YANKEE NUCLEAR POWER STATION

OPERATION REPORT NO. 105

DOCKET NO. 50-29

For the Month of

September 1969

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Submitted by

YANKEE ATOMIC ELECTRIC COMPANY

Boston Massachusetts

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This report covers the operation of the Yankee Atomic Electric Company plant at Rowe, Massachusetts, for the month of September, 1969.

At the beginning of the period, the plant was continuing its Core VII - VIII refueling and maintenance outage. Transfer of fuel was complete and loading of other core components was underway preparatory to reinstalling the reactor vessel head.

The drive shafts and attached dash pots for control rods No's. 7, 17, 21, and 22 were replaced with new drive assemblies. All core components were in place, and the reactor vessel head was installed on September 4, following return of the shield tank cavity borated water to the safety injection tank. During draining of the shield tank cavity, a test was performed for determination of points of leakage from the cavity. Results of the test were inconclusive, other than that the major leakage was from the area of the inner moat ring and its expansion joint.

Work involving removal, testing and reinstallation of the No. 1 and No. 2 safety valves on the low pressure surge tank was completed on September 3.

On September 4, the No. 1 steam generator primary side inlet manway diaphragm seal weld developed a leak. The steam generator was drained and successful repairs to the seal weld were completed on September 5.

The fuel transfer train, including upender, carriage, and carriage weight tube were removed from the vapor container for repair of damage incurred during the abnormal occurrence No. 69-5 (See Operation Report No. 104). In order to free the weight tube, shield blocks were removed from over the fuel chute in main coolant loop No. 4, and the sheave box was opened. Cables were detached from the tube at this access point, and the tube was pulled into the shield tank cavity for subsequent removal. Unexpectedly high radiation levels in the sheave box revealed a small unidentified particle which exhibited a radiation level of approximately 10 r/hr at a distance of one foot. The particle was removed from the sheave box, reducing work area radiation levels to 5 - 15 mr/hr. Removal of the fuel transfer train was commenced September 8, and concluded the following day.

The installation of reactor head closure studs commenced September 8 and was completed on September 9.

On September 12, vapor container integrity was set; the four main coolant loops were isolated for hydrostatic testing; and all four main coolant pumps were started for coolant heatup to 268°F. At this temperature, main coolant pressure was increased to 2485 psig. A slight leak developed on the North conoseal at the lower gland. Coolant pressure was reduced to 300 psig to permit tightening of the mechanical seal. Coolant pressure was then raised to 2485 psig and the leak did not reappear. On September 13 the coolant temperature and pressure was lowered to 190°F and 200 psig, respectively.

Plant heatup was not commenced until September 16 to preclude possible presence of steam at the lower control valves, which were being welded in place at this time. In the interim period, September 14 - 16, control rod exercises and cold rod drops were completed, successfully. On September 16, plant heatup was commenced preparatory to completion of the physics testing program, including hot rod drops; and subsequent plant startup. The Core VIII reactor core

was brought critical on September 17 at 1525 hours. The reactor physics testing program was terminated September 19 at 0705 hours.

During the physics testing period, a leak developed from a weld in the blowdown line for No. 4 steam generator, and the pressurizer low set safety valve was found to be leaking. On September 19, following completion of physics testing, plant cooldown was initiated for repairs. The leak in the blowdown line was from a weld made during modifications, as described in Operation Report No. 104, and was located immediately outside the steam generator shell. Successful repair of this leak was completed September 20. Upon removal of the pressurizer safety valve, the valve stem was found to be untrue, and a hairline crack was detected in the valve disc. The faulty components were replaced; the safety valve was successfully tested; and reinstallation was completed September 23.

During cooldown of the primary system commencing September 19, further leakage was detected at the North conoseal, once again through the mechanical seal. At this time, seal welds were made at the top and bottom of the conoseal bell housing, thereby containing any further leakage through the mechanical seal. Surveillance of the repaired conoseal revealed continuing leakage; this time from around the incore instrumentation tubes. Inspection showed, that although the conoseal bell was welded to the adapter plug at the top, the tube flare guide was attached to the adapter plug at only four tack welded points. This configuration permitted leakage inward at the joint between the tube flare guide and the plug adapter, and then upward around the tubes penetrating the tube guide. Repair consisted of a complete circumferential seal weld at the tube flare guide - plug adapter joint, and resealing of the weld joining the conoseal bell to the top of the adapter plug. Final repairs were concluded on September 22.

A load test of the emergency diesel was performed, satisfactorily, on September 20.

On September 21, a complete functional test of the safety injection system under simulated, low pressure conditions was performed; all components operated as required.

Steam line warm up commenced on September 24 at 1700 hours, and turbine rolling was initiated following the establishment of vacuum in the main condenser. The generator was phased on line at 0045 hours on September 25. The reactor power level was increased to 480 MWt and then 540 MWt. On September 26 at 0210 hours, full power was attained with plant generation at 175.2 MWe (600 MWt). Plant load remained essentially the same during the remainder of the period, as the circulating water inlet temperature fluctuated only between 60°F and 62°F.

The Core VII - VIII refueling and maintenance outage time was approximately 54 days.

Plant Abnormal Occurrences

There were no plant abnormal occurrences during the month of September, 1969.

Plant Load Reductions

There were no plant load reductions during the period following return to power operation on September 25.

Plant Shutdowns

Shutdown No. 101-7-9 : August 2, 1969 to September 25, 1969.
A 1290.5 hour scheduled shutdown for
Core VII - VIII refueling and maintenance.

Core VII - VIII Major Work Items

The below listed major work items are a continuation of those listed in Operation Report No. 104.

1. Replacement installation of two of the three turning vane elbows in the inlet piping to the moisture separators was completed. An extended delivery date for the third elbow made its installation impracticable. However, the turning vane section of the existing third elbow was removed; the elbow was inspected and found to be sound; and a new turning vane assembly was welded in place. Replacement of the two deflector rings was also completed.

2. Replacement was completed of the 18" section of piping of the No. 2 feedwater heater extraction line at the point of confluence of the two 12" lines.

3. Work was completed on replacement of the inner cylinder nozzle chamber for each of the four control valves on the high pressure turbine.

Plant Maintenance

The following is a list of pertinent maintenance items performed, additional to the major work items, during the month of September, 1969.

1. Preventive maintenance was performed on the vapor container purge line valves.

2. The No. 1 & No. 2 control valve servomotor test valves were converted from hand to electrical operation. These lower control valves may now be closed by operating selector switches on the turbine start-up panel; the same as the two upper valves, No. 3 and No. 4.

3. The vapor container high pressure relay switch was converted from straight electrical operation to both hand and electrical operation by the addition of new shafts and cams.

4. An inspection was performed of all 24 control rod position indication coil stacks and maintenance was performed as required.

5. A complete inspection of the exciter was made including insulation tests of fields, commutator, and cables. Pins and springs were replaced in the

brush holders, as necessary. The commutator slots were undercut and the bars were beveled. The commutator was given a hand stoning and polish during reactor start-up.

6. Inspection of the turbine generator, which commenced with plant shutdown in August, 1969, was completed during this report period. A complete set of dielectric absorption tests were performed. The polarization index of each winding was satisfactory. Insulation and impedance tests of the rotor were satisfactory. The generator RTD's were checked for ohmic value and for grounds.

Instrumentation and Control

The following is a list of pertinent instrumentation and control maintenance items performed by the plant staff during the month of September, 1969.

1. Five new coaxial cables were installed between the No. 2 main coolant loop pull box and the No. 3 neutron detector thimble.

2. A dew point detection system was installed atop the reactor head in the shield tank cavity. A detector was placed in each of the two cable trays where they penetrate the missile shield. The purpose of the system is to serve as monitors for possible coolant leakage from penetrations in the reactor vessel head.

Reactor Plant Performance

Following heatup of the primary plant, the reactor was brought critical and loaded to 450 MWt. Power defect and xenon poisoning were measured with the reactivity computer. Following a calorimetric and six hour hold, plant load was increased to 540 MWt and held until 0135 on September 26, when 75% of 540 MWt equilibrium xenon was satisfied. Plant load was then increased to 600 MWt.

The following parameters were determined by means of incore instrumentation.

581.7 MWt; 525.3°F Tavg; control rod group A @ 82^{4}; B, C and D @ 87°; 1190 ppm boron.

F_Q = 2.3

$F_{\Delta H}$ = 2.3

Minimum DNBR = 3.1

Maximum outlet temperature = 597°F

Core VIII Startup Physics Test Program

The physics test program was commenced September 14, at 1930 hours and was terminated September 19 at 0705 hours. Test results were as follows:

Rod Worth

Group A: .85%

Group B: 2.42%

Group C: 1.81%

Maximum Worth Rod

With Group A in: Rod #4 = .35%

With Groups A & B in: Rod #8 = .36%

With Groups A, B, & C in: Rod #16 = 1.16%

Temperature Coefficient (1915 ppm boron): -1.93×10^{-4} $\Delta K/K/^{o}F$

Inverse Boron Worth: 200 ppm/% $\Delta K/K$

A problem developed with Group D during cold rod drops. At the 38 2/8" level during rod insertion, the primary indicating light showed that the group had dropped into the core without a scram breaker trip. Further exercising of the group failed to effect a repeat of the rod drop occurrence. This occurrence was similar to that reported in Operation Report No. 88 for Group C at the start of the Core VII physics test program. The stationary gripper coil voltages had been set prior to the rod exercise. A check of the voltages following the rod drop indicated no abnormal conditions. It is possible that the stationary gripper coil voltage suffered a transient, which permitted Group D to drop into the core.

Secondary Plant Performance

Feedwater heater terminal differences were as follows:

No. 1: 5.0 No. 2: 11.1 No. 3: 5.5

Chemistry

On September 12 filling and venting of the main coolant system was completed and hydrazine was added to scavenge the residual oxygen.

The main coolant boron concentration averaged 2957 ppm until September 17 when the concentration was decreased by dilution for physics testing, to a low of 1201 ppm. The concentration was increased on the 19th and averaged 2276 ppm until the 24th when the main coolant system was diluted to 1635 ppm preparatory to return to power operation. At the end of the period the boron concentration was 1190 ppm.

The main coolant pH at the beginning of the period was 4.72. Due to changes in coolant boron concentrations, the pH had increased to 5.0 when the generator was phased on line at 0045 hours on September 25. During the balance of the period, the main coolant pH averaged 5.15.

The main coolant gross beta-gamma and tritium specific activities increased from an average of 4.57×10^{-4} uc/ml and 3.61×10^{-2} uc/ml respectively, prior to reactor startup, to 7.30×10^{-2} uc/ml and 2.20 uc/ml respectively, following return to power operation.

The highest crud level recorded during the month was 0.54 ppm.

Following reactor startup, main coolant iodine values increased from below detectable concentrations to an iodine - 131 specific activity of 6.35×10^{-6} uc/ml with an iodine 131/133 ratio of 0.36.

A representative crud sample for the month, collected on September 29, had the following radiochemical analyses: dpm/mg crud

Cr-51	Mn-54	Fe-59
3.14×10^{6}	5.02×10^{6}	1.28×10^{6}
Co-58	**Co-60**	**Ag-110M**
1.50×10^{7}	7.60×10^{6}	1.30×10^{5}

A main coolant gas sample collected on September 29 had the following radiochemical analyses: uc/cc gas

Xe-133	Xe-135	Ar-41
1.78×10^{-3}	5.22×10^{-3}	7.66×10^{-1}

Health and Safety

Three shipments of radioactive waste were made during the period, totalling 159 drums and containing a total activity of 355.80 mc.

Waste disposal liquid releases totalled 82,790 gallons containing 0.06 mc of gross beta-gamma activity and 30.44 curies of tritium. Gaseous releases during the period totalled 134.89 mc of gross beta-gamma activity. Secondary plant water discharged totalled 123,686 gallons containing 0.13 mc of gross beta-gamma activity and 0.71 curies of tritium.

In addition to the above releases 1.39 curies of tritium as a vapor, was discharged to the environment through the primary vent stack.

Radiation exposure doses for Yankee personnel and N.E.P.S. Co. personnel as measured by film badge for the month of September, 1969 were:

Yankee Plant Personnel:

Average accumulated exposure dose: 529 mrem
Maximum accumulated exposure dose: 2040 mrem

N.E.P.S.Co. Personnel:

Average accumulated exposure dose: 569 mrem
Maximum accumulated exposure dose: 2040 mrem

Operations

Attached is a summary of plant operating statistics and a plot of daily average load for the month of September, 1969.

YANKEE ATOMIC ELECTRIC COMPANY - OPERATING SUMMARY

September 1969

ELECTRICAL		MONTH	YEAR	TO DATE
Gross Generation	KWH	24,260,600	811,520,000	9,815,281,800
Sta. Service (While Gen. Incl. Losses)	KWH	1,542,644	51,501,256	646,095,515
Net Output	KWH	22,717,956	760,018,744	9,169,186,285
Station Service	%	6.36	6.35	6.58
Sta. Service (While Not Gen. Incl. Losses)	KWH	1,066,794	2,498,586	28,782,236
Ave. Gen. For Month (720)	KW	33,695	- -	- -
Ave. Gen. Running 143.75	KW	168,769	- -	- -

PLANT PERFORMANCE				
Net Plant Efficiency	%	27.61	28.46	28.38
Net Plant Heat Rate	BTu/KWH	12,361	11,991	12,025
Plant Capacity Factor	%	19.05	67.94	73.98
Reactor Plant Availability	%	21.65	77.87	83.41

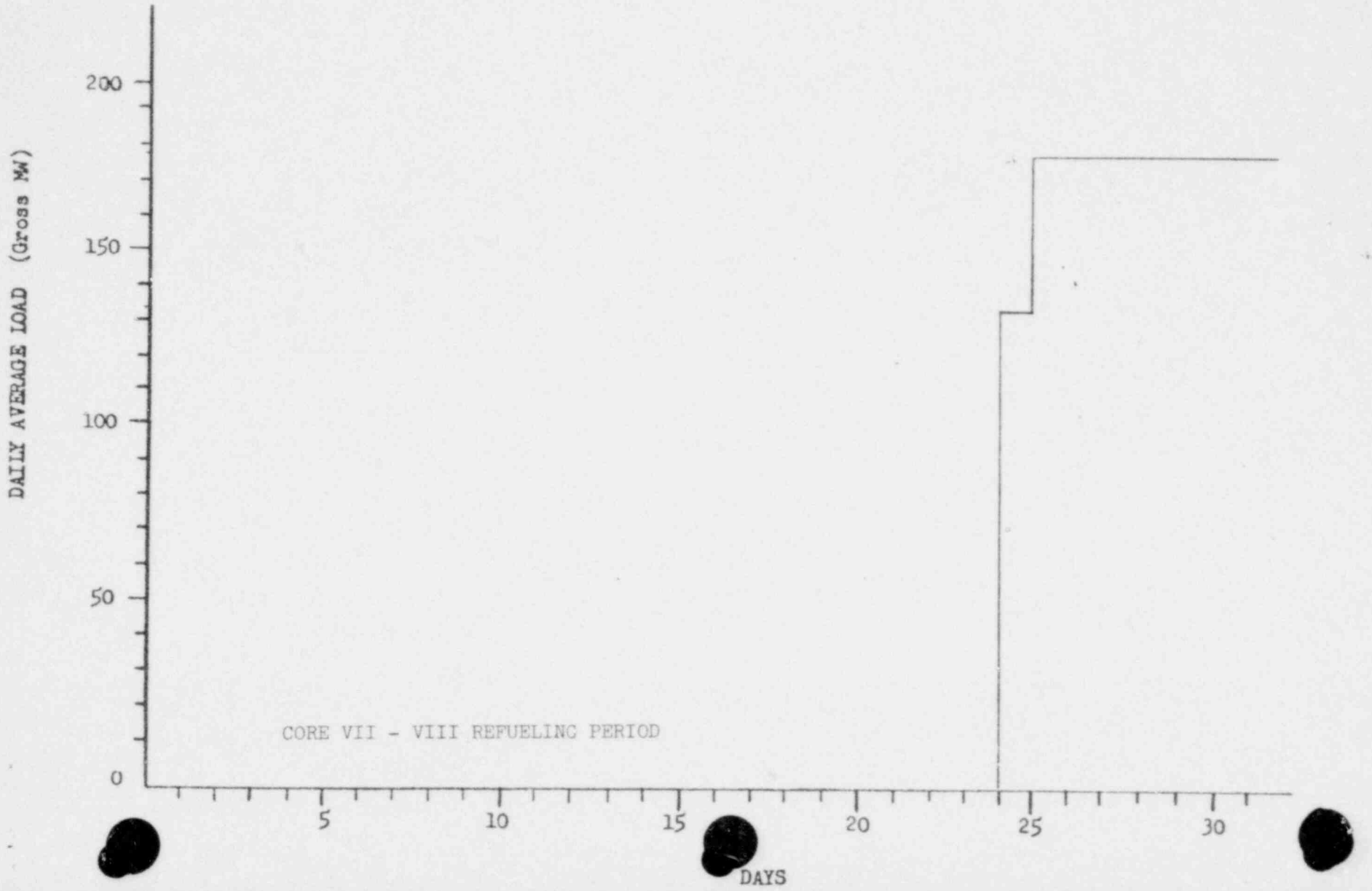
NUCLEAR		MONTH	CORE VIII	TOTAL
Hours Critical	HRS	186.70	186.70	66,006.48
Times Scrammed				
Burnup				
Core Average	MWD/MTU	164.98	164.98	- -
Region Average	MWD/MTU			
A (INNER)		169.34	169.34	30,612.30
B (MIDDLE)		190.88	190.88	24,124.07
C (OUTER)		138.51	138.51	9,788.62
D (ZIRCALOY)		- -	- -	- -

YANKEE ATOMIC ELECTRIC COMPANY

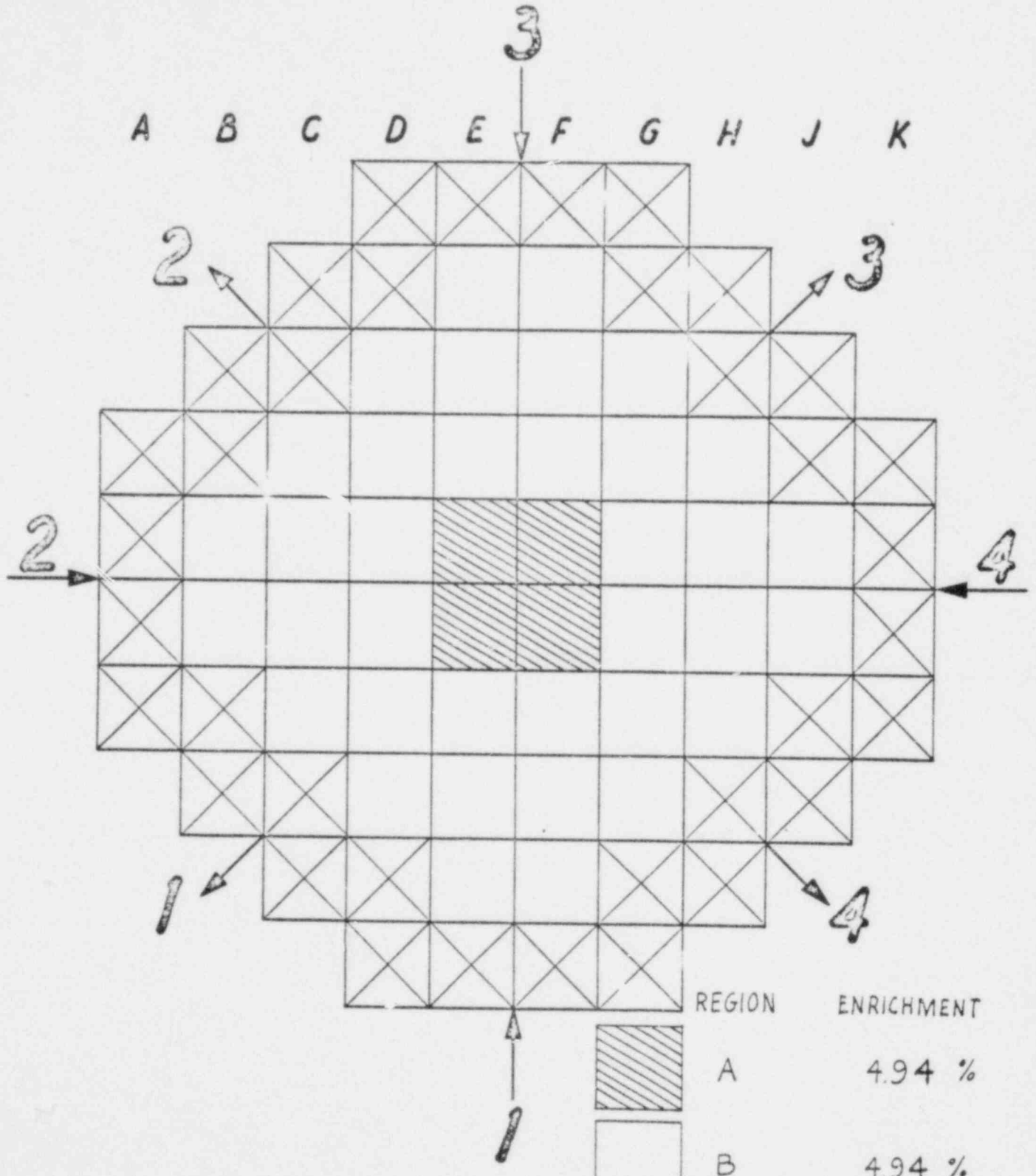
DAILY AVERAGE LOAD

for

September 1969



CORE VIII



REGION	ENRICHMENT
A	4.94 %
B	4.94 %
C	4.94 %

FORM RE-5