SAXTON NUCLEAR EXPERIMENTAL CORPORATION

Operations Report for August 1966

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 July 24th.

A containment vessel leakage rate test which was in progress at the beginning of the month was completed on August 2nd.

The period August 3rd to August 12th was devoted primarily to the handling of test fuel subassemblies. Subassemblies #503-9-1 (2x2), #503-4-25 (3x3), #503-4-27 (3x3) and a materials irradiation capsule assembly were removed from reactor core positions N-1, N-3, N-5 and N-6 respectively and were inspected with the underwater periscope.

On August 10th the irradiated fuel shipping cask, containing subassembly #503-9-1 (four rods); subassembly #503-4-24 consisting of five non-removable rods; four removable rods from the plutonium subassembly #503-4-26; two removable rods, #123 (defect) and #1 (thin clad) from subassembly #503-4-25; and the materials irradiation capsule was removed from the containment vessel and returned to the Westinghouse Post Irradiation Facility at Waltz Mill, Pa.

Test fuel subassemblies #503-4-25 (five fuel rods and four rods containing zirconium alloy test specimens), #503-4-27 (nine fuel rods), and #503-4-2 (eight fuel rods) were inserted in reactor core positions N-1, N-5 and N-3 respectively.

Restoration of the reactor vessel head to normal conditions for operation was completed on August 17th. Concurrently with the work on the reactor vessel head, maintenance was performed on several of the remote operated valves in the charging and purification systems.

Filling and venting of the main coolant system and pressure testing it to 500 psig was completed on August 16th. Heat-up to 250°F using the main coolant pump and pressurizer heaters was completed on August 18th.

2. REACTOR OPERATIONS

The reactor was made critical on August 19th and was used to heat the main coolant system from 250°F to 530°F. Upon completion of the heat-up the reactor was shutdown and a hot leak test of the main coolant system was conducted.

On August 20th and 21st the reactor was used for start-up training for five Spanish trainees.

The reactor was made critical on August 22nd and was maintained in a low power condition until the secondary system was started up in the morning of August 23rd. The reactor load was increased to 21 MWt and held at this level while a flux map was made and evaluated. On August 24th the reactor power level was increased to 23.5 MWt. Operation at 23.5 MWt was continued through the remainder of the month.

3. EXPERIMENTAL PROGRAM

The following irradiated fuel rods and materials were shipped to the Westinghouse Facility for examination in the hot lab:

Four fuel rods, Nos. 3, 4, 8 and E-4 in subassembly #503-9-1.

Fuel rod No. 123 - defect rod.

Fuel rod No. 1 - thin clad rod.

Four plutonium enriched fuel rods, Nos. D, E, X1 and X5 (two Vi-pac and two pelletized) from subassembly No. 503-4-26.

Five fuel rods, Nos. 301, 302, 303, 311 and 312 in subassembly No. 503-4-24.

A capsule containing reactor vessel material specimens.

Test fuel subassembly No. 503-4-25 (3x3) was installed in the center core position, N-1. The four removable rods in this subassembly are clad with Zircaloy-4 having a nominal thickness of 23.5 mils and contain a series of Zircaloy-4 test capsules. Each capsule contains one or more zirconium alloy test specimens. These rods are being irradiated to provide information on the in-pile performance of zirconium alloy test specimens subjected to combined thermal and radiation fluxes, with particular emphasis on the amount of stress relaxation experienced with specimens loaded to simulate conditions which would be present in a fuel assembly spring clip.

Test fuel subassembly No. 503-4-27 (3x3) was installed in a peripheral core position, N-5. The four removable rods in this subassembly are Nos. 783, 784, 711 and 712. Fuel rods Nos. 783 and 784 are identical to standard fuel rods except that they are internally pressurized to produce tensile stresses of approximately 41,000 psi in the clad at reactor operating conditions. Fuel rods Nos. 711 and 712 are clad with Zircaloy-4 and contain uranium dioxide pellets enriched to 17.49% U-235. These rods are internally pressurized to produce a maximum tensile stress of 22,000 psi in the clad at reactor operating conditions. All four removable rods have previous irradiation exposures. The five fixed rods are identical to standard fuel rods with the exception that the end closure welds are sub-standard. The continued irradiation of the fuel rods in subassembly No. 503-4-27 will provide information on the in-pile performance of sub-standard end closure welds and of 304 SS and zircaloy-4 cladding that is subjected to large tensile stresses.

A full core flux map was made at full power equilibrium xenon conditions with control rod #2 at 27.5 inches and the other five control rods fully withdrawn. A full set of thermal and hydraulic measurements were also made. This data will be compared with that obtained previously for the same operating conditions.

4. OPERATIONAL TESTS

An integral leakage rate test on the containment vessel was completed on August 2nd. The test was conducted for 80 hours at an average pressure of 10.19 psig. The leakage rate was determined to be 0.076% of the net free volume per 24 hours. The technical specifications limit at the test pressure of 10.19 psig is 0.136% per 24 hours.

On August 10th, the response times from initiation of scram signal to scram breaker opening was measured for all scram circuits. The manual scram response was 0.25 seconds. The minimum automatic response time was 0.102 seconds and the maximum was 0.278 seconds.

On August 20th and 21st drop times were measured for the control rods with the main coolant at normal operating conditions. The minimum drop time recorded was 0.854 seconds and the maximum was 0.913 seconds.

The radiation monitoring system circuits were tested on August 26th.

5. MAINTENANCE

The principal items of mechanical maintenance during the month included installing three new stuffing boxes and three cermaloy coated plungers on charging pump No. 1; repairing the RWDF building exhaust filter housing; rewelding the charging system accumulator in place after replacing the bladder and gas assembly; replacing the carbon vanes in a vacuum pump in a particulate monitoring channel of the radiation monitoring system; installing a new seat in the regenerative heat exchanger relief valve and resetting the valve; cleaning the secondary system sample coolers; acid cleaning the power water strainers on the boiler feed pumps; replacing the mechanical seals on two plungers of No. 2 charging pump with stuffing boxes and ring packing; replacing the seal rings in the mechanical seal on the third plunger of the No. 2 charging pump; repairing the chain drive on the tool for handling the removable rods in fuel subassemblies; installing new desiccant in the instrument air dryers; installing a new seat, plug and stem in the letdown flow control valve in the purification system; installing new cartridges in the purification system pre-post filter; cutting to fit and installing new insulation on the reactor vessel head ports; processing eleven drums of evaporator bottoms; installing new teflon gaskets on the low pressure side of the charging pump relief valves; lapping the seats of the remote operated valves HIC-23, HIC-24 and HIC-27 in the charging and purification systems; repairing three high pressure main coolant sample valves in the sample panel; removing fuel subassembly Nos. 503-9-1, 503-4-25 and 503-4-27 from the reactor vessel; removing a materials irradiation capsule assembly from the reactor vessel head port N-6 and shearing the support tube from it; loading fuel subassembly No. 503-9-1, subassembly No. 503-4-24, four removable rods from subassembly No. 503-4-26, two removable rods No. 123 and No. 1 from subassembly 503-4-25, and the materials irradiation capsule into the spent fuel shipping cask; preparing the spent fuel shipping cask for shipment; changing the removable rods in fuel subassemblies Nos. 503-4-25 and 503-4-27; installing subassemblies Nos. 503-4-25, 503-4-27 and 503-4-2 in the reactor vessel; and restoring the reactor vessel head to operating conditions.

The major items of electrical and instrument maintenance for the month included calibrating the boiler feed pump pressure gages; setting the boiler feed pump low oil pressure alarm; calibrating the No. 2 generator electric output recorder; replacing the paging system phone in the containment vessel primary compartment; installing a new detector cable for nuclear instrumentation source channel B; repairing the low voltage power supply for nuclear instrumentation source channel A; performing the scram circuit response time tests; repairing an M.I. cable connector in the power feeder to No. 1 storage well pump; repairing the roller bar for the variable frequency motor-generator set air circuit breaker; replacing the filter paper in site particulate monitor RIC-9; calibrating and aligning the variable frequency motor generator set output voltage, frequency and scram setting; replacing the brushes on the powerstat for group No. 3 pressurizer heaters; checking the resistance on the stator windings of the sample pump; cleaning the electrical contacts in the controller for the RWDF gas release control valve; replacing the solenoid valve in the control air system for clearing system remote operated shut-off valve HIC-24; installing new chart drive mechanisms on the nuclear instrumentation system power range and start-up range recorders; repairing the pressure gage on the discharge header of the storage well pumps; replacing the photomultiplier tube in the RWDF liquid release monitor, channel RIC-6, of the radiation monitoring system; repairing and adjusting the high power-low pressure scram circuits; and installing a new air regulator on the steam generator level controller.

6. CHEMISTRY

The main coolant system was in a cold shutdown condition during the first seventeen days of the month. On August 18th, 127 grams of hydrazine was added in preparation for system heat-up. The main coolant system was successfully leak tested at operating temperature on August 19th and hydrogen was added in preparation for power operation. Power operation was begun on August 23rd.

A summary of the analyses made on the main coolant samples taken during the month is contained in the following table:

Main Coolant System	Minimum	Maximum
pH at 25°C	5.41	6.42
Conductivity, umhos	4.96	24.8
Boron, ppm	781	2057 *
Chlorides, ppm	< .005	.050 *
Lithium, ppm	< .01	0.135
Oxygen, ppm	< .005	< .100 *
Hydrogen, ppm	< 5.0 *	42.0
Crud, ppb (one determination)	35.2	35.2
Gross Beta-Gamma (15 Min. degassed) uc/cc	0.0426	2.96
Tritium, uc/cc	4.51×10^{-4}	4.50×10^{-2}

* Reactor in cold shutdown condition

Except for a short period after startup on August 23rd the secondary system chlorides were maintained at less than 0.150 ppm. The average activity of the steam generator during the month 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 shipments. The following maximum radiation readings were taken:

Location	Radiation Reading
C&A Building	
Waste Drum (baling machine)	1.4 mrem/hr beta-gamma
Charging Pump (contact with chamber)	60 mrem/hr beta-gamma
Sample Room (door of sample panel)	6 mrem/hr beta-gamma
Chemical Lab Hot Sink (1" from drain)	20 mrem/hr beta-gamma
RWDF	
Evaporator (under bottom)	20 mrem/hr beta-gamma
Evaporator (contact outside upper level)	6 mrem/hr beta-gamma
Drum Storage Area (at HRA fence)	3.5 mrem/hr beta-gamma
C.V.	
Primary Compartment (general lower level) 344.5 hrs. after shutdown	25 mrem/hr beta-gamma
Primary Compartment (regenerative H.X.) 344.5 hrs. after shutdown	130 mrem/hr beta-gamma
Reactor Deck (water level at grating) 530 hrs. after shutdown	20 mrem/hr beta-gamma
Reactor Deck (waist level) 530 hrs. after shutdown	25 mrem/hr beta-gamma
Reactor Deck (instrument ports) 530 hrs. after shutdown	300 mrem/hr beta-gamma
Reactor Deck (storage well railing) 530 hrs. after shutdown	15 mrem/hr beta-gamma
Filter Vault (at doorway) 315.5 hrs. after shutdown	250 mrem/hr beta-gamma
Miscellaneous	
Fuel Transfer #9, Radioactive Materials Shipment #125 (at contact with shipping cask	7 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 areas were generally within the "Clean Area" limits. The controlled areas were 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	1.64×10^5 d/m/smear beta-gamma
Charging Room Floor	3300 d/m/smear beta-gamma
Sample Room Sink	3720 d/m/smear beta-gamma
Sample Room Floor	230 d/m/smear beta-gamma
Chemical Lab Hot Sink	9700 d/m/smear beta-gamma
RWDF	
Pump Room Floor	650 d/m/smear beta-gamma
Shipping Room Floor	< 100 d/m/smear beta-gamma
C.V.	
Reactor Deck (head)	11750 d/m/smear beta-gamma
Miscellaneous	
(W) Fuel Cask	Less than ICC Limits
New fuel rods and irradiation specimens	No detectable contamination

Liquid and gaseous effluents from the SNEC site for the month of August 1966 were as follows:

Effluent Type	(Curie) Activity This Month	(Curie) Activity Year to Date	(Curie) Activity Last Twelve Months
Tritium	0.000000	12.659266	20.144713
Liquid	0.000206	0.009414	0.012236
Air, Xe	0.925035	83.076451	83.193907
Air, I-131	0.000125	0.049544	0.055522
Air, M.F.P.	0.009250	0.830764	0.831940

Ten 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 July 1966 were a maximum of 220 mrem with an average of 29.8 mrem.

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OPERATING STATISTICS

MONTH AUGUST YEAR 1966

NUCLEAR	UNIT	MONTH	YEAR	TO DATE
TIMES CRITICAL	NO.	4	21	476
HOURS CRITICAL	HRS.	222.7	4,239.48	17,120.61
TIMES SCRAMMED (MANUAL)	NO.	3	20	282
* TIMES SCRAMMED (INADVERTANT)	NO.	0	1	30
THERMAL POWER GENERATION	MWH	4,801.95	91,426.14	300,675.96
AVERAGE BURNUP (Pu Region)	MWD/MTU	391.97	7,462.84	7,524.56

CONTROL ROD POSITIONS AT END OF MONTH AT EQUILIBRIUM POWER OF 23.32 MWt

MAIN COOLANT BORON 781 PPM

RODS OUT - INCHES

NO. 1 40 NO. 2 18 NO. 3 40

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

ELECTRICAL	UNIT	MONTH	YEAR	TO DATE
GROSS GENERATION	MWH	836.00	15,952.00	50,234.00
STATION SERVICE	MWH	172.84	1,706.27	9,908.56
STATION SERVICE	%	20.67	10.70	19.72
AVG. PLANT EFFICIENCY - MWH(e)/MWH(t)	%	17.41	17.45	16.71
AVG. GENERATION RUNNING (207.3 HRS)	KW	4,032.80	3,938.08	3,250.56
PLANT LOAD FACTOR - (AVG. GEN. FOR MONTH/MAX. LOAD)	%	25.42	61.88	29.58
AUXILIARY STEAM SUPPLY - NUCLEAR				
STEAM SUPPLIED BY REACTOR	HRS.	208.7	4,098.28	13,797.25
RWDF EVAPORATOR OPERATION	HRS.	13.25	1,161.52	3,222.77

* REMARKS: _____

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DAILY AVERAGE POWER LEVELS FOR AUGUST 1966