂ H ₄			--	--	--

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

** Additional treatment to boilers required in special cases.

TABLE V
Non-Operating Heat Exchangers
Water Chemistry

Water Conditions	Specifications	Non-Operating Heat Exchangers			
		1A	1B	1C	1D
1. Specific Cond. $\mu\text{mho/cm}$ (Hot Layup)	Min. ---	--	5.8	5.6	7.2
	Max. 10	--	16.0**	16.0**	19.0**
(Cold Layup)	Min. ---	45**	10	10	10
	Max. 30	50**	26	26	26
2. pH (Hot Layup)	Min. 8.00	--	8.62	8.60	8.75
	Max. ---	--	9.60	9.65	9.70
(Cold Layup)	Min. 9.50	10.05	9.55	9.20**	9.52
	Max. 10.50	10.48	10.10	10.07	10.10
3. Chloride 0 ppm	Min. ---	0.10	0.06	0.07	.05
	Max. 0.50	0.20	0.15	0.16	.15
4. Hydrazine - ppm (Hot Layup)	Min. Residual	--	.002	.002	.002
	Max. ---	--	68	58	66
(Cold Layup)	Min. 50	60	32**	32**	32**
	Max. 100	113**	108**	106**	109**
5. Chemicals Used in lbs. Na_3PO_4 Na_2HPO_4 N_2H_4 $\text{C}_2\text{H}_4\text{NO}$		-- -- 8 --	-- -- 79 1/2 --	-- -- 79 1/2 --	-- -- 82 1/2 --

* 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:

Demineralizer Building Modification

Conversion of the Demineralizer Building into a clean storage area was completed during the beginning of this quarter.

Main Unit Turbine

As a result of the Main Unit Turbine failure during the first quarter, the entire unit internal and external components have been dismantled and shipped to the Westinghouse Electric Corporation Turbine Repair Center in Lester, Pennsylvania for overhaul.

Main Unit Generator

The Main Unit Generator Rotor was shipped to East Pittsburgh, Pennsylvania and the Main Unit Generator Exciter was shipped to Glassport for inspection and repairs in connection with the main unit turbine failure.

1-C Traveling Intake Screen

The 1-C Traveling Intake Screen remained out of service for overhaul during this quarterly report period.

1-B Circulating Pump

The 1-B Circulating Pump was made ready for service during the quarter after completion of the overhaul.

1-A Steam Generator

The 1-A Steam Generator remained out of service throughout the quarter.

Radioactive Waste Disposal System

The A and B Vent Gas Compressors were removed from service for overhaul during this quarter.

Women's Change Room

A women's change room facility was being installed in the reactor service building during the quarter.

M-160 Spent Fuel Shipment

The final shipment of spent PWR-2 Seed 1 fuel was loaded for shipment in the M-160 container during the report period.

LWBR Preparations

Work continued in accordance with established schedules to support planned installation of LWBR demonstration core beginning in late 1975.

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.

Three tests were performed during the report period. One test was completed and two were temporarily interrupted due to the station being shutdown to perform turbine plant repair. Table VI lists these tests and Figure II indicates the performance dates. Information pertaining to chemistry tests may be found in the chemistry section of this report.

TABLE VI

Tests Performed During First Quarter of 1974

DLCS 5830297	Fedal System (Operation during Station Start-Up)
DLCS 6590102	Reactor Pressure Drop and Coolant Flow Characteristics
DLCS 6600102	Reactivity Lifetime Test

PERFORMANCE DATES OF TESTS PERFORMED DURING 1ST QUARTER-1974

Test Program

* PERFORMANCE INCOMPLETE AT END OF REPORT PERIOD

Figure II

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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
μ c	microcuries

Glossary

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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