SAXTON NUCLEAR EXPERIMENTAL CORPORATION

Operations Report for June 1967

1. GENERAL

At the beginning of this report period preparations were being made to remove the reactor vessel head to investigate the malfunction of control rod No. 5 and/or its drive mechanism. On June 2nd the reactor vessel head was removed and stored on the operating floor.

On June 5th it was shown by making an inverse count rate plot that the boron concentration, 2037 ppm, in the storage well was adequate to hold the reactor subcritical for the control rod configuration - Nos. 1, 3, 4, 6 and 2 fully withdrawn and No. 5 fully inserted.

On June 7th a lifting force was applied to the top of control rod No. 5. The force was applied with a manually operated gear hoist which was suspended from a stationary support erected over the storage well. The control rod became free when a force of 162 pounds was applied with the hoist. This force was in addition to that applied to the control rod with the drive mechanism. Once the control rod was free to move it was raised to 40 inches and then lowered to zero inches with the hoist. While the weight of the control rod was on the hoist the drive rod bundle was raised to 9 inches and then lowered to zero inches with the drive mechanism. These operations gave evidence that the obstruction which had blocked the movement of the control rod had been dislodged.

While control rod No. 5 was still attached to the hoist, all six control rods were positioned at approximately 8 inches from the bottom. Control rod No. 5 and No. 2 were then withdrawn to 40 inches. An inverse count rate plot made during the rod movements showed the reactor to be subcritical with the two highest worth rods fully withdrawn. This procedure verified that the shutdown reactivity requirement for the removal of any two control rods from the core was met.

In the days that followed a special maintenance instruction was carried out to inspect control rod No. 5 and adjacent fuel assemblies with the underwater periscope for mechanical defects, and to verify the proper operation of the drive mechanism.

The upper core barrel with instrument frame was removed from the reactor vessel on June 9th and was placed on its storage platform in the storage well.

The three fuel assemblies occupying core positions D-3, D-4 and C-4 adjacent to control rod No. 5 were removed from the core on June 13th. Each assembly was inspected with the underwater periscope and then placed in the fuel storage rack. No defects were found.

On June 14th control rod No. 5 was carefully lifted from the reactor vessel and was transferred to the underwater periscope for inspection. The rod was found to be normal in all respects except for a vertical line of gouges on one side of one blade of the solid stainless steel top adapter of the absorber section. The uppermost and longest of the gouges was estimated to be 1/8" wide, 1/16" deep and 3/8" long.

It was determined, that when the control rod was in its fully inserted position in the reactor vessel, the gouged area on the adapter was at the same general level as the upper control rod guide block which is mounted on the underside of the upper core support plate. Upon completion of the underwater inspection the control rod was placed in the fuel storage rack.

The drive mechanism for control rod No. 5 was exercised on June 16th. The drive rod was raised and lowered in increments of 10 inches over its full range of travel, 40 inches. The performance of the drive mechanism was normal.

The fuel assembly occupying core position C-3, adjacent to control rod No. 5, was removed from the reactor vessel and inspected with the underwater periscope on June 16th. No defects were observed. The fuel assembly was placed in the storage rack.

An Inspection Engineer for the Materials Testing Laboratory of Pittsburgh, Pa. was on the site on June 21st. All 36 reactor vessel head studs were ultrasonically inspected. Nine of the same studs were magnetic particle inspected. All 36 nuts for the head studs were ultrasonically inspected. The hook for the 20 ton rotary crane and the hook for the refueling crane in the containment vessel were magnetic particle inspected. All items inspected were found to be free of cracks and discontinuities of the types that can be located by the inspection methods used.

On June 22nd the water in the storage well was lowered to grating level. The plugs over the two reactor vessel material surveillance specimens capsules were removed and with the aid of special lighting it was observed that the capsules were still in the retaining baskets mounted on the thermal shield.

The water level was raised to six feet above the reactor vessel flange and from the vantage point of a scaffold erected over the reactor vessel the visible areas of the lower [illegible] support plate were inspected for abnormalities and foreign material. None were seen. [illegible]e bottom guide block for control rod No. 5 was viewed with a borescope. No defects were observed.

Also on June 22nd five new single plutonium enriched fuel rods were received from the Westinghouse Fuel Fabrication Facility at Cheswick, Pa.

On June 23rd the upper core support plate and the accessible surfaces of the upper guide block for control rod No. 5 were inspected with a borescope. Some scoring was visible on the vertical edge of the guide block that was directly opposite to the gouged area on the control rod adapter when the control rod was fully inserted in the core. The gouges on the control rod adapter and the scoring seen on the upper guide block were evidence enough to conclude that the immobilization of control rod No. 5 was caused by a small piece of hard material, origin and present location unknown, falling into the narrow opening between the upper core support plate and the control rod adapter and becoming wedged between the adapter and the upper guide block. No significant damage was done in freeing the control rod.

The four 9x9 fuel assemblies (C-3, C-4, D-4 and D-3) and control rod No. 5 were removed from the storage rack and returned to the reactor vessel on June 26th. The components were transferred in the reverse sequence of that in which they were removed from the core. Control rod No. 5 was installed in its slot with an orientation that differed 180° from that which it formerly had.

Control rod No. 2 was removed from the reactor vessel and was inspected with the underwater periscope. Some heavy rubbing marks were seen on the cladding of two rods in the upper follower section and what appeared to be a defect in the cladding was observed on one rod in the lower section of the follower. The control rod was returned to the reactor vessel.

The last four days of the month were devoted primarily to the inspection of all 9 of the removable fuel rods in the plutonium portion of the core. Five of these rods were inspected with the underwater periscope and then placed in the fuel storage rack. The remaining four rods were inspected with the underwater periscope, three were measured with a profilometer and all were returned to new locations in the core. The five new fuel rods that were received on June 22nd were inserted in the vacant core positions.

On June 30th control rods Nos. 1, 3 and 6 were removed from the reactor vessel, inspected with the periscope and then returned to the reactor vessel. No abnormalities were seen on these control rods.

2. EXPERIMENTAL PROGRAM

All nine of the 9x9 removable zircaloy clad fuel rods in the plutonium portion of the core were removed for inspection. Five of the fuel rods (serial Nos. 503-15-1, 503-15-3, 503-15-4, 503-15-7 and 503-16-1) four having pelletized fuel and one having vibratory compacted fuel were placed in the fuel storage rack. The remaining four rods (serial Nos. 503-15-2, 503-15-5, 503-15-6 and 503-16-2) three having pelletized fuel and one having vipac fuel were returned to new locations in the core. Five new rods (serial Nos. 503-15-8, 503-15-9, 503-16-3, 503-16-4 and 503-16-5) two having pelletized fuel and three having vipac fuel were installed in the vacant locations.

No wear or fretting aside from normal contact marks were noted on any of the removable rods except 503-15-7. On this rod clad wear in the order of 0.0005 inch deep was found at the top grid support location and at the bottom grid support location minor fretting in the order of 0.001 inch deep was noted. These conditions were not considered to be a problem.

The four 9x9 fuel assemblies in core locations B-3 (#503-2-3), D-4 (#503-12-1), C-3 (#503-12-3) and D-3 (#503-13-1) were inspected with the underwater periscope for crud deposition. In general, the appearance of the fuel assemblies was good. The corrosion product deposition, where found, varied with location from a light spotty distribution to a fairly uniform pattern. The deposit thickness is estimated at varying between 0 and 3 mils. The heaviest deposit occurs only along relatively small regions.

The high pressure nitrogen compressor for the supercritical technology test loop was relocated from the containment vessel to the auxiliary equipment room of the control and auxiliary building.

3. OPERATIONAL TESTS

The radiation monitoring system circuits were tested on June 13th.

On June 27th and 28th control rod No. 5 was raised to 40 inches (full out position) with the drive mechanism and dropped a total of 5 times. The shortest time recorded for a drop was 815 milliseconds and the longest was 846 milliseconds. The drops were made with the reactor in a cold, no-flow condition. A temporary guide block substituted for the guide block on the upper core support plate. The drop times recorded compared favorably with previous data taken for the same reactor conditions.

4. MAINTENANCE

The principal items of mechanical maintenance for the month included removing the reactor vessel head; rigging a manually operated gear hoist and freeing control rod No. 5; removing the upper core barrel from the reactor vessel and placing it on a storage platform; cleaning the thirty-six reactor head studs, acorn nuts and washers; preparing the reactor vessel head for painting; processing four drums of evaporator bottoms; painting the internal surfaces of the magnetic clutch for the variable frequency motor generator set with three coats of epoxy paint; repairing a universal joint on the containment vessel rotary crane; replacing the seats in fifteen conference room chairs; painting the reactor head bolt can; replacing the carbon vanes in the air pump for the northeast site particulate monitor, RIC-8; and handling fuel, control rods and other core components.

The major items of electrical and instrumentation maintenance for the month included cleaning contacts on relays in the control circuits for the refueling crane; replacing the "zero" potentiometer in nuclear instrumentation source range channel A log microammeter; replacing the G-M tube in the area radiation monitor (labitron) located in the chemistry laboratory; assembling a borescope for use in the reactor vessel; installing a new gear train in the nuclear instrumentation start-up range recorder; pressurizing the underwater periscope for use in inspecting fuel in the storage well; replacing a circuit breaker in the sewage plant distribution panel; repairing the fast start-up rate alarm; repairing the scaler and audible alarm for the portable neutron detecting channel used in fuel handling operations; replacing the transmitter in the paging phone for the operating area in the containment vessel; replacing a decade unit in the G-M scaler in the count room; measuring the voltages on the cathodic protection system for buried pipes and tanks; repairing the voltmeter used in the control room for calibrating nuclear instrumentation; replacing the bulbs in two underwater refueling lights; and repairing the alpha scaler in the count room.

6. CHEMISTRY

The main coolant system was in a cold shutdown condition and open to the storage well throughout this report period. The boron concentration of the water in the storage well was 2050 ppm. The shutdown cooling system was operated as necessary to remove core residual heat. A summary of the analyses taken from the shutdown cooling system during the month is given in the following table:

Shutdown Cooling System	Minimum	Maximum
pH at 25°C	5.13	6.08
Conductivity, umhos	7.55	17.3
Boron, ppm	1087	2060
Chlorides, ppm	0.015	0.02
Gross Beta-Gamma (15 Min. Degassed) uc/cc	0.0026	0.172
Tritium, uc/cc	0.012	0.013

7. RADIATION AND WASTE DISPOSAL

Radiation surveying consisted of routine plant surveys, C.V. during shutdown and materials shipments. The following maximum radiation readings were taken:

Location	Radiation Reading
C&A Building	
Waste Drum (baling machine)	20.0 mrem/hr beta-gamma
Charging Pump (contact with chamber)	18.0 mrem/hr beta-gamma
Sample Room (door of sample panel)	2.0 mrem/hr beta-gamma
Chemical Lab Hot Sink (1" from drain)	3.0 mrem/hr beta-gamma
RWDF	
Evaporator (under bottom)	35 mrem/hr beta-gamma
Evaporator (contact outside upper level)	< 1 mrem/hr beta-gamma
Drum Storage Area (at HRA fence)	5.0 mrem/hr beta-gamma
C.V.	
Primary Compartment (general upper level)	38 mrem/hr beta-gamma
Primary Compartment (contact M.C. pump volute)	230 mrem/hr beta-gamma
Primary Compartment (S.G. bottom)	80 mrem/hr beta-gamma
Primary Compartment (pressurizer bottom)	80 mrem/hr beta-gamma
Primary Compartment (general lower level)	15 mrem/hr beta-gamma
Primary Compartment (Regen. HX)	120 mrem/hr beta-gamma
Primary Compartment (Non-Regen. HX)	42 mrem/hr beta-gamma
Auxiliary Equipment Compt. (S.C.H.X.)	12 mrem/hr beta-gamma
Auxiliary Equipment Compt. (D.T. top)	12 mrem/hr beta-gamma
Auxiliary Equipment Compt. (D.T. bottom)	170 mrem/hr beta-gamma
Auxiliary Equipment Compt. (general lower level)	9 mrem/hr beta-gamma
Reactor Deck (head removed)	1000 mrem/hr beta-gamma
Reactor Deck (waist level)	200 mrem/hr beta-gamma

Contamination surveying consisted of routine plant site surveys, surveys of materials shipped, tools, equipment and C.V. during shutdown. The clean areas were within the "Clean Area" limits. The controlled area was generally within the "Clean Area" limits. The controlled area was cleaned frequently to keep and/or to return it to the "Clean Area" limits. The exclusion areas were cleaned periodically to minimize the amount of smearable contamination. The following contamination levels were observed:

Location	Contamination Reading
C&A Building	
Charging Pump Chamber	34800 d/m/smear beta-gamma
Charging Pump Chamber	< 10 d/m/smear alpha
Charging Room Floor	995 d/m/smear beta-gamma
Sample Room Sink	171000 d/m/smear beta-gamma
Sample Room Sink	< 10 d/m/smear alpha
Sample Room Floor	886 d/m/smear beta-gamma
Chemical Lab Hot Sink	7520 d/m/smear beta-gamma
Chemical Lab Hot Sink	< 10 d/m/smear alpha
RWDF	
Pump Room Floor	653 d/m/smear beta-gamma
Shipping Room Floor	448 d/m/smear beta-gamma
C.V.	
Operating Deck	2860 d/m/smear beta-gamma
Operating Deck	< 10 d/m/smear alpha
Primary Compartment (grating)	5960 d/m/smear beta-gamma
Primary Compartment (grating)	< 10 d/m/smear beta-gamma

Liquid and gaseous effluents from the SNEC site for the month of June 1967 were as follows:

Effluent Type	(Curie) Activity This Month	(Curie) Activity Year to Date	(Curie) Activity Last Twelve Months
Tritium	0.206537	4.800909	22.790027
Liquid	0.001946	0.016132	0.022345
Air, Xe	0.000000	11.053901	80.146183
Air, I-131	0.000000	0.000850	0.10615[illegible]
Air, M.F.P.	0.000000	0.110539	0.801462

2

IMAGE EVALUATION TEST TARGET (MT-3)

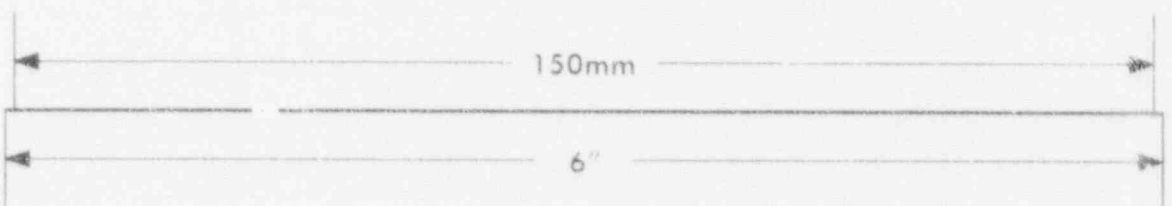

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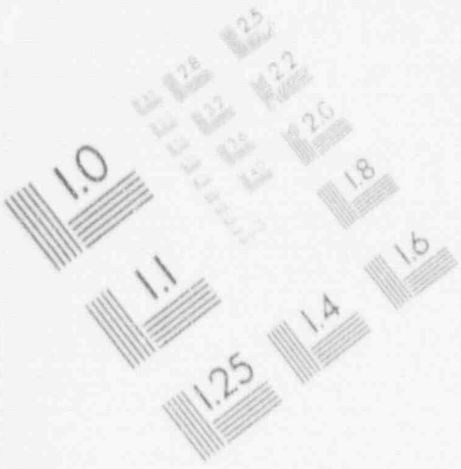
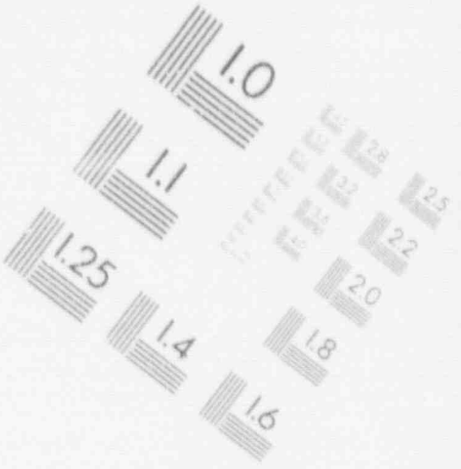
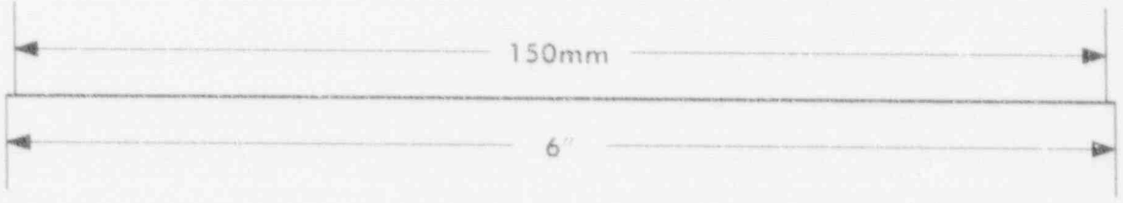
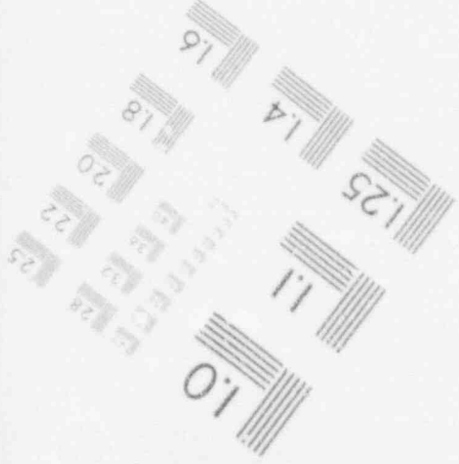
IMAGE EVALUATION TEST TARGET (MT-3)









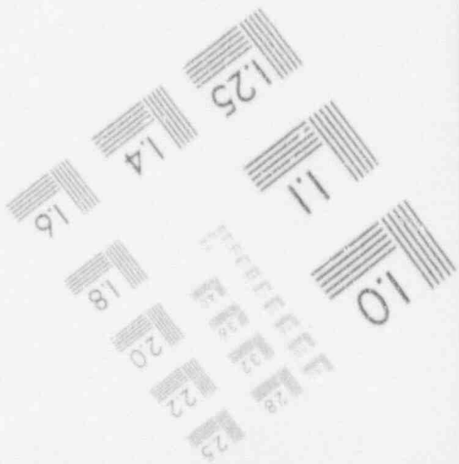


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IMAGE EVALUATION TEST TARGET (MT-3)

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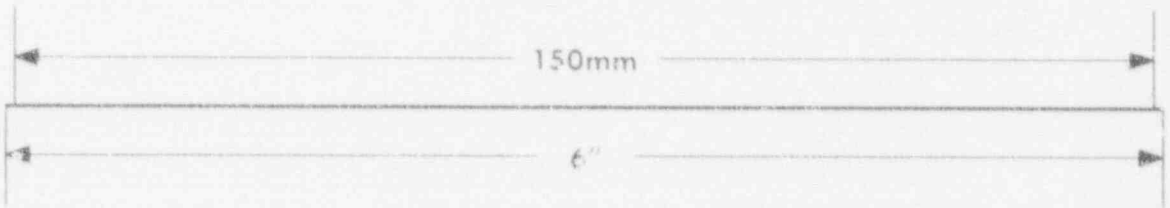
IMAGE EVALUATION
TEST TARGET (MT-3)



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Five (5) barrels of waste were drummed for temporary storage. No drums were shipped from the site.

Radiation exposure for all SNEC personnel as measured by film badges for the month of May 1967 were a maximum of 680 mrem with an average of 53.2 mrem.

Radiation exposure for all visiting personnel as measured by film badges for the month of May 1967 were a maximum of 900 * mrem with an average of 53.87 mrem.

The average radiation exposure for all personnel as measured by film badges for the month of May 1967 was 53.39 mrem.

* Penelec maintenance personnel assigned to SNEC

SAXTON NUCLEAR EXPERIMENTAL CORPORATION

OPERATING STATISTICS

MONTH JUNE YEAR 1967

NUCLEAR	UNIT	MONTH	YEAR	TO DATE
TIMES CRITICAL	NO.	0	0	495
HOURS CRITICAL	HRS.	0	754.70	19,617.65
TIMES SCRAMMED (MANUAL)	NO.	0	1	292
* TIMES SCRAMMED (INADVERTANT)	NO.	0	0	31
THERMAL POWER GENERATION	MWH	0	17,665.02	357,749.89
AVERAGE BURNUP (PuRegicn)	MWD/MTU	0	1,441.94	12,183.74

CONTROL ROD POSITIONS AT END OF MONTH AT EQUILIBRIUM POWER OF 0 MWt

MAIN COOLANT BORON 2044 PPM

RODS OUT - INCHES

NO. 1 0 NO. 2 0 NO. 3 0

NO. 4 0 NO. 5 0 NO. 6 0

ELECTRICAL	UNIT	MONTH	YEAR	TO DATE
GROSS GENERATION	MWH	0	3,367	60,842.00
STATION SERVICE	MWH	89.34	733.48	11,452.67
STATION SERVICE	%	-	21.78	18.82
AVG. PLANT EFFICIENCY - MWH(e)/MWH(t)	%	0	19.06	17.01
AVG. GENERATION RUNNING (0 HRS)	KW	0	4,462.85	3,398.53
PLANT LOAD FACTOR - (AVG. GEN. FOR MONTH/MAX. LOAD)	%	0	17.07	29.33

AUXILIARY STEAM SUPPLY - NUCLEAR

STEAM SUPPLIED BY REACTOR	HRS.	0	754.50	16,244.75
RWDF EVAPORATOR OPERATION	HRS.	115	1,009.67	4,925.25

* REMARKS: _____