SAXTON NUCLEAR EXPERIMENTAL CORPORATION

Operations Report for March 1968

1. GENERAL

At the beginning of this report period the main coolant system was in a cold depressurized condition in continuation of the plant outage which was begun on February 16th.

On March 4th the fuel shipping cask containing eleven irradiated fuel rods and two irradiated rods enclosing zirconium alloy test specimens was removed from the containment vessel and returned to the Westinghouse Post Irradiation Facility at Waltz Mill, Pa.

The period March 5th to March 13th was devoted to maintenance work and to completing plant modifications necessary for the power escalation program. The main coolant pump was disassembled for an internal inspection and the replacement of volute flange gaskets. A careful visual examination was made of the stator, rotor, bearings, thrust runner, thermal barrier, and impeller. No abnormalities were found. The two safety valves for the steam generator were reinstalled after set pressures had been determined on a test stand.

On March 13th the main coolant system was filled and vented. The pressure in the containment vessel was raised to 5 psig on March 14th. The door gaskets and all accessible penetrations were satisfactorily tested with soap bubbles. The leak test was conducted to verify a tight containment vessel for the escalated power program. Heat-up of the main coolant system to 500°F, using the main coolant pump and the pressurizer heaters, was completed on March 16th.

The period March 18th through the end of the month was devoted primarily to work on the pressurizer relief valves. The valves were tested with the newly installed anti-simmer devices energized. The anti-simmer devices had no detrimental effects on the pressure relieving performance of the valves; however, the use of these devices did not prevent the valves from leaking at the new system operating pressure of 2200 psig. The main coolant system was cooled down three times so that the relief valves could be checked and the seats and discs lapped. A service engineer for the manufacturer of the valves supervised the lapping work and the reassembly of the valves on March 29th. Heat-up of the main coolant system was completed and retesting of the relief valves was begun on the last day of the month.

2. REACTOR OPERATIONS

The reactor was made critical at 1:55 PM on March 27th and was operated at low power for the purpose of heating the main coolant system from 250°F to 485°F. The reactor was manually scrammed when heat-up was completed.

3. EXPERIMENTAL PROGRAM

The following irradiated fuel rods and materials were shipped to the Westinghouse Post Irradiation Facility for examination and/or disposal:

Eight fuel rods (304 SS, UO_2) - from damaged 3x3 Subassembly #503-4-1

Fuel rod No. 503-14-4 (D) - (Zr, PuO_2-UO_2, Pelleted), 9x9 removable fuel rod

Fuel rod No. 503-16-1 (D) - (Zr, PuO_2-UO_2, Vipac), 9x9 removable fuel rod

Fuel rod No. 781 (304 SS, UO_2, pressurized), 3x3 removable fuel rod

Zircaloy Relaxation Test Rod No. 21 (Zirconium alloy test specimens)

Zircaloy Relaxation Test Rod No. 22 (Zirconium alloy test specimens)

Preparations for the escalated power program were continued throughout the month.

There was no reactor operation during the month. The total effective full power hours of operation for Core II is 7475 and estimates of the fuel burn-up as of March 31, 1968 are: Core II average 8725 MWD/MTM; plutonium region average 14,377 MWD/MTM; peak plutonium rod 18,150 MWD/MTM; peak plutonium pellet 24,225 MWD/MTM.

4. OPERATIONAL TESTS

The No. 2 turbine overspeed trip was tested on February 26, 1968. The trip was actuated at a turbine speed of 1925 RPM.

On March 14th the response time from signal initiation to scram breaker opening was measured for the reactor scram circuits, including those added for power operation above 23.5 MWt. The minimum automatic scram response time was 0.079 seconds and the maximum was 0.230 seconds.

The radiation monitoring system circuits were tested on March 15th.

A successful test of the safety injection system was completed on March 19th.

Drop times were measured for all six control rods on March 28th. The main coolant system was being maintained at normal operating conditions of temperature, pressure and flow. The minimum drop time recorded was 0.890 seconds and the maximum was 0.914 seconds.

5. PLANT MODIFICATIONS

The following modifications and additions were made to plant equipment to accomodate the escalated power program (Technical Specification Change No. 25).

Anti-Simmer Devices

An air loading device was mounted on the bonnet of each of the pressurizer relief valves. The air loading device is a diaphragm operator which transmits a constant force to the valve spindle. The additional force is desirable to reduce the probability that the valve will weep when the main coolant system is operated at 2200 psig.

The diaphragm operator will vent, thus freeing the relief valve to function solely on spring load, when the main coolant system pressure exceeds 2300 psig. Redundency in equipment is provided to improve the overall reliability of the system.

Variable Frequency Motor-Generator Set

During the increased power operation of Core II, the main coolant pump will be supplied power at 63 Hertz from the variable frequency motor-generator set. The motor-generator set will be used to assure an increased flow coast down of the main coolant pump in the event of a loss of AC power to the plant. The modifications made to the plant electrical system to provide the increased coast down are as follows:

The output breaker of the motor-generator has been electrically and mechanically prevented from opening.

The over-current protection for the main coolant pump was transferred from the generator breaker to the motor breaker.

Equipment has been added to automatically transfer the excitation for the generator from the AC driven excitor to the 125V DC station battery in the event of loss of power to the AC driver exciter and/or in the event of low voltage at the generator output terminals.

A relay has been provided to remove the excitation for the electromagnetic clutch of the motor-generator set in the event of a loss of the normal generator field excitation. Measurements of the main coolant pump flow coast down with the coast down energy of the generator were made.

Reactor Scram Circuits

Two underfrequency relays have been added to trip the reactor in the event of low variable frequency M-G set output frequency. These relays will assure that the frequency of the power supplied to the main coolant pump, during reactor operation above 23.5 MWt, will not drift down and cause a lower pump speed.

Two micro-switches on the main steam pressure reducing valve (PRV) have been wired into the reactor trip circuits. These switches are actuated by the movement of the valve stem and will position contacts to scram the reactor when the PRV closes beyond a set position.

Two mercoid switches have been added to the turbine auto stop oil system. These switches are actuated by low oil pressure and will trip the reactor in the event of a turbine trip.

A manually actuated switch that permits the above new reactor trips to be blocked when the reactor is operated at power levels below 23.5 MWt has been installed. The trip circuits are automatically restored when the main steam flow exceeds a value coresponding to a reactor power level of 23.5 MWt and/or when the PRV valve position corresponds to that for a reactor power level of 23.5 MWt.

Safety Injection System Circuits

The safety injection control circuit has been revised so that the safety injection pumps are no longer stopped after a preset number of gallons. An alarm is still actuated by the flow totalizer-timer to alert the operator.

Main Steam Pressure Reducing Valve (PRV) Control Circuit

A new switch that makes it possible to close the 4 inch PRV during warming of the main steam line preparatory to start-up of the secondary system has been installed on the control board in the reactor control room.

6. MAINTENANCE

The principal items of mechanical maintenance for the month included replacing a valve in the control rod drive mechanism room sump drain line; checking the set pressure of both steam generator safety valves on a test stand and re-installing the valves; replacing the filter cartridges in the filters in the purification and storage well systems; painting the component cooling system heat exchangers;

disassembling and internally inspecting the main coolant pump; tightening the bolts on the pressurizer heater flange; replacing the shaft, vari-disc, and drive belt on the vari-drive for No. 1 charging pump; replacing a rupture disc in the discharge piping of one of the steam generator safety valves; repacking the vent valves on the steam generator; repairing the steam coils in the inlet air handler for the containment vessel; cleaning and setting the safety valve on the soft water header to the cation demineralizer units in the make-up water treating system; replacing a cracked fitting in the discharge piping of the storage well system pumps; repairing the door to the drums handling room in the radioactive waste treatment facility; preparing the reactor vessel head for operation; installing and testing the anti-simmer devices on the pressurizer safety valves; and lapping the seats and discs in the pressurizer safety valves.

The major items of electrical and instrument maintenance included installing a new coil on a solenoid valve in the steam generator blowdown sampling system; cleaning and setting the relief valves and the flow detector in the primary system flange and valve leak detecting system; repairing the motor in the conductivity recorder on the control board for the water treatment plant; replacing the electrical connectors and remaking the seals on the detector for nuclear instrumentation power range channel A; replacing the differential pressure gauge on the storage well system filters; cleaning, lubricating and replacing the brushes in the tachometer-generator on No. 1 charging pump; replacing the indicating meter on a radiation monitor system computer-indicator; calibrating the multi-point temperature recorder in the reactor control room; checking the response time for all reactor scram circuits; repairing the selector switch on the alpha scaler in the count room; measuring the main coolant pump coast down time; replacing the brake discs on the containment vessel crane; replacing a transformer and repairing a circuit board in the computer-indicator for site radioactive particulate monitor, RIC-8; installing a radiation detector in the primary compartment with a remote readout in the reactor control room; repairing the motor on the clean area vacuum cleaner; and repairing the paging phone in the auxiliary equipment room.

7. CHEMISTRY

Main coolant system chemistry was maintained for cold shutdown conditions from the beginning of the month until filling and venting of the system on March 12th and 13th. Hydrazine was added on March 13th to reduce the dissolved oxygen content of the system prior to heat-up. Smaller quantities of hydrazine were added on March 15th, 26th and 29th to maintain oxygen specifications for the remainder of the month. Boron concentrations ranged from a high of 1787 ppm during cold shutdown at the beginning of the month to a low of 750 ppm at the end of the month.

Summary of the analyses performed on main coolant samples taken during the month is contained in the following table:

Main Coolant System	Minimum	Maximum
pH at 25°C	5.26	5.94
Conductivity, umhos	3.90	7.05
Boron, ppm	750	1787
Chlorides, ppm	< 0.005	< 0.005
Oxygen, ppm	< 0.005	0.025
Gross Beta-Gamma (15 Min. Degassed) uc/cc	1.30×10^{-2}	2.20×10^{-2}
Tritium, uc/cc	1.52×10^{-2}	3.06×10^{-2}

An analysis of a storage well water sample taken on March 4th showed the boron concentration to be 1884 ppm, chlorides to be 0.055 ppm and the gross beta-gamma activity to be 2.79×10^{-3} uc/cc.

8. 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)	4.5 mrem/hr beta-gamma
Charging Pump (contact with chamber)	30 mrem/hr beta-gamma
Sample Room (door of sample panel)	1.5 mrem/hr beta-gamma
Chemical Lab Hot Sink (1" from drain)	1.4 mrem/hr beta-gamma
Sample Room Sink (1" from drain)	17 mrem/hr beta-gamma
RWDF	
Evaporator (under bottom)	50 mrem/hr beta-gamma
Evaporator (contact outside upper level)	10 mrem/hr beta-gamma
Drum Storage Area (at HRA fence)	0.7 mrem/hr beta-gamma
C.V.	
Primary Compartment (general upper level)	100 mrem/hr beta-gamma
Primary Compartment (contact M.C. pump volute)	410 mrem/hr beta-gamma
Primary Compartment (S.G. bottom)	250 mrem/hr beta-gamma
Primary Compartment (pressurizer bottom)	110 mrem/hr beta-gamma
Primary Compartment (general lower level)	65 mrem/hr beta-gamma
Primary Compartment (Regen. HX)	270 mrem/hr beta-gamma
Primary Compartment (Non-Regen. HX)	30 mrem/hr beta-gamma
Auxiliary Equipment Compartment (S.C.H.X.)	8 mrem/hr beta-gamma
Auxiliary Equipment Compartment (D.T. top)	6 mrem/hr beta-gamma

Location	Radiation Reading
C.V. (Continued)	
Auxiliary Equipment Compartment (D.T. bottom)	30 mrem/hr beta-gamma
Auxiliary Equipment Compartment (general lower level)	3 mrem/hr beta-gamma
Reactor Deck (water level at grating)	45 mrem/hr beta-gamma
Reactor Deck (instrument ports)	350 mrem/hr beta-gamma
Reactor Deck (waist level)	50 mrem/hr beta-gamma
Reactor Deck (storage well railing)	50 mrem/hr beta-gamma
Miscellaneous	
Main Coolant Pump (impeller blade)	2000 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	3590 d/m/smear beta-gamma
Charging Pump Chamber	< 10 d/m/smear alpha
Charging Room Floor	705 d/m/smear beta-gamma
Sample Room Sink	376000 d/m/smear beta-gamma
Sample Room Sink	< 10 d/m/smear alpha
Sample Room Floor	328 d/m/smear beta-gamma
Chemical Lab Hot Sink	42400 d/m/smear beta-gamma
Chemical Lab Hot Sink	< 10 d/m/smear alpha
RWDF	
Pump Room Floor	782 d/m/smear beta-gamma
Shipping Room Floor	< 100 d/m/smear beta-gamma
C.V.	
Operating Deck	2680 d/m/smear beta-gamma
Operating Deck	< 10 d/m/smear alpha
Reactor Deck (head)	42100 d/m/smear beta-gamma
Reactor Deck (head)	< 10 d/m/smear alpha
Reactor Deck (grating)	31600 d/m/smear beta-gamma
Reactor Deck (grating)	< 10 d/m/smear alpha
Primary Compartment (grating)	2130 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 March 1968 were as follows:

Effluent Type	(Curie) Activity This Month	(Curie) Activity Year to Date	(Curie) Activity Last Twelve Months
Liquid	0.000665	0.001386	0.009847
Tritium	0.217065	1.632098	3.529642
Air, Xe	2.003970	4.179335	15.018640
Air, I-131	0.000000	0.000173	0.001826
Air, M.F.P.	0.020039	0.041793	0.150186

One barrel of waste was drummed for temporary storage. Twenty-four drums were shipped from the site.

Radiation exposure for all SNEC personnel as measured by film badges for the month of February 1968 were a maximum of 240 mrem with an average of 38.02 mrem.

Radiation exposure for all visiting personnel as measured by film badges for the month of February 1968 were a maximum of 0 mrem with an average of 0 mrem.

The average radiation exposure for all personnel as measured by film badges for the month of February 1968 was 20.9 mrem.

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OPERATING STATISTICS

MONTH March YEAR 1968

NUCLEAR	UNIT	MONTH	YEAR	TO DATE
TIMES CRITICAL	NO.	1	84	626
HOURS CRITICAL	HRS.	2.6	346.86	20,919.86
TIMES SCRAMMED (MANUAL)	NO.	1	33	360
* TIMES SCRAMMED (INADVERTANT)	NO.	0	1	34
THERMAL POWER GENERATION	MWH	0	6,554.69	384,624.62
AVERAGE BURNUP	MWD/MTU	0	543.20	14,377.43

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

MAIN COOLANT BORON 750 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	1,189	64,465.50
STATION SERVICE	MWH	175.76	950.89	13,166.79
STATION SERVICE	%	0	79.97	20.42
AVG. PLANT EFFICIENCY - MWH(e)/MWH(t)	%	0	17.87	16.76
AVG. GENERATION RUNNING (0 HRS)	KW	0	4,173.68	3,380.70
PLANT LOAD FACTOR - (AVG. GEN. FOR MONTH/MAX. LOAD)	%	0	12.69	27.15
AUXILIARY STEAM SUPPLY - NUCLEAR				
STEAM SUPPLIED BY REACTOR	HRS.	0	289.57	17,440.66
RWDF EVAPORATOR OPERATION	HRS.	105.5	105.5	5,563.40

* REMARKS: _____