QUARTERLY OPERATING REPORT
First Quarter 1978
DLCS 5000178

Approved by: T. D. Jones
T. D. Jones
Superintendent

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

Contract E-(36-1)-292
United States Department of Energy

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

MASTER

Table of Contents

Preface	i
1. SUMMARY OF OPERATIONS	1
2. SUMMARY OF STATION PERFORMANCE	4
3. CHEMISTRY	5
4. MAINTENANCE	13
5. TEST PROGRAM	14
6. HEALTH PHYSICS	18
7. GLOSSARY	20

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 Department of Energy, Technical Information Center at Oak Ridge, Tennessee, where this information is readily available.

1. SUMMARY OF OPERATIONS

Throughout the first quarter of 1978, the Shippingport Atomic Power Station was in operation with the 1A, 1B, 1C and 1D reactor coolant loops and the 1AC and 1BD purification loops in normal service. The PWR Core 2 was in storage under shielding water in the deep pit of the Fuel Handling Building. Twelve Core 2 fuel assemblies and five Melba sub-assemblies were shipped offsite this quarter.

During the quarter, the station was operated for the Duquesne Light Company system grid including base load and swing load operation. Full power base load operation was necessary for most of the quarter to generate nuclear produced power for the system grid due to the shortage caused by the long coal strike. Fifty swing load operations have been performed on the LWBR Core (including 9 this quarter) to meet the objective of the LWBR operating plan during this operating phase. The LWBR Core has generated 3766.7 EFPH from start-up through the end of the quarter. The generator load factor this quarter was 95.6%.

Three unscheduled shutdowns occurred this quarter:

A reactor scram from full load occurred on January 10, 1978 as a result of a signal from the Nuclear Protection System caused by a severe voltage transient on the Duquesne Light Company grid when a 345 KV breaker failed at the Sammis generating plant. After a reactor precritical checkout was completed, the reactor was taken critical and the main turbine-generator placed in service on the same day.

On March 4, 1978, the turbine-generator was removed from service to repair turbine steam leaks. The unit was returned to service on March 5, 1978. The reactor remained critical in the Intermediate Range during the shutdown.

A second turbine-generator shutdown was performed on March 18, 1978 for additional steam leakage repair and returned to service on March 19, 1978. The reactor again was maintained critical in the Intermediate Range during the shutdown.

During the turbine-generator start-up on March 19, 1978, the 1C reactor coolant pump tripped off while starting the 1B flywheel generator for normal operation. Investigation revealed that the 1C reactor coolant pump trip was caused by the operation of the B phase overcurrent relay. Station operation continued on 3 loop operation at approximately 22% reactor power, while investigating the cause of the pump trip. A thorough electrical checkout of the 1C reactor coolant pump was completed and the pump was released for operation. In order to return the 1C reactor coolant pump to service, the turbine-generator was shutdown and the reactor manually shut down. The 1C reactor coolant pump was restarted and the movable fuel assemblies relatched. Reactor criticality was attained at a fuel height of 40.26" on March 19, 1978. Then a station startup was conducted with four loops in service and the turbine-generator was placed back in service on March 20, 1978. All flywheel generators were returned to service without difficulty and the station load increased for full power operation.

1. Summary of Operations (cont'd)

The 1A, 1B, 1C and 1D 991 psig self-actuated steam relief valves remained gagged during the quarter to prevent leakage through the valve seats. Gagging of redundant relief valves is permitted by ASME Code and approved operating procedures. The 1A, 1B, 1C and 1D flywheel generators were removed from service one at a time to inspect and repair faulty coupling alignments.

Electrical spiking on the 1A and 1B Nuclear Protection Channels caused several safety insertion alarms and three from Nuclear Protection System Channel 1A resulted in movable fuel assembly motion. The cause of the Channel 1A spiking was traced to a faulty trimmer resistor which was replaced. Cause of the Channel 1B insertion alarms has not been determined and investigation is continuing.

The Reactor Coolant System average leak rate for this quarter was 8 gallons per hour. The leakage is collected in the Waste Processing System.

Two environmental studies were undertaken this quarter. The first involving reduction of main unit condenser chlorination and the second, river intake screen, fish impingement/entrainment procedures. Both studies are calendar year 1978 programs.

During the first quarter of 1978, 2293 cubic feet of radioactive solid waste was shipped out of state for burial. These shipments contained 0.105 curie of radioactivity which does not include irradiated components and irradiated fuel which was shipped offsite. (See Maintenance Section.) There were no liquid discharges from the Radioactive Waste Processing System to the river this quarter. The liquid waste discharge line was blanked off to prevent inadvertent discharges. The gaseous waste portion of the RWP System was Freon and static leak tested during the quarter to locate and correct any gas leakage. This check was in progress at the end of the quarter.

Generator Output and Reactor Coolant Temp. During First Quarter

Average Daily Generator Output (MW Net)

Reactor Coolant Temp. °F

Figure 1

2. SUMMARY OF LWBR STATION PERFORMANCE

Electrical output (Gross) to date	.kwhr	283,529,000
EFPH to date	.hr	3,766.73
EFPH for the quarterly period	.hr	1,983.8
Hours reactor critical to date.	.hr	4,600.4
Hours reactor critical for the quarterly period	.hr	2,139.0
No. 1 main unit service hours (quarterly period).	.hr	2,090.8
Net Station Output (quarterly period)	.kwhr	122,270,000
No. of forced outages*.		1

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

3. CHEMISTRY

During the first quarter of 1978, the Chemistry section maintained specifications in the various plant systems and fulfilled the station manual requirements.

Reactor Plant

The reactor coolant system was maintained within all chemical specifications during operations and the two short periods of hot standby without any exceptions. Refer to Table I.

The only out-of-specification conditions which existed in the reactor plant auxiliary systems occurred in the coolant charging water system. These conditions were that of high pH values and high specific conductances*. The high pH's and specific conductances were attributed to the presence of ammonia which entered the system during an ammonium hydroxide chemical treatment of the primary coolant system. The coolant charging water is currently approaching its specifications by the effects of dilution as additional make-up water is added to the Reactor Plant Water Storage Tank in preparation for the forthcoming planned station shutdown. Refer to Table II.

During this quarter, Test Procedure LWBR-DLCS 58001, "Reactor Coolant Fission Product Monitoring During Reactor Startup," was performed in accordance with test requirements three times. Samples of reactor coolant were drawn and analyzed for Gross Iodine and Iodine-131. The results showed no abnormal peaking of Iodine activities as the reactor power was increased in accordance with scheduled power range operations, verifying the integrity of the core cladding. No other testing during this quarter occurred, however, Test Procedure LWBR-DLCS 59201, "Periodic Radiochemical Analysis of LWBR Reactor Coolant," which was performed in the fourth quarter of 1977, was completed and the results are included in this quarterly operating report. Refer to Tables V and VI.

Turbine Plant

The station was placed in the hot standby condition for two short periods in order to repair main steam leaks. During the extensive period of operation, the boilers were maintained within all specifications except for an occurrence of high specific conductivity.* The high specific conductivity was attributed to out-of-specification make-up water being added to the boilers from the deaerator. Subsequent boiler blowdowns re-established chemistry control by lowering the boiler conductivities to within specifications. Refer to Table III.

During the hot standby condition, the boilers experienced high pH values. *This out-of-specification condition was attributed to higher than usual concentrations of morpholine due to the low recirculation of water in the boilers. Boiler blowdowns aided in the re-establishment of boiler water chemistry control as the pH values were decreased to within specifications. Refer to Table IV.

3. CHEMISTRY (cont'd)

Radioactive Waste Processing

There were no liquid discharges from the Radioactive Waste Processing System this quarter. However, one gaseous discharge to the environment occurred which resulted in release of 0.0046 curie over a period of approximately 31 days.

The radioactivity released from Shippingport is far too small to have any measurable effect on the general background environmental activity outside the plant.

*All of the out-of-specification conditions were of short duration and are not expected to have had a detrimental effect on plant materials.

TABLE I
REACTOR COOLANT SYSTEM

WATER CONDITIONS AND CHEMICAL ADJUSTMENTS

OPERATING CONDITIONS

CHEMICAL CONDITIONS	SPECIFICATIONS	ANALYTICAL RESULTS		NH ₄ OH (liters)	H ₂ (cu.ft.)	DEGASSIFICA- TION (Hours)
		Min.	Max.			
pH @ 25°C	10.10 - 10.30	10.10	10.30			
Conductivity (μmhos/cm)	Consistent with pH	30	58			
Chloride	0.10 ppm max.	----	<0.10			
Total Gas	125 cc/kg. max.	65	118			
Hydrogen	60 cc/kg. max. 10 cc/kg. min.	29.6	59.6			
Chemicals Added				208.5	0.0	89.0

TABLE II

Reactor Plant Auxiliary Systems
Water Conditions

System	Conductivity $\mu\text{mhos/cm}$	pH at 25°C	Conc. - ppm			Gross Gamma Activity $\mu\text{Ci/ml}$
			CrO_4^{--}	Cl^-	Dis. O_2	
Component Cooling Specifications	N.S.	8.30 - 10.50	500-1000	1 ppm max.	N.S.	N.S.
Measured	N.P.	N.P.	523-647	0.10 - 0.44	N.P.	<MDA - 1.60×10^{-6}
Coolant Charging Water Specifications	2.50 max.	6.00 - 8.00	N.S.	0.1 ppm max.	Note	N.S.
Measured	6.5* - 12*	8.31* - 9.31*	N.P.	<0.10	N.P.	N.P.
Canal Water Specifications	5.00 max.	5.80 - 8.00	N.S.	N.S.	N.S.	N.S.
Measured	0.60 - 1.15	5.81 - 6.08	N.P.	N.P.	N.P.	<MDA - 8.30×10^{-5}

Specification is <0.14 ppm for reactor plant cold wet layup.

*See Reactor Plant Section of QOR.

N.S.: No limit needed, therefore, no limit has been specified.

N.P.: Analysis is not necessary and not performed.

MDA = $8.20 \times 10^{-8} \mu\text{Ci/ml}$

TABLE III

Operating Boiler Water Chemistry

Volatile Water Chemistry

WATER CONDITIONS	SPECIFICATIONS	BOILERS			
		1A	1B	1C	1D
Conductivity	Min. ----- Max. 10 μ hos/cm	5.8 12*	6.3 12*	5.9 11*	4.8 11*
Chloride	Min. ----- Max. 0.20 ppm	<0.10 0.10	<0.10 0.10	<0.10 0.10	<0.10 0.10
Hydrazine	Min. 0.005 ppm Max. 0.125 ppm	0.010 0.038	0.010 0.029	0.006 0.029	0.012 0.113
Morpholine	Min. 0.50 ppm Max. 6.0 ppm	0.65 1.60	0.70 1.30	0.71 1.40	0.65 1.30
Silica	Min. ----- max. 25ppm	1.00 1.12	1.00 1.05	1.00 1.10	0.96 0.98
pH @ 25°C	min. 8.50 max. 9.30	8.53 9.25	8.52 9.22	8.69 9.21	8.57 9.20
Chemicals used in lbs.					
N ₂ H ₄		10.88	10.88	10.88	10.88
C ₄ H ₉ NO		15.44	15.44	15.44	15.44

* See Turbine Plant Section of QOR

TABLE IV

Non-Operating Boiler Chemistry

Hot Standby

Water Chemistry

WATER CONDITIONS	SPECIFICATIONS	BOILERS			
		1A	1B	1C	1D
Conductivity	Min. ----- Max. 10 μ hos/cm	6.7 19*	6.3 23*	6.1 9.7	5.6 20*
Chloride	Min. ----- Max. 0.20 ppm	--- <0.10	--- <0.10	--- <0.10	--- <0.10
Morpholine	Min. 0.50 ppm Max. 6.0 ppm	0.55 1.05	0.55 1.00	0.50 0.90	0.52 0.90
pH @ 25°C	Min. 8.50 Max. 9.30	8.66 9.45*	8.51 9.47*	8.66 8.92	8.78 9.49*
Chemicals used in lbs.					
N ₂ H ₄		0.38	0.38	0.38	0.38
C ₄ H ₉ NO		0.47	0.47	0.47	0.47

* See Turbine Section of QOR

TABLE V

PRIMARY SYSTEM LONG-LIVED CRUD ANALYSIS

DATE	EFPH AT SAMPLE TIME	VOLUME OF COOLANT IN LITERS	CRUD WEIGHT IN mg.	ACTIVITY IN $\mu\text{Ci/ml}$								% Acc.
				Co^{60}	Co^{58}	Zr^{95}	Fe^{59}	Cr^{51}	Mn^{54}	Other	Total	
11/16/77	946	150.57	1.19	1.0×10^{-5}	1.0×10^{-5}	1.4×10^{-7}	4.3×10^{-6}	7.0×10^{-6}	5.5×10^{-7}	None	3.20×10^{-5}	94.5

DLCS 5000178

TABLE VI

LWBR STARTUP AND POWER RANGE TESTING ACTIVATION AND FISSION PRODUCT ANALYSIS

Date	Sample Time	Sample Location	Flow Rate lbs/hr	Rx. EFPH	No. of Loops in Service	No. IX's in Serv.	% Reactor Power	Measured Activities in $\mu\text{Ci/ml}$ at Sample Time											Gross α
								Gross Iodine	I^{131}	I^{133}	Sr^{89}	Sr^{90}	Ba^{140}	Cs^{134}	Cs^{137}	Xe^{133}	Xe^{135}	Ar^{41}	
11/19/77	1400	AC-BIX	6.63×10^4	1007	4	2	96	2.0×10^{-4}	7.4×10^{-7}	1.2×10^{-5}									
11/21/77	1909	AC-BIX	6.63×10^4	1056	4	2	97				4.7×10^{-8}	1.1×10^{-9}	1.1×10^{-7}	** <MDA	1.8×10^{-8}				2.0×10^{-9}
11/16/77	1315	AC-AIX	6.63×10^4	940	4	2	97									1.2×10^{-4}	2.5×10^{-4}	1.4×10^{-2}	

** MDA = $6.5 \times 10^{-9} \mu\text{Ci/ml}$

* Activity is extrapolated to 100% power and maximum purification flow at sample time.

4. MAINTENANCE

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

PWR II - Fuel Shipments

Eight PWR-II Seed Assemblies and four PWR-II Blanket Fuel Assemblies were shipped in an M-160 Irradiated Fuel Shipping Container to the Expended Core Facility in Idaho.

MELBA Shipments

The remaining five Multi-Purpose, Extended Life Blanket Assemblies (MELBA) from PWR-II were shipped to the Expended Core Facility in Idaho.

Variable Orifice Adjustment

Variable Orifice Adjustments were performed on twelve selected PWR-II Fuel Blanket Assemblies.

Neutron Barrier Installation

Preparation and staging of all equipment and materials for installation of the Neutron Barrier in the Auxiliary Enclosure was conducted.

Main Unit Turbine

The Main Unit Turbine Drain Line to the "C" Feedwater Heater was repaired.

Refueling Equipment Disposal

Disposal of all refueling equipment, which has no future potential use, is in progress.

5. TEST PROGRAM

The primary objective of the test program during the quarterly report period was to continue reactivity depletion of the LWBR Core for proof of breeding.

Fourteen tests were performed during the report period. Ten tests were completed and four remained in progress at the end of the quarter. Table VII 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 three required performances of test procedure LWBR-DLCS 55201, Safety Injection System Monthly Periodic Pump Tests, were satisfactorily completed for this quarter.

Portions of LWBR-DLCS 55203, SIS Quarterly Periodic Valve Tests, were performed during the quarter. Approximately one half of the valves were tested in accordance with the procedure and found to meet the acceptance criteria specified in the procedure. The remaining valves will be tested in the next quarter.

Three performances of test procedure LWBR-DLCS 58301, Delayed Neutron Loop Monitoring System During Station Startup, were satisfactorily completed during this report period as required for each reactor startup.

One performance of test procedure LWBR-DLCS 58401, Delayed Neutron Loop Monitoring system Operational Test, was conducted this quarter at approximately 2000 EFPH. This test was satisfactorily conducted for only the Number 1 DN Loop Monitor, because the isolation valve for the redundant Number 2 Monitor was closed during testing and cannot be reopened due to a damaged valve stem. In the event both redundant monitors are out of service, increased primary coolant sampling and analysis would be required during operations.

A shortened version of test procedure LWBR-DLCS 63301, Xenon Reactivity Transient, was satisfactorily performed on March 4, 1978 during a required maintenance shutdown to repair a turbine drain line steam leak.

The second performance of test procedure LWBR-DLCS 63501, Flux Wire Activations for Equilibrium Xenon, was conducted satisfactorily for power range conditions at approximately 3000 EFPH as required by the LWBR Test Index.

The second performance of test procedure LWBR-DLCS 64201, Neutron Noise Monitoring Test for Full Power Operations, was satisfactorily completed at approximately 3000 EFPH as required by the LWBR Test Index.

5. Test Program (Cont'd)

Test procedure LWBRLCS 65001, Thorium and U^{233} Activations was satisfactorily performed at approximately 3000 EFPH as required by the LWBRL Test Index.

Two special test procedures were conducted during the report period. LWBRLCS 70801, Transferring Test Tank Water to a Canal Pit, which remained in use, as required, at the end of the report period and LWBRLCS 77201, FWG Bearing Ambient Air Temperature vs Bearing Temperature Survey, which was completed.

Test procedures LWBRLCS 65901, Reactor Pressure Drop and Coolant Flow Characteristics and LWBRLCS 66001, Reactivity Lifetime Test, which are on-going, continued through the report period.

TABLE VII

Tests Performed During First Quarter of 1978

LWBR-DLCS 5520104-06	SIS Monthly Periodic Pump Tests
LWBR-DLCS 5800106-08	Reactor Coolant Fission Product Monitoring During Reactor Startup
LWBR-DLCS 5830108-10	Delayed Neutron Loop Monitoring System Operation During Station Startup
LWBR-DLCS 5840106	Delayed Neutron Loop Monitoring System Operational Test
LWBR-DLCS 5920101	Periodic Radiochemical Analysis of LWBR Reactor Coolant
LWBR-DLCS 6330102	Xenon Reactivity Transient
LWBR-DLCS 6350102	Flux Wire Activations (for Equilibrium Xenon)
LWBR-DLCS 6420102	Neutron Noise Monitoring Test
LWBR-DLCS 6500101	Thorium and U ²³³ Activations
LWBR-DLCS 7720101	FWG Bearing Ambient Air Temperature vs Bearing Temperature Survey

Tests Remaining in Progress at End of Report Period

LWBR-DLCS 65901	Reactor Pressure Drop and Coolant Flow Characteristics
LWBR-DLCS 66001	Reactivity Lifetime Test
LWBR-DLCS 5520301	SIS Quarterly Periodic Valve Tests
LWBR-DLCS 70801	Transferring Test Tank Water to a Canal Pit

PERFORMANCE DATES OF TESTS PERFORMED DURING FIRST QUARTER

January

February

March

05 10 15 20 25 30 05 10 15 20 25 28 05 10 15 20 25 30

*Performance incomplete at end of report period

FIGURE 2

6. HEALTH PHYSICS

External Radiation Exposure

Table VIII provides information on radiation exposure experience of Duquesne Light Company personnel at the Shippingport Station. Table VIII is based on a standard form used for radiation exposure experience at central station nuclear power plants.

ANNUAL REPORT OF EXTERNAL RADIATION EXPOSURE EXPERIENCE AT SHIPPINGPORT

-1977-

TABLE VIII

DLCS 5000178

Work & Job Function	Number of Personnel (>100 mrem)		Total Man-Rem	
	Station Emp.	Other Emp.*	Station Emp.	Other Emp.*
Reactor Operations & Surveillance				
Maintenance Personnel	0		0	
Operating Personnel	69		19	
Health Physics Personnel	3		1	
Supervisory Personnel	3		1	
Engineering Personnel	1		1	
Routine Maintenance				
Maintenance Personnel	54		36	
Operating Personnel	0		0	
Health Physics Personnel	12		8	
Supervisory Personnel	2		1	
Engineering Personnel	6		2	
Inservice Inspection				
Maintenance Personnel	27		18	
Operating Personnel	0		0	
Health Physics Personnel	6		3	
Supervisory Personnel	6		3	
Engineering Personnel	10		5	
Special Maintenance				
Maintenance Personnel	34		23	
Operating Personnel	0		0	
Health Physics Personnel	7		4	
Supervisory Personnel	7		3	
Engineering Personnel	14		6	
Waste Processing				
Maintenance Personnel	2		1	
Operating Personnel	1		1	
Health Physics Personnel	1		1	
Supervisory Personnel	1		1	
Engineering Personnel	1		1	
Refueling				
Maintenance Personnel	12		8	
Operating Personnel	0		0	
Health Physics Personnel	2		2	
Supervisory Personnel	5		2	
Engineering Personnel	7		3	
TOTAL				
Maintenance Personnel	129		86	
Operating Personnel	70		20	
Health Physics Personnel	31		19	
Supervisory Personnel	24		11	
Engineering Personnel	39		18	
GRAND TOTAL	293	0	154	0

*Duquesne Light Company employees not regularly assigned to Shippingport Station.

7. GLOSSARY

AIX	.after ion exchanger (outlet)
a/o	.atomic percent
BAPL	.Bettis Atomic Power Laboratory
BIX	.before ion exchanger (inlet)
CIC	compensated ionization chamber
DAS	Data Acquisition System
DE	demineralizer effluent
DF	decontamination factor
DOE	Department of Energy
EFPH	equivalent full power hour
Hc	critical height
HDS	Heat Dissipation System
LWBR	Light Water Breeder Reactor
magamp	magnetic amplifier
MDA	Minimum Detectable Activity
mR	milliroentgen
mrem	.milliroentgen equivalent man
NIS	Nuclear Instrumentation System
NPS	Nuclear Protection System
ORMS	Operational Radiation Monitoring System
PWR	Pressurized Water Reactor
QOR	Quarterly Operating Report
R	roentgen

7. GLOSSARY (Cont'd)

RC		resistance capacitance
RCS		Reactor Coolant System
rem		roentgen equivalent man
RPC		Reactor Plant Container
RWPS		Radioactive Waste Processing 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
μ Ci		microcuries
v/o		percent by volume
VOS		Valve Operating System