YANKEE NUCLEAR POWER STATION

OPERATION REPORT NO. 48

For the month of

DECEMBER 1964

Submitted by

YANKEE ATOMIC ELECTRIC COMPANY
Boston Massachusetts

January 25, 1965

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

Throughout the reporting period the plant operated at or near full output of 185 MWe. Total generation for the month amounted to 135,901,700 KWH establishing a new record high for an individual month.

Plant operations were generally normal and routine except for two brief periods of chemistry testing which are described in the Chemistry section of this report.

Spent ion exchange resin disposal and subsequent capsule reclamation continued throughout most of the reporting period. Operations have now been suspended to permit acquisition of shipping casks with increased shield thickness, which were found to be required as the radiation levels of individual capsules now left in storage exceed the capabilities of the present casks.

No reactor scrams or shutdowns occurred during December.

Plant Maintenance

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

1. The heat exchanger for the primary water storage tank was installed.
2. Repacked and changed rams on Number 1 charging pump.
3. Repaired a broken shaft on Number 1 gravity drain tank transfer pump.
4. Replaced a diaphram valve in the water treatment plant.
5. Replaced a failed gland bolt on the water treatment acid pump.
6. Reworked the distillate accumulator drain valve in the waste disposal building.
7. Made thread chasing tool for cleaning reactor vessel studs.
8. Repaired a steam regulator in the water treatment area.
9. Changed filters in the auxiliary bay fan room.
10. Completed modifications to the control rod drive test stand for compressing dash pots.
11. Weekly lubrication and inspections were carried out as scheduled.

Chemistry

During December a series of tests was conducted to add to the data collected previously on crud releases and crud now distributed in the

main coolant system. The object of the tests was to dete. 'ne the self cleanup rate of the main coolant system without external in lences and to evaluate the present corrosion and crud release rates.

On December 3, following a rod exercise and subsequent increase in the circulating crud level, coolant feed, bleed, and purification were secured. Crud levels decreased at a main coolant system half removal rate of 12 hours. (Time required for crud levels to decrease by a factor of two).

A similar test was performed on December 9, except that bleed, feed, and purification were left in service. The total half removal rate was measured at 7 hours as compared to a calculated theoretical rate of 11 hours with 25 gpm purification flow. The four hour difference was attributed to crud dropout and deposition in the main coolant system as represented by the main coolant system half removal rate measured in the previous test. This rate was calculated from the results of the second test to be 18 hours.

A third test was performed in which a circulating crud equilibrium level was established with the bleed, feed, and purification systems operating. These systems were then secured until a new higher equilibrium level was reached. Calculations based on this data and an assumed constant corrosion rate gave a main coolant system half removal rate of 19 hours which was in close agreement with the calculated value of 18 hours in the December 9 test. Essentially these tests have pointed out that the main coolant system is itself a crud removal system and actually purifies water by allowing crud to drop out in low velocity areas and pockets.

During the month the average main coolant gross non-gaseous specific activity was measured at 6.2×10^{-2} μc/ml. Of this total, only 1.2×10^{-5} μc/ml was due to I-131. The I-131/I-133 atomic ratio was measured at 0.45 thus indicating that essentially no fuel defects are present in Core IV. This is particularly significant when one considers fuel assembly A-8 which is now on its third burnup cycle achieving thus far a total burnup of approximately 25,000 MWD/T.

Coolant boron concentration decreased from 440 ppm at the beginning of the reporting period to 302 ppm at month's end.

A typical main coolant gas analysis performed December 12, 1964 indicated:

Xe - 135	5.0×10^{-2} μc/cc
A - 41	3.97×10^{-1} μc/cc

A typical main coolant crud analysis performed on December 1, 1964 indicated:

Cr - 51	1.8×10^{6} μc/ml
Mn - 54	7.0×10^{5} μc/ml
Fe - 59	1.8×10^{6} μc/ml
Co - 58	3.5×10^{6} μc/ml
Co - 60	6.7×10^{5} μc/ml
Hf - 181	Not detected
In - 116m	1.5×10^{8} μc/ml

Previous Operation Reports have discussed test programs that were established to determine which of the two neutron sources removed from service during the past refueling was leaking. After storage in the Spent Fuel Pit for several weeks, the two sources were separately encapsulated, pressurized and flushed with demineralized water to remove all traces of pit water activity from the encapsulation can. Both sources were encapsulated for a minimum of 72 hours and both were sampled at least two times after de-pressurization.

Sampels from both capsules contained measurable amounts of 60 day Sb-124. However, the conclusion that both sources leaked was in some doubt since it was not known if antimony was plated on the internal can surface and subsequently released into the test water. In an effort to resolve this question, the test can was filled with demineralized water and put aside for a three day period. At the end of this time the can was sampled. A small concentration of the Ag-110m nuclide was present in the test water; however, following silver separation, no antimony was found. It is, therefore, concluded that both neutron sources are leakers.

Reactor Plant Performance

A small (0.1%) slowly occurring reactivity gain was realized during the three day chemistry test mentioned previously. It is believed that this gain was due to the increase in main coolant pH caused by the buildup of sodium and lithium. On December 18, following termination of the test, the entire gain was lost when purification flow was re-established. The core depletion rate returned to normal following the reactivity loss.

During the first 3200 MWD/T average burnup of the core, which encompasses the period September 2, 1964 to December 31, 1964, the core depletion rate was found to be 0.98% Δ Keff/1000 MWD/T. This data is in excellent agreement with calculated data at the measured flux distribution in the core.

The results of a five (5) wire flux wire irradiation were:

@ 596 MW_t, 376 ppm C_B, 527°F Tavg

Group A @ 86 5/8 inches

F_Q	-	2.6
$F^{\Delta H}$	-	2.2
QDNBR	-	2.8
Hot Channel Outlet	-	598°F

Turbine Plant Performance

Recent calorimetric data has indicated a slight drop in secondary plant performance. The information obtained thus far is incomplete, however, and a more detailed follow of the problem is underway. It is expected that a more definitive statement will be available for the January, 1965, Operation Report.

Feedwater heater terminal differences measured during the period were:

No. 1	12.0°F
No. 2	13.2°F
No. 3	11.3°F

Circulating water inlet temperatures continued to drop during the month resulting in a much lower condenser back pressure and subsequent higher plant electrical output at rated reactor plant conditions of 600 MW_t.

Instrumentation and Control

Following is a summary of major activities carried out by the Instrumentation and Control group during December:

1. Readjusted demineralizer flow meter controls.
2. Repaired several survey meters and the P.C.A. check point smear counter.
3. Completed rebuilding of spare UIC and CIC neutron detectors.
4. Calibrated and installed a new main steam throttle pressure gage.
5. Prepared a check-off procedure for use in interchanging nuclear power range panels while operating at power.
6. Completed preventive maintenance on all the area radiation monitors in the plant.
7. Completed a check-off list for Vapor Container trip valve testing.
8. Investigated improvements for shutdown cooling temperature control.
9. Adjusted the low pressure surge tank high level dump valve controller.
10. Repaired the printing cycle circuit in the radiation monitoring recorder.

Health and Safety

During the month of December, 1964, 46 drums of radioactive waste containing a total activity of 68.685 curies were prepared and shipped from the site. This shipment consisted of 22 drums of routine waste containing a total activity of 38 mc, and 24 drums of special waste (expended ion exchange resin) containing 68.647 curies.

Liquid wastes containing a total activity of 0.05 mc were discharged during December. Gaseous waste containing an estimated 17.6 mc of activity due to radiochemistry sampling were discharged during the same period.

Ion exchange pit leakage during December amounted to 117,849 gallons containing a total activity of 0.24 mc.

Pumping and disposal of expended ion exchange resins continued during the month. Contact levels on the casks at time of shipment varied from 20 to 170 mr/h

Near the end of the reporting period resin disposal operations were suspended as the shield thickness of the shipping casks proved inadequate for resins from capsules reading > 50 R/hr contact. New cask designs with increased shield thicknesses have been submitted by the contractor.

Five salvaged ion exchange capsules were decontaminated to less than 1,000 dpm/ft^2 and placed in the drum storage area. Radiation levels ranged from 15 mr/hr to 150 mr/hr contact.

Equipment used during resin removal operations has been bagged, tagged, and placed in temporary storage for future reuse. Contact radiation and contamination levels range from 2 - 30 mr/hr and 10^3 - 10^5 dpm/ft^2.

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

Average for all station personnel	- 120 mr
Maximum individual exposure	- 700 mr

Plant Operations

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

Correction

The Gross Generation, Station Service and Net Generation figures for November should be corrected to read:

	Month	Year	To Date
Gross Generation	129,971,400	1,121,654,600	3,827,214,500
Station Service (While Generation Incl. Losses)	7,872,253	73,676,192	271,448,227
Net Generations	122,099,147	1,047,978,408	3,555,766,273

YANKEE ATOMIC ELECTRIC COMPANY -- OPERATING SUMMARY

ELECTRICAL		MONTH	YEAR	TO DATE
Gross Generation	KWH	135,901,700	1,257,556,300	3,963,116,200
Sta. Service (While Gen. Incl. Losses)	KWH	8,213,884	81,890,076	279,662,111
Net Generation	KWH	127,687,816	1,175,666,224	3,683,454,089
Station Service	%	6.04	6.51	7.05
Sta. Service (While Not Gen. Incl. Losses)	KWH	0	1,753,000	20,608,651
Ave. Gen. For Month (744 HRS)	KW	182,663	--	--
Ave. Gen. Running (744 HRS)	KW	182,663	--	--

PLANT PERFORMANCE				
Net Plant Efficiency	%	28.87	27.99	--
Net Plant Heat Rate	Btu/KWH	11,821	12,193	--
Lbs. Steam/Net KWH		14.03	14.39	--
Circulating Water Inlet Temp.				
Maximum	°F	51	--	--
Minimum	°F	36	--	--
Plant Operating Factor	%	99.06	79.71	69.13

NUCLEAR		MONTH	CORE IV	TO DATE
Times Critical		0	19	344
Hours Critical	HRS	744	2829.09	30,629.58
Times Scrammed		0	5	49
Equivalent Reactor Hours @ 600 MWt	HRS	737.03	2660.29	21,548.99
Average Burnup of Core	MWD/mtU	*	*	*

Control Rod Position at Month End

Equilibrium at 595 MW_t 527°F Tavg

Group A Rods out-inches	89[2]
Group B	90
Group C	90
Group D	90

* REGION	MONTH	CORE IV
INNER	992.60	12,103.67
MIDDLE	1100.48	6856.94
OUTER	675.36	2433.11
E-6	815.82	25,054.10

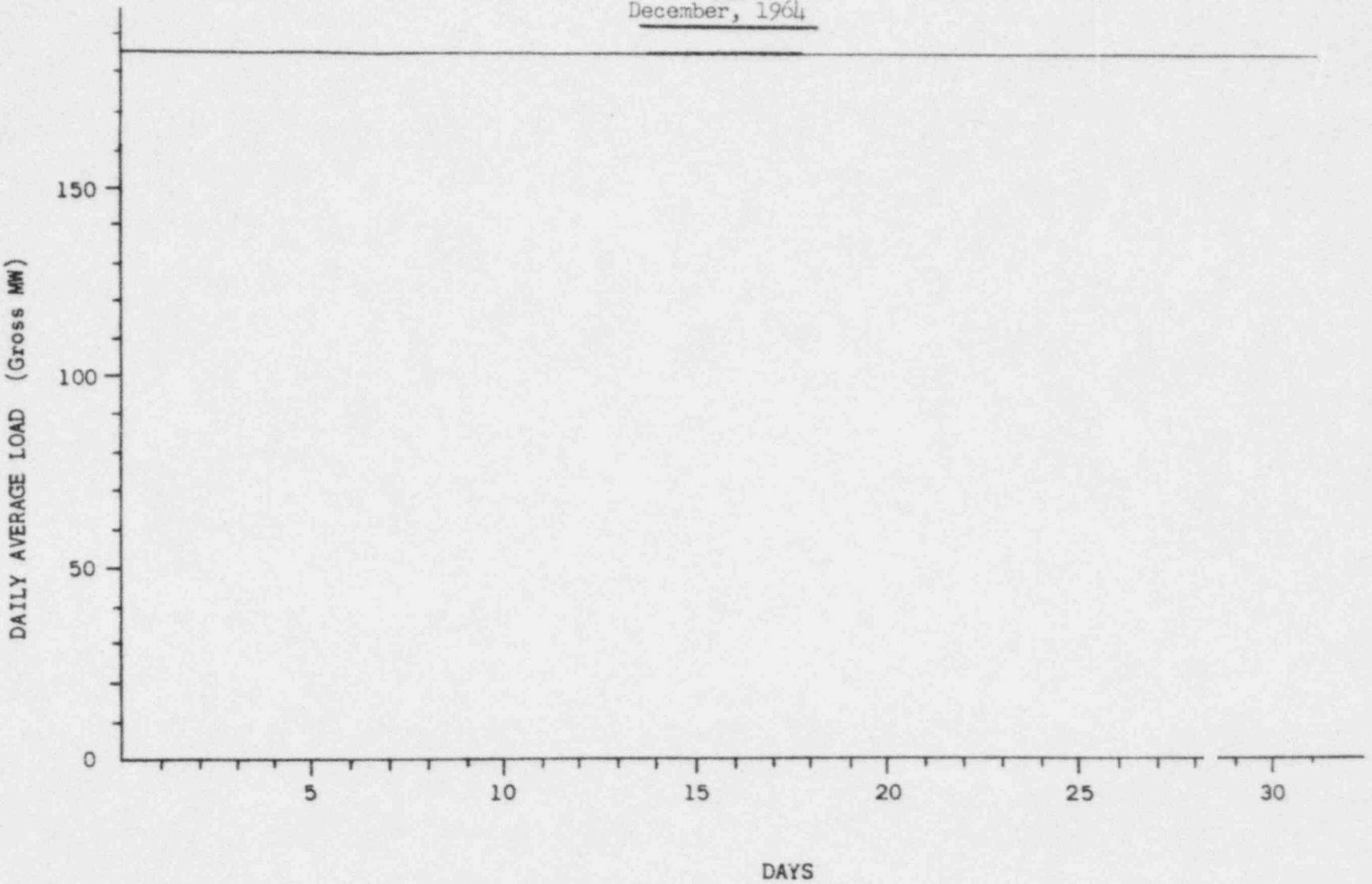
Boron 302 ppm

YANKEE ATOMIC ELECTRIC COMPANY

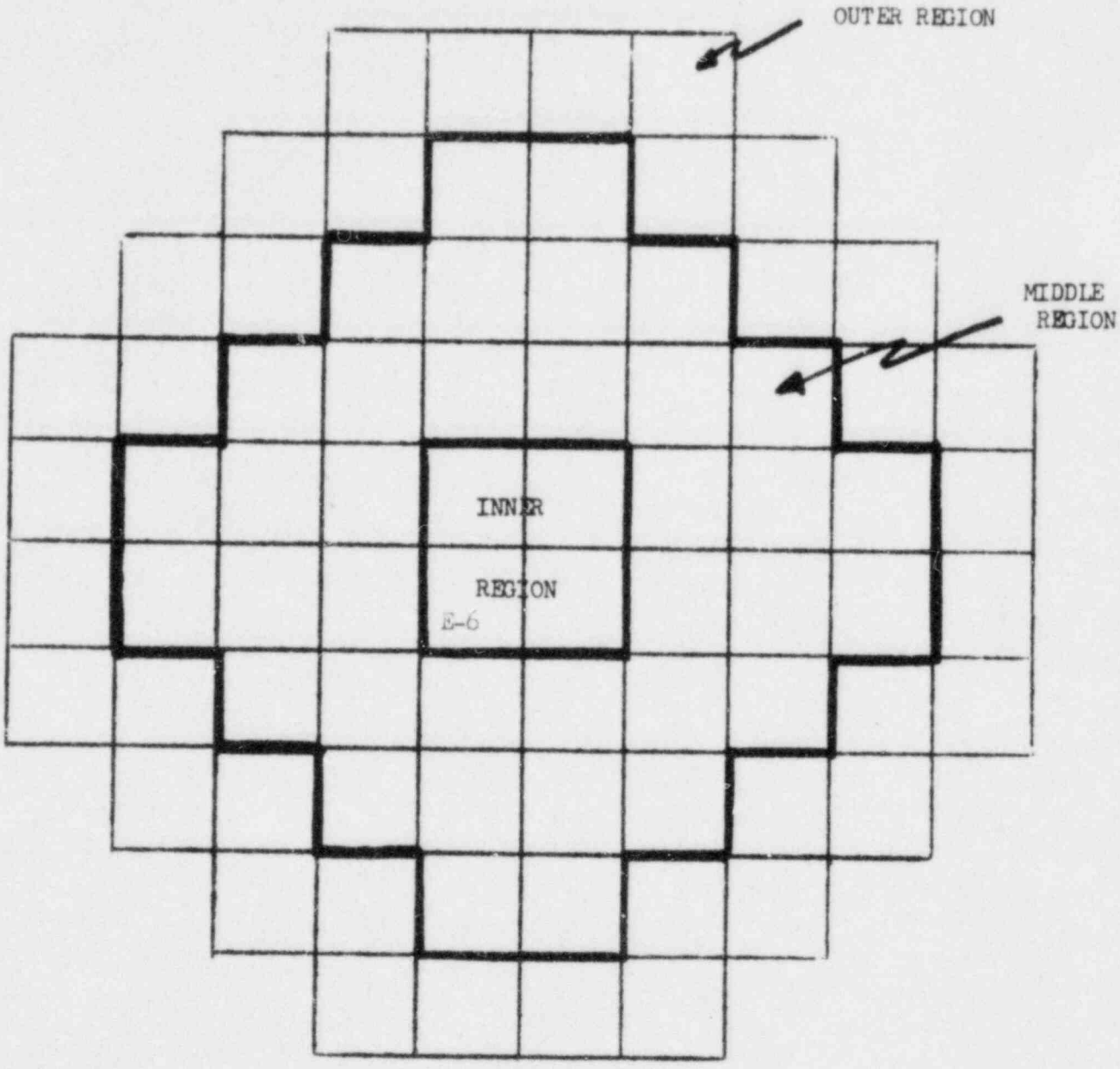
DAILY AVERAGE LOAD

for

December, 1964



CORE IV REGION LOCATIONS



E-6 Assembly No. A-8