E-4

SAXTON NUCLEAR EXPERIMENTAL CORPORATION

Operations Report for June 1965

1. GENERAL

At the beginning of this report period the reactor was in a cold shutdown condition in continuation of the plant outage begun on January 22, 1965.

On June 1st the structural materials irradiation capsule assembly was inserted in reactor vessel head port N-6; the 2x2 fuel subassembly (503-9-1) was inserted in port N-1; the nine thimble assembly containing the flux oscillator rod was inserted in port N-2; the 3x3 plutonium fuel subassembly (503-4-26) was inserted in port N-5; and the superheat dummy assembly was inserted in head port N-4.

On June 2nd fuel rods No. 701 and No. 702 were inserted in the 3x3 fuel subassembly 503-4-25. The subassembly was then inserted in head port N-3. The removable fuel rods in subassembly 503-4-25 for the next operating period are Nos. 701, 702, 123 and 102.

The filling and venting procedure for the main coolant system was commenced on June 5th. A successful cold leak test of the main coolant loop was conducted on June 7th and heat-up was begun.

2. REACTOR OPERATIONS

The reactor was made critical at 9:31 AM on June 9th. On June 9th and 10th during the 4-12 and 12-8 shifts and on June 11th during the 12-8 shift the reactor was used for training purposes. On June 10th, with the main coolant system in a non-borated condition, the main coolant temperature was raised from approximately 250°F to normal operating temperature, 530°F, using the reactor as a heat source. A successful hot leak test on the main coolant system was conducted at a pressure of 2300 psig.

The secondary system was started up and the reactor was loaded to 15 MWt on June 11th. Power operation at 15 MWt continued until June 17th when the power level was increased to 20 MWt for a period of eight hours for the purpose of making a flux map of the core and thermal and hydraulic measurements, and then was returned to 15 MWt.

Due to a loss of power to the No. 2 turbine-generator auxiliaries and to the reactor plant water treating motor control center the reactor was shutdown on June 21st. Power was restored and the reactor was returned to 15 MWt operation nine hours after shutdown.

Power operation at 15 MWt was continued until June 25th. During the period June 28th to June 29th the reactor power level was increased in a stepwise fashion to 23.5 MWt. After 2.5 hours of operation at 23.5 MWt on June 29th the reactor was unloaded and shutdown to begin a scheduled plant outage for the purpose of changing two fuel rods in the 2x2 fuel subassembly 503-9-1. Cooldown of the main coolant system was in progress at the close of the month.

3. EXPERIMENTAL PROGRAM

On June 10th a nuclear heat start-up was conducted. With the main coolant system boron concentration at less than 10 ppm the reactor was used as the source of heat for raising the temperature of the main coolant from approximately 250°F to 530°F. A heat-up rate of approximately 80°F/hour was maintained.

The major effort during this report period was devoted to determining the maximum power level at which the reactor can be operated within license and not exceed a peak power production of 26.5 Kw/ft in the fuel rods of the 2x2 subassembly located in the center of the core. Flux maps were made and thermal and hydraulic data was taken as the power was increased in steps from 15 MWt to 20 MWt with less than 10 ppm boron in the main coolant and from 18 MWt to 23.5 MWt with 315 ppm boron in the main coolant. At 20 MWt and unborated the maximum power generated in the fuel rods of the 2x2 subassembly was calculated to be 22.1 Kw/ft. At a reactor power level of 23.5 MWt and borated the peak power generation in the 2x2 was determined to be 25.2 Kw/ft.

Ammonia was used for pH control during most of this report period. An ammonia depletion test was conducted and pH reactivity effect due to changes in ammonia concentration were studied.

4. OPERATIONAL TESTS

On June 8, 1965 a normal test of the safety injection system was conducted.

The radiation monitoring system circuits were tested on June 9th.

The response time from initiation to scram breaker opening was measured for the "main coolant pump trip" scram circuit on June 8th. The time was determined to be 0.115 seconds.

5. MAINTENANCE

The principal items of mechanical maintenance during the month included the transferring of three fuel subassemblies, the materials irradiation capsule assembly, the nine thimble assembly containing the flux oscillator rod, and the superheat dummy assembly, from storage to the reactor vessel; restoring the reactor vessel head to normal operating condition; painting the insulation on the volute of the main coolant pump; lapping the seat and plug of the regenerative heat exchanger relief valve; adjusting the stroke and the control air pressure on non-regenerative heat exchanger by-pass valve TIC-24V; replacing the absolute filters and the pre-filters in the exhaust air handlers located in the RWDF and the C&A Building; acid cleaning the RWDF gas compressor manifold drain; installing a new rupture disc on the RWDF decontamination room liquid storage tank; repairing several leaks on the C&A Building roof; installing new belts on the C&A Building exhaust air handler; replacing the diaphragms on the vacuum regulating valves on both RWDF gas compressors; and cleaning the vacuum line to the water treating acid measuring tank.

The major items of electrical maintenance during this month included adjusting the brakes on the rotary crane in the containment vessel; repairing the control circuit of charging pump No. 2; testing the purification system flow controller, FRC-22; measuring the response time for the "main coolant pump trip" circuits; removing, drying, and reinstalling the detector for the stack gas radiation monitoring channel, RIC-3; repairing the count room energy spectrometer; calibrating the recorder measuring steam generator flow and steam generator pressure; repairing alarm switches on the RWDF gas compressor suction manifold; decontaminating and recalibrating the detector from containment vessel radiation monitoring channel RIC-1; replacing batteries in and calibrating the water treatment pH meter; replacing shorted relay coil in the control circuitry of the pressurizer pressure controller PRC-2; repairing the rod drop alarm circuit; repairing two count room scalers; and fabricating parts for new seals to be installed on the nuclear instrumentation detector containers.

6. PLANT CHANGES

Fuel subassembly No. 503-4-26 containing 8 rods of mixed PuO_2-UO_2 fuel was inserted in the reactor on June 1, 1965. Four of the rods contain pelletized fuel and in four of the rods the fuel is vibratory compacted. The plutonium enrichment is 6.6 w/o PuO_2.

The 2x2 test fuel subassembly No. 503-9-1 which had previously been located in a periphery core position was inserted in the center core position on June 1st.

7. CHEMISTRY

The main coolant system was in a cold shutdown condition at the beginning of this report period. Hydrazine was added to the main coolant on June 6th and again on June 7th for oxygen control prior to system heat-up. The boron concentration in the main coolant was reduced to 54 ppm by bleed and feed and then to 2 ppm by demineralization. A demineralizer containing a cation resin was placed in service to remove potassium in preparation for an ammonia stability and pH effects on reactivity tests. Sufficient ammonium hydroxide was added to the main coolant on June 11th to raise the ammonia concentration to 9.3 ppm. The ammonia concentration decreased to 3.4 ppm by June 15th at which time the concentration was further reduced to 0.7 ppm by demineralization. Ammonia was again added to the system on June 16th to a concentration of 11 ppm. This had decreased to 2.8 ppm on the 22nd. An addition of ammonia on the 22nd increased the concentration to 11 ppm once more. At the time of reactor shutdown on June 29th the ammonia concentration had decayed to 1.6 ppm.

A summary of the analyses made on the main coolant during the month are shown in the following table:

Main Coolant System	Minimum	Maximum
Conductivity, umhos	1.25	49.0
Boron, ppm	1.5	1052 *
Lithium, ppm	< 0.010	0.084

Main Coolant System (Continued)	Minimum	Maximum
Potassium, ppm	0.03	0.94
Chlorides, ppm	< 0.005	0.005
Oxygen, ppm	< 0.005	~ 8.0 *
Hydrogen, cc/kg H_2O	< 5 *	37.2
Crud, ppm	0.035	0.66 *
Ammonia, ppm	0.4	11.0
Sodium, ppm	< 0.60	0.60
Activity, 15 Min. Gross Beta-Gamma, uc/cc	2.32×10^{-3} *	1.71

* Reactor in cold shutdown condition

Except for a short period after the start-up of the secondary system on June 11th the chlorides in the steam generator remained below 0.185 ppm. The average activity of the steam generator blowdown during the month was less than 1×10^{-8} uc/cc.

3. RADIATION AND WASTE DISPOSAL

Radiation surveying consisted of routine plant site surveys, new fuel shipments, shipment of samples and C.V. during shutdown. The following maximum readings were measured.

Location	Radiation Reading
C&A Building	
Charging Pump (contact with chamber)	31 mrem/hr beta-gamma
Sample Room (door of sample panel)	3.0 mrem/hr beta-gamma
Chemical Lab Hot Sink (1" from drain)	5.0 mrem/hr beta-gamma
Waste Drum (baling machine)	10.0 mrem/hr beta-gamma
Sample Shipment (contact with box)	20.0 mrem/hr beta-gamma
RWDF	
Evaporator (under bottom)	110 mrem/hr beta-gamma
Evaporator (contact outside upper level)	10 mrem/hr beta-gamma
Drum Storage Area (at HRA fence)	3.5 mrem/hr beta-gamma
Waste Drums for Storage (contact)	150 mrem/hr beta-gamma
Waste Drums for Storage (meter)	10.0 mrem/hr beta-gamma
C.V. - 4 Hours after Shutdown	
Primary Compartment (general-upper level)	25 mrem/hr beta-gamma
Primary Compartment (contact - MC pump volute)	150 mrem/hr beta-gamma
Primary Compartment (contact - regen. HX)	80 mrem/hr beta-gamma
Primary Compartment (contact - non-regen. HX)	40 mrem/hr beta-gamma
Auxiliary Compartment (general-lower level)	2.0 mrem/hr beta-gamma

Location	Radiation Reading
C.V. - 16 Hours after Shutdown	
Reactor Deck (instrument ports)	40 mrem/hr beta-gamma
Reactor Deck (waist level)	25 mrem/hr beta-gamma
Reactor Deck (contact - grating)	40 mrem/hr beta-gamma
New Fuel	
Pu Fuel Assembly (contact)	8.0 mrem/hr beta-gamma

Contamination surveying consisted of routine plant site surveys, surveys of C.V. during shutdown, new fuel, waste drums for storage, and shipment of samples. The clean and controlled areas were generally within the "Clean Area" limits with the exception of permanent exclusion areas and other areas used for decontamination or temporary maintenance and testing. All exclusion areas were cleaned periodically to minimize the amount of smearable contamination. The following contamination readings were taken:

Location	Contamination Reading
C&A Building	
Charging Pump Chamber	154000 d/m/smear beta-gamma
Charging Room Floor	2230 d/m/smear beta-gamma
Sample Room Sink	5200 d/m/smear beta-gamma
Sample Room Floor	710 d/m/smear beta-gamma
Sample Room Sample Panel Tray	109500 d/m/smear beta-gamma
Chemical Lab Hot Sink	5350 d/m/smear beta-gamma
RWDF	
Evaporator Room	666 d/m/smear beta-gamma
Pump Room	1920 d/m/smear beta-gamma
C.V.	
Operating Deck	3070 d/m/smear beta-gamma
Reactor Deck	232000 d/m/smear beta-gamma
Primary Compartment (upper)	5000 d/m/smear beta-gamma
Primary Compartment (lower)	40000 d/m/smear beta-gamma
Auxiliary Compartment (lower)	26300 d/m/smear beta-gamma

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Liquid and gaseous effluents from the SNEC site for the month of June 1965 were as follows:

Effluent Type	(Curie) Activity This Month	(Curie) Activity Year to Date	(Curie) Activity Last Twelve Months
Liquid	0.001009	0.005377	0.009867
Air, Xe	1.202197	12.028432	49.259389
Air, I-131	0.000058	0.000331	0.000883
Air, M.F.P.	0.012022	0.120285	0.686534

Seven barrels of waste were drummed for temporary storage and no drums were shipped from the site.

Radiation exposure for all SNEC personnel as measured by film badges for the month of May 1965 were a maximum of 800 mrem with an average of 75 mrem.

Radiation exposure for all visiting personnel as measured by film badges for the month of May 1965 were a maximum of 250 mrem with an average of 25.5 mrem.

The radiation exposure average for all personnel as measured by film badges for the month of May 1965 was 49 mrem.

SAXTON NUCLEAR EXPERIMENTAL CORPORATION

OPERATING STATISTICS

MONTH JUNE YEAR 1965

NUCLEAR	UNIT	MONTH	YEAR	TO DATE
TIMES CRITICAL	NO.	15	15	392
HOURS CRITICAL	HRS.	439.52	953.92	11,897.15
TIMES SCRAMMED (MANUAL)	NO.	7	8	224
* TIMES SCRAMMED (INADVERTANT)	NO.	1	1	26
THERMAL POWER GENERATION	MWH	6,889.26	16,386.88	194,652.70
AVERAGE BURNUP	MWD/MTU	331.78	786.29	8,789.20

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

MAIN COOLANT BORON 278 PPM

** RODS OUT - INCHES

NO. 1 - NO. 2 - NO. 3 -

NO. 4 - NO. 5 - NO. 6 -

ELECTRICAL	UNIT	MONTH	YEAR	TO DATE
GROSS GENERATION	MWH	914.00	2,509.00	32,155.00
STATION SERVICE	MWH	198.04	758.33	7,289.89
STATION SERVICE	%	21.67	30.22	22.67
AVG. PLANT EFFICIENCY - MWH(e)/MWH(t)	%	13.27	15.31	16.52
AVG. GENERATION RUNNING (423.57 HRS)	KW	2,157.85	2,676.07	3,234.75
PLANT LOAD FACTOR - (AVG. GEN. FOR MONTH/MAX. LOAD)	%	35.86	16.32	22.98
AUXILIARY STEAM SUPPLY - NUCLEAR				
STEAM SUPPLIED BY REACTOR	HRS.	392.57	906.57	8,962.39
RWDF EVAPORATOR OPERATION	HRS.	251.83	251.83	15,839.83

* REMARKS: Manual scram on June 21 at 9:55 AM due to the anticipation of a hot leg scram and loss of emergency feed supply.

** Reactor shut down June 29, 1965

SAXTON NUCLEAR EXPERIMENTAL CORPORATION

DAILY AVERAGE POWER LEVELS FOR JUNE 1965

-- INTERMITTENT OPERATION — CONTINUOUS OPERATION