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YANKEE NUCLEAR POWER STATION

OPERATION REPORT NO. 46

For the month of

OCTOBER 1964

Submitted by

YANKEE ATOMIC ELECTRIC COMPANY
Boston Massachusetts

November 25, 1964

This report covers the operation of the Yankee Atomic Electric Company plant at Rowe, Massachusetts for the month of October, 1964.

At the beginning of the reporting period the plant was operating at a power level of 178 MWe. Output remained essentially constant at that point until October 18, when it was necessary to shutdown to investigate a vibrating noise in the main condenser. Inspection showed that a baffle plate at the condensate recirculating penetration had broken loose and dropped into the hotwell.

With the plant off the line the main condenser tubing was cleaned in an attempt to improve the cleanliness factor which has been abnormally low since Core IV startup.

Following completion of the maintenance items within the condenser, the generator was phased and loaded to 164 MWe. On October 20, the plant load was increased to 180 MWe.

On October 22, an unscheduled scram from full power occurred as a result of accidental operation of the power range gain control knob on a main control board power level indicator. As the scram was readily determined to be of a spurious nature, preparations were made for an immediate return to power generation whereupon difficulties were encountered in restoring the left hand turbine throttle valve to its open position. Turbine roll-off was accompanied by a second reactor scram, the cause of which is discussed in the Turbine Plant Performance section of this report. Following the scram the throttle valve and servo mechanisms were disassembled and inspected. No abnormalities were noted within the mechanisms and following assembly, the valve operated normally. The plant was, therefore, returned to line at 1656 hours on October 23. Plant output reached 182 MWe on October 25, and remained constant at that point throughout the balance of the reporting period.

During the outage a vapor container inspection was made with no abnormalities noted.

Control rod and turbine valve exercising were carried out as scheduled during the month.

Plant Shutdowns

Shutdown No. 75-4-4	10-18-64	A 12.17 hour scheduled shutdown for main condenser maintenance.
Shutdown No. 76-4-5	10-22-64	A 22.35 hour shutdown resulting from a reactor scram.
Scram No. 47-4-3	10-22-64	An automatic reactor scram from a power level of 595 MW_t resulting from inadvertent operation of the power range gain control knob on the main control board.

Scram No.	48-4-4	10-22-64	An automatic reactor scram from a power level of $< 1 MW_t$ resulting from a turbine trip.

Plant Maintenance

Following is a summary of major activities carried out by the plant maintenance staff during October.

1. The waste disposal incinerator was cleaned.
2. Replaced steam trap in rear of No. 1 house heating boiler.
3. Removed and repaired VD915 in PAB valve room.
4. Footings for the primary water storage tank heat exchanger were poured.
5. The vapor container purge fan was inspected.
6. New carbon rings were installed in No. 3 charging pump packing boxes.
7. The decontamination room ventilation fan was inspected.
8. Exciter brushes and air filters were inspected.
9. Cleaned main condenser tubes in both water boxes during scheduled shutdown.
10. Opened left hand turbine throttle valve for inspection.
11. Repaired a leaking boiler feed pump flange.
12. Inspected the exciter field air circuit breaker.
13. Repaired a failed baffle in the main condenser.
14. Cleaned and inspected No. 2 steam heating boiler.
15. Both control air compressors were cleaned and inspected.

Chemistry

Throughout the reporting period the main coolant oxygen concentration remained below the point of detection.

At various times during the period the average main coolant specific activity was measured at 7.8×10^{-2} μc/ml, 7.6×10^{-2} μc/ml, 7.5×10^{-2} μc/ml and 7.2×10^{-2} μc/ml.

Turbine Plant Performance

Continued poor condenser performance data coupled with the previously mentioned condenser baffle failure led to the shutdown of October 18. The condenser cleanliness factor has been continuously below the Core III set point since Core IV startup. In September a plant shutdown was made to clean tubes causing the cleanliness factor to increase from 59% to 68%. The second cleaning on October 18, resulted in a further increase to 75%, a net increase overall of approximately 12 MWe at corrected conditions. At the end of the reporting period the condenser cleanliness factor was approximately the same as that measured during Core III operation.

Following the initial scram on October 22, the turbine was returned to slow roll and speed was increased gradually until the governor took over. As the left hand throttle controller was run down to open the valve, an unsual noise was heard and the turbine speed quickly rose to 2000 rpm. Coincident manual and automatic overspeed tripped the turbine and was quickly followed by a reactor scram since the turbine trip circuit was activated with one throttle valve closed.

As memtioned previously the valve was opened and inspected. No adverse conditions were found and the valve was reassembled. Both throttle valves were tested and operated satisfactorily. Steam was again admitted to the turbine and phasing was accomplished without incident at 1654 hours on October 23rd.

During the month vibration measurements were obtained on the main steam piping at the same locations as data obtained during Core III operation. The results indicate that the latest measurements are essentially the same as those made during Core III.

Instrumentation and Control

The following is a list of major activities carried out by the plant Instrumentation and Control group during October.

1. Recalibrated the charging flow transmitter and receiver.

2. Checked operation of the vapor container air particulate monitor after moisture had condensed in the air lines.

3. Checked the plateau on the primary vent stack monitor.

4. Removed instrumentation from the stripper cubicle.

5. Made up new coaxial jumper cables for the ion chamber thimbles to maintain a spare cable supply adequate for complete cable replacement.

Health and Safety

During the month of October, 96 drums of radioactive wastes containing a total activity of 734 mc were prepared and shipped from the site. This shipment consisted of 51 drums of routine waste containing 496 mc,

The Iodine-131 activity was measured at 2.5×10^{-5} μc/ml, 1.3×10^{-5} μc/ml, 7.9×10^{-6} μc/ml and 1.2×10^{-5} μc/ml; the I-131/I-133 atomic ratio was 0.92, 0.68, 0.58 and 0.69 respectively.

Core burnup follow through boron concentration reduction proceeded uniformly during the month with the concentration measured at 690 ppm at the beginning of the reporting period, decreasing to 550 ppm at month's end.

The main coolant crud concentration remained essentially below 1 ppm throughout the month except for short periods of increase to approximately 2.5 ppm following control rod exercising.

A typical main coolant gas analysis performed on October 14, 1964 indicated:

Xe - 133	6.2×10^{-3} μc/cc
Xe - 135	1.0×10^{-2} μc/cc
A - 41	9.3×10^{-2} μc/cc

A typical main coolant crud analysis performed on October 23, 1964 indicated:

Cr - 51 = 4.1×10^{6} dpm/mg	Co - 60 = 1.3×10^{6} dpm/mg
Mn - 54 = 9.7×10^{5} dpm/mg	Hf - 181 = 6.0×10^{5} dpm/mg
Fe - 59 = 2.1×10^{6} dpm/mg	In - 116m = 7.8×10^{7} dpm/mg
Co - 58 = 7.0×10^{6} dpm/mg	

Both sources that were removed from the core during the past refueling were leak tested in the spent fuel pit. The results obtained are now under investigation and will be reported in a future Operations Report.

Reactor Plant Performance

Core reactivity follow is maintained on a daily basis to determine composite unexplained gains or losses in reactivity. During the month the Core IV data previously obtained was recalculated using a new boron worth curve that shows changes in boron worth with changes in boron concentration. The revised reactivity curve was found to be in excellent agreement with a predicted depletion rate of 1.12% $\Delta\rho$ per 1000 $MW_t D/MTU$.

Analysis of a six wire flux wire irradiation during transient Xenon at 540 MW_t gave the following results.

@ 526°F Tavg 612 ppm Boron Gp. A @ 34 1/8"

F_Q	-	2.7
F^{Δ}_{H}	-	2.1
QDNBR	-	4.3
Hot Channel Outlet	-	587°F

16 drums of expended ion exchange resins containing 15 mc and one drum containing a low flux specimen hole plug consisting of 50 mc.

Liquid wastes containing a total activity of 0.26 mc were discharged during October. Gaseous wastes containing a total activity of 4 mc due primarily to radiochemistry sampling were discharged during the same period.

A radiation survey in the vapor container during the shutdown of October 18, produced the following results.

Location	Radiation Level mr/hr Loop 1	Loop 2	Loop 3
M.C. Piping T_h Contact Maximum	150	350	200
M.C. Piping T_c Contact Maximum	125	300	70
M.C. Stop Valve T_h Contact Maximum	40	160	200
M.C. Stop Valve T_c Contact Maximum	70	90	70
Bypass Valve Contact Maximum	90	300	150
Bypass Valve Contact Maximum	125	350	225
Drain Valve Contact Maximum	125	1000	200
General Cubicle Area	13-40	--	15-95

Leakage from the ion exchange pit during October was measured at 117,849 gallons containing a total activity of 0.18 mc.

During the month a local contractor utilized to analyze and evaluate the environmental survey program reported the presence of slight activity in the plant well water supply. Although the concentration of activity was below levels for human consumption, as a precaution, the plant drinking water was turned off and replaced by bottled water.

Subsequent plant investigation served to confirm the contractor's findings; however, some doubt was raised as to the value of the data. The normal background of the chemistry counting room is such that defining of low level isotopes in environmental samples is difficult. Additional samples were, therefore, sent to the original contractor and one other independent agency whereupon both organizations confirmed that the activity was due to natural occurring radium and radium decay product with the well water below levels for human consumption.

Personnel exposure for Yankee plant personnel as measured by film badge for the month of October, 1964 were:

Average for all station personnel = 49 mr
Maximum individual exposure = 220 mr

Plant Operations

Attached is a summary of plant operation statistics for the month of October, 1964, and a plot of daily average plant load for the same period.

During the month an error was discovered in the January, 1964 Operations Report wherein the Equivalent Reactor Hours @ 600 MW_t was incorrectly reported. The corrected data is presented below:

	Month	Core III	To Date
January	731.17	1651.68	15,278.81
February	662.22	2313.90	15,941.03
March	720.53	3034.43	16,661.56
April	626.55	3660.98	17,288.11
May	586.32	4247.30	17,874.43
June	519.59	4766.89	18,394.02
July	478.78	5245.67	18,872.80
August	15.90	5261.57	18,888.70
		Core IV	
September	512.60	512.60	19,401.30

YANKEE ATOMIC ELECTRIC COMPANY -- OPERATING SUMMARY

ELECTRICAL		MONTH	YEAR	TO DATE
Gross Generation	KWH	125,143,400	991,683,200	3,697,243,100
Sta. Service (While Gen. Incl. Losses)	KWH	7,679,895	65,803,939	263,575,974
Net Generation	KWH	117,463,505	925,879,261	3,433,667,126
Station Service	%	6.14	6.64	7.13
Sta. Service (While Not Gen. Incl. Losses)	KWH	199,100	1,753,200	20,608,651
Ave. Gen. For Month (745 HRS)	KW	167,977	--	--
Ave. Gen. Running (709 HRS)	KW	176,506	--	--

PLANT PERFORMANCE				
Net Plant Efficiency	%	28.22	27.82	--
Net Plant Heat Rate	Btu/KWH	12,093	12,267	--
Lbs. Steam/Net KWH		13.01	13.45	--
Circulating Water Inlet Temp.				
Maximum	°F	65	--	--
Minimum	°F	49	--	--
Plant Operating Factor	%	93.11	75.78	67.64

NUCLEAR		MONTH	CORE IV	TO DATE
Times Critical		2	19	344
Hours Critical	HRS	717.53	1365.09	29,165.58
Times Scrammed		2	5	49
Equivalent Reactor Hours @ 600 MWt	HRS	693.63	1206.23	19,913.90
Average Burnup of Core	MWD/mtU	*	*	*

Control Rod Position at Month End

Equilibrium at 595 MW_t 527°F Tavg

		REGION	MONTH	CORE IV
Group A Rods out-inches	72 3			
Group B	90	INNER	871.9	10,269.0
Group C	90	MIDDLE	1033.0	6701.9
Group D	90	OUTER	636.4	1080.0
		E-6	737.8	23,540.7

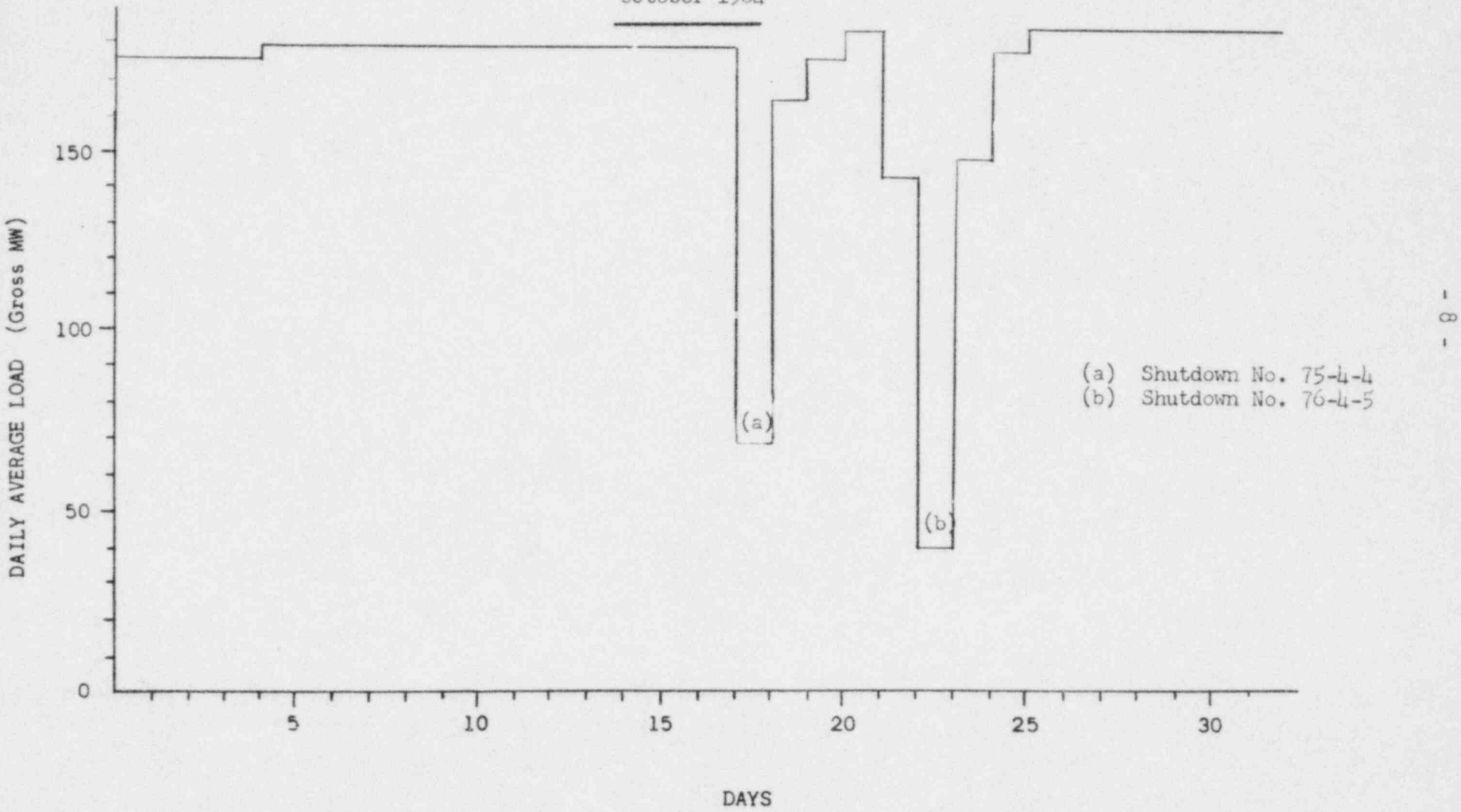
Boron 550 ppm

YANKEE ATOMIC ELECTRIC COMPANY

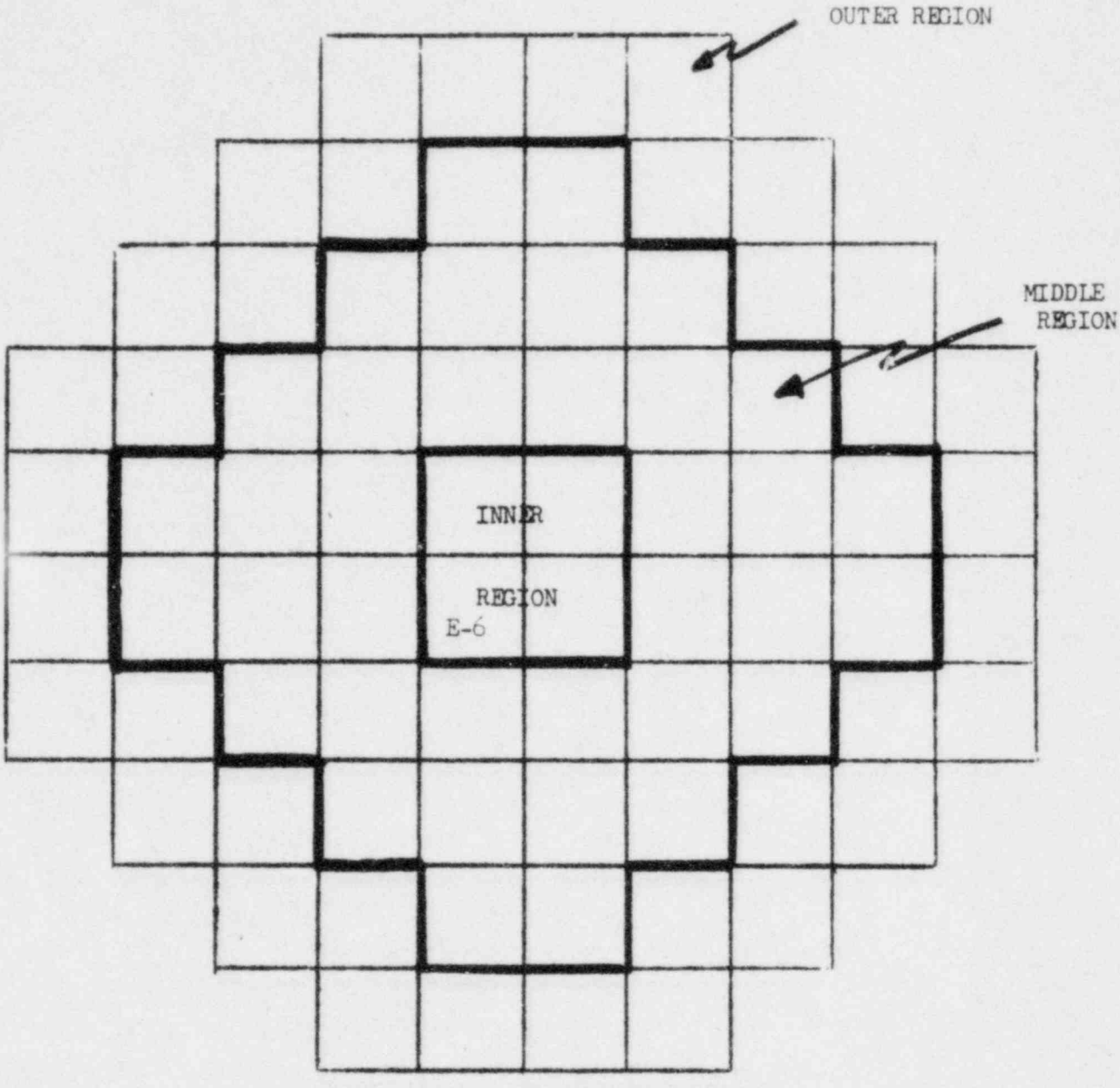
DAILY AVERAGE LOAD

for

October 1964



CORE IV REGION LOCATIONS



E-6 Assembly No. A-8