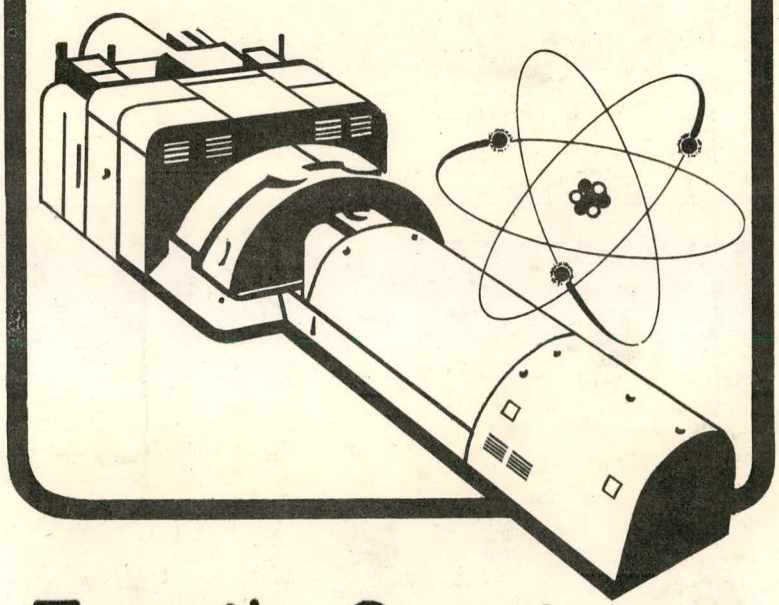
DLCS 5000470

DUQUESNE LIGHT COMPANY

Shippingport Atomic Power Station

Quantenly

OPERATING REPORT



Fourth Quarter

1970

Contract AT-11-1-292

United States Atomic Energy Commission

DISCLAIMER

QUARTERLY OPERATING REPORT
Fourth Quarter 1970
DLCS 5000470

Approved by F. J. Bissert
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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 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 fourth quarter of 1970, the Shippingport Atomic Power Station was operated as required for Duquesne Light Company system load demand, testing and maintenance. The Heat Dissipation System remained shutdown throughout the period.

At the beginning of the quarter, the Station was in a hot shutdown for training, with a partial scram in effect. The 1A, 1B and 1D Reactor Coolant Loops were operating, with the 1C Reactor Coolant Loop isolated and drained for maintenance.

The Station was operated for training purposes during the period of October 1 through October 25, with Reactor shutdown operations and cooldowns in effect.

The 1A Reactor Coolant Loop was isolated and drained on October 20 for heat exchanger tube repairs. The 1C Reactor Coolant Loop remained isolated and drained for maintenance. During the period of October 25 to November 5, the Reactor was operated with two loops in service (1B and 1D) at a maximum allowable power output of 64 Mw(e).

On November 6, the station was shutdown to return the 1A Reactor Coolant Loop to service. The 1A Boiler was successfully hydrostatically tested, and the M. U. generator was returned to service on November 8 with three loops in operation. On November 25, the station was shutdown to return the 1C Loop to service. The 1C Boiler was successfully hydrostatically tested, and the 1C Loop returned to service on November 28. The Station operated with 4 loops in service on November 30.

A Main Transformer differential trip occurred inadvertently on November 30 resulting in a turbine throttle trip casualty accompanied by a controlled steam relief operation. The incident was traced to an unbalanced current due to improperly connected sensing cable in the new Beaver Valley Relay House. The Reactor was maintained critical while the Main Transformer and generator were meggered. No grounds or fault conditions were found. The relay circuit was restored to normal and the plant was returned to power operations.

On December 21, a minor release to atmosphere emergency drill was conducted involving the entire station complement and Beaver Valley construction personnel.

On December 27, a primary system leak was discovered in the bonnet seal ring of the 1C Loop Manual Outlet Valve. The 1C Loop was isolated and a cooldown of the loop was initiated. The crack in the bonnet seal ring was repair welded and hydrostatically tested successfully. The 1C Loop remained isolated and drained at the end of the report period.

During the fourth quarter period, there were no shipments of radioactive waste made from the facility. However, a shipment of radioactive waste was made the previous quarter that was not reported. On August 25, there was a shipment of solid radioactive waste for off-site disposal of 695.03 millicuries of radioactivity contained in 137 drums weighing 26,904 pounds.

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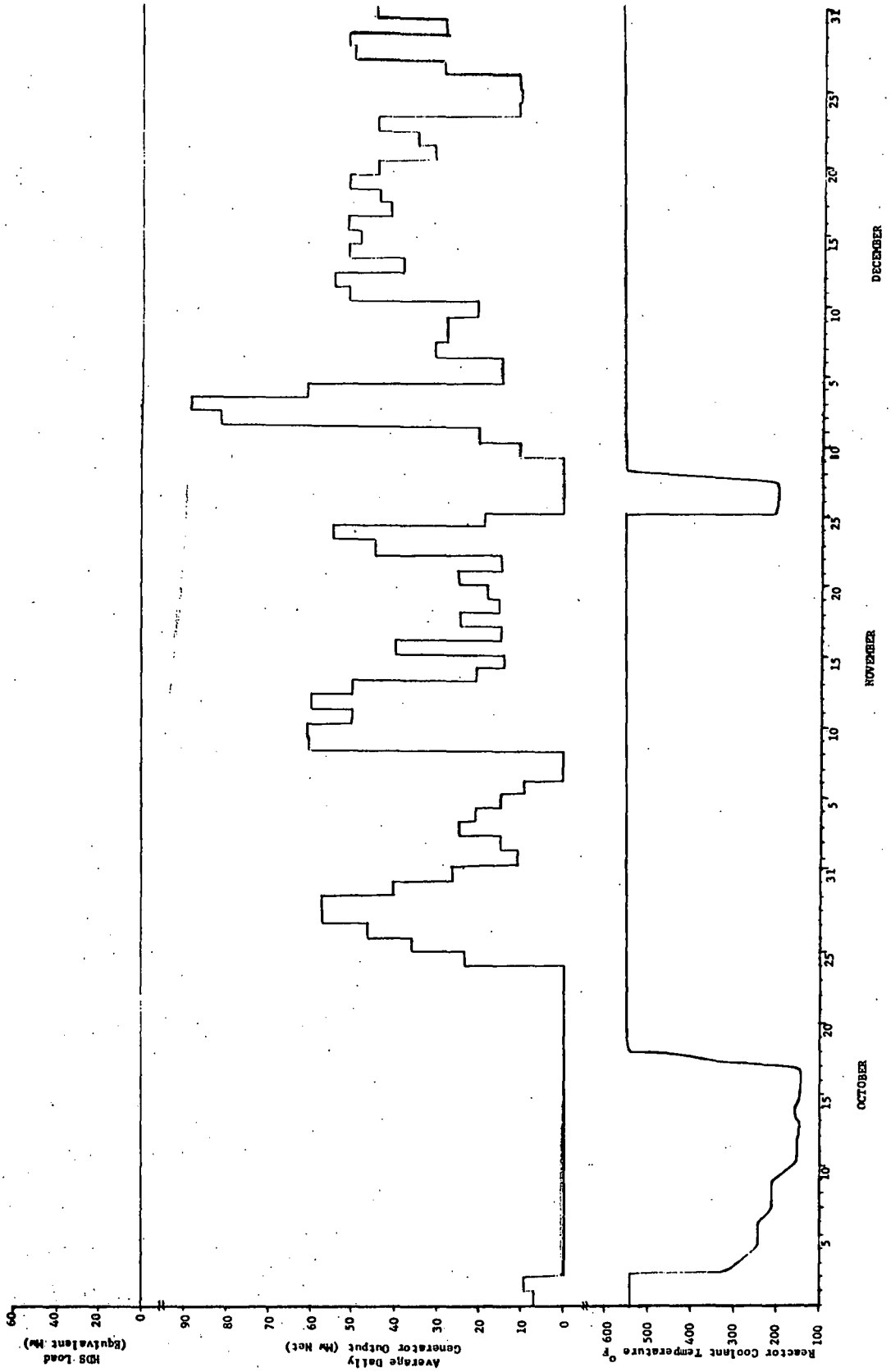


FIGURE 1

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	2,623,409,700
EFPH to date (Blanket operating time).	hr	18,167.5
EFPH to date (Core 2 Seed 2 operating time). . . .	hr	4,515.5
EFPH for the quarterly period.	hr	438.2
Hours reactor critical to date	hr	40,015.4
Hours reactor critical for the quarterly period. .	hr	1,525.9
No. 1 main unit service hours (quarterly period) .	hr	1,500.2
Net Station output (quarterly period).	kwhr	50,596,000
No. of forced outages* (quarterly period).		1

* Interruption of electrical output due to protective relay action and/or operator action as required to protect the Station.

3. CHEMISTRY

Reactor Plant

The 1C reactor coolant loop and the AC purification demineralizer were returned to service on November 28, 1970 after being out of service since the beginning of the quarter. The 1A reactor coolant loop was taken out of service on October 21, 1970 because of a primary to secondary leak, and returned to service on November 6, 1970. During this period the reactor was operated on 2 reactor coolant loops for the first time. On December 27, 1970 the 1C reactor coolant loop and the AC purification demineralizer were taken out of service again because of a leak in the loop in the vicinity of the 1C loop manual outlet valve. The specifications of the reactor coolant loops were maintained in accordance with the station manual (see Tables I & II). There were out of specification power and shutdown conditions during the quarter. See tables for explanations.

The component cooling water system remained in specifications during the entire quarter except for one-day due to maintenance. The primary coolant charging water was out of specifications, at times, during the quarter because some of the ammonium hydroxide (NH_4OH) which was to be added to the reactor coolant made its way to the primary water storage tank during recirculating of the primary storage tank water. (See Table III)

The Cs^{138} activity of the reactor coolant remained relatively constant during this quarter. All values are corrected to standard base of 67% reactor power, four reactor coolant loops, two purification demineralizer loops in service at full flow, and 536°F Tavg operation.

Average Cesium - 138 Activity

Month	dpm/ml	uc/ml	No. of Observations
October	488	2.22×10^{-4}	2
November	563	2.56×10^{-4}	5
December	483	2.20×10^{-4}	5

During the fourth quarter test DLCS 58001 was performed in conjunction with the test program. Samples for Reactor Coolant Fission Product Activity (DLCS 58001) were collected on November 30, 1970. These samples were analyzed and the results indicated no failed fuel elements.

The AC purification demineralizer remained out of service until November 28, 1970 when it was put back into service. The station then operated on two purification demineralizers until December 27, 1970 when the AC purification demineralizer was again taken out of service, and remained out of service through the end of the quarter. Gross non-volatile gamma activities after fifteen minutes decay ranged from 45,562 cpm/ml to 8,096 cpm/ml at 67% and 14% reactor power respectively. The decontamination factors ranged from 556 to 102 at 15 minutes after sampling.

The weekly crud samples had a specific activity ranging from 3.42×10^7 cpm/mg to 1.07×10^7 cpm/mg after 120 hour decay and had a concentration range of 10.53 ppb to 1.81 ppb.

Turbine Plant

The 1C steam generator remained out of service until November 28, 1970 when it was placed back into service. The 1A steam generator was taken out of service on October 21, 1970 and returned to service on November 6, 1970. During this period (October 21 - November 6) the station operated on two coolant loops for the first time. On December 27, 1970 the 1C steam generator was taken out of service and remained out of service throughout the remainder of the quarter. There were several hot and cold lay-ups during this period (see Table V) There were out of specification conditions for the heat exchangers during operation and lay-ups. (See Tables IV and V)

Radioactive Waste Disposal System

The radioactive waste disposal ion exchangers were used to process liquid waste from 11 surge tanks. Radioactive liquid waste from the chemical waste tanks was processed through the evaporator. The effluents of these two processing systems were combined at the test tanks. Six (6) of these test tanks were returned to the surge tank for reprocessing, and 42 test tanks were discharged to the Ohio River. The Xe^{133} activity of the vent gas system ranged from 0.57 dpm/cc to 2.90 dpm/cc (2.55×10^{-7} uc/cc to 1.32×10^{-6} uc/cc).

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	10.10	10.30	106	36
2. Specific Conductivity umhos	- - - -	33	55		
3. Ammonia - ppm	- - - -	14	24		
4. Total Gas - cc/kg	125 Maximum	50	103		
5. Hydrogen - cc/kg	10 - 60	21	48		

TABLE II

Reactor Coolant System

Water Conditions and Chemical Adjustments

Shutdown Conditions

Chemical Conditions	Temp.	Specifications	Analytical Results Min.	Analytical Results Max.	NH_4OH Additions Liters	H_2 Addition cu. ft.	Degas. Hrs.
1. pH @ 25° C	≥ 200°F	10.10 - 10.30	10.12	10.30	24.7	188	16
	< 200°F	6.0 - 10.50	9.80	10.27	8.5	26	-
2. Total Gas - cc/kg	> 200°F	80 Max.	13	74			
	< 200°F	25 Max.*	10	23			
3. Hydrogen - cc/kg	> 200°F	10 - 60	5**	43			
	< 200°F		0	17			
4. Oxygen - ppm	≥ 200°F	≤ 0.14	0.020	0.020			
	< 200°F	< 0.3	0.005	0.010			
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 minimun required for reactor coolant pump operation.

** H_2 concentration was below specification because reactor was shutdown and the NH_4OH did not dissociate to form H_2, thus daily additions of H_2 were required. These additions, however, failed to keep the Reactor Coolant System in specification from day to day.

TABLE III

Reactor Plant Auxiliary Systems

Water Conditions

System	Specified Conductivity umhos	pH at 25° C	Concentration - 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		8.73- 9.80	445-708****	<0.05	-	Bkgd.
Coolant Charging Water						
Specifications	2.50 max.	6.00- 8.00	none	0.1 ppm max.	none**	none
Observed	1.8 -5.3*****	6.60- 9.30*****	-	<0.05	1 - 8	-
Canal Water						
Specifications	5.00 max.	6.00- 8.00	none	none	none	none***
Observed	1.10 - 1.32	6.00- 6.25	-	-	-	Bkgd. -13

* Multiply tabular value by 4.55×10^{-7} to obtain uc/ml

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

*** Normally near background

**** The $[CrO_4^=]$ was temporarily out of specification due to draining and refill for maintenance

***** The charging water had a high pH and conductivity because NH_4OH which was to be added to the reactor coolant, made its way to the Primary Water Storage Tank during recirculation.

TABLE IV

Operating Heat Exchanger Chemistry

Water Chemistry

Water Conditions	Specifications	Operating Heat Exchangers 1A	1B	1C	1D
1. Dis. Salts - ppm	Min. ---	60	25	80	39
	Max. 1000	243	195	162	188
2. Phosphate - ppm	Min. 5	32	16	38	18
	Max. 100	152*	106**	99	104**
3. Chloride - ppm	Min. 0	0.10	0.12	0.12	0.10
	Max. 0.5	0.48	0.70***	0.40	0.70***
4. Hydrazine - ppm	Min. (residual)	0.008	0.025	0.034	0.004
	Max. ---	0.11	0.14	0.083	0.11
5. Silica - ppm	Min. 0	2.2	0.87	1.7	0.25
	Max. 25	8.1	8.60	7.4	8.30
6. pH at 25°C	Min. 9.50	9.60	9.50	9.00****	9.50
	Max. 11.00	10.80	10.70	10.49	10.60
7. Chemicals Used, lbs.					
Na_3PO_4		17	46.3/4	8.3/4	43.3/4
Na_2HPO_4		4.3/8	17.3/8	1.1/8	15.3/8
NaH_2PO_4		0	0	0	0

* High $[PO_4^{\equiv}]$ due to a copious addition because of a miscalculation
** High $[PO_4^{\equiv}]$ due to steaming of heat exchanger after lay-up conditions
*** High $[Cl^-]$ due to an unexplainable rapid increase in chlorides which lasted for a period of approximately 2 weeks
**** Low pH due to a blowdown

TABLE V

Non-Operating Heat Exchangers

Water Chemistry

Water Conditions	Specifications	Non-Operating Heat Exchangers 1A	1B	1C	1D
1. Dis. Salts - ppm	Min. ---	46	65	51	50
	Max. 1000	228	188	137	181
2. Phosphate - ppm					
(Hot Lay-up)	Min. 5	28	28	44	28
	Max. 1000	154*	110*	44	120*
(Cold Lay-up)	Min. ---	40	32	28	38
	Max. ---	93	78	98	68
3. Chloride - ppm	Min. ---	< 0.05	< 0.05	< 0.05	< 0.05
	Max. 0.50	0.31	0.31	0.30	0.31
4. pH @ 25°C	Min. 10.00	9.70**	10.05	10.30	9.91
	Max. 11.00	10.80	10.70	10.65	10.70
5. Hydrazine - ppm					
(Hot Lay-up)	Min. Residual	Res.	Res.	10	Res.
	Max. ---	83	108	10	60
(Cold Lay-up)	Min. 50	10***	51	30***	54
	Max. 100	76	70	100	66
6. Chemicals Used (Pounds)					
Na_3PO_4		65	26	22	25
Na_2HPO_4		33	13	7	13
N_2H_4		82	30	42	34

* High $[PO_4^{\equiv}]$ due to a copious addition because of a miscalculation

** Low pH due to sampling before treatment for lay-up

*** Low $[N_2H_4]$ due to sampling too soon after treatment - mixing was incomplete

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 components which were repaired during this report period are summarized as follows:

AC Purification Sample Valves

Four sample valves in the AC Purification System were replaced during the October shutdown due to leakage through the valves.

AC Charging System Check Valve

The AC Charging System check valve was repaired to correct a backflow leakage problem.

1C Steam Generator

Repair of the 1C reactor coolant loop steam generator, which had been undertaken during the previous quarter, was completed during the present quarter. The contractor conducted a planned tube inspection prior to installing a flow blocker plate at a previously determined distressed area. The steam generator was returned to service on November 28, 1970.

1C Reactor Coolant Pump

During the final phases of the contractor's work on the 1C steam generator, the 1C reactor coolant pump was prepared for return to service. The upper radial bearing was inspected and new capscrews installed in the bearing housing.

AC and C Loop Relief Valves

The "AC" purification relief valve and the "1C" reactor coolant loop relief valves were replaced due to excessive leakage through the valves.

1A Steam Generator

During the plant shutdown in October, an increase in the 1A steam generator leak rate resulted in removing the 1A reactor coolant loop from service. The leaking tubes were located and later verified by eddy current testing. The four (4) leaking tubes were plug welded. The steam generator was returned to service on November 7, 1970.

Main Unit Turbine

During the plant shutdown in October, the main unit turbine governor was overhauled to correct a problem of sudden load fluctuations of several megawatts when the main unit load was adjusted by means of the main governor control system.

C Loop 18" Manual Stop Valve

During normal plant operation a leak was discovered on the 1C reactor coolant loop outlet manual isolation valve. The loop was isolated from the Reactor Coolant System on December 27, 1970. A small leak was located in the valve bonnet seal ring. The defective area was ground out and welded. The repairs were not completed at end of quarter.

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 calibration of the Data Acquisition System and the primary plant temperature and flow instrumentation. Tests were also performed to check the operation of the FEDAL System, control rod drive mechanisms and two loop operation. Radiation surveys were taken on the reactor coolant loops, reactor vessel head and the purification demineralizers. The reactor plant container integrity was checked at the butterfly valves. Special tests included instrumentation on the D heat exchanger and RWD micron filter evaluation.

Seventeen tests were performed during the report period. Fourteen tests were completed and three 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 Periodic Intercalibration of Temperature Sensing Elements (DLCS 60901) was performed twice in this report period. All of the temperature instrumentation for the 1B and 1D Reactor Coolant Loops were calibrated on October 3, 12-15, 21-23. On November 8 the 1A Reactor Coolant Loop Norwood Th and Tc instrumentation were calibrated before returning the loop to service. The second performance in this report period occurred on November 29 when the 1C Reactor Coolant Loop Norwood Th and Tc instrumentation were calibrated before returning the loop to service. The tenth performance of Periodic Calibration of Reactor Plant Flow Instrumentation (DLCS 61301) was a calibration of 1A, 1B and 1D Coolant Loop Flow performed on October 12, 13 and 14, respectively. The eleventh performance was a calibration of the 1C Coolant Loop Flow on November 25. The Data Acquisition System (DLCS 60401) was scaled in conjunction with the above temperature and flow calibrations.

The FEDAL System (Checkout Test) (DLCS 58201) found that the flow rate of both the bypass and sample train were too low and had to be adjusted. Also, all five channels of each monitor were calibrated. The seed fuel element at core location G-10 was monitored by the FEDAL System (DLCS 58302) on Port 9 during station start-up. The tests yielded normal results indicating no cladding failure in this element. The FEDAL System Operational Test (DLCS 58401) experienced difficulties with the multiport valve skipping ports. One of the scalers was also out of service. This resulted in utilizing the same scaler for both monitors, thus, extending the length of time to complete the test.

The Control Rod Drive Mechanism Periodic Test (DLCS 66101) was performed on October 19 and 20 with two reactor coolant pumps in operation on fast speed. The rod full travel scram times ranged from 1.55 seconds for rod 23 to 1.68 seconds for rods 21 and 53 which is below the allowable maximum full travel scram time of 1.8 seconds.

Two loop operation was experienced during this report period. Flow Distribution Across the Core (DLCS 65605) was performed on October 22 as a prerequisite for Power Distribution - Two Loop Operation (DLCS 66401). These tests were both required for initial two loop power operation.

Radiation surveys of the demineralizers were conducted on November 5 and December 8 and 9 (DLCS 58502). The surveys on AC and BD Demineralizer indicated that both units are below the established resin dumping criteria. On October 3 the AC Purification Heat Exchanger, BD Demineralizer and Purification Heat Exchanger and the A, B and D loops were surveyed (DLCS 58501).

The Periodic Radiation Survey of the Reactor Vessel Head (DLCS 58601) was also performed during the plant shutdown on October 3. The data did not show any unusually high or abnormal radiation levels.

The Reactor Plant Container Integrity Test (Butterfly Valve Test) was performed on October 12, 13 and 15, (DLCS 58602). Acceptable leak rates were obtained on both the supply and exhaust valves.

Special Instrumentation Test on D Heat Exchanger (DLCS 57801) was performed on October 24 operating at 0% power with a Tavg of 536^{o}F and on October 29 at 63 Mw gross generator load. Tape recordings were taken on both days. RWD Micron Filter Evaluation (DLCS 59802) was started on December 21 but was not completed at the time of the writing of this report.

TABLE VI

Test Performed During Fourth Quarter of 1970

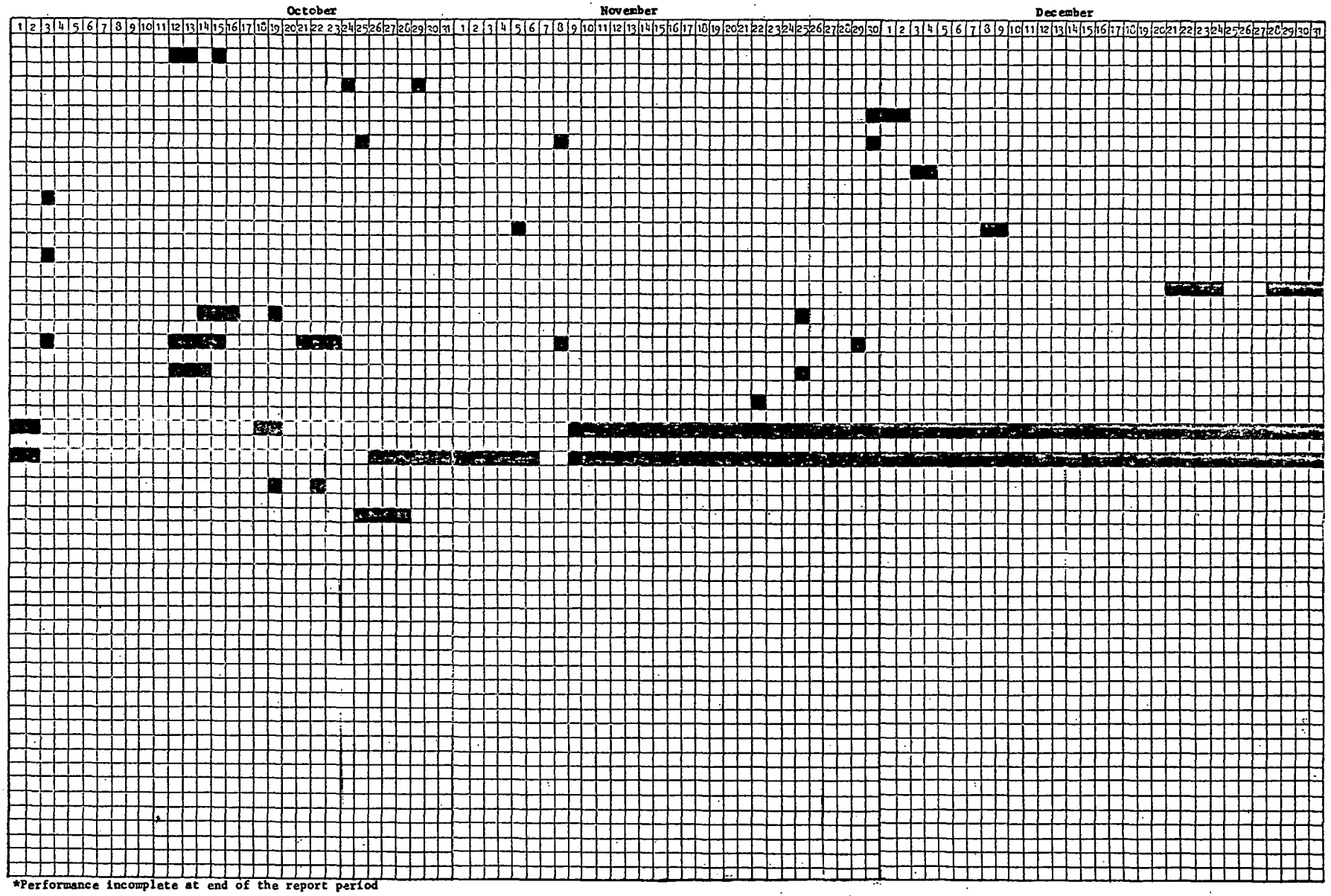
DLCS 5680212	Reactor Plant Container Integrity Test (Butterfly Valve Test)
DLCS 5780102	Special Instrumentation Test on D Heat Exchanger
DLCS 5820128	FEDAL System (Checkout Test)
DLCS 5830203,4,5	FEDAL System (Operation During Station Start-Up)
DLCS 5840127	FEDAL System Operational Test
DLCS 5850130	External Radiation Levels of Reactor Coolant System Piping and Components and Purification System Demineralizers and Heat Exchangers
DLCS 5850209,10	Radiation Survey of the Demineralizers
DLCS 5860114	Periodic Radiation Survey of the Reactor Vessel Head
DLCS 6040111,12	Data Acquisition System Calibration Test
DLCS 6090111,12	Periodic Intercalibration of Temperature Sensing Elements
DLCS 6130110,11	Periodic Calibration of Reactor Plant Flow Instrumentation
DLCS 6560501	Flow Distribution Across the Core
DLCS 6610106	Control Rod Drive Mechanism Periodic Test
DLCS 6640101	Power Distribution - Two Loop Operation

Tests Remaining In Progress at End of Report Period

DLCS 5980201	RWD Micron Filter Evaluation (Special Test Procedure)
DLCS 6590102	Reactor Pressure Drop and Coolant Flow Characteristics
DLCS 6600102	Reactivity Lifetime Test

FIGURE 2

PERFORMANCE DATES
OF
TESTS PERFORMED DURING FOURTH QUARTER OF 1970



*Performance incomplete at end of the report period

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

FMI . . . . . flow measurement instrumentation

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