SAXTON NUCLEAR EXPERIMENTAL CORPORATION

Operations Report for April 1968

1. GENERAL

The primary work effort during the first seventeen days of this report period was devoted to repairing and testing the pressurizer safety valves. The main coolant system was cooled down four times to facilitate work on these valves. A suspected crack in the seat of valve V-373 finally enlarged to where it was plainly visible. Upon the recommendation of the valve manufacturer the stellited portion of about 3/32" of seat material was removed. The seat was then reshaped and lapped flat. A service engineer for the valve manufacturer was present for the work on valve V-373 and he also supervised lapping the seat and disc and reassembly of valve V-372. Both valves were adjusted and tested and eventually were made leak tight at 2200 psig.

The inverter-diverter was taken out of service on April 18th. Low resistance to ground on the field windings led to failure of the DC voltage regulator and a reverse current relay in the control circuit. The AC-DC/DC-AC motor generator set was sent to an electrical apparatus repair shop for general overhaul. A new voltage regulator and a reverse current relay were procurred and installed. The inverter-diverter was reinstalled, tested and placed back in service on April 26th.

On April 23rd the main coolant system was cooled down to 225°F to facilitate repairs to relief valve V-53 on the purification system regenerative heat exchanger. Reheat of the main coolant system, using the pump and pressurizer heaters to 400°F and nuclear heat from 400°F to 425°F, was completed on April 24th.

2. REACTOR OPERATIONS

During the period April 18th to April 26th the reactor was used intermittently for main coolant system heat-ups, low power physics measurements and reactor operator training. Three SNEC employees received reactor start-up training.

The reactor was made critical at 5:10 PM on April 26th. The secondary system was started up and the reactor was loaded to 23.5 MWt. Operation at a reactor power level of 23.5 MWt continued until the morning of April 29th.

At 9:46 AM on April 29th the reactor scrammed when a mercury switch in the No. 2 turbine auto stop oil system was inadvertantly bumped by an engineer who was measuring turbine bearing vibrations. The mercury switch is part of a "Turbine Trip" scram circuit installed for the power escalation program. The reactor was maintained in a hot shutdown condition for the remainder of the day. The containment vessel was entered and maintenance work was performed on the nuclear instrumentation. The uncompensated ionization chamber in intermediate range channel A was removed, dried, and reinstalled.

The reactor was made critical at 9:45 AM on April 30th. The start-up of the secondary system was interrupted when the reactor scrammed due to closure of the pressure regulating valve (PRV) below the 23.5 MWt position after it had opened beyond that position during the initial roll of the turbine. The "PRV" position scram is automatically unblocked when the valve opens beyond the 23.5 MWt position or when the steam flow exceeds the 23.5 MWt value. Both the PRV position scram and steam flow unblock were installed for the power escalation program. The reactor was made critical again at 2:15 PM. The No. 2 generator was synchronized on the line at 3:58 PM and the reactor power level was increased to 23.5 MWt. Reactor operation at 23.5 MWt continued for the remainder of the month.

3. EXPERIMENTAL PROGRAM

The temperature coefficient as determined from measurements made at zero power on April 19th was -2.5×10^{-4} $\Delta k/k$ per degree Fahrenheit at 805 ppm boron and 495°F main coolant temperature.

The core subassembly status did not change in April. It is as follows:

Core Position	Subassembly
H-1	No. 503-4-26 (Plutonium - Removable Rods KJ, PH, JO and CK)
H-2	No. 3 Reactivity (Flux) Oscillator Rod
H-3	No. 503-4-28 (pH Test)
H-4	Stainless Steel Plug
H-5	No. 503-4-29 (Burnable Poison Test - Removable Rods #783, #784 and two unfueled poison rods)

The total effective full power hours (EFPH) of operation for Core II is now 7546 and estimates of the fuel burn-up as of April 30, 1968 are: Core II average 8808 MWD/MTM; plutonium region average 14,514 MWD/MTM; peak plutonium rod 18,322 MWD/MTM; peak plutonium pellet 24,145 MWD/MTM.

4. OPERATIONAL TESTS

The pressurizer safety valves were tested on April 16th. Valve No. V-372 opened at 2498 psig and reset at 2228 psig. Valve No. V-373 opened at 2484 psig and reset at 2373 psig.

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

On April 26th a normal test of the safety injection system was conducted.

5. MAINTENANCE

The principal items of mechanical maintenance during the month included replacing the pre-filters on the RWDF exhaust air handler; lapping the seat and plug in the purification system remote operated stop valve, HIC-23; lapping the seat and disc in the regenerative heat exchanger relief valve, V-53; processing seven drums of RWDF evaporator bottoms; cleaning check valves on the three RWDF spent resin storage tanks; repairing the pressure gage line on No. 2 cation resin tank in the make-up water treatment system; draining the RWDF evaporator and steam cleaning the level column; tightening the flange bolts on the steam generator safety valve, V-1046; cleaning the RWDF compressor suction manifold drain line; installing a new air conditioner in the C&A building office area; repairing a steam leak in the heating unit located in the west stairwell of the C&A building; fabricating a gag for the safety injection system air operated valves; cutting ninety mils off of the seat of pressurizer safety valve, V-373; and lapping the seats and discs and adjusting the set pressures of both pressurizer safety valves, V-372 and V-373.

The major items of electrical and instrument maintenance during the month included checking and setting the temperature controller for the containment vessel inlet air handler; repairing the tachometer generator no No. 1 charging pump; replacing the cooling water regulating valve for the magnetic clutch of the variable frequency M-G set; replacing the coil on the solenoid valve in the control air line to the shutdown cooling system stop valve, HIC-29; replacing the diaphragm in the vacuum regulating valve on RWDF gas compressor No. 1; replacing the uncompensated ionization chamber, connectors, and one cable in nuclear instrumentation power range channel A; replacing a D.C. voltage regulator and a reverse current relay in the control circuits for the vital bus inverter-diverter after it had been overhauled in an electrical apparatus repair shop; repairing and calibrating the gamma energy spectrometer in the count room, replacing the wobble disc in the steam generator blowdown meter; replacing the vacuum pump in the hydrogen analyzer in RWDF; replacing the motors on two fans in the instrument and control cabinets for the radiation monitoring system; replacing the vacuum tubes in the dilute acid meter in the make-up water treating system; installing new strip heaters in the box covering the nuclear instrumentation cable penetrations in the containment vessel; cleaning a restrictor in the controller for the auxiliary steam pneumatic operated relief valve; repairing the liquid scintillation counter in the count room; and replacing the carbon vanes in the air pumps for site air particulate monitoring channels, RIC-8 and RIC-9.

6. CHEMISTRY

At the beginning of the month main coolant system chemistry was being maintained for hot shutdown conditions. For the next three weeks the chemistry was alternately maintained for hot and cold shutdown conditions for maintenance of safety valves. Hydrogen was added in preparation for power operation over the weekend of April 20-21 and the secondary system was started on April 26th. Power operating conditions were maintained throughout the remainder of the month. Boron concentration varied from a high of 956 ppm during one of the valve maintenance periods to a low of 468 ppm for power operation at the end of the month.

A summary of the analyses performed on samples taken from the main coolant system is contained in the following table:

Main Coolant System	Minimum	Maximum
pH at 25°C	5.44	6.11
Conductivity, umhos	2.60	6.67
Boron, ppm	468	956
Chlorides, ppm	< 0.005	< 0.005
Oxygen, ppm	< 0.005	0.050
Hydrogen, cc/kg H_2O at STP	8	48
Gross Beta-Gamma (15 Min. Degassed) uc/cc	9.98×10^{-3}	2.70×10^{-1}
Tritium, uc/cc	2.37×10^{-3}	4.82×10^{-2}

A component cooling sample analyzed on April 22nd showed the pH to be 8.10, the chromates to be 450 ppm and the gross beta-gamma activity to be at background or less than statistical error.

Analyses performed on primary make-up water on April 22nd and April 23rd showed chlorides to be less than 0.005 ppm, oxygen to be less than 0.005 ppm and silica to be less than 0.002 ppm.

Steam generator chlorides remained well within specifications for the operating period except for a brief period during start-up on April 26th. The average activity of steam generator blowdown during this period was less than 1×10^{-8} uc/cc.

7. RADIATION AND WASTE DISPOSAL

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

Location	Radiation Reading
C&A Building	
Waste Drum (baling machine)	0.5 mrem/hr beta-gamma
Charging pump (contact with chamber)	30 mrem/hr beta-gamma
Sample Room (door of sample panel)	1.8 mrem/hr beta-gamma
Chemical Lab Hot Sink (1" from drain)	0.6 mrem/hr beta-gamma
R/WDF	
Evaporator (under bottom)	35 mrem/hr beta-gamma
Evaporator (contact outside upper level)	19 mrem/hr beta-gamma
Drum Storage Area (at HRA fence)	1.3 mrem/hr beta-gamma

Location	Radiation Reading
C.V.	
Primary Compartment (general upper level)	100 mrem/hr beta-gamma
Primary Compartment (ontact M.C. pump vo ite)	450 mrem/hr beta-gamma
Primary Compartment (S.G. bottom)	250 mrem/hr beta-gamma
Primary Compartment (pressurizer bottom)	150 mrem/hr beta-gamma
Primary Compartment (general lower level)	60 mrem/hr beta-gamma
Primary Compartment (Regen. HX)	400 mrem/hr beta-gamma
Primary Compartment (Non-Regen. HX)	50 mrem/hr beta-gamma
Auxiliary Equip. Compt. (S.C.H.X.)	6 mrem/hr beta-gamma
Auxiliary Equip. Compt. (D.T. top)	5 mrem/hr beta-gamma
Auxiliary Equip. Compt. (D.T. bottom)	25 mrem/hr beta-gamma
Auxiliary Equip. Compt. (general lower level)	3 mrem/hr beta-gamma
Reactor Deck (water level at grating)	50 mrem/hr beta-gamma
Reactor Deck (instrument ports)	450 mrem/hr beta-gamma
Reactor Deck (waist level)	100 mrem/hr beta-gamma
Reactor Deck (storage well railing)	75 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	50450 d/m/smear beta-gamma
Charging Pump Chamber	< 10 d/m/smear alpha
Charging Room Floor	390 d/m/smear beta-gamma
Sample Room Sink	22270 d/m/smear beta-gamma
Sample Room Sink	< 10 d/m/smear alpha
Sample Room Floor	610 d/m/smear beta-gamma
Chemical Lab Hot Sink	6053 d/m/smear beta-gamma
Chemical Lab Hot Sink	< 10 d/m/smear alpha
RWDF	
Pump Room Floor	1760 d/m/smear beta-gamma
Shipping Room Floor	430 d/m/smear beta-gamma

Location	Contamination Reading
C.V.	
Operating Deck	2810 d/m/smear beta-gamma
Operating Deck	10 d/m/smear alpha
Reactor Deck (head)	41200 d/m/smear beta-gamma
Reactor Deck (head)	10 d/m/smear alpha
Reactor Deck (grating)	39210 d/m/smear beta-gamma
Reactor Deck (grating)	10 d/m/smear alpha
Primary Compartment (grating)	6030 d/m/smear beta-gamma
Primary Compartment (grating)	10 d/m/smear alpha

Liquid and gaseous effluents from the SNEC site for the month of April 1968 were as follows:

Effluent Type	(Curie) Activity This Month	(Curie) Activity Year to Date	(Curie) Activity Last Twelve Months
Liquid	0.000962	0.002348	0.010697
Tritium	0.723950	2.356048	4.109530
Air, Xe	7.492550	11.671885	22.510608
Air, I-131	0.000000	0.000173	0.001824
Air, M.F.P.	0.074925	0.116718	0.225106

Ten (10) 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 March 1968 were a maximum of 510 mrem with an average of 126 mrem.

Radiation exposure for all visiting personnel as measured by film badges for the month of March 1968 were a maximum of 195 mrem with an average of 14.5 mrem.

The average radiation exposure for all personnel as measured by film badges for the month of March 1968 was 92.8 mrem.

SAXTON NUCLEAR EXPERIMENTAL CORPORATION

OPERATING STATISTICS

MONTH APRIL YEAR 1968

NUCLEAR	UNIT	MONTH	YEAR	TO DATE
TIMES CRITICAL	NO.	14	98	640
HOURS CRITICAL	[illegible]	92.4	439.26	21,012.26
TIMES SCRAMMED (MANUAL)	.	2	38	365
* TIMES SCRAMMED (INADVERTANT)	NO.	2	3	36
THERMAL POWER GENERATION	MWH	1680.08	8334.77	386,304.70
AVERAGE BURNUP	MWD/MTU	137.14	680.34	14,514.57

CONTROL ROD POSITIONS AT END OF MONTH AT EQUILIBRIUM POWER OF 23.5 MWt

MAIN COOLANT BORON 469 PPM

RODS OUT - INCHES

NO. 1 40 NO. 2 26 NO. 3 40

NO. 4 40 NO. 5 40 NO. 6 40

ELECTRICAL	UNIT	MONTH	YEAR	TO DATE
GROSS GENERATION	MWH	266	1,455.00	64,731.50
STATION SERVICE	MWH	242.98	1,193.87	13,409.77
STATION SERVICE	%	91.30	82.05	20.72
AVG. PLANT EFFICIENCY - MWH(e)/MWH(t)	%	15.83	17.46	16.76
AVG. GENERATION RUNNING (71.85 HRS)	KW	3,702.15	4,078.71	3,381.91
PLANT LOAD FACTOR - (AVG. GEN. FOR MONTH/MAX. LOAD)	%	9.28	11.68	26.89

AUXILIARY STEAM SUPPLY - NUCLEAR

STEAM SUPPLIED BY REACTOR	HRS.	72.6	362.17	17,513.26
RWDF EVAPORATOR OPERATION	HRS.	120.26	225.26	6,683.66

* REMARKS: April 29 - Reactor scram was due to an operator inadvertantly bumping the turbine trip solenoid while measuring turbine bearing vibration. (35 MW Scrams were Inserted).

April 30 - Reactor scram was due to PRV closure. Steam flow increased over 80,000#/hr while attempting to roll the turbine. This unblocked the 35 MW scrams and when the PRV was closed the reactor scrammed.

SAXTON NUCLEAR EXPERIMENTAL CORPORATION

DAILY AVERAGE POWER LEVELS FOR April 1968