SAXTON NUCLEAR EXPERIMENTAL CORPORATION

Operations Report for December 1965

1. REACTOR OPERATIONS

At the beginning of this report period heat-up of the main coolant system was underway. The main coolant pump and the pressurizer heaters were the source of heat. Normal operating conditions of 530°F temperature and 2000 psi pressure were attained on December 2nd.

The pressurizer relief valves were tested for lifting pressure and control rod drop times were measured on December 2nd and 3rd.

The initial criticality for Core II was established at 7:10 PM on December 6th. The approach to criticality was made by diluting boron with all control rods essentially out. The main coolant at the time was at 530°F temperature, 2000 psi pressure, and contained 2295 ppm boron.

A scheduled main coolant system cooldown was initiated on December 7th. During the cooldown and then at ambient temperature the reactor was operated for zero power physics measurements. On December 8th the reactor was shutdown for the purpose of entering the containment vessel to investigate a leak at the pressurizer heater flange. Reactor operation was resumed at 8:50 PM on the same day and zero power testing was continued. A reactor scram occured on December 9th due to the loss of excitation voltage to the magnetic clutch of the variable frequency motor-generator set which was being used as the source of power for the main coolant pump. Criticality was re-established and zero power testing at ambient temperature was continued to December 10th.

During the period December 10th to December 18th the gaskets on the pressurizer heater flange were replaced, pressurizer relief valve No. V-373 was relapped, and the pressurizer spray valve was repacked. On December 15th filling and venting of the main coolant system was completed and a leak test was conducted.

On December 17th and 18th the main coolant system was heated up from 250°F to 530°F using the reactor as a heat source. The average heat-up rate was 78°F/hour.

During the period December 18th through the 22nd the reactor was used for operator training, operator examinations, and zero power physics tests. Five persons were examined by AEC examiners for operating licenses or equivalent. Three of these were SNEC employees, one was a Westinghouse employee, and the other was an employee of the Southern California Edison Company. Two of the SNEC employees were examined for senior operator licenses.

On December 23rd pressurizer relief valve No. V-373 was tested for lifting pressure.

The reactor was made critical on December 27th and was operated at low power for a leak test on the secondary system steam header. On December 28th with the turbine rolling and on governor control a reactor loss of load test was conducted. After recovery from the loss of load test the turbine was rolled and the generator was synchronized on the line at 3:35 PM. The generator was then loaded to produce a reactor power level of 10 MWt. On December 29th the reactor power level was increased to 17 MWt. High chlorides in the steam generator due to excessive condenser leakage made it necessary to temporarily curtail power operation. A reactor loss of load test from 17 MWt was initiated at 8 PM on December 29th. Repairs were made to the condenser and reactor power operation was resumed at 6:27 PM on December 30th. At 8:57 PM the reactor

was scrammed manually when the feedwater valve increased the feedwater flow to the steam generator and caused the reactor power level to increase above the desired 17 MWt. Recovery from shutdown was commenced immediately and the generator was synchronized on the line at 11:37 PM. A reactor power level of 17 MWt was established at 12:50 AM on December 31st.

2. EXPERIMENTAL PROGRAM

The zero power physics testing program was completed on December 23rd. The parameters measured during the program include:

Differential rod worths - hot and cold
Temperature coefficient at various temperatures and rod positions
Pressure coefficient
Boron worth
Flux map at approximately 20 MWt

The elevated power physics testing program was started on December 27th. The tests performed in the program during the month were:

Power coefficient
Loss of load tests from approximately 6 MWt and 17 MWt
Flux and thermal hydraulic maps at 10 MWt and 17 MWt
Noise measurements
Temperature coefficients

3. OPERATIONAL TESTS

The pressurizer relief valves were tested for lifting pressure during the month. Valve No. V-372 opened at 2410 psig and reset at 2246 psig. Valve No. V-373 opened at 2457 psig and reset at 2214 psig.

On December 2nd and 3rd drop times were measured for the control rods with the main coolant system at normal operating conditions. The minimum drop time recorded was 0.818 seconds and the maximum was 0.970 seconds.

A successful test on the safety injection system was completed on December 6th.

The radiation monitoring circuits were tested on December 15th.

4. MAINTENANCE

The principal items of mechanical maintenance during the month included replacing the bearings in the vacuum pump for the containment vessel alpha and beta particulate monitors; tightening the packing on high pressure valves in the sample room; lapping the seat and plug and stroking the deaerator high level overflow valve; installing new rupture discs on RWDF spent resin storage tanks No. 2 and No. 3; installing a new mechanical seal on boiler feed pump No. 2; installing a new mechanical seal on the shutdown cooling system pump No. 1; repacking and stroking the pressurizer spray valve; repairing a leak in the water treatment acid flow meter; installing a new bearing and building up the shaft on the pump for the control and auxiliary building condensate sump pump; installing new bearings in the vacuum pump for site radiation monitor, RIC-8; repacking plungers No. 1 and No. 2 on charging pump No. 1; installing a

new pin in the operating mechanism for the containment vessel manual exhaust valve; replacing the gaskets on the pressurizer heater flange; repairing the leak-off line on the pressurizer heater and spray flanges; testing the pressurizer relief valves; plugging leaky tubes in the main condenser for No. 2 turbine; replacing the cation resin in the purification demineralizer and the anion resin in the boric acid demineralizer; repairing a valve in the steam tracing line on the boric acid line from the boric acid mix tank to the refueling water storage tank; and welding a stop on the latching mechanism for the outer door of the containment vessel personnel air lock.

The major items of electrical and instrument maintenance included adjusting the spring tension and the air pressure on the operator of the pressurizer spray valve, PRC-2; replacing electronic tubes in the computer-indicator for radiation monitor channel RIC-8; replacing the G-M tube in the health physics office labitron; calibrating the steam generator level recorder, LRC-491; replacing the motor in the space heater in the variable frequency motor generator room; adjusting the position of the nuclear instrumentation detectors; installing new filter paper in radiation monitoring channel RIC-1 and RIC-8; repairing the portable alpha survey meter; adjusting the purification system letdown flow control valve; blowing down all control air regulators inside the containment vessel; repairing a relay in the inverter-diverter control circuits; and repairing a ground on the pre-amp cable in radiation monitoring system channel RIC-2.

5. PLANT CHANGES

The installation of a "High Radiation Area" alarm system was completed during the month. The purpose of the alarm system is to warn or remind persons entering the area that radiation levels of 100 mr/hr or over are present and also to warn the control room operators when a door or gate to a high radiation area is opened. A light alarm at each entrance to a high radiation area and a light alarm and an audible alarm in the control room are energized when the gate or door to the entrance is opened. The light alarms remain energized until the door or gate is closed again. The areas that are designated high radiation areas are: (1) the containment vessel, (2) the fenced in section of the pipe tunnel that is adjacent to the northeast section of the containment vessel, (3) the RWDF filled drums storage area, and (4) the RWDF evaporator bottoms handling room.

6. CHEMISTRY

The main coolant system was in a hot shutdown condition at the beginning of this report period. The boron concentration of the main coolant was varied over the range 2744 ppm maximum down to a minimum of 1037 ppm for low power physics testing. The main coolant system was cooled down on December 7th. The system was vented and drained down for the purpose of changing gaskets on the pressurizer heater flange. Hydrazine was added to the main coolant on December 16th in preparation for a nuclear heat-up. Normal operating conditions of temperature and pressure were attained on December 18th. Hydrogen was added to the main coolant on December 27th. Power operation was begun on December 28th. High chlorides in the steam generator necessitated a shutdown on December 29th. Power operation was resumed on December 30th with a high secondary system blowdown to maintain the chloride concentration in the steam generator below 0.3 ppm. On December 31st with the generator on the line one-half of the condenser at a time was removed from service and was "candled". Several leaky tubes were found and plugged. The steam generator chlorides were reduced to less than 0.1 ppm with the normal amount of blowdown.

A total of 107 grams of Li(7) OH-H_2O was added to the main coolant system during the month for pH control.

A summary of the analyses performed on samples taken from the main coolant system is tabulated below:

Main Coolant System	Minimum	Maximum
pH @ 25°C	5.05	6.23
Conductivity, umhos	5.89	14.5
Boron, ppm	1037	2744
Chlorides, ppm	<.005	0.030
Lithium, ppm	0.015	0.86
Sodium, ppm	<0.01	<0.01
Hydrogen, cc/kg H_2O	<5	45
Oxygen, ppm	<.005	.005
Crud, ppm	0.026	0.457
Gross Beta-Gamma (15 Min. degassed) uc/cc	5.4×10^{-3}	0.565

The average activity of the steam generator blowdown was less than 1×10^{-8} uc/cc during the month.

6. RADIATION AND WASTE DISPOSAL

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

Location	Radiation Reading
C&A Building	
Waste Drum (baling machine)	50 mrem/hr beta-gamma
Charging Pump (contact with chamber)	3 mrem/hr beta-gamma
Sample Room (door sample panel)	2 mrem/hr beta-gamma
Chemical Lab Hot Sink (1" from drain)	1.2 mrem/hr beta-gamma
Sample Shipment (flux wire)	0.6 mrem/hr beta-gamma
Sample Shipment (flux wire)	0.6 mrem/hr beta-gamma
RWDF	
Evaporator (under bottom)	85 mrem/hr beta-gamma
Evaporator (contact outside)	30 mrem/hr beta-gamma
C.V.	
Primary Compartment (general upper level)	13 mrem/hr beta-gamma
Primary Compartment (contact MC pump volute)	50 mrem/hr beta-gamma
Primary Compartment (contact pressurizer bottom)	30 mrem/hr beta-gamma
Primary Compartment (contact S.G. bottom)	35 mrem/hr beta-gamma
Primary Compartment (general lower level)	15 mrem/hr beta-gamma
Primary Compartment (contact regen. HX)	35 mrem/hr beta-gamma
Primary Compartment (contact non-regen. HX)	45 mrem/hr beta-gamma
Reactor Deck (instrument ports)	90 mrem/hr beta-gamma
Reactor Deck (waist level)	21 mrem/hr beta-gamma
Reactor Deck (contact with grating)	50 mrem/hr beta-gamma

Contamination surveying consisted of routine plant site surveys, surveys of shipping containers, tools and equipment during shutdown. The clean areas were within the "Clean Area" limits. The controlled areas were generally within the "Clean Area" limits. The controlled area is cleaned frequently to keep and/or to return to the clean area limits. The exclusion areas are cleaned periodically to minimize the amount of smearable contamination. The following contamination readings were taken:

Location	Contamination Readings
C&A Building	
Charging Pump Chamber	31000 d/m/smear beta-gamma
Charging Room Floor	28470 d/m/smear beta-gamma
Sample Room Sink	2520 d/m/smear beta-gamma
Sample Room Floor	1570 d/m/smear beta-gamma
Chemical Lab Hot Sink	337030 d/m/smear beta-gamma
RWDF	
Pump Room	2660 d/m/smear beta-gamma
Evaporator Room	910 d/m/smear beta-gamma

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

Effluent Type	(Curie) Activity This Month	(Curie) Activity Year to Date	(Curie) Activity Last Twelve Months
Liquid	0.002256	0.009188	0.009188
Air, Xe	0.001870	36.307521	36.307521
Air, I-131	0.000000	0.001803	0.001803
Air, M.F.P.	0.000019	0.363076	0.363076

Two 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 November were a maximum of 925 mrem with an average of 69 mrem.

Radiation exposure for all visiting personnel as measured by film badges for the month of November were a maximum of 170 mrem with an average of 12 mrem.

The radiation exposure average for all personnel as measured by film badges for the month of November was 39 mrem.

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OPERATING STATISTICS

MONTH December YEAR 1965

NUCLEAR	UNIT	MONTH	YEAR	TO DATE
TIMES CRITICAL	NO.	40	79	455
HOURS CRITICAL	HRS.	194.39	1,938.90	12,882.13
TIMES SCRAMMED (MANUAL)	NO.	8	46	262
* TIMES SCRAMMED (INADVERTANT)	NO.	2	4	29
THERMAL POWER GENERATION	MWH	756.08	30,979.01	209,244.83
AVERAGE BURNUP	MWD/MTU	-	-	-

CONTROL ROD POSITIONS AT END OF MONTH AT EQUILIBRIUM POWER OF 16.6 MWt

MAIN COOLANT BORON 1209 PPM

RODS OUT - INCHES

NO. 1 40 NO. 2 0 NO. 3 40

NO. 4 40 NO. 5 26.55 NO. 6 40

ELECTRICAL	UNIT	MONTH	YEAR	TO DATE
GROSS GENERATION	MWH	100	4,636.12	34,282.00
STATION SERVICE	MWH	324.12	1,670.73	8,202.29
STATION SERVICE	%	-	36.04	23.93
AVG. PLANT EFFICIENCY - MWH(e)/MWH(t)	%	13.23	14.96	16.38
AVG. GENERATION RUNNING (55.7 HRS)	KW	1,795.33	2,666.09	2,919.66
PLANT LOAD FACTOR - (AVG. GEN. FOR MONTH/MAX. LOAD)	%	5.02	14.11	21.51
AUXILIARY STEAM SUPPLY - NUCLEAR				
STEAM SUPPLIED BY REACTOR	HRS.	55.58	1,643.15	9,698.97
** RWDF EVAPORATOR OPERATION	HRS.	0	251.83	2,061.25

* REMARKS: 9:05 AM, Dec. 2 - Main coolant pump trip out scram from loss of variable frequency set coupling. 6:57 PM, Dec. 30 - Manual scram to avoid overpower scram after the feedwater valve malfunctioned.

** There has been a mistake in the RWDF operation hours to date since August 1964. The correct values are: Sept '64 thru Oct '64 - 1,558.80; Nov '64 - 1,719.00; Dec '64 thru May '65 - 1,809.42; June '65 thru Dec '65 - 2,061.25

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DAILY AVERAGE POWER LEVELS FOR DECEMBER 1965

-- INTERMITTENT OPERATION — CONTINUOUS OPERATION