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U.S. Nuclear Regulatory Commission
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Subject: Docket #50-184

Gentlemen:

Transmitted herewith is Operations Report No.44 for the NBSR. The report covers the period January 1, 1991 to December 31, 1991.

Sincerely,

J. Michael Rowe
Chief, Reactor Radiation Division

Enclosure

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NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY REACTOR (NBSR)

Docket #50-184

Facility License No. TR-5

Operations Report

--#44--

January 1, 1991 - December 31, 1991

This report contains a summary of activities connected with the operations of the NBSR. It is submitted in fulfillment of section 7.8(3) of the NBSR Technical Specifications and covers the period from January 1, 1991 to December 31, 1991.

Section numbers in the report (such as 7.8(3)(a)) correspond to those used in the Technical Specifications.

March 30, 1992

J. Michael Rowe
Chief, Reactor Radiation Division

TABLE OF CONTENTS

7.8(3)(a) Summary of Plant Operations

During the calendar year 1991, the reactor was critical for 5741 hours and the energy generated was 91983 MWH.

In April, 1991, one of the main heat exchangers was taken out of service. Reactor operations continued with the remaining heat exchanger at reduced power of 15 MW. Highlights of this and other significant activities are presented below:

1. Heat Exchangers: A very small leak in the older main heat exchanger proved virtually impossible to find. Repeated efforts and the plugging of numerous tubes were unsuccessful because of the tiny size of the leak, at times less than a drop a minute. The decision was then made to take this heat exchanger out of service and continue operation with the remaining heat exchanger at reduced power of 15 MW.

Fabrication of three new plate-type heat exchangers began in late 1991 with completion expected by the end of 1992.

2. Regulating Rod Drive: The regulating rod drive had several blown fuses over a period of time. The problem was traced to corrosion in some of the pins in the connector, which were repaired.

3. Diesel Batteries: All the batteries for the diesels were replaced with fresh batteries after several battery failures during diesel start testing. In the interim, the starting function was tested weekly as required.

4. Dropped Element: During refueling, a new unirradiated fuel element fell off the tool while being transferred into position in the core, a distance of about one foot. The element was retrieved, was undamaged, inspected and reinserted into its position in the core.

5. Shearing of a Rabbit: During removal of a rabbit from the sender-receiver unit ins[illegible] a laboratory hood, the operator noted that the rabbit did not drop out as it should have. He repeated the procedure by cycling the cylinder of the unit to its original position and then back to the drop-out position. Apparently, the rabbit had partially dropped initially, which could not be seen by the operator. By cycling the cylinder again, the rabbit and the sample inside it were sheared in half. There was local contamination from the sample which was

cleaned up. One operator was assigned 515 mrem to the hands. There was little or no other exposure to personnel.

6. Neutron Beam Tube Experiment: An experimenter reported that his elbow and forearm might have inadvertently been in a beam for a few minutes while observing adjustments being made to a sample. This could not be confirmed by the senior experimenter making the adjustment and it seems doubtful that the beam was actually open. Nevertheless, the conditions were reconstructed and careful measurements were made. Based on the measurements, it is possible, though not likely, that the individual could have received an exposure of as much as 550 mrem to the elbow as an upper limit. This value was assigned to the individual's exposure record. In the meantime, all experimenters and researchers were reminded and instructed that all changes must be performed with the beam turned off. In addition, the articulated bars that mark the beam position were made rigid so that they cannot be tilted upwards and streamers were hung from them.

7. Neutron Guide Tube: One of the side panels in one of the neutron guide tubes failed. Most of the glass was subsequently found on the floor underneath the point of failure, but approximately 10% traveled the length of the tube through a thin magnesium alloy window and was stopped by a 0.060 inch wall aluminum filter cryostat. The failure of a glass panel has no effect on the reactor nor does it present any hazard to personnel. It is suspected that a defect in the glass caused the failure since failure due to radiation damage is considered unlikely. Calculations and comparison with similar facilities showed that the threshold of radiation damage, sufficient to cause a failure, would not occur for at least another 3 years. The glass was replaced and as a precaution, the first five meters of the guides within the confinement building were filled with helium. The latter had been planned to be done within six months.

7.8(3)(b) Unscheduled Shutdowns

1. There were four (4) scrams due to a commercial power dip during electrical storms. The reactor returned to power immediately.

2. There was one (1) scram due to a commercial power dip. The reactor returned to power immediately.

3. There were two (2) scrams due to a commercial power dips. The reactor stayed shutdown because it was at the end of the fuel cycle.

4. There was a scram due to no apparent cause. After completing the O.I. 1.1B check list the reactor returned to power. About ten minutes later the reactor scrammed again and a momentary Hi Flux annunciator was observed. Checked power channels NC–6, 7, & 8 and found setpoints below 100%. Reset the setpoints to 125% and returned to power while monitoring closely

5. There was a scram on low flow when the motor on the #1 main cooling pump shorted out. The reactor returned to power the next day after the motor was replaced.

6. There were three (3) scrams due to a commercial power dip because of power company problems. The reactor returned to power immediately two times but on the third attempt the Reg. Rod stopped driving. The reactor was shutdown and a fuse in the Reg. Rod drive motor was replaced. After testing the IN and OUT drive times the reactor was returned to power.

7.8(3)(c) Tabulation of Major Items of Plant Maintenance

1. Replaced relief valve at air reducing station #7 (by CO_2 gas holder in Process Room)
2. Plugged two leaking tubes of experimental demin HX
3. Plugged 6 suspected leaking tubes of HE–1A: (C/R) 16/6, 38/2, 39/3, 29/9, 29/11, & 29/41
4. Installed new motor bearings in #1, #4, #5, & #6 secondary pumps
5. Changed filters of experimental demin, storage pool, thermal shield, and primary purification systems
6. Cleaned inlet distribution–tree fingers and screens of storage pool IX column
7. Replaced differential pressure switch on DWV–3 (#1 main D_2O pump discharge valve)
8. Tightened valve packing of FTV--3
9. Changed both battery banks of A & B diesel generators
10. Changed resin in both thermal shield IX columns
11. Replaced motor of #1 main D_2O pump
12. Replaced sightglasses on diesel fuel day–tank and demin water day–tank

13. Repaired BT-1 shutter assembly
14. Electrical shop performed annual PM's on A & B substations
15. Replaced DWV 403 & 404 with new valves (primary system sample recirc station)
16. Replaced #3 shim arm drive cavity shielding with 2-inch poly sheets instead of using numbered lead bricks
17. Installed new motor for RM 3-1 (secondary N-16 pump #2)
18. Installed new pump on secondary N-16 pump #1
19. Regenerated demineralized water station IX resin
20. Removed piping that was used to supply steam to cooling tower basin
21. Drained and cleaned cooling tower basin
22. Installed new flow meter for cooling tower make-up
23. Refurbished #2 shim arm drive mechanism
24. Treated numerous thermal shield ring header and floor header leaking cooling coils to stop/minimize leakage
25. Installed new seat in SCV-216 (secondary outlet of HE-1A)
26. Changed air operator diaphragm for DWV-8 (#1 D_2O shutdown pump discharge)
27. Changed air operator diaphragm for DWV-6 (#4 main D_2O pump discharge valve)
28. Changed diaphragm of DWV-133 (2-in. drain header in Process Room)
29. Changed out C-4 and C-6 refueling pickup tools
30. Replaced end of small refueling tool
31. Replaced shaft sleeve, mechanical seal, and both impeller gaskets of #2 and #3 main D_2O pumps
32. Removed and cleaned rabbit tip flow indicator for RT-1
33. Removed auto flipping RT-4 rabbit receiver and replaced with old style manual receiver
34. Repaired #2 helium blower sightglass packing leak
35. Replaced diaphragm and solenoid of HEV-4 (helium valve for blowing D_2O to storage tank during refueling)
36. Replaced mechanical seal of #1 experimental demin pump
37. Performed regularly scheduled Tech Specs and plant PM's
38. Replaced zener diode in annunciator panel AN-3
39. Replaced differential pressure switch on DWV-3 valve
40. Replaced and calibrated millivolt/current transducer on TIA-8
41. Calibrated Secondary Auxiliary Cooling flow FIA-17
42. Replaced GM-tube and calibrated Area Monitor RM1-8

43. Cleaned and wiped setpoint potentiometers on NC–6, 7, & 8
44. Replaced GM–tube and calibrated filter monitor RM 1–13
45. Resoldered connection to #2 Shim Arm Readout
46. Replaced flow transmitter on Secondary Inlet flow for HE–1B
47. Replaced meter driver card on RM4–2
48. Replaced meter alarm assembly on RM 3–4 & 5
49. Replaced flow transmitter on D_2O flow for HE–2
50. Replaced level transmitter on Liquid Waste Hold–Up tank
51. Replaced fuse in "A" Regulating Rod motor circuit
52. Replaced detector for Radiation Monitor in C–001 lab
53. Replaced card in Primary IX Outlet conductivity monitor
54. Replaced reduction gear in Regulating Rod drive B
55. Replaced zener diode on annunciator panel AN–5
56. Replaced zener diode on annunciator panel AN–4
57. Repaired Irradiated Air Monitor RM3–4
58. Replaced fuse in "A" Regulating Rod motor circuit
59. Cleaned control switch on #1 Shim Arm
60. Replaced "A" Regulating Rod with "B" Regulating Rod
61. Replaced annunciator power switch on 125–V DC DCP–2 panel
62. The following instrument calibration surveillance tests were performed:

NC–1	Nuclear Source Range Start Up
NC–2	Nuclear Source Range Start Up
TIA–40B	Reactor Delta Temperature
TRA–2	Reactor Outlet Temperature
FR–1	Reactor Outlet Flow
TR–1	Reactor Delta Temperature
LIA–3	Storage tank level calibration
BTUR	Reactor Thermal Power
NC–7	Nuclear Power Range
NC–8	Nuclear Power Range
FIA–15	Thermal Shield Flow
RM 3–4	Irradiated Air Monitor
BT–4A&B	BT–4 Area Monitor
RM 1–1—10	Reactor Building Area Monitors

NC-4	Nuclear Intermediate Power Range
RM 4-1	Stack Monitor
RM 4-2	Auxiliary Stack Monitor
FRC-4	Reactor Outer Plenium Flow
FRC-3	Reactor Inner Plenium Flow
RM 4-4N	Criticality Monitor
RM 4-4S	Criticality Monitor
NC-5A	Linear Power Range and Regulating Rod Controller
LRC-1	Reactor Vessel Level
NC-3	Reactor Intermediate Power Range
PC-3	Normal Air Exhaust Pressure Controller
PC-27	Process Room Air Exhaust Pressure Controller
SPC-150	Emergency Fan Controller
SPS-151	Vacuum Breaker Controller
SPS-150	Emergency Standby Fan Controller
NC-9	Nuclear Safety System
NC-6	Nuclear Power Range
FIA-40	Reactor Flow
LIA-40	Reactor Vessel Level
TIA-40A	Reactor Delta Temperature
RM 3-2	Fission Product Monitor
RM 3-1	Secondary Cooling N-16 Monitor
RM 3-3	Secondary Cooling N-16 Monitor

7.8(3)(d) Tabulation of Major Changes in the Facility and Procedures, and the Test and Experiments, Carried Out Without Prior Approval by the NRC pursuant to 10 CFR 50.59.

Relevant Engineering Changes are summarized below:

ECN-362 Replaced Confinement Building personnel doors with heavy duty automatic opening and closing doors. All functions and alarms are unchanged, therefore there are no unreviewed safety questions.

ECN–370 Installed a level float switch in the Storage Pool pump pit to prevent the water in the pit from overflowing onto the floor by shutting off the make–up water valve to the pit. This change involves no unreviewed safety question.

ECN–373 Replaced the Amperex #18509 GM tube with a #18529 GM tube in the Helium Sweep monitor system to increase the rang of detection. This change involves only a change of the detector and does not affect the accident analyses or safety margins and therefore there are no unreviewed safety questions.

ECN–375 Installed a bulk storage tank for the helium supply to the D_2O sweep gas system. This provides a more dependable supply of high purity helium without the necessity handling high pressure cylinders. Since this system only provides an additional supply of helium it will not reduce the margin of safety that has been previously evaluated. Therefore there are no unreviewed safety questions.

ECN–378 Installed electric motor soft–starts on the Thermal Shield cooling system pump motors to reduce starting current and torque during power up and thereby reducing the water pressure surges into the thermal shield system. All trips and alarm settings remain the same, therefore there are no unreviewed safety questions.

ECN–380 Installed an area radiation monitor in room C–001 (known as the Rabbit Lab) to provide indication of a High Radiation level condition created by a rabbit returned to the hood in that room. This enhances the radiation safety of the area and does not impact on reactor systems or reactor safety, therefore there are no unreviewed safety questions.

ECN–383 Installed a new plate–type heat exchanger in the Secondary System to cool and isolate the oil cooling system of the new cryogenic helium compressor. Safety analysis within the body of the ECN shows that this modification does not add to any reactor accident or introduce new ones, nor will it reduce any safety margin. Therefore there are no unreviewed safety questions.

ECN–385 Removed remote readouts for liquid waste system batching tanks which are no longer a part of the liquid waste system. No reactor systems are affected by this change and therefore does not involve an unreviewed safety question.

7.8(3)(e) Summary of Radioactive Material Released and Results of Environmental Surveys Performed.

The gaseous waste released was 251 curies of tritium and 971 curies of Argon-41. There were 1.8 curies of tritium and 1.6 millicuries of other beta-gamma emitters released into the sanitary sewer. Environmental samples of the streams, vegetation, and/or soil, and air showed no significant changes.

7.8(3)(f) Summary of Significant Exposures Received by Facility Personnel and Visitors.

1. None to visitors.

2. Dosimetry results for this reporting period indicated that no facility personnel received significant exposures.