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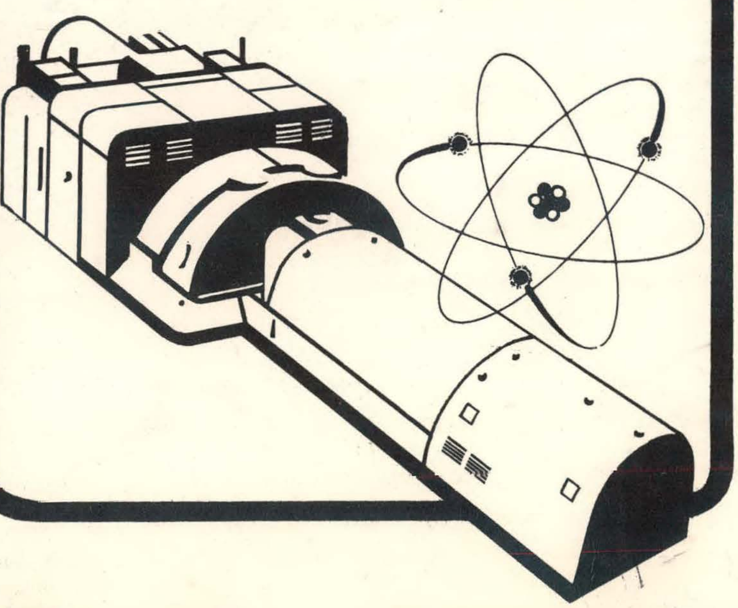
DLCS 5000473

DUQUESNE LIGHT COMPANY

Shippingport Atomic Power Station

Quarterly

OPERATING REPORT



Fourth Quarter

1973

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

DISCLAIMER

QUARTERLY OPERATING REPORT
Fourth Quarter 1973
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Approved by [signature]
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 fourth quarter of 1973, the Shippingport Atomic Power Station was operated as required for Duquesne Light Company system load demand, testing and maintenance. The 1A Reactor Coolant Loop was isolated on November 14 due to a primary to secondary tube leak. Two forced outages and the scheduled semiannual shutdown and cooldown occurred during the fourth quarter. The Reactor Coolant System leak rate averaged 11.4 gallons per hour and the 1A Boiler Leak Rate, before isolation, averaged 4.2 gallons per hour.

The annual fall shutdown for maintenance, testing, training and operational checks commenced at 2203 on October 12 and was completed at 1334 on November 19 when the station was returned to power operation.

During the shutdown several personnel and equipment incidents occurred. On October 25, following replacement of the 1BD purification loop relief valve approximately 30 gallons of water and 6 cubic feet of resin were flushed from the demineralizer onto the enclosed cubicle floor. During the incident all radioactive gaseous and liquid material was confined to the spill area. On October 28, the majority of the clean-up work was completed and normal air recirculation was established.

Two failures of the 1B loop self-actuated relief valve occurred during the shutdown. The original relief valve was replaced due to excessive leakage with a rebuilt spare valve. The containment bellows of the spare valve failed during hot testing. A second replacement rebuilt relief valve failed during testing as a result of a foreign metal particle being lodged under the seat. Following failure of the second valve, the relief valve lines were cut and capped pending further investigation. Also during this period, leakage was observed from the bellows of one pressurizer self-actuating steam relief valve. The valve bellows and internal parts were replaced with spare components.

An unscheduled reactor shutdown occurred on November 29 at 1946 hours for the purpose of repairing a damaged gate in the twin basket river water booster pump strainer. Following the completion of the job the station was put back on line at 1323 on November 30.

A reactor scram occurred at 1827 hours on December 22 due to a power level spike on Nuclear Protection System Channel 1A. Although the condition could not be duplicated the cause of the power signal is postulated to have been caused by excessive disturbance of the signal cable when the chassis drawer was being removed for alignment of NPS Channel B. The station was returned to power operation at 1440 hours on December 23.

During the fourth quarter 2652.23 cubic feet of solid radioactive waste containing approximately 6 curies of activity were shipped off-site for burial.

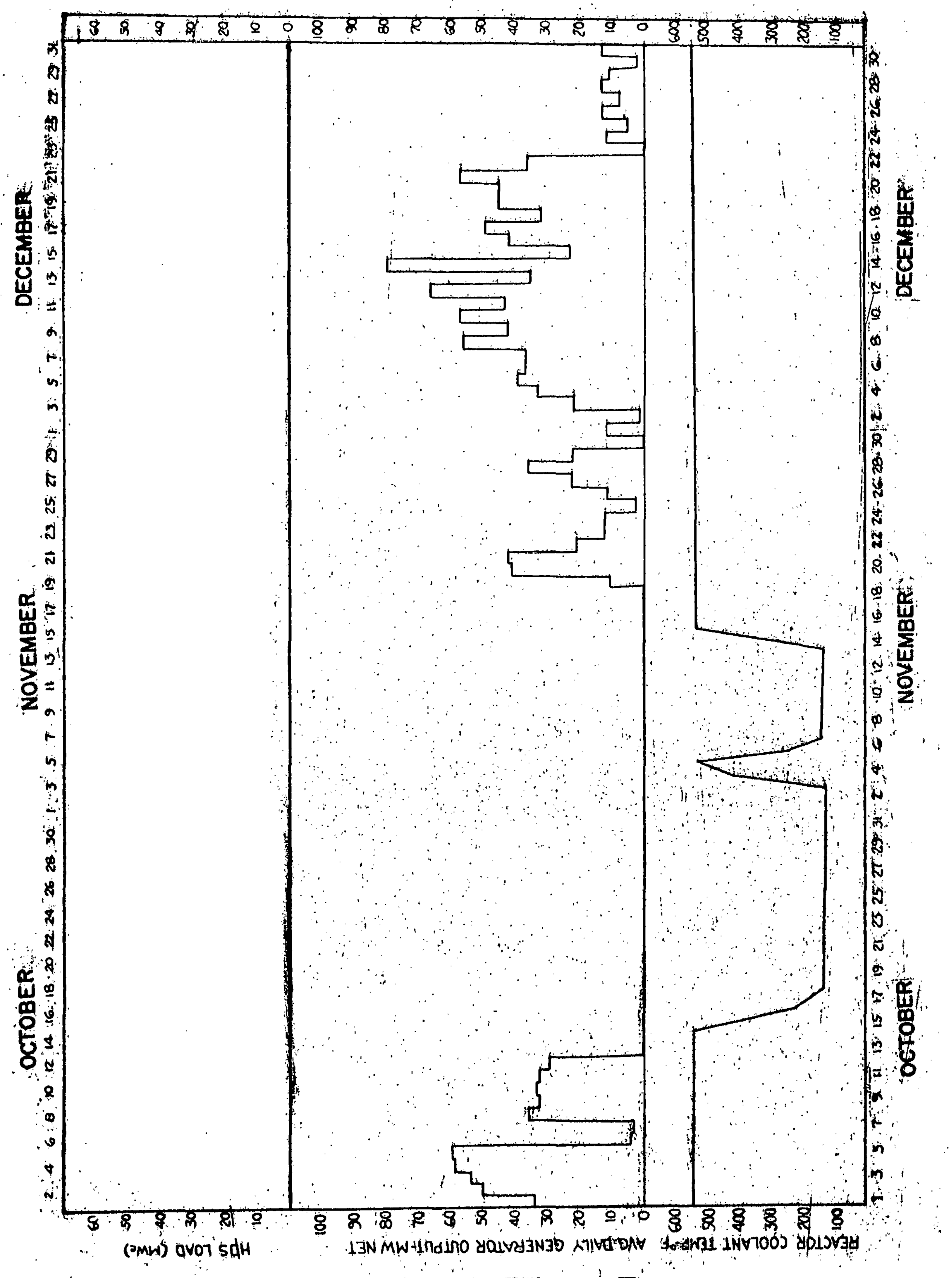


FIGURE 1
Generator Output, HDS Load and Reactor Coolant Temperature During Fourth Quarter Period

2. SUMMARY OF CORE 2 STATION PERFORMANCE

Electrical output (Gross) to date	kwhr	3,446,152,300
EFPH to date (Blanket operating time).	hr	23,609.7
EFPH to date (Seed 2 operating time)	hr	9,957.7
EFPH for the quarterly period	hr	343.2
Hours reactor critical to date	hr	61,436.2
Hours reactor critical for the quarterly period . .	hr	1,279.2
No. 1 main unit service hours (quarterly period) . .	hr	1,263.7
Net Station Output (quarterly period).	kwhr	35,672,000
No. of forced outages*		1

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

3. CHEMISTRY

During the fourth quarter of 1973, the Chemistry section maintained specifications in the various plant systems and fulfilled station manual requirements.

Reactor Plant

During the fourth quarter, the station operated using the 1A, 1B, 1C, and 1D reactor coolant loops and the AC and BD purification demineralizers. In the latter half of the fourth quarter, the 1A reactor coolant loop and the BD purification demineralizer were not in service. There were no out-of-specification reactor coolant conditions during operating periods. However, under hot lay-up conditions, the reactor coolant had a low pH value (< 10.10) and a low hydrogen concentration (< 10 cc/kg). The low pH value resulted from going from a cold lay-up condition to a hot lay-up condition. Also, in anticipation of cold lay-up, no hydrogen was added to the reactor coolant system, and thus the low hydrogen concentration condition occurred. See Tables I and II. The reactor plant auxiliary systems were maintained within specifications throughout the entire quarter. See Table III for further information.

The Cs^{138} 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.

Average Cs^{138} Activity

Month	dpm/ml	μc/ml	No. of Observations
October	676	3.04×10^{-4}	4
November	785	3.53×10^{-4}	4
December	756	3.41×10^{-4}	8

The gross non-volatile gamma activity of the reactor coolant after a 15 minute decay ranged from 8,262 cpm/ml at 8% reactor power to 62,599 cpm/ml at 67% reactor power. The D.F. (Decontamination Factor) across the demineralizer ranged from 222 to 1526 after a 15 minute decay.

As required by the station manual, radiochemical analysis of reactor coolant for insoluable activity is performed each 1000 EFPH. Samples for the tenth performance of this requirement were collected from November 20, 1973 to November 22, 1973. The sample analysis has not been completed during this quarter, therefore the results will be shown in the next quarterly report. Included in this quarterly report is the 1000 Hour Fission Product Analysis.

Turbine Plant

During the entire fourth quarter, all boilers operated on volatile chemistry. The 1B, 1C and 1D heat exchangers were in service throughout the quarter. The 1A heat exchanger has been on cold lay-up since November 5, 1973. Near the beginning of the quarter, the station was shutdown and the heat exchangers were placed in cold lay-up and then hot lay-up conditions. The only out-of-specification operating condition consisted of high specific conductivities (> 10 µmho/cm) in the 1B, 1C, and 1D heat exchangers. This high specific conductivity condition was remedied by "blowing down" the boilers. The only out-of-specification conditions during hot lay-up consisted of high specific conductivities (> 10 µmho/cm) in the 1A, 1B, 1C, and 1D heat exchangers. The high specific conductivity values resulted from ammonia formation while "steaming" the heat exchangers in going from cold to hot lay-up. The out-of-specification conditions experienced during cold lay-up were low pH values in the 1A, 1B, and 1D heat exchangers, high specific conductivity in the 1A heat exchanger, and low and high hydrazine concentrations in all four of the heat exchangers. Treatment with hydrazine corrected the low pH and low hydrazine concentration conditions. 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 is attributed to ammonia forming from hydrazine decomposition. See Tables IV and V.

Since the 1A heat exchanger has been kept under cold lay-up conditions, there has been no evidence of a primary to secondary leak in the remaining three heat exchangers. Activity checks on the 1B, 1C, and 1D heat exchangers indicate that the Fluorine-18 radioactivity is below the minimum detectable activity.

An incident occurred on December 10, 1973, during the sampling of the 1A steam generator when 18 gallons of sample water containing a minimum amount of activity overflowed into the basement sump and subsequently to the effluent channel. The activity of the effluent channel after dilution with one (1) circulating pump in service was calculated to be an insignificant one percent of the allowable discharge limit.

Radioactive Waste Disposal System

The total radioactivity, exclusive of tritium and short lived Fluorine-18 discharged from Shippingport during the quarter was approximately 0.0015 curies, which is only 0.1% of the allowable limit. The quantity of short lived radioactivity (F-18) released was 0.0003 curies. The quantity of 0.16 curie of Tritium was an insignificant 0.02% of the allowable limit. Gaseous discharges were made from the gaseous waste system to the environment during the quarter. The total gaseous activity released, identified as Xenon 133 and Xenon 135, was approximately 0.001 curies. 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 Min.	Analytical Results Max.	NH_4OH Additions Liters	Degassification Hours
1. pH @ 25° C	10.20 $\pm$ 0.10	10.13	10.28	88.5	71.4
2. Specific Conductivity µmhos/cm	---	31	47		
3. Total Gas - cc/kg	125 Maximum	40	96		
4. Hydrogen - cc/kg	10 - 60	22	44		

TABLE II

Reactor Coolant System

Water Conditions and Chemical Adjustments

<u>Shutdown Conditions</u>

Chemical Conditions	Temperature	Specifications	Analytical Results Min.	Analytical Results Max.	NH_4OH Additions Liters	H_2 Addition cu. ft.	Degas. Hours
1. pH @ 25° C	> 200°F	10.10 - 10.30	10.00**	10.22	10.5	36	5.5
	< 200°F	6.0 - 10.50	9.71	10.15	0	0	0
2. Total Gas - cc/kg	> 200°F	80 Max	16	76			
	< 200°F	25 Max*	--	24			
3. Hydrogen - cc/kg	> 200°F	10 - 60	7**	36			
	< 200°F		11	--			
4. Oxygen - ppm	> 200°F	<0.14	.005	.030			
	< 200°F	<0.3	.005	.030			
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.

** See Reactor Plant Section of QOR

TABLE III

Reactor Plant Auxiliary Systems

Water Conditions

System	Specific Conductivity μmhos/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	1130-1550	9.01 - 9.26	507-890	<0.05-0.5		Bkgd - 5.8
Coolant Charging Water Specifications	2.50 max.	6.00 - 8.00	none	0.1 ppm max	none**	none
Observed	1.20-2.25	6.20 - 8.00		<0.05	5.8-7.6	
Canal Water Specifications	5.00 max.	6.00 - 8.00	none	none	none	none***
Observed	1.40-1.70	6.00 - 7.47				.008 - 1.8

* Multiply tabular valve by 4.50×10^{-7} to obtain μc/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. ---- Max. 10	3.3 4.5	4.5 14***	4.3 14***	5.4 11.0***
2. Phosphate - ppm	Min. ---- Max. 2	---- ----	0.00	0.00	0.00
3. Chlorides - ppm	Min. ---- Max. 0.5	0.10 0.13	0.07 0.15	0.05 0.15	0.07 0.16
4. Hydrazine - ppm	(Residual)	.052 .078	.044 .092	.038 .082	.041 .086
5. Silica - ppm	Min. ---- Max. 25	0.56 0.56	0.76 1.40	0.72 1.40	1.5 9.2
6. pH at 25°C	Min. 8.0 Max. ----	8.60 9.03	8.37 8.98	8.47 8.97	8.40 8.90
** 7. Chemicals Used in lbs Na_3PO_4 Na_2HPO_4 NaH_2PO_4 N_2H_4		---- ----	---- ----	---- ----	---- ----

* 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.

*** See Turbine Plant Section of QOR.

TABLE V

Non-Operating Heat Exchangers

Water Chemistry

Water Conditions	Specifications	Non-Operating Heat Exchangers 1A	1B	1C	1D
1. Specific Cond. - μmho/cm					
(Hot Lay-up)	Min. ---	4.5	2.4	2.1	2.2
	Max. 10	26.0***	18.0***	20.0***	25.0***
(Cold Lay-up)	Min. ---	3.2***	6.2	13.0	10.4
	Max. 30	48.0	30.0	30.0	29.0
2. pH					
(Hot Lay-up)	Min. 8.00	8.70	8.60	8.40	8.40
	Max. ---	9.79	9.80	9.80	9.85
(Cold Lay-up)	Min. 9.50	8.50***	9.00***	9.55	9.30***
	Max. ---	10.90	10.10	10.06	10.03
3. Chloride - ppm	Min. ---	0.07	0.05	0.05	0.05
	Max. 0.50	0.16	0.18	0.13	0.18
4. Hydrazine - ppm					
(Hot Lay-up)	Min. Residual	.001	.002	.001	.002
	Max. ---	10.0	43.0	40.0	40.0
(Cold Lay-up)	Min. 50	.001***	.001***	24.0***	14.0***
	Max. 100	148***	144***	131.0***	130.0***
** 5. Chemicals Used in lbs.					
Na_3PO_4		—	—	—	—
Na_2HPO_4		—	—	—	—
N_2H_4		81.5**	76.3**	76.3**	82.3**
C_4H_9NO		—	—	—	—

** Additional treatment to boilers required in special cases.

*** See Turbine Plant Section of QOR

TABLE VI

1000 Hour Fission Product Analysis

E.F.P.H.	Cs^{137}* dpm/ml	Cs^{134}* dpm/ml	I^{131}** dpm/ml	I^{133}** dpm/ml	Xe^{133}*** dpm/ml	Ar^{41}*** dpm/ml
950	non-dect.	non-dect.	4.1	1.11×10^2	18	1.94×10^4
1690	non-dect.	non-dect.	1.6	4.50×10^1	96	2.64×10^4
2445	non-dect.	non-dect.	2.6	4.3×10^1	72	2.80×10^4
3827	non-dect.	non-dect.	3.5	4.9×10^1		
4008					49	4.61×10^4
4535	non-dect.	non-dect.	3.5	4.80×10^1	56	3.84×10^4
5746	non-dect.	non-dect.	2.7	3.10×10^1	no results	4.16×10^4
6654	3.12	2.51	20.5	1.57×10^2	475	4.85×10^4
7725	1.45	1.96	17.2	1.79×10^2	75	3.56×10^4
8841	2.27	2.29	33.5	2.86×10^2		
9587					319	1.18×10^4

Multiply above values by 4.50×10^{-7} to obtain µCi/ml

* Values are measured values.

** Values are corrected for 4 reactor coolant loops, 2 purifications and a standard base of 67% reactor power.

*** Values are corrected for 4 reactor coolant loops and a standard base of 67% reactor power.

The data in this table are measured activity levels adjusted to the conditions indicated in the above notes.

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:

M-160 Spent Fuel Shipment

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

Demineralizer Building Modification

Conversion of the Demineralizer Building into a clean storage area was continued and near completion during this quarter.

1C Traveling Intake Screen

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

Primary System Relief Valves

Spare primary relief valves were rebuilt and installed during the Fall Station Shutdown.

MELBA Spent Fuel Shipment

The first three of six MELBA bundles were shipped out during this report period.

RWD Evaporator

The RWD evaporator compressor was removed from service during the quarter to install a new compressor and a new evaporator feed pump.

1B Circulating Pump

The 1B circulating pump was removed from service for preventive maintenance and the pump bearings were replaced. After repair and assembly the pump was reinstalled. The motor repairs were not completed at the end of the quarter.

1-A Steam Generator

The 1-A Steam Generator was removed from service during the Fall Station Shutdown and repairs were made for steam leaks at two secondary hand hole covers. The unit was left out of service when the station was returned to power due to a primary to secondary tube leak.

Fall Station Shutdown

All items that were scheduled for inspection and repair were completed and returned to service during the first part of this quarterly 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 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 operation of the Control Rod Drive Mechanisms. Radiation surveys were taken on the reactor coolant loops, purification demineralizers, and the reactor vessel head.

Eleven tests were performed during the report period. Nine tests were completed and two remained in progress at the end of the quarter. TableVII 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 periodic Intercalibration of Temperature Sensing Elements (DLCS 60901) was started on October 13, 1973 and was completed on November 18. This completed the eighteenth performance of this test. The seventeenth performance of the Periodic Calibration of Reactor Plant Flow Instrumentation (DLCS 61301) included the calibration of all four coolant loops flows and was completed on November 8. DLCS 61001, Periodic Calibration of Pressure Instrumentation, was performed for the fourteenth time during this quarter. This test included the calibration of the 1D and 1B Coolant Loops, on October 30 and 31, respectively. In conjunction with these instrument calibrations, the Data Acquisition System Calibration Test was performed, completing the eighteenth performance of DLCS 60401.

The Control Rod Drive Mechanism Periodic Test was performed on November 16 and 17 with three reactor coolant pumps operating on fast speed. All rod full travel scram times were below the allowable maximum full travel scram time of 1.80 seconds. This completed the twelfth performance of DLCS 66101.

On October 13, radiation surveys of the reactor vessel head (DLCS 58601) and the AC and BD Heat Exchangers and Demineralizers along with the 1A, 1B, 1C, and 1D Reactor Coolant Loops (DLCS 58501) were taken.

The reactor plant container integrity was checked at the butterfly valves (DLCS 56802), completing the eighteenth performance of the test. All four valves closed within the 4 second time allowance. Acceptable leak rates were obtained for both the supply and exhaust valves.

The Fedal System (Operation during Station Start-Up) Test (DLCS 58302) was performed monitoring Seed Assembly E-10, which corresponds to Port 9 on the multiport valve. Performances 94, 95 and 96 were executed during this report period.

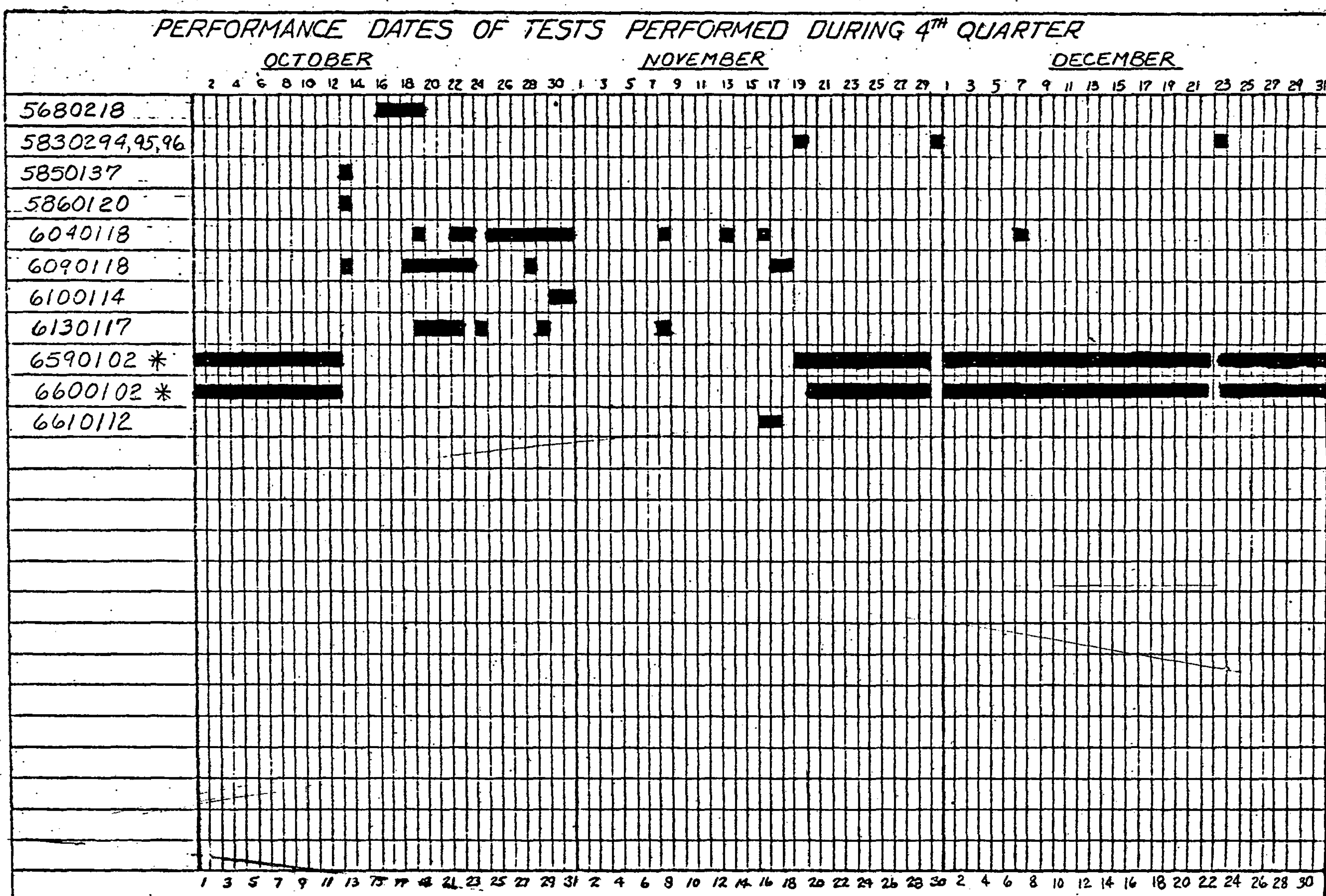
TABLE VII

Tests Performed During the Fourth Quarter of 1973

DLCS 5680218	Reactor Plant Container Integrity Test (Butterfly Valve Test)
DLCS 5830294,95,96	FEDAL System (Operation during Station Start-Up)
DLCS 5850137	External Radiation Levels of Reactor Coolant System Piping and Purification System Demineralizers and Heat Exchangers
DLCS 5860120	Periodic Radiation Survey of the Reactor Vessel Head
DLCS 6040118	Data Acquisition System Calibration Test
DLCS 6090118	Periodic Intercalibration of Temperature Sensing Elements
DLCS 6100114	Periodic Calibration of Pressure Instrumentation
DLCS 6130117	Periodic Calibration of Reactor Plant Flow Instrumentation
DLCS 6610112	Control Rod Drive Mechanism Periodic Test

Tests Remaining in Progress at End of Report Period

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



* 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	Pressurized Water Reactor
R	roentgen
RC	resistance capacitance
μc	microcuries

RCS . . . . Reactor Coolant System

rem . . . . roentgan 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