# QUARTERLY OPERATING REPORT
Second Quarter 1976
DLCS 5000276

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## DISCLAIMER

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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 Energy Research and Development Administration, Division of Technical Information Extension at Oak Ridge, Tennessee, where this information is readily available.

# 1. SUMMARY OF OPERATIONS

During the second quarter of 1976, the Shippingport Atomic Power Station remained shutdown for PWR/LWBR (Pressurized Water Reactor/ Light Water Breeder Reactor) core conversion. The PWR Core has been removed from the reactor vessel and remains in storage in the deep pit of the Fuel Handling Canal. At the beginning of the second quarter, the 1D reactor coolant loop was isolated from the reactor vessel, filled and on head tank pressure. The 1C reactor coolant loop was isolated from the reactor and drained for 1C Main Coolant Pump removal. The 1A and 1B reactor coolant loops were open to the reactor vessel. The pressurizer was open to the reactor vessel.

At the beginning of the quarter, a filter basket was installed in the reactor vessel and pre-core installation preconditioning was in progress. Pre-core installation preconditioning began on March 29. On April 4, the 1D reactor coolant loop was opened to the reactor vessel. The 1C reactor coolant loop was returned to service on April 17 but the 1C main coolant pump was shut down shortly thereafter due to a high bearing temperature indication. The 1C main coolant pump was returned to service on April 21 following replacement of faulty thermocouples. Cooldown following pre-core installation preconditioning began on May 3. The 1A, 1B, 1C and 1D reactor coolant loops were isolated from the reactor vessel on May 7 and on May 8 the pressurizer was isolated from the reactor vessel. The pressurizer was drained and draining began on the 1C reactor coolant loop on May 9. The reactor vessel level was maintained at 706'0" beginning on May 9. Draining of the 1C reactor coolant loop was completed on May 10 and a nitrogen purge was established. The reactor vessel test head and filter were removed from the reactor vessel on May 14. The 1B reactor coolant loop was drained and a nitrogen purge established on May 25. The 1D and 1A reactor coolant loops were placed in the same condition on June 1 and June 7 respectively. On June 17, the reactor vessel water level was lowered to 701'6" and on June 21, the LWBR Core Barrel was installed in the reactor vessel.

During the second quarter, training involving nuclear protection source and intermediate range alignments, and $BF_3$ and discriminator plateau curves was performed.

At the beginning of the quarter, the 1A and 1B secondary loops were partially drained for preconditioning and the 1C and 1D secondary loops were filled and on head tank pressure. The 1D secondary loop was partially drained on April 9 and the 1C secondary was partially drained on April 17 for preconditioning. Following pre-core installation preconditioning, the 1B, 1C and 1D secondary loops were placed in wet layup and recirculated on the reactor plant cooldown and temperature control heat exchanger.

1. Summary of Operations

Work on reinstalling the turbine generator has been completed as far as plant conditions will permit. An oil flush of the turbine oil system which had begun in the first quarter has continued throughout the quarter.

During the second quarter of 1976, 3455 cubic feet of radioactive solid waste was shipped off-site for burial. These shipments contained about 0.2 curie of radioactivity.

## 2. CHEMISTRY

During the second quarter of 1976, the Chemistry section maintained specifications in the various plant systems and fulfilled station manual requirements.

Reactor Plant

Pre-core installation preconditioning of the reactor coolant system was in progress for the 1A, 1B and 1D reactor coolant loops near the beginning of this quarter. The BD purification demineralizer was also in service. The AC purification loop remained isolated at the beginning of the quarter in preparation for removal and replacement of the 1C main coolant pump. The 1C main coolant pump was removed and replaced during this quarter. The 1C reactor coolant loop was then filled and opened to the reactor vessel for preconditioning along with the 1A, 1B and 1D reactor coolant loops. The AC purification demineralizer was then placed in service. During preconditioning, an accidental resin overheat occurred in the AC purification demineralizer. The AC purification loop was isolated and the resin in the AC purification demineralizer was removed. Pre-core installation preconditioning of the reactor coolant system concluded during this quarter following which all reactor coolant loops were drained and placed under a nitrogen purge.

Out-of-specification reactor coolant chemistry conditions under cold lay-up were high oxygen, low pH, and conductivity versus pH mismatch in the 1C reactor coolant loop. All of these out-of-specification chemistry conditions resulted from an inadvertent draining of the 1C reactor coolant loop while being filled. Treatment with hydrazine and ammonium hydroxide resulted in all chemistry conditions returning to within specifications. See Table I. The only out-of-specification reactor coolant chemistry conditions under hot standby were that of high pH, conductivity and chlorides in the effluent of the AC purification demineralizer. These out-of-specification conditions resulted from an accidental overheat of the AC purification resin. The AC purification loop was isolated, and all reactor coolant chemistry conditions were returned to within specifications by passing the coolant through the BD purification resin at maximum flow. The AC purification resin was removed. See Table II.

Out-of-specification conditions in the Reactor Plant Auxiliary Systems were high pH in the coolant charging water and low pH in the canal waters. The high pH in the coolant charging water was attributed to the presence of ammonia. Since the water in the Primary Water Storage Tank had previously been heated and a steam blanket was being maintained, the high pH values fell to within specifications without any action being taken. The low pH values for the canal waters were a result of exhaustion of the resin in the B demineralizer. Recirculation of the canal waters through the A demineralizer raised the pH of the canal waters to within specifications. The resin in the B canal water demineralizer was flushed and replaced with new resin. See Table III.

## 2. Chemistry

### Turbine Plant

The station has been shutdown the entire quarter. Preconditioning of the 1A, 1B and 1D heat exchangers was in progress near the beginning of the quarter. The 1A, 1B and 1D heat exchangers were in a hot standby condition during preconditioning. The 1C heat exchanger remained in cold wet layup until the 1C reactor coolant loop was filled. The 1C heat exchanger was then placed in hot standby for preconditioning along with the 1A, 1B and 1D heat exchangers. After preconditioning concluded, the 1B, 1C and 1D heat exchangers were placed in cold wet layup, recirculating on the cooldown heat exchanger. The 1A heat exchanger was placed in a partially drained condition with a nitrogen blanket established.

The only out-of-specification chemistry conditions in the heat exchangers under cold wet layup were those of low pH and low hydrazine concentrations in the 1B, 1C and 1D heat exchangers. The low pH and low hydrazine concentrations were a result of insufficient chemical treatment when the heat exchangers were placed in cold wet layup from a hot standby condition following preconditioning. Treatment with additional hydrazine raised the pH and hydrazine concentrations to within specifications. See Table IV.

The only unusual chemistry conditions experienced in the 1A, 1B, 1C and 1D heat exchangers while in hot standby were high pH and conductivity values. These conditions were expected and resulted from the decomposition of hydrazine to ammonia as the heat exchangers were "steaming off". No corrective action was required for these conditions as the pH and conductivity fell within specifications as the "steaming off" continued. High conductivity values in the 1A and 1D heat exchangers after "steaming off" had concluded were reduced to within specifications by use of blowdowns. See Table V.

### Radioactive Waste Processing System

The total radioactivity, exclusive of tritium, discharged from Shippingport during the quarter was 0.0001 curie, which is only 0.007% of the allowable limit. The quantity of 0.008 curie of tritium was an insignificant 0.0009% 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
Cold Lay-up (<200°F)

| Chemical Conditions | Specifications | Analytical Results Min. | Max. | $N_2H_4$ (lbs) | $NH_4OH$ (liters) |
|---|---|---|---|---|---|
| Oxygen - ppm max. | 0.14 | 0.04 | 1.6** | | |
| Conductivity µmhos/cm | Consistent with pH | 28** | 45 | | |
| pH@25°C | 10.1 - 10.3 | 9.78** | 10.20 | | |
| Chloride ppm max. | 0.1 | <0.1 | | | |
| Total gas-cc/kg max. | 25* | -- | -- | | |
| Chemicals added | | | | 0.146 | 1.447 |

** See Reactor Plant Section of QOR.
* 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 II
Reactor Coolant System
Water Conditions and Chemical Adjustments
Hot Standby (>200°F)

| Chemical Conditions | Specifications | Analytical Results Min. | Max. | $N_2H_4$ (lbs) | $NH_4OH$ (liters) |
|---|---|---|---|---|---|
| Oxygen - ppm max. | 0.14 | 0.03 | 0.08 | | |
| Conductivity µmhos/cm | Consistent with pH | 34 | 330* | | |
| pH@25°C | 10.1 - 10.3 | 10.10 | 10.66* | | |
| Chloride ppm max. | 0.1 | <0.1 | 14.5* | | |
| Total Gas-cc/kg-max. | 125 | 16 | 18.4 | | |
| Chemicals Added | | | | -- | 7 |

* See Reactor Plant Section of QOR.

TABLE III

Reactor Plant Auxiliary Systems
Water Conditions

| System | Conductivity µmhos/cm | pH at 25°C | Conc. - ppm | | | Gross Gamma * Activity - dpm/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. |
| Observed | 1300 - 1973 | 8.34 - 8.87 | 504-691 | 0.15 - 0.28 | N.P. | <MDA* - 2.1 |
| Coolant Charging Water Specifications | 2.50 max. | 6.00 - 8.00 | N.S. | 0.1 ppm max. | Note ** | N.S. |
| Observed | 0.57 - 1.54 | 6.53 - 8.26*** | N.P. | <0.1 | 0.005-0.075 | N.P. |
| Canal Water Specifications | 5.00 max. | 6.00 - 8.00 | N.S. | N.S. | N.S. | N.S. |
| Observed | 0.54 - 1.45 | 5.55***-6.12 | N.P. | N.P. | N.P. | <MDA**** - 269 |
| | | | | | | |

* Multiply tabular value by $4.50 \times 10^{-7}$ to obtain µCi/ml; MDA = 0.41 dpm/ml.
** Specification is ≤0.14 ppm for reactor plant cold wet layup.
*** See Reactor Plant Section of QOR.
**** MDA = 0.30 dpm/ml.

N.S.: No limit needed, therefore, no limit has been specified.
N.P.: Analysis is not necessary and not performed.

TABLE IV
Non-Operating Heat Exchangers
Cold Layup
Water Chemistry

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| Water Conditions | Specifications | Non-Operating Heat Exchangers | | | |
|---|---|---|---|---|---|
| | | 1A | 1B | 1C | 1D |
| 1. Conductivity Max. μmhos/cm | 30 | 25 | 19 | 18 | 22 |
| 2. pH@25°C Min. | 9.50 | 9.57 | 9.24* | 9.26* | 9.21* |
| Max. | 10.50 | 9.76 | 9.71 | 9.76 | 9.75 |
| 3. Chloride ppm Max | 0.5 | 0.4 | 0.3 | 0.3 | 0.3 |
| 4. Hydrazine ppm | | | | | |
| Min. | 50 | 70 | 46* | 48* | 45* |
| Max. | 100 | 99 | 84 | 84 | 77 |
| 5. Chemicals used in pounds: | | | | | |
| $N_2H_4$ | | 21.4 | 22.9 | 22.9 | 29.9 |
| $C_4H_2NQ$ | | -- | -- | -- | -- |

*See Turbine Plant Section of QOR.

TABLE V
Non-Operating Heat Exchangers
Hot Standby
Water Chemistry

| Water Conditions | Specifications | Non-Operating Heat Exchangers | | | |
|---|---|---|---|---|---|
| | | 1A | 1B | 1C | 1D |
| 1. Conductivity Max. μmhos/cm | 10 | 12* | 16* | 30* | 43* |
| 2. pH@25°C Min. | 8.00 | 8.02 | 8.13 | 8.28 | 8.24 |
| Max. | 9.30 | 9.35* | 9.57* | 10.07* | 10.18* |
| 3. Chloride ppm Max | 0.5 | 0.4 | 0.3 | 0.2 | 0.3 |
| 4. Morpholine ppm | | | | | |
| Min. | 0.5 | 0.6 | 0.6 | 0.5 | 0.5 |
| Max. | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |
| 5. Chemicals Used in pounds: | | | | | |
| $N_2H_4$ | | -- | -- | -- | -- |
| $C_4H_2NO$ | | 7.09 | 4.06 | 1.63 | 5.55 |

*See Turbine Plant Section of QOR.

## 3. MAINTENANCE

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

### Main Unit Turbine

Progress on the reassembly of the main unit turbine is presently on hold while the oil systems flush is in progress. All bearing lines and the seal oil lines are being flushed and continuously filtered to remove metal particles and other impurities. Various mechanical methods are being used to accomplish this task. A list of these methods includes air-powered hammers, air injection, manual hammering, and thermal shock. The main oil reservoir was thoroughly cleaned and both oil coolers were disassembled and cleaned to remove the metal fragments and other impurities which they contained. While progress is slow in obtaining good oil quality, the quality has improved very much as we enter the third quarter of 1976.

### Main Unit Generator

Generator and exciter work also await the completion of the oil flush since the generator hydrogen seal oil is also being flushed. To protect the generator internals from corrosion due to condensation, a dehumidifier was placed in the base of the unit for the duration of the flush.

### Pressurized Water Reactor Components

The pressurized water reactor core barrel and fuel assemblies remain in the fuel handling canal. The Core II reactor vessel head along with the old 1A and 1D loop heat exchangers have been shipped for disposal.

### Preconditioning

Preconditioning has been completed. The reactor vessel filter was removed and is stored in its shipping container on a trailer awaiting shipment. The test head was removed and is stored in the decontamination room awaiting decontamination.

### Light Water Breeder Reactor Core Barrel

Assembly of the upper and lower core barrel was completed. The barrel has been inserted into the reactor vessel with welding of the lower omega seal complete.

3. Maintenance

"1C" Loop Main Coolant Pump

The 1C loop main coolant pump was removed and shipped off-site for repairs. A Core I pump was installed as a replacement for preconditioning.

Plant Modifications and Improvements

Construction continued on a diesel generator system and on an auxiliary control room. Construction began on the Safety Injection System piping during this quarter.

Refueling

All reflector assemblies have been received and trial fitted in the core barrel.

## 4. TEST PROGRAM

During the second quarter the following test procedures were performed or were in progress to support plant recovery and preconditioning:

1. LWBR-DLCS 53001 - Piping Movement During Reactor Plant Warm-Up.
2. LWBR-DLCS 53302 - Flywheel Generator/Pump Flow Coastdown Test.
3. LWBR-DLCS 57101 - Pressurizer and Pressure Relief System Checkout.
4. LWBR-DLCS 59101 - Preconditioning of the Reactor Coolant System.
5. LWBR-DLCS 60201 - Movable Fuel Control System Precritical Test.
6. LWBR-DLCS 60301 - Initial Checkout of LWBR Nuclear Protection System Modification.
7. LWBR-DLCS 61002 - Periodic Calibration of Pressure Instrumentation.
8. LWBR-DLCS 62301 - Main Coolant Pump Vibration.
9. LWBR-DLCS 71501 - Reactor Coolant Pump Circuitry Test.
10. LWBR-DLCS 71703 - Hydrostatic Test of an Isolated Boiler.
11. LWBR-DLCS 72202 - Inspection of Reactor Coolant Pump Flange Gasket for Leakage.
12. LWBR-DLCS 72501 - Heat Up for Pre-Core Preconditioning Hot Operations.
13. LWBR-DLCS 72502 - Pre-Core Preconditioning Hot Operations.
14. LWBR-DLCS 72503 - Cooldown Following Pre-Core Preconditioning Hot Operations.
15. LWBR-DLCS 72510 - Operation of the RWPS Gaseous Waste System Using a Temporary Configuration During Pre-Core Preconditioning.
16. LWBR-DLCS 72601 - Primary Relief Valve Testing.
17. LWBR-DLCS 72701 - Secondary Relief Valve Testing.
18. LWBR-DLCS 72901 - Calibration of Temperature Sensing Elements for Preconditioning.
19. LWBR-DLCS 73205 - RWPS Ion Exchanger Piping Modification Hydrostatic Test.
20. LWBR-DLCS 73206 - RWPS Sand Bed Filter Installation Hydrostatic Test.
21. LWBR-DLCS 73216 - Hydrostatic Test of 1C RCP CCW Piping.
22. LWBR-DLCS 73219 - RPC Gravity Drainage Strainer (43-E18-2) Hydrostatic Test.
23. LWBR-DLCS 73601 - Saturated Steam Test During Preconditioning.

## 5. HEALTH PHYSICS

External Radiation Exposure

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

TABLE VI

ANNUAL REPORT OF EXTERNAL RADIATION EXPOSURE EXPERIENCE AT SHIPPINGPORT - 1975

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| Work & Job Function | Number of Personnel (>100 mrem) Station Emp. | Other Emp.* | Total Man-Rem Station Emp. | Other Emp.* |
|---|---|---|---|---|
| Reactor Operations & Surveillance | | | | |
| Maintenance Personnel | 5 | | 9 | |
| Operating Personnel | 38 | | 26 | |
| Health Physics Personnel | 5 | | 9 | |
| Supervisory Personnel | 14 | | 15 | |
| Engineering Personnel | 10 | | 10 | |
| | | | | |
| Routine Maintenance | | | | |
| Maintenance Personnel | 42 | | 70 | |
| Operating Personnel | | | | |
| Health Physics Personnel | 15 | | 26 | |
| Supervisory Personnel | 7 | | 7 | |
| Engineering Personnel | | | | |
| | | | | |
| Inservice Inspection | | | | |
| Maintenance Personnel | THERE WAS NO INSERVICE INSPECTION | | | |
| Operating Personnel | | | | |
| Health Physics Personnel | PERFORMED DURING 1975 | | | |
| Supervisory Personnel | | | | |
| Engineering Personnel | | | | |
| | | | | |
| Special Maintenance | | | | |
| Maintenance Personnel | 11 | | 19 | |
| Operating Personnel | | | | |
| Health Physics Personnel | 4 | | 7 | |
| Supervisory Personnel | 2 | | 2 | |
| Engineering Personnel | | | | |
| | | | | |
| Waste Processing | | | | |
| Maintenance Personnel | 3 | | 5 | |
| Operating Personnel | | | | |
| Health Physics Personnel | 1 | | 2 | |
| Supervisory Personnel | 1 | | 1 | |
| Engineering Personnel | | | | |
| | | | | |
| Refueling | | | | |
| Maintenance Personnel | 60 | | 101 | |
| Operating Personnel | | | | |
| Health Physics Personnel | 13 | | 23 | |
| Supervisory Personnel | 15 | | 16 | |
| Engineering Personnel | 10 | | 11 | |
| | | | | |
| TOTAL | | | | |
| Maintenance Personnel | 121 | | 204 | |
| Operating Personnel | 38 | | 26 | |
| Health Physics Personnel | 38 | | 66 | |
| Supervisory Personnel | 39 | | 40 | |
| Engineering Personnel | 20 | | 20 | |
| | | | | |
| | | | | |
| | | | | |
| GRAND TOTAL | 256 | 0 | 356** | 0 |

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

** Total is different from sum of individual numbers due to rounding to nearest man-rem

# 6. 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

EFPH . . . . . equivalent full power hour

ERDA . . . . . Energy Research and Development Administration

Hc . . . . . critical height

HDS . . . . . Heat Dissipation System

magamp . . . . . magnetic amplifier

MDA . . . . . Minimum Detectable Activity

mR . . . . . milliroentgen

mrem . . . . . milliroentgen equivalent man

NPS . . . . . Nuclear Protection System

ORMS . . . . . Operational Radiation Monitoring System

PWR . . . . . Pressurized Water Reactor

QOR . . . . . Quarterly Operating Report

## 6. Glossary

| | |
|---|---|
| R | roentgen |
| 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 |
| µCi | microcuries |
| v/o | percent by volume |
| VOS | Valve Operating System |

## ABSTRACT

During the Second Quarter 1976 report period, Shippingport was shutdown for preconditioning preparation and plant modification required for the Light Water Breeder Reactor Program. The Station efforts were directed toward plant maintenance and the preparations for the preconditioning of the new steam generator primary coolant surfaces. The report presents a summary of events which occurred in operations, chemistry, maintenance and testing.