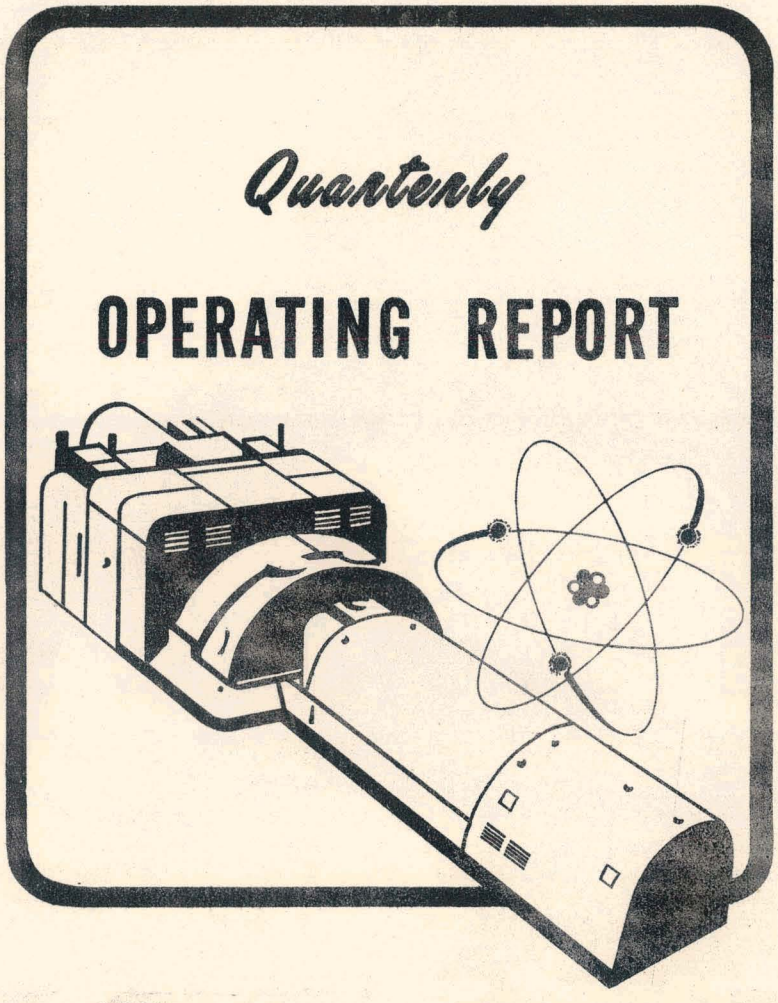
DLCS 5000173

# DUQUESNE LIGHT COMPANY

## Shippingport Atomic Power Station

*Quantenly*

# OPERATING REPORT



# First Quarter 1973

MASTER

Contract AT-11-1-292

United States Atomic Energy Commission

## DISCLAIMER

# QUARTERLY OPERATING REPORT
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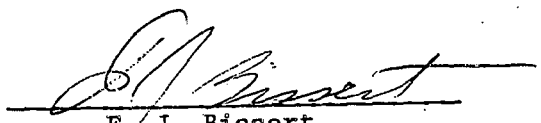
Approved by 
F. J. Bissert
Superintendent

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. 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 1973, the Shippingport Atomic Power Station was operated as required for Duquesne Light Company system load demand, testing, training and maintenance. The Heat Dissipation System remained shutdown throughout the report period.

A reactor shutdown occurred on January 28, 1973 due to a voltage transient in a nuclear protection system power supply when an oil filled filter capacitor failed. The station returned to power operation the same date.

Beginning March 16, the Station was shutdown for the semi-annual testing, training, and maintenance program. A cooldown was initiated on March 18 and the station was in a cold plant condition at the end of the report period. Station startup for resumption of power is scheduled for April 15, 1973.

During power operation, the contained reactor coolant system leak rate averaged approximately 10-12 gallons per hour. The 1A boiler primary to secondary leak rate remained constant at approximately 1.5 gallons per hour.

During the period of the first quarter, one off-site shipment of solid radioactive waste was made. This shipment contained 170 - 55 gallon drums and 25 - 30 gallon drums weighing 38,658 pounds and containing 0.1587 curies of activity.

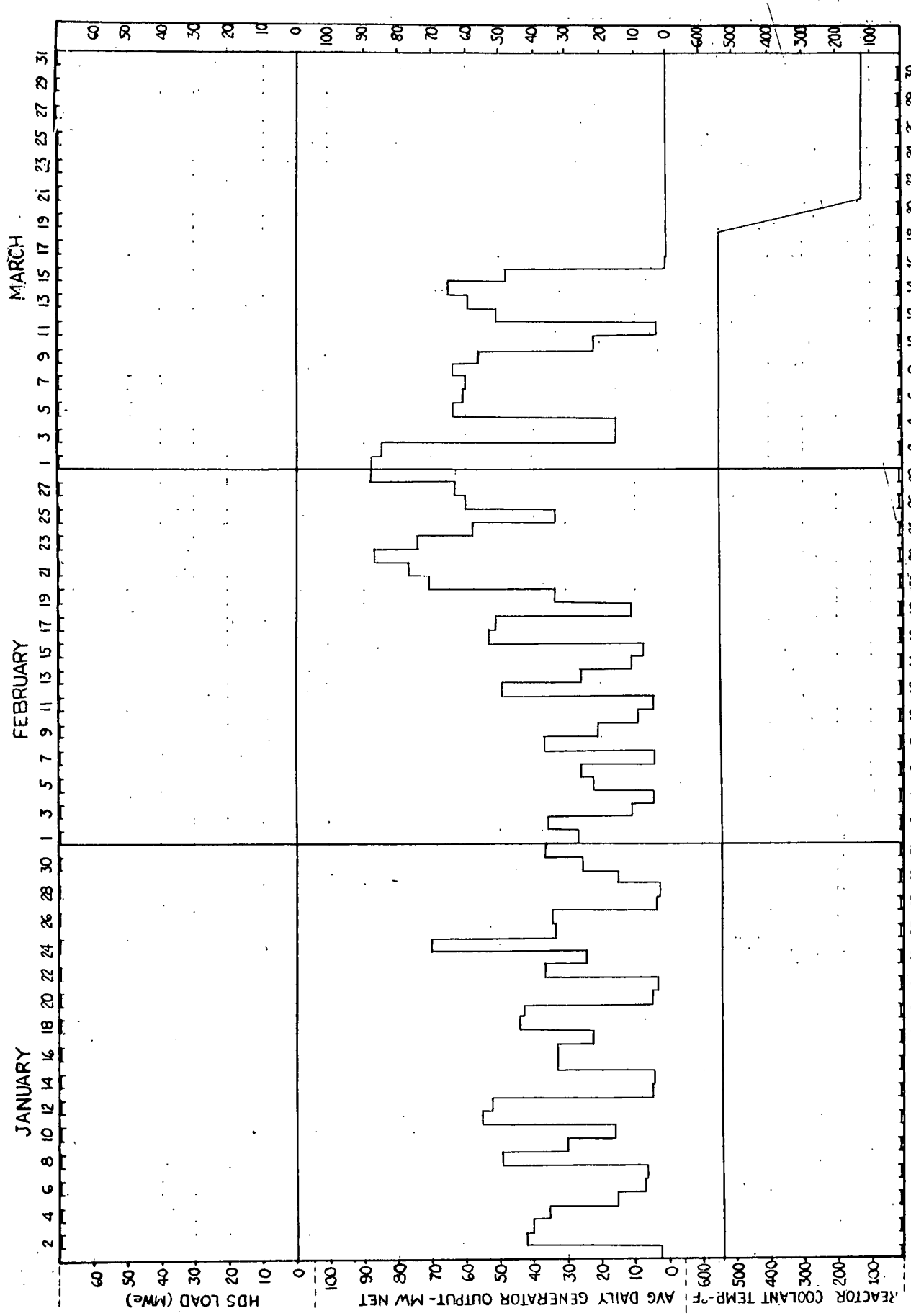



FIGURE I
Generator Output, HDS Load and Reactor Coolant Temperature During First Quarter Period

## 2. SUMMARY OF CORE 2 STATION PERFORMANCE

| | | |
|---|---|---|
| Electrical output (Gross) to date | kwhr | 3,262,979,300 |
| EFPH to date (Blanket operating time) | hr | 22,378.9 |
| EFPH to date (Seed 2 operating time) | hr | 8,726.9 |
| EFPH for the quarterly period | hr | 534.2 |
| Hours reactor critical to date | hr | 56,096.5 |
| Hours reactor critical for the quarterly period | hr | 1,779.3 |
| No. 1 main unit service hours (quarterly period) | hr | 1,777.3 |
| Net Station output (quarterly period) | kwhr | 60,598.0 |
| 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 1973, the chemistry section maintained specifications in the various plant systems and fulfilled station manual requirements.

### Reactor Plant

During the first quarter, the station operated using the 1A, 1B, 1C, and 1D reactor coolant loops and the AC and BD purification demineralizers. There were no out-of-specification reactor coolant conditions during this period. See Tables I and II.

The reactor plant auxiliary systems experienced out-of-specification conditions during this quarter. The coolant charging water had high specific conductivity (>2.50 μmho/cm) and pH (>8.00) values. This was attributed to back leakage and recirculation following ammonium hydroxide ($NH_4OH$) addition to the reactor coolant system. A low pH (>6.00) in the canal waters resulted from absorption of carbon dioxide ($CO_2$) from the air. The component cooling water system was maintained within specifications throughout the entire quarter. See Table III for further information.

The $Cs^{138}$ activity of the reactor coolant continued to show the expected buildup during the quarter and indicates continued operation with no fuel element abnormalities. All values are corrected to 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.

Average $Cs^{138}$ Activity

| Month | dpm/ml | μc/ml | No. of Observations |
|---|---|---|---|
| January | 638 | $2.9 \times 10^{-4}$ | 11 |
| February | 652 | $2.9 \times 10^{-4}$ | 10 |
| March | 621 | $2.8 \times 10^{-4}$ | 5 |

The gross non-volatile gamma activity of the reactor coolant after a 15 minute decay ranged from 7,445 cpm/ml at 11% reactor power to 54,642 cpm/ml at 67% reactor power. The D.F. (Decontamination Factor) across the demineralizer ranged from 71 to 869 after a 15 minute decay.

### Turbine Plant

During the entire fourth quarter, all boilers operated on volatile chemistry. The 1A, 1B, 1C, and 1D heat exchangers were in service throughout the quarter. At the end of the quarter, the station was shutdown and the heat exchangers were in cold lay-up. The only out-of-specification operating condition consisted of high specific conductivities (>10 μmho/cm) in the 1A and 1D heat exchangers. This high specific conductivity condition was remedied by "blowing down" the boilers. The out-of-specification conditions during lay-up periods consisted of high specific conductivities (>10 μmho/cm) in the 1A, 1B, 1C, and 1D heat exchangers during hot lay-up. "Blowing down" the

heat exchangers corrected this out-of-specification condition. The out-of-specification conditions experienced during cold lay-up were below minimum pH values (<9.50) in the 1A and 1B heat exchangers, below minimum hydrazine ($N_2H_4$) concentrations (<50 ppm) in the 1A, 1B, 1C, and 1D heat exchangers and above maximum hydrazine concentrations (>100 ppm) in the 1A, 1B, 1C, and 1D heat exchangers. Treatment with hydrazine corrected the low hydrazine concentrations in the heat exchangers. The low pH values and high hydrazine concentrations were due to insufficient mixing of the heat exchanger water after treatment with hydrazine. The primary to secondary leak in the 1A heat exchanger, which was discovered during the fourth quarter 1972, remained relatively constant with a leak rate of approximately 1.5 gal/hr. The radioactivity of the heat exchanger also remained relatively constant at approximately $4.1 \times 10^{-6}$ μCi/ml at 11% reactor power. See Tables IV and V.

Radioactive Waste Disposal System

During the quarter, 87 Test Tank volumes of liquid effluent were discharged to the Ohio River. The $Xe^{133}$ activity for the quarter ranged from 30.4 dpm/cc to 102.0 dpm/cc ($1.37 \times 10^{-5}$ μCi/cc to $4.59 \times 10^{-5}$ μCi/cc) contained in the gas hold tanks and associated system. No gaseous discharges were made to the environment during the quarter. The total liquid activity discharged for the quarter, exclusive of tritium and fluorine-18, was about .0013 curie, which is a small fraction of allowable AEC limits.

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 | 10.15 | 10.29 | 157 liters | 124.5 hours |
| 2. Specific Conductivity umhos/cm | - - - - | 33 | 48 | | |
| 3. Ammonia - ppm | - - - - | | | | |
| 4. Total Gas - cc/kg | 125 Maximum | 60 | 102 | | |
| 5. Hydrogen - cc/kg | 10 - 60 | 27 | 48 | | |

TABLE II

Reactor Coolant System

Water Conditions and Chemical Adjustments

Shutdown Conditions

| Chemical Conditions | Temp. | Specifications | Analytical Results Min. | Max. | $NH_4OH$ Additions Liters | $H_2$ Addition cu. ft. |
|---|---|---|---|---|---|---|
| 1. pH @ 25° C | > 200°F | 10.10 - 10.30 | 10.18 | 10.24 | 2.0 | |
| | < 200°F | 6.0 - 10.50 | 9.66 | 10.20 | | |
| 2. Total Gas - cc/kg | > 200°F | 80 Max | 21 | 55 | | |
| | < 200°F | 25 Max* | | | | |
| 3. Hydrogen - cc/kg | > 200°F | 10 - 60 | 10 | 24 | | |
| | < 200°F | | | | | |
| | | | 0.010 | 0.015 | | |
| 4. Oxygen - ppm | > 200°F | <0.14 | 0.010 | 0.015 | | |
| | < 200°F | <0.3 | | | | |
| 5. Chloride - ppm | > 200°F | <0.1 | <0.05 | | | |
| | < 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/cm | 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 | 1150-1370 | 8.60- 9.61 | 503- 686 | <0.05 | | BKGD - 3.3 |
| Coolant Charging Water | | | | | | |
| Specifications | 2.50 max. | 6.00- 8.00 | none | 0.1 ppm max. | none** | none |
| | 4.50-6.90 | 8.90- 9.46 | | <0.05-0.07 | 7.7-8.2 | |
| Canal Water | | | | | | |
| Specifications | 5.00 max. | 6.00- 8.00 | none | none | none | none*** |
| Observed | 1.09-1.40 | 5.70- 6.17 | | | | BKGD - 0.96 |

* Multiply tabular value by $4.50 \times 10^{-7}$ to obtain uc/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 - µmhos/cm | Min. ---- | 6.8 | 5.8 | 5.8 | 6.6 |
| | Max. 10 | 11.4 | 9.6 | 9.5 | 10.0 |
| 2. Phosphate - ppm | Min. ---- | -- | -- | -- | -- |
| | Max. 2 | -- | -- | -- | -- |
| 3. Chlorides - ppm | Min. ---- | 0.10 | 0.10 | 0.09 | 0.08 |
| | Max. 0.5 | 0.25 | 0.25 | 0.22 | 0.25 |
| 4. Hydrazine - ppm | (residual) | 0.009 | 0.007 | 0.009 | 0.007 |
| | | 0.090 | 0.109 | 0.097 | 0.107 |
| 5. Silica - ppm | Min. ---- | 1.00 | 1.00 | 0.60 | 1.00 |
| | Max. 25 | 1.61 | 1.45 | 1.02 | 1.67 |
| 6. pH at 25° C | Min. 8.0 | 8.34 | 8.37 | 8.37 | 8.30 |
| | Max. ---- | 9.11 | 9.10 | 9.15 | 9.09 |
| ** 7. Chemicals Used in lbs | | | | | |
| $Na_3PO_4$ | | -- | -- | -- | -- |
| $Na_2HPO_4$ | | -- | -- | -- | -- |
| $NaH_2PO_4$ | | -- | -- | -- | -- |
| $N_2H_4$ | | -- | -- | -- | -- |
| $C_4H_9NO$ | | -- | -- | -- | -- |

* NOTE: Hydrazine and morpholine are added continuously to all operating Heat Exchangers via the Turbine Plant condensate system during normal plant operations.

** NOTE: 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. - µmho | | | | | |
| (Hot Lay-up) | Min. --- | 8.9 | 8.2 | 7.0 | 7.9 |
| | Max. 10 | 11.5 | 12.9 | 10.4 | 11.3 |
| (Cold Lay-up) | Min. --- | 14.0 | 9.1 | 15.1 | 15.0 |
| | Max. 30 | 22.0 | 21.9 | 21.9 | 22.5 |
| 2. pH | | | | | |
| (Hot Lay-up) | Min. 8.00 | 8.52 | 8.45 | 8.55 | 8.52 |
| | Max. --- | 8.86 | 8.73 | 8.75 | 8.75 |
| (Cold Lay-up) | Min. 9.50 | 9.33 | 9.38 | 9.53 | 9.60 |
| | Max. --- | 9.98 | 9.90 | 9.88 | 9.90 |
| 3. Chloride - ppm | Min. --- | <0.05 | 0.10 | 0.10 | 0.08 |
| | Max. 0.50 | 0.20 | 0.25 | 0.20 | 0.20 |
| 4. Hydrazine - ppm | | | | | |
| (Hot Lay-up) | Min. Residual | 0.006 | 0.006 | 0.006 | 0.006 |
| | Max. --- | 0.044 | 0.066 | 0.041 | 0.038 |
| (Cold Lay-up) | Min. 50 | 46 | 24 | 48 | 41 |
| | Max. 100 | 110 | 114 | 110 | 106 |
| ** 5. Chemicals Used in lbs. | | | | | |
| $Na_3PO_4$ | | -- | -- | -- | -- |
| $Na_2HPO_4$ | | -- | -- | -- | -- |
| $N_2H_4$ | | 48.83 | 53.50 | 35.33 | 37.33 |
| $C_4H_9NO$ | | | | | |

* NOTE: Hydrazine and morpholine are added continuously to all operating Heat Exchangers via the Turbine Plant condensate system during normal plant operations.

** NOTE: Additional treatment to boilers required in special cases.

# 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:

## Refueling Equipment Inventory

The inventory of refueling equipment stored at SAPS and the evaluation of its condition continued during the report period. The inventory is about 85-90% complete.

## Load Testing 25 Ton Main Crane

The 25 ton (auxiliary) hook on the fuel handling building main crane was load tested during this quarter.

## 1B Test Tank

During the report period, the cleaning of the 1B test tank in the Radioactive Waste Disposal System (RWD) was initiated.

## ORMS Channel 11

The Operational Radiation Monitoring System (ORMS), Channel 11 was overhauled.

## Head Storage Pit

The head storage pit was cleared of all nonreusable materials and decontaminated for future storage space.

## Clean Room Preparations for LWBR

Preparations of the Clean Room for future core assembly operations for the Light Water Breeder Reactor (LWBR) continued during the reporting period.

## Spring Shutdown Items

The Main Unit exciter was removed for machining the commutator, cleaning, balancing, and re-insulating the armature.

The anion resin in the Make-up Demineralizer was replaced. All laterals were inspected and cleaned where required.

Test connections were installed on the Main Unit Turbine Governor control oil system to trouble shoot erratic operation of the Main Unit Governor.

A general inspection of numerous plant valves was performed during the Shutdown. Repairs were made as required.

## 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, and also the Data Acquisition System. Tests were also performed to verify the integrity of the Reactor Plant container and the 1A boiler chamber hatch. Radiation surveys were taken on the reactor coolant loops, reactor vessel head, and the purification demineralizers. One special test was performed during this period and that was to check for leaks at RWD. (SPD 160)

Fourteen tests were performed during the report period. Eight tests were completed and six 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 core axial flux was measured for power range, equilibrium xenon conditions (DLCS 63502) on February 27 and March 1, 1973. Iron-Manganese wires were irradiated for seven and one-half minutes at 67 percent reactor power. This completed the twenty-seventh performance of this test.

The Reactor Plant Container Hatch Integrity Test (DLCS 56804) was performed on March 26. This completes the fourth performance of this test.

On March 17, radiation surveys of the reactor vessel head (DLCS 58601) and the AC and BD Heat Exchangers and Demineralizers and the 1A, 1B, 1C, and 1D Reactor Coolant loops (DLCS 58501) were taken.

On March 21-23, the eighth performance of Nuclear Protection System (checkout of high Th and P/F circuitry) DLCS 60801 was performed. The response times of the master trip units were well within both the time limit for excessive power to flow conditions and the time limit for high hot leg temperature conditions.

Comparison of Reactor Plant Pressure Instrumentation at Operating Pressure and Temperature (DLCS 61002) was performed on March 18 in conjunction with (DLCS 61001) Periodic Calibration of Pressure Instrumentation. DLCS 61001 included the calibration of N.R. Pressurizer Pressure and the 1D Coolant Loop on March 31. (DLCS 61201) Periodic Calibration of Pressurizer Level Instrumentation was performed on March 26-29 completing the ninth performance of the test.

Four other tests were initiated during this period but not yet completed. These are listed in Table VI.

A special test was performed on March 25. The purpose of this test was to search for leaks at Radioactive Waste Disposal using a Halogen detector. The test confirmed the overall integrity of the vent gas system in Waste Disposal.

On February 24, the AEC conducted an aerial radiation survey of a 500 square mile area surrounding the Shippingport site. The specially instrumented aircraft used in the survey is capable of detecting gamma ray exposure rates in the microroentgen per hour range. The survey showed that the concentrations and relative abundance of radioisotopes are consistent with normal background radiation levels and with the geology of the region. No readings were detected that could be attributed to Shippingport plant operations.

In addition, at the AEC request, the Environmental Protection Agency also conducted studies at Shippingport and the surrounding area in February and March. Milk and soil samples were collected and dosimeters for measuring total gamma radiation were placed in various locations. The dosimeters will be recovered in early April, and a report of the results of the EPA study will be distributed at a later date.

TABLE VI

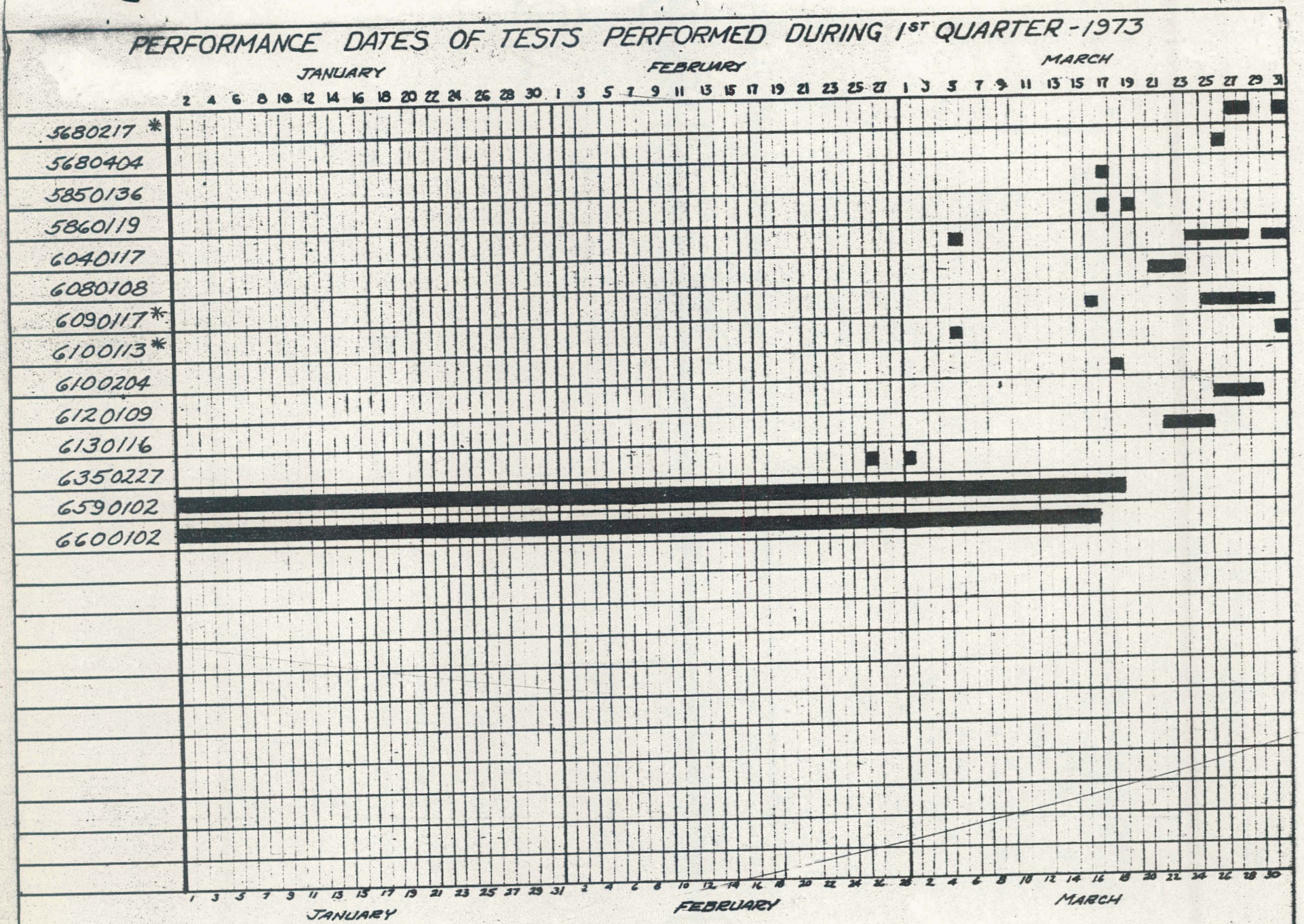
Tests Performed During First Quarter of 1973

| | | |
|---|---|---|
| DLCS | 5680404 | Reactor Plant Container Hatch Integrity Test |
| DLCS | 5850136 | External Radiation Levels of Reactor Coolant System Piping and Purification System Demineralizers and Heat Exchangers |
| DLCS | 5860119 | Periodic Radiation Survey of the Reactor Vessel Head |
| DLCS | 6080108 | Nuclear Protection System (High Th and P/F Circuitry) |
| DLCS | 6100113 | Periodic Calibration of Pressure Instrumentation |
| DLCS | 6100204 | Comparison of Reactor Plant Pressure Instrumentation at Operating Pressure and Temperature |
| DLCS | 6120109 | Periodic Calibration of Pressurizer Level Instrumentation |
| DLCS | 6350227 | Axial Flux Measurement Test (Power Range Equilibrium Xenon) |

Tests Remaining in Progress at End of Report Period

| | | |
|---|---|---|
| DLCS | 5680217 | Reactor Plant Container Integrity Test (Butterfly Valve Test) |
| DLCS | 6040117 | Data Acquisition System Calibration Test |
| DLCS | 6090117 | Periodic Intercalibration of Temperature Sensing Elements |
| DLCS | 6130116 | Periodic Calibration of Reactor Plant Flow Instrumentation |
| DLCS | 6590102 | Reactor Pressure Drop and Coolant Flow Characteristics |
| DLCS | 6600102 | Reactivity Lifetime Test |

# PERFORMANCE DATES OF TESTS PERFORMED DURING 1ST QUARTER - 1973




* PERFORMANCE INCOMPLETE AT END OF REPORT PERIOD

FIGURE #2

# 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