SAXTON NUCLEAR EXPERIMENTAL CORPORATION

Operation Report for November 1964

1. REACTOR OPERATIONS

At the beginning of this report period the reactor was being operated at a power level of 20 MWt in preparation for a synthetic crud test. On November 2nd and 3rd the boron concentration in the main coolant was reduced to less than 5 ppm. On November 5th load rejection tests from a power level of 15 MWt were conducted for the purpose of determining the response of the pressurizer to system temperature transients. Upon completion of the load rejection tests the reactor was manually scrammed and crud [$Fe(OH)_2$] was added to the main coolant for the purpose of verifying the injection rate and sampling and analysis techniques. The reactor was made critical and was loaded to 20 MWt at 9:50 on November 6th.

With the reactor plant operating at 20 MWt crud was added to the main coolant system on November 9th and again on November 10th. At the completion of the addition on November 10th a total of 458 grams of magnetite (Fe_3O_4) had been added. On November 11th the reactor power level was reduced to 10 MWt. Boric acid was added to the main coolant on November 13th to raise the boron concentration to 478 ppm. On November 16th the reactor power level was returned to 20 MWt.

Operation at 20 MWt continued until November 18th when the power level was raised to 23.5 MWt. On November 20th the power level was decreased to 10 MWt and then on November 23rd it was returned to 20 MWt.

On November 24th trouble was experienced with channel "B" power range nuclear instrumentation. A resistance check showed that the trouble was in the detector cables inside the containment vessel. The decision was made to shut the reactor down and enter the containment vessel. The cable trouble was located in a junction box which is common to all nuclear instrumentation cables. Excessive moisture had accumulated on and inside the cable connectors after one of the heaters in the junction box had failed.

On November 25th the decision was made to cool the main coolant system down and remove the center and one peripheral 3x3 fuel subassemblies from the reactor vessel and inspect them with the underwater periscope for crud deposition.

Reactor plant cooldown was completed on November 27th. The plant remained in a cold shutdown condition during the remainder of the month.

2. EXPERIMENTAL PROGRAM

Rod worth measurements at power were made for control rods #5 and #2 as the main coolant boron concentration was reduced from 525 ppm to 3 ppm.

Measurements were made to determine the pressurizer response to system temperature transients which were introduced by tripping the generator "off the line" with the reactor load at 15 MWt.

The synthetic crud test was initiated on November 5th. Crud injections were stopped after 458 grams of Fe_3O_4 had been added to the main coolant system. The apparent reactivity loss associated with the crud addition indicated that sufficient crud had been deposited on the core to establish the desired conditions for a boron hideout test. Boron was added to the main coolant while the reactor was operating at 10 MWt, a non-nucleate boiling condition. There was no change in unexplained reactivity detected when the power level was increased to 20 MWt and then to 23.5 MWt.

During the month flux wire irradiations, noise measurements, and pile oscillator tests were performed in connection with the crud test.

3. OPERATING TESTS

On November 18th the radiation monitoring system circuits were tested.

A normal test of the safety injection system was conducted on November 19th.

4. MAINTENANCE

The principal items of mechanical maintenance for the month included the preparation of the reactor vessel head for the removal of two 3x3 fuel subassemblies for inspection; installing new bearings on the RWDF control room supply air handler; repairing the steam coils on the RWDF supply air handler for the concentrates handling area; replacing the pre-filters on the C&A Building air intake; installing a new valve in the service water line in the decontamination room; servicing the tow motor that is used for handling 55 gallon drums in the RWDF; installing a funnel and drain for the steam generator blowdown vent; replacing the gasket on a steam trap on the main steam header; installing new fittings on a hydrogen sample bomb; processing nine drums of RWDF evaporator concentrates; remounting the eye wash fountain foot pedal in the chemistry laboratory; cleaning and lapping the seat of the RWDF gas stripper cooling water relief valve; installing new belts on the control rod drive mechanism room air handler; installing a new section of pipe in the RWDF auxiliary steam system condensate return line; and replacing the fan belt on the containment vessel auxiliary compartment air handler.

The major items of electrical maintenance included the installation of a recorder in the control room for recording the ΔT across the core center fuel subassembly; calibrating the steam generator pressure transmitter; repairing the recorder in the RWDF hydrogen analyzer; repairing a solenoid operated valve on the steam generator blowdown sample collecting tank; installing permanent high radiation area alarm lights at the personnel entrances to the containment vessel; cleaning and drying nuclear detector cable connectors; replacing a defective heater element in the junction box for the nuclear detector cables; installing and checking the plateau on a new BF_3 in source range nuclear instrumentation channel B; meggering all nuclear instrumentation detector cables; replacing the G.M. tubes in the sample room radiation monitor; repairing the count room alpha scaler; resetting the temperature controller for the shutdown cooling system heat exchanger component cooling water control valve; and reconnecting a remote indicator on the RWDF control panel to read stack effluent radioactivity.

5. PLANT CHANGES

A one-inch carbon steel pipe line was installed from the monitor tanks to the suction of the RWDF discharge tanks pump. The new line provides a means for draining the monitor tanks via the same piping system as is used to drain the discharge tanks.

6. CHEMISTRY

During the early part of this report period the boron and potassium concentrations in the main coolant were reduced to less than 5 ppm and 0.1 ppm respectively in preparation for the synthetic crud test.

The initial crud addition of 66.6 grams of Fe_3O_4, as $Fe(OH)_2$, was made on November 5th, with the reactor at zero power. Subsequent crud additions were made with the reactor operating at a power level of 20 MWt on November 9th and 10th. A total of 458 grams of Fe_3O_4 were added to the main coolant. The maximum level of crud that was detected at any time during crud injection was 1.86 ppm. Approximately 16 hours after the final crud injection the crud level in the main coolant had dropped to 0.07 ppm.

A summary of the main coolant chemistry analyses made during the month are contained in the following table:

Main Coolant System	Minimum	Maximum
Conductivity, umhos	1.29	15.6
Boron, ppm	3	525
Potassium, ppm	0.04	1.58
Lithium, ppb	8	125
Chlorides, ppm	.010	.065
Hydrogen, cc/Kg H_2O	<5 (*)	70
Oxygen, ppm	<.005	<.005
Crud, ppm	.053	2.8 (**)
Activity, uc/cc	0.197	1.355

(*) Reactor in cold shutdown condition
(**) Crud burst when MC pump was restarted during plant cooldown

Except for a short period after secondary system startup on November 5th the chlorides in the steam generator were maintained below 0.240 ppm. The average activity of the steam generator blowdown during the month was less than 1×10^{-8} uc/cc.

7. RADIATION AND WASTE DISPOSAL

Radiation surveying consisted of routine plant site surveys, RWDF, waste drums for storage and shipment, sample shipment, and truck after loading of radioactive waste drums. The following maximum readings were taken:

Location	Radiation Reading
RWDF	
Evaporator (under bottom)	200 mrem/hr beta-gamma
Evaporator (contact outside upper level)	40 mrem/hr beta-gamma
Waste Drum (for storage - contact)	90 mrem/hr beta-gamma
Waste Drum (for storage - meter)	6 mrem/hr beta-gamma
Drum Storage Area (at HRA fence)	9.5 mrem/hr beta-gamma
C&A Building	
Waste Drum (baling machine - contact)	9 mrem/hr beta-gamma
Sample Storage Drum (contact)	16 mrem/hr beta-gamma
Sample Room (at door of panel)	10 mrem/hr beta-gamma
Charging Pump (contact with chamber)	80 mrem/hr beta-gamma
Chem Lab Hot Sink (1" from drain)	9.0 mrem/hr beta-gamma

Location	Radiation Reading
Miscellaneous	
C.V. Exhaust Air Handler (contact filters - inside)	6.0 mrem/hr beta-gamma
C.V. Exhaust Air Handler (contact filters - outside)	2.0 mrem/hr beta-gamma
Fence (closest point to C.V. exhaust air handler)	0.6 mrem/hr beta-gamma
C.V. (1 Hour after shutdown on 11-4-64)	
Primary Compartment (MC pump volute)	155 mrem/hr beta-gamma
Primary Compartment (steam generator - top)	10 mrem/hr beta-gamma
Primary Compartment (steam generator - bottom)	50 mrem/hr beta-gamma
Primary Compartment (pressurizer - top)	110 mrem/hr beta-gamma
Primary Compartment (pressurizer - bottom)	70 mrem/hr beta-gamma
Primary Compartment (general upper level)	40 mrem/hr beta-gamma
Primary Compartment (regenerative HX)	160 mrem/hr beta-gamma
Primary Compartment (non-regenerative HX)	110 mrem/hr beta-gamma
Primary Compartment (general lower level)	50 mrem/hr beta-gamma
Auxiliary Compartment (shutdown cooling HX)	65 mrem/hr beta-gamma
Auxiliary Compartment (discharge tank - top)	23 mrem/hr beta-gamma
Auxiliary Compartment (discharge tank - bottom)	50 mrem/hr beta-gamma
Filter Vault (at door)	6 mrem/hr beta-gamma
Control Rod Drive Room (arms reach up drive mech.)	45 mrem/hr beta-gamma
C.V. (12 Hours after Shutdown on 11-24-64)	
Primary Compartment (MC pump volute)	70 mrem/hr beta-gamma
Primary Compartment (steam generator - bottom)	38 mrem/hr beta-gamma
Primary Compartment (pressurizer - top)	100 mrem/hr beta-gamma
Primary Compartment (pressurizer - bottom)	36 mrem/hr beta-gamma
Primary Compartment (general upper level)	24 mrem/hr beta-gamma
Primary Compartment (regenerative HX)	90 mrem/hr beta-gamma
Primary Compartment (non-regenerative HX)	70 mrem/hr beta-gamma
Primary Compartment (general lower level)	48 mrem/hr beta-gamma
Auxiliary Compartment (discharge tank - top)	15 mrem/hr beta-gamma
Auxiliary Compartment (discharge tank - bottom)	38 mrem/hr beta-gamma
Auxiliary Compartment (shutdown cooling HX)	35 mrem/hr beta-gamma
Reactor Deck (contact grating)	140 mrem/hr beta-gamma
Reactor Deck (at instrument penetrations)	90 mrem/hr beta-gamma

Contamination surveying consisted of routine plant site surveys, surveys of a portion of the C.V. during shutdown, tools, waste drums, and a shipment of radioactive material. The clean and controlled areas were generally within the "Clean Area" limits with the exception of permanent exclusion areas. All areas were cleaned periodically to minimize the amount of smearable contamination. The following contamination readings were taken:

Location	Contamination Readings
C.V. (Prior to Flooding of Storage Well)	
Operating Deck	2780 d/m/smear beta-gamma
Bridge	7250 d/m/smear beta-gamma
Reactor Deck	53700 d/m/smear beta-gamma

SNEC Operation Report for
November 15th . . . . #5

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

Effluent Type	(Curie) Activity This Month	(Curie) Activity Year to Date	(Curie) Activity Last Twelve Months
Liquid	0.000372	0.019977	0.019977
Air, Xe	14.881245	31.602880	31.602880
Air, I-131	0.000172 (*)	0.000274 (*)	0.000274 (*)
Air, M.F.P.	0.148812	37.700874	37.700874

(*) Minimum instrument sensitivity

Nine barrels of waste were drummed for temporary storage and twenty barrels of waste were shipped from the site.

Radiation exposures for all personnel as measured by film badges for the month of October, 1964, were a maximum of 520 mrem with an average of 67 mrem.

SAXTON NUCLEAR EXPERIMENTAL CORPORATION

OPERATING STATISTICS

MONTH November YEAR 1964

NUCLEAR	UNIT	MONTH	YEAR	TO DATE
TIMES CRITICAL	NO.	1	31	268
HOURS CRITICAL	HRS.	564.20	3,832.08	10,572.04
TIMES SCRAMMED (MANUAL)	NO.	1	25	208
* TIMES SCRAMMED (INADVERTANT)	NO.	0	6	25
THERMAL POWER GENERATION	MWH	9,014.19	71,135.17	171,136.65
AVERAGE BURNUP	MWD/MTU	431.38	3,037.21	7,709.18

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

MAIN COOLANT BORON 445 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	1,352	11,903	28,673
STATION SERVICE	MWH	208.53	2,062.30	6,333.57
STATION SERVICE	%	15.42	17.33	22.09
AVG. PLANT EFFICIENCY - MWH(e)/MWH(t)	%	15.00	16.73	16.75
AVG. GENERATION RUNNING (561.54 HRS)	KW	2,407.66	3,425.30	3,346.06
PLANT LOAD FACTOR - (AVG. GEN. FOR MONTH/MAX. LOAD)	%	44.00	30.80	27.34

AUXILIARY STEAM SUPPLY - NUCLEAR

STEAM SUPPLIED BY REACTOR	HRS.	562.75	3,492.87	8,618.57
RWDF EVAPORATOR OPERATION	HRS.	131.75	746.90	1,690.55

* REMARKS: _____

SAXTON NUCLEAR EXPERIMENTAL CORPORATION

DAILY AVERAGE POWER LEVELS FOR NOVEMBER 19 64

-- INTERMITTENT OPERATION — CONTINUOUS OPERATION