YANKEE NUCLEAR POWER STATION DOCKET NO. 50-29

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OPERATION REPORT NO. 58

For the month of

OCTOBER 1965

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 October 1965.

At the start of the period, the scheduled refueling shutdown was still in progress with efforts concentrated on the removal of the southeast specimen basket. (See Operation Report No. 57). A hole was drilled through the thermal shield in an attempt to remove the bolt holding the basket to the thermal shield. The drill was not centered on the bolt and this attempt failed. An impact tool which was used unsuccessfully before, was tried again, and was able to break the bolt. The basket was then removed. The southwest basket, which appeared intact, was then removed. The impact tool was used to break the bolt and an underwater shear was used to cut the upper straps.

During the period from October 7 to October 23, efforts were concentrated upon the installation of the secondary core supports and the clamp devices on the thermal shield. Underwater impressions were made to measure contours of the thermal shield before final machining of the parts. It was necessary to machine the secondary core supports to insure that no interference would exist with the lower core barrel assembly. After installation measurements were taken to insure that the supports and clamps were installed properly and that the barrel assembly would fit without interferences.

A sampling of the lower shroud tube tie plate capscrews were checked for tightness with none of those checked being found loose. It was then assumed that the one bolt that had fallen out was an isolated incident and not a general problem.

A new capscrew was installed under shroud tube #17 to replace the one that had fallen free. It is held in place by a lockwasher as it would be impossible to install a locking cap of the original design.

Two new neutron sources were installed in the east and west positions and a blank blade was installed in the north position of the reactor core.

The bottom of the vessel was cleaned and the core barrel assembly was easily re-installed on the 23rd. The fifty foot borescope was used to check orientation of two of the secondary core supports with respect to the lower core support plate. The inspection showed that the supports were installed properly and that no interference exists between the supports and the capscrews in the lower core support plate. Reference scribe marks have been made on the thermal shield clamps to make monitoring of movement with time possible. The scribe marks were easily seen on the new unoxidized clamps and their position recorded.

After the barrel assembly was in place, the remaining control rod inspection schedule was completed. Two new control rods of stainless steel and Ag-In-Cd construction were inserted in the central region of the core, replacing two hafnium sections. The fit of the new absorber sections with the old follower sections was questionable and new followers were installed on these control blades.

During the period of vessel internal work, the manway of the pressurizer was opened. This decision was made to open the pressurizer after hearing of problems of others whose vessels were similarly internally clad, and because the pressurizer represents the potentially most serious environment of the main coolant system, except for the effect of neutron irradiation.

The water was at refueling level, which allows inspection of upper five feet of the vessel. The area around the manway forging received the most attention. The forging is clad by weld deposited stainless, while the rest of the hemispherical head is clad by sheet stainless stitch welded to the base metal by the B&W process. The area was dye penetrant checked. Cracks were seen in the stitch clad and at the joint between the two types of clad. The final disposition of this problem remains pending at the period end.

The loading of Core V fuel assemblies began on the 26th and was completed on the 28th, with only minor dealys due to mechanical problems.

The flux wire system eggcrate, which rests within the upper core barrel assembly, was inspected again this year to insure that no further wear has occurred on the individual tubes. Some cracks were observed in the flux wire tubes where they leave the thimble seal backup plug outside the reactor vessel. The north backup plug containing the cracks was removed and a new backup plug employing Inconel tubes was installed. This problem has occurred before. It is felt that the cracks may have been caused by a combination of bending the tubing during installation and localized corrosion. The removed backup plug will be examined more closely as time permits.

The upper core barrel assembly was easily re-installed in the reactor vessel. The control rod drive shafts, guide tube support plates, guide tube shim plugs and guide tube hold down plate were installed. Considerable difficulty was again experienced installing the drive shafts and this problem is again under review. All shafts were re-installed on their respective rods, except number 2, the most bowed shaft which will be analyzed further for effect on rod drive misstepping.

A portion of the vessel head cladding was inspected and dye penetrant tested. No cracks were observed in the stitch cladding or weld deposit cladding. Some indication of minor porosity was found in the weld deposit cladding.

Control rod travel housing #21 was cut from the vessel head and will be destructively tested. A new spare travel housing was installed on the head.

Preparations were being made to flush all pressure housings and to install the vessel head at the period end.

The overhaul of the turbine-generator was completed during this period and the unit was placed on turning gear. Work is continuing on the new moisture separator turning vane elbows and insulating steam lines.

The sample system modifications have been completed and the system is now ready for operation.

Plant Maintenance

Following is a summary of major activities carried out by the plant maintenance staff, augmented by personnel of the New England Power Service Company.

1. Installed a flow meter in the charging pump suction line.

2. Installed a new cylinder block and ground the valves on the No. 1 charging pump.

3. Installed and wired SA-MOV-513, the new motor operated root valve in the sample system.

4. Repaired the position indicating coil stack on control rod 22.

5. Insulated various high temperature lines in the vapor container.

6. Installed steam generator feedwater distribution ring supports.

7. Replaced the turning vane elbows on the moisture separators.

8. Began cleaning and applying anti-seize compound to the reactor vessel studs.

9. Relocated the waste disposal filter and began final connections.

10. Set up the rig to flush all control rod pressure housings before vessel head installation.

The following work was performed on the turbine-generator unit:

1. Installed the spindle, blade rings, cover and No. 3 and No. 4 control valves on the high pressure turbine.

2. Repaired the rubbed shroud band on the 1st row, generator end, blading of the low pressure spindle.

3. Installed the spindle, cover and seals on the low pressure turbine.

4. Repaired leaks and installed new bearings on the turbine oil centrifuge.

5. Installed the turning gear on the turbine.

6. Installed the pedestal cover.

7. Adjusted the throttle valves.

8. Installed filters and flushed the turbine oil lube system.

Chemistry

The shield tank cavity water gross activity varied from 2.7×10^{-4} µc/ml to 9.7×10^{-5} µc/ml, while the crud varied from 0.08 ppm to .12 ppm, during the reporting period.

The fuel pit water gross activity increased from 2.9×10^{-5} µc/ml to 1.0×10^{-4} µc/ml, due primarily to fuel movements to the vapor container.

The boron concentration in the shield tank cavity varied between 2213 and 2220 ppm.

Reactor Plant Performance

The inspection of the pre-selected control and shim rods was completed. Excessive wear was noted on the north faces of the east and west vanes of inspected rods in group C. Varying degrees of wear were noted on rods in group D that were inspected. The wear consists mainly of horizontal depressions where the control rod blade contacts the guide blocks in the upper core support plate. The worn areas are at several elevations, but occur mainly at the bottom, which corresponds to the rods out or nearly out positions which existed throughout most of the core life with boron shim operation. Five of the more severely worn control rods were rotated 180° to even the wear distribution. The control rods rotated were: in group D; FG-12, AB-45, and JK-67 and, in group C; EF-23, and BC-56. The four rods in group D which are located in front of the vessel outlet nozzles were rotated during Core III-IV refueling and nothing further was done at this time.

From the wear observed on the control rods at this refueling as compared with previous refuelings it is apparent that the new redesigned guide tubes installed at Core III-IV refueling did not appreciably reduce the amount of wear.

The flux wire system eggcrate was inspected underwater by means of the 1½" borescope. The installation of spacer tubes within fuel assemblies which accept flux wire thimbles has stopped the wear which occurred during Core I and Core II operation. The condition of the incore portion of the thimbles had not changed since the last refueling inspection. The original wear areas were visible but they have now filled with crud.

The two in-core instrumentation flux wire entrance ports were examined. Several of the tubes were cracked where they leave the north port plug adapter. This was corrected by cutting off the old plug adapter, which includes the cracked tube area, and installing a new plug in its place. A device is incorporated to keep a carbon dioxide atmosphere within these tubes to prevent the possible formation of nitric acid. This device was not in use during Core IV operation while there were leaks in several thimble extensions. In addition, the tubing extensions in the new plug are Inconel, as opposed to stainless steel in the removed

plug. This tubing is less susceptable to stress corrosion cracking and may alleviate the problem.

A full core of 76 fuel assemblies was loaded in less than two days, including down time for repairs to the fuel handling system. The fully loaded core, which contains 38 assemblies cycled in Core IV, 36 new stainless clad assemblies and two new zircaloy clad test assemblies were measured to be at least 5.5% Δ K shutdown with all control rods inserted and 2220 ppm of boron in the refueling water.

The 76 Core V fuel assemblies consist of the following:

36 new, 4.9% enriched assemblies in the outer region, called Region C
34 single cycle 4.1% enriched assemblies in the middle region, called Region B
4 two cycle 4.1% enriched assemblies in the center region, called Region A
2 zircaloy clad, 2.9% enriched assemblies in middle region, called Position D

Turbine Plant Performance

The feedwater flow system instrumentation was recalibrated. Curves were generated of turbine control oil pressure vs. all four turbine control valve position.

Instrumentation and Control

Following is a summary of major activities carried out by the plant Instrumentation and Control staff during October:

1. Recalibrated the low pressure surge tank controls and indicators, both at the tank and in the control room.

2. Overhauled and calibrated the incore thermocouple recorder.

3. Completed the installation and testing of the vapor container air temperature detectors.

4. Adjusted the waste disposal loop seal alarm switches.

5. Checked the calibration of the BF_3 nuclear channels before fuel loading commenced.

Health and Safety

During the month of October 1965, the following solid radioactive wastes were shipped off site for disposal:

Two shipments, a total of 106 drums, with a total activity of 1084.4 millicuries.

27,510 gallons of liquid waste, containing a gross beta-gamma activity of 0.26 mc and 34.23 curies of tritium, were discharged during October. Gaseous waste containing a total activity of 5.274 curies of tritium was discharged during the same period due to the constant vapor container purge to the primary vent stack.

Remote gamma scans were made in the spent fuel pit of two antimony-beryllium source vanes, one from Core III and one from Core IV. The maximum levels through one foot of water were: 216 r/hr from the Core III vane and 5650 r/hr from the Core IV vane. Levels were taken at increasing distances from the vanes until the lower limit of the detector was reached (~0.6 r/hr). The distances were: 4 feet for the Core III source and 6 feet for the Core IV source.

Radiation measurements taken through the pressurizer manway with the water level about 5 feet from the top were: 40 mr/hr one foot below the flange, 100 mr/hr three feet down, and 140 mr/hr at the surface of the water. No beta radiation was detected. Contamination levels on the inside surface was about 60,000 dpm/ft^2.

The reactor vessel was surveyed using a pocket dosimeter, sealed and lowered through the water into the vessel. Levels along the centerline were: 3 r/hr elevation of thermal shield top, 20 r/hr midway down, and 50 r/hr contact bottom center of vessel. Levels measured on contact with the thermal shield were: 300 r/hr top rim, 2800 r/hr midway down, and 1000 r/hr bottom rim.

Yankee plant personnel radiation exposures as measured by film badge for the month of October 1965 were:

Yankee Personnel

Average	262 mrem
Maximum individual exposure	820 mrem

N. E. Power Service Company Personnel

Average	207 mrem
Maximum individual exposure	560 mrem

Plant Operations

Attached is a summary of plant operation statistics for the month of October 1965.

YANKEE ATOMIC ELECTRIC COMPANY -- OPERATING SUMMARY

OCTOBER 1965

ELECTRICAL		MONTH	YEAR	TO DATE
Gross Generation	KWH	0	826,833,000	4,789,949,200
Sta. Service (While Gen. Incl. Losses)	KWH	0	54,499,983	334,162,092
Net Generation	KWH	0	772,333,017	4,455,787,108
Station Service	%	0	6.59	6.98
Sta. Service (While Not Gen. Incl. Losses)	KWH	396,252	1,662,627	21,461,078
Ave. Gen. For Month	KW	0	--	--
Ave. Gen. Running	KW	0	--	--

PLANT PERFORMANCE				
Net Plant Efficiency	%	0	28.08	
Net Plant Heat Rate	Btu/KWH	-	12,154	
Lbs. Steam/Net KWH		-	14.01	
Circulating Water Inlet Temp.				
Maximum	°F	Not in Service		
Minimum	°F			
Plant Operating Factor	%	0	62.84	67.98
Reactor Plant Availability	%	0	73.93	80.38

NUCLEAR		MONTH	CORE V	TO DATE
Times Critical		0	0	357
Hours Critical	HRS	0	0	35,960.96
Times Scrammed		0	0	49
Equivalent Reactor Hours @ 600 MWt	HRS	0	0	26,159.04
Average Burnup of Core	MWD/MTu			
Control Rod Position at Month End [1]				
Equilibrium at				
Group A Rods out-inches				
Group B				
Group C				
Group D				

REGION	MONTH	TOTAL BURNUP
A (INNER)		
B (MIDDLE)		
C (OUTER)		
ZIRCALOY TEST ASSEMBLIES		

Boron ~ 2200 ppm

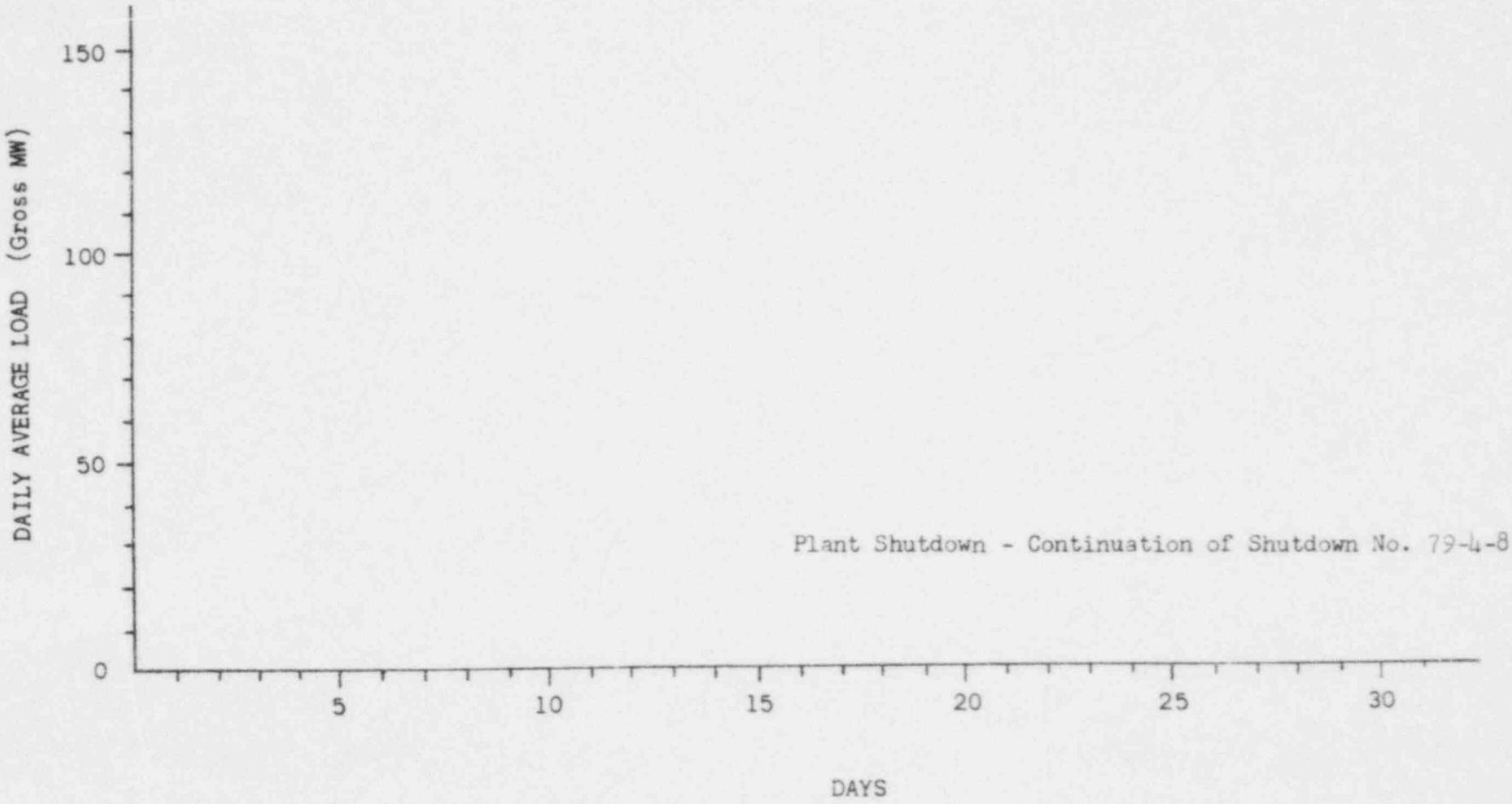
[1] Shutdown for refueling

YANKEE ATOMIC ELECTRIC COMPANY

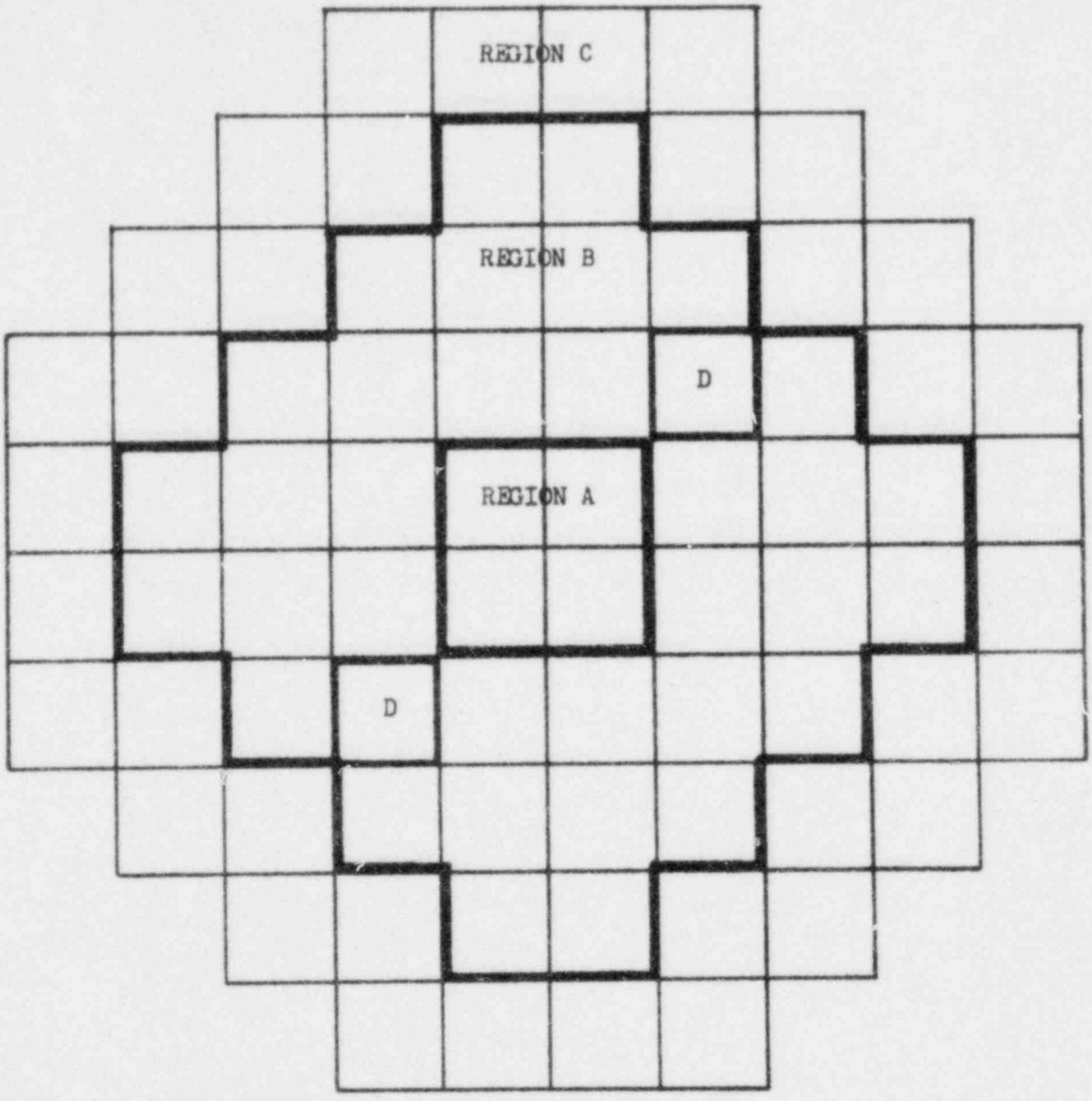
DAILY AVERAGE LOAD

for

OCTOBER 1965



CORE V REGION LOCATIONS



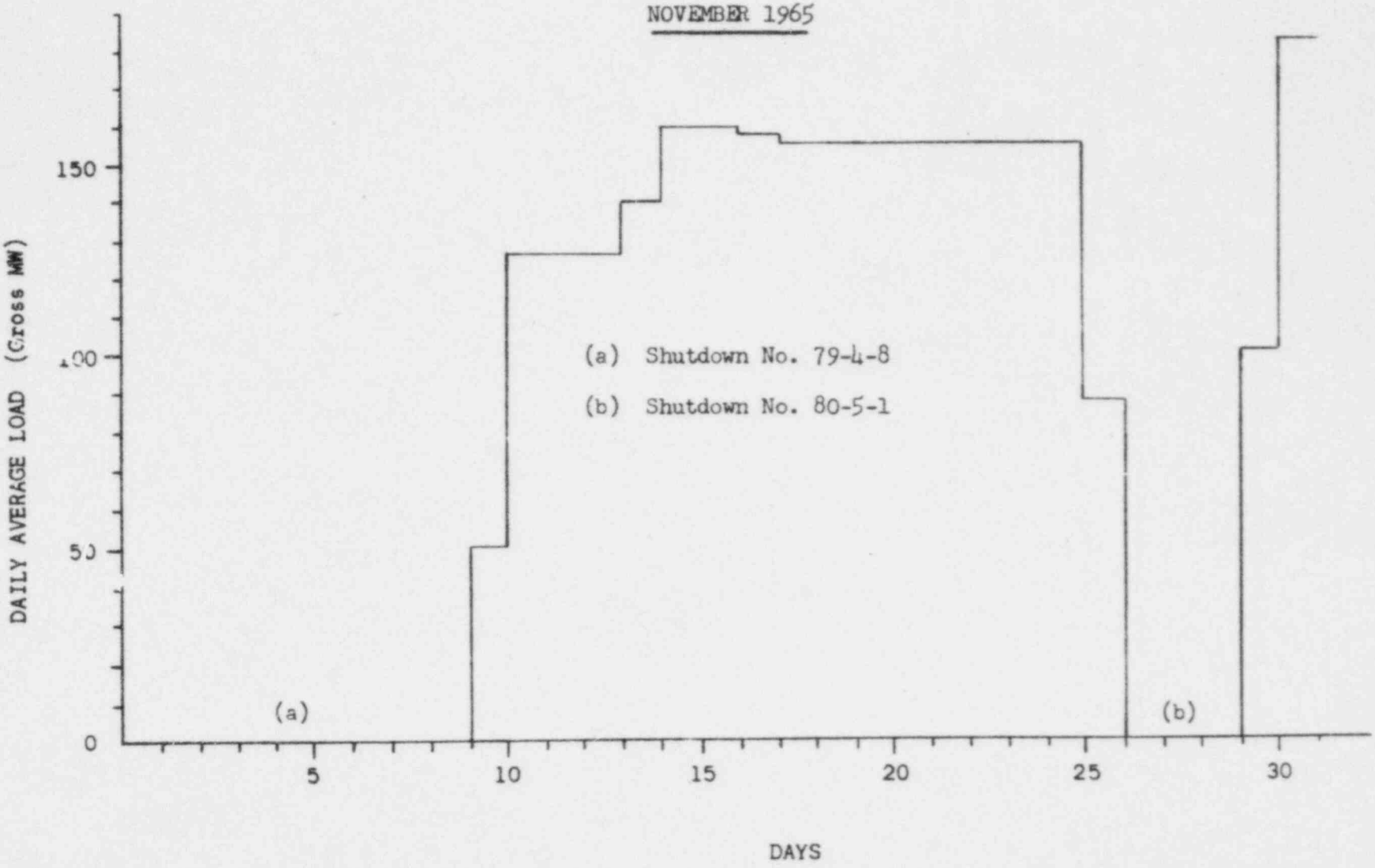
D - ZIRCALOY TEST ASSEMBLIES

YANKEE ATOMIC ELECTRIC COMPANY

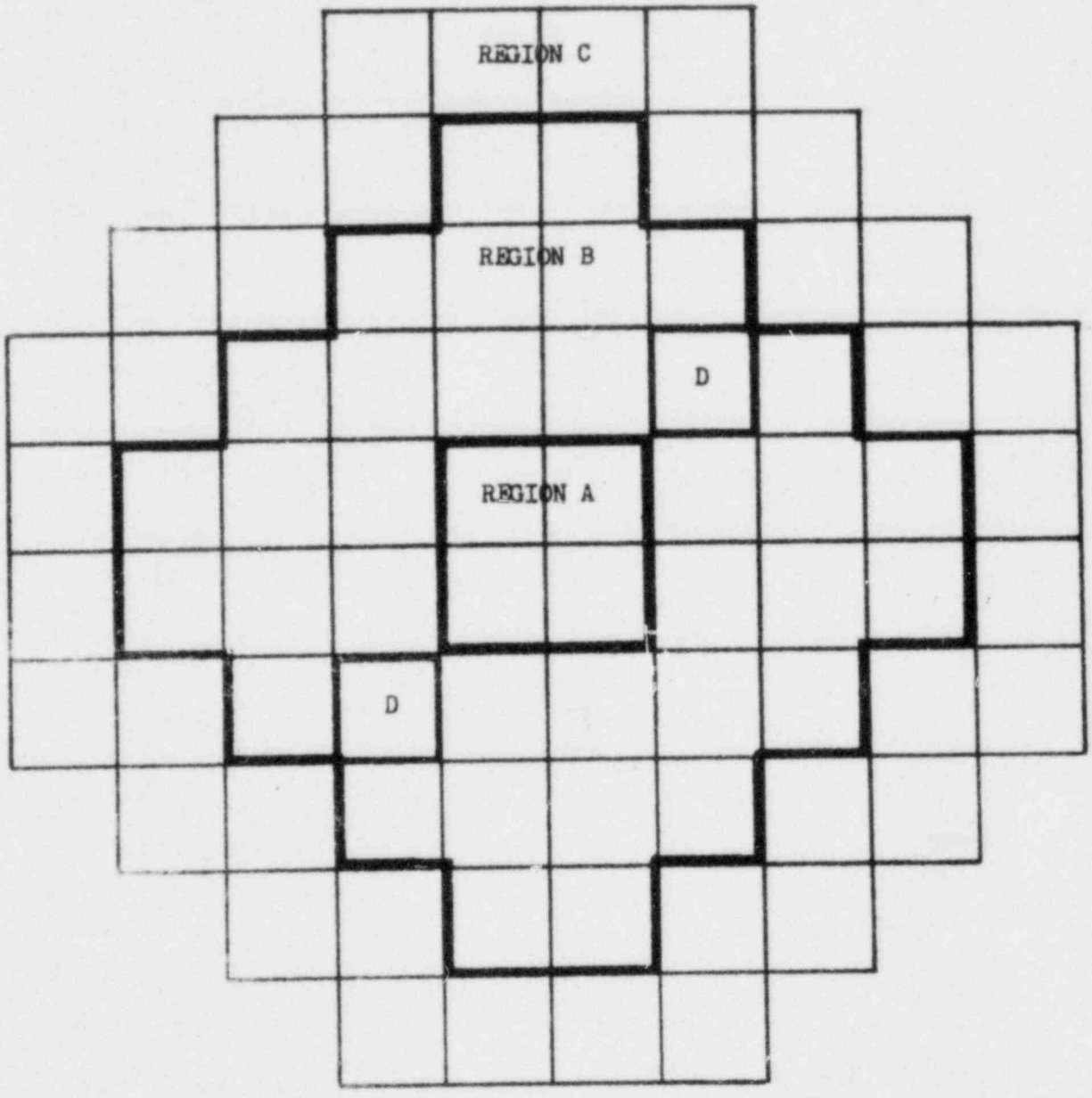
DAILY AVERAGE LOAD

for

NOVEMBER 1965



CORE V REGION LOCATIONS



D - ZIRCALOY TEST ASSEMBLIES