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Bulk Shielding Facility Quarterly Report January, February, and March 1985

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FOR THE UNITED STATES
DEPARTMENT OF ENERGY

Printed in the United States of America. Available from
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road, Springfield, Virginia 22161
NTIS price codes—Printed Copy: A03; Microfiche A01

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Operations Division
Reactor Operations Section

BULK SHIELDING FACILITY QUARTERLY REPORT JANUARY, FEBRUARY, AND MARCH 1985

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Operations Division

Date Published - July 1985

Notice: This document contains information of a preliminary nature. It is subject to revision or correction and, therefore, does not represent a final report.

Prepared by the
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831
operated by
Martin Marietta Energy Systems, Inc.
for the
U.S. DEPARTMENT OF ENERGY
under Contract No. DE-AC05-84OR21400

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BULK SHIELDING FACILITY QUARTERLY REPORT
JANUARY, FEBRUARY, AND MARCH 1985

SUMMARY

The BSR operated at an average power level of 1370 kW for 8.0% of the time during January, February, and March. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory.

The PCA was not used during the quarter.

BULK SHIELDING FACILITY

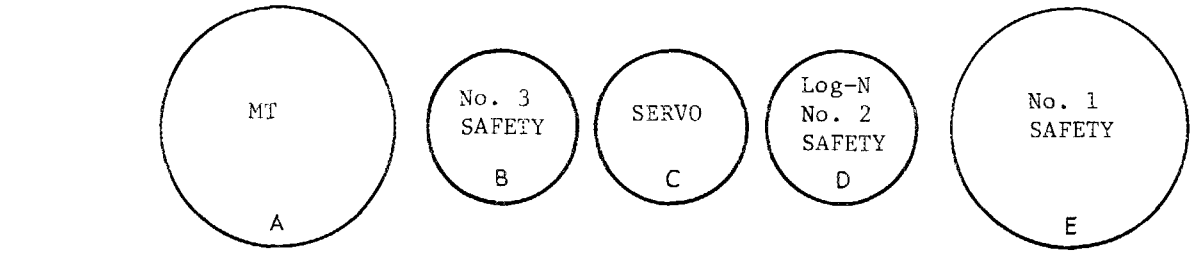
OPERATIONS

The BSR remained down for most of the quarter due to no request to operate. The brief periods of operation were used for functional checks, NLTNIF thermal test, flux mapping, rod calibrations, personnel training, university student training, and sample irradiation.

The preliminary work for the National Low-Temperature Neutron Irradiation Facility (NLTNIF) installation continues on schedule.

Basic operating data for this period are given in Table 1.

The new core loading 102 (Fig. 1) was made to establish enough excess reactivity to override peak xenon.



81	82	83	84	FC 85	Al Can 86	Al Can 87	Al Can 88	Al Can 89
71	72	73	74	Al Can 75	Al Can 76	Al Can 77	Al Can 78	Al Can 79
61	EAST 62	63	64	OR-98-F 200 65	BSF-S-17 64 66	BSF-A10 188 67	BSF-S-18 65 68	BSF-A9 178 69
51	D_2O 52	53	54	BSF-T6 218 55	M-111-F 180 56	YZP-0049 204 57	BSF-T2 182 58	BSF-T5 215 59
41	TANK 42	43	44	BSF-S-T2 110 45	BSF-T1 173 46	BSF-S-T4 109 47	BSF-T3 198 48	Al Plug[a] 49
31	32	33	34	M-110-F 181 35	M-59-H 202 36	M-102-F 198 37	M-104-F 202 38	BSF-T4 216 39
21	22	23	24	M-60-H 187 25	BSF-S-T1 85 26	M-95-F 185 27	BSF-S-T3 85 28	M-61-H 189 29
11	12	13	14	Al Plug 15	Al Plug 16	Al Plug 17	Al Plug 18	Al Plug 19

BSR CORE

LOADING NO.	102
DATE	March 21, 1985
EXCESS REACTIVITY	4.95% Δk/k
OPERATING MASS	4014 g

ROD POSITIONS AT CRITICAL
(With Operating Mass)

ROD NO.	IN. WITHDRAWN	
1	9.09	10.88
2	9.09	10.88
3	9.09	10.88
4	9.09	10.88
5	23.00	10.88
6	23.00	10.88

REMARKS:

[a]Core position for the National Low Temperature Neutron Irradiation Facility.

Fig. 1. Core loading 102, BSR.

UCN-8504
(3 7-78)

Table 1. Basic operating data
(January-March 1985)

	This quarter	Last quarter	Year to date
Total energy, kWd	9,857	393	9,857
Average operating power, kW	1,370	920	1,370
Time operating, %	8.0	0.5	8.0
Reactor availability, %	99.9	99.9	99.9
Reactor water radioactivity, counts min^{-1} ml^{-1}(av)	2,565	(BG)[a]	2,565[b]
Reactor water resistivity, ohm-cm (av)	1,059,000	1,289,000	1,059,000
Research samples	1	3	1

[a]Operating time very short; therefore, no activity buildup.
[b]Average water radioactivity during operating time.

Shutdowns

There were no unscheduled shutdowns during the quarter. Table 2 gives an analysis of the scheduled shutdowns.

Table 2. Analysis of shutdowns

Description of shutdown	Number	Downtime (h)
Scheduled		
Experimenters;		
No request to operate	2	1812.500
Reactor Operations:		
Quarterly checks	1	96.000
Training and six shim rod calibrations	7	78.851
Subtotal:	10	1987.351
Unscheduled		
Experimenters:	0	0
Reactor Operations:	0	0
Subtotal:	0	0
TOTAL:	10	1987.341

Maintenance and Changes

Maintenance and changes to the instrumentation components in the complex are listed in Table 3.

Maintenance and changes of the process systems are listed in Table 4. Maintenance and changes of the mechanical systems are listed in Table 5.

Operational Activities

The operational activities for the quarter are listed in Table 6.

Table 3. Maintenance and changes, instrumentation and controls

Date	Components	Trouble/change	Reason for maintenance
1-7-85	Servo programmed controller	Lost run mode	Reprogrammed for run
1-22-85	Heating elements in flow transmitter hutch	Inadequate	Adapted for 220 V rather than 110 V
1-31-84	High bay monitron	Erratic	Retubed to correct erratic operation
1-31-85	Log gamma radiation monitor	Failed	Removed to shop for bench test
2-11-85	No. 3 safety channel sensitivity switch	Failed	Installed a new stop on sensitivity switch
2-12-85	No. 3 safety channel	Failed	Replaced recorder amplifier
2-19-85	Primary flow transmitter	Damaged by a freeze	Replaced with a new transmitter
2-20-85	High bay monitron	Failed	Removed for repairs
2-26-85	High bay monitron	Rebuilt	Reinstalled
2-27-85	Servo programmed controller	Failed	Replaced with a spare unit
3-7-85	5 R/h gamma monitor	Upgrade	Installed new solid state model
3-14-85	Miscellaneous radiation recorder	Erratic	Repaired the recorder
3-15-85	Pump house PA system	Upgrade	Repaired by installing new wire
3-19-85	pH meter	Failure	Removed, repaired, and reinstalled
3-19-85	Conductivity meter	Upgrade	Installed new unit

Table 3. (continued)

Date	Component	Trouble/change	Reason for maintenance
3-22-85	Conductivity probe	Upgrade	Installed in anion column outlet
3-27-85	Servo recorder amplifier	Failure	Replaced the recorder amplifier

Table 4. Maintenance and changes, process systems

Date	Component	Trouble/change	Reason for maintenance
1-21-85	Pool room steam heater	Noise	Heater noise interferred with security surveil-lance
1-21-85	Water supply header to south annex	Ruptured	Water froze in header
2-20-85	Water supply NLTNIF laboratory	New	Contractor welded new 1-in. line for water supply
3-6-85	Anion column	Inspection	Opened column for access
3-7-85 thru 3-22-85	Anion lower strainer arm	Failure	Removed for repair and installed new spray heads
3-26-85	Demineralizer	Precaution	Replaced strainer in exit water line

Table 5. Maintenance and changes, mechanical system

Date	Components	Trouble/change	Reason for maintenance
1-15-85	No. 2 shim rod drive	Faulty clutch operation	Clutch switch malfunction. The push rod was cleaned
2-6-85	Tower fans ball float valve	Faulty	Replaced makeup water ball float valve
3-12-85	North tower fan	Operation failure	Replaced SS shot in the dodge coupling
3-15-85	Walkover	New	Installed over NLTNIF southwest cryostat piping
3-25-85	Bridge rail	New	Installed rail stops for positioning reactor to align with NLTNIF cryostat

Table 6. Operational activities

Date	Remarks
1-21-85	Water supply to annex valved out due to frozen ruptured line
2-5-85	Conducted training for UT students (ATC and RC)
2-6-85	Conducted training for UT students (ATC and RC)
2-7-85	Conducted training for UT students (ATC and RC)
2-8-85	Conducted training for UT students (ATC and RC)
2-11-85	Valved off steam to heater located in southwest corner of pool room due to a steam leak
2-11-85	Added biocide treatment to anion column
2-13-85	Conducted requalification startup test
2-13-85	Regenerated demineralizer cation column
2-14-85	Regenerated demineralizer anion column
2-16-85	Placed demineralizer in service
2-19-85	Conducted training for LSU students (ATC and RC)
2-22-85	Closed flapper valve and started primary flow (1000 gpm)
2-24-85	Filled NLTNIF liquid nitrogen trap twice per shift
2-25-85	Filled NLTNIF liquid nitrogen trap twice per shift
2-26-85	Removed demineralizer from service
2-26-85	Installed flux monitors in BSR core
2-27-85	Returned demineralizer to service
2-28-85	Made flux run and removed flux wires for decay
2-28-85	Made measurements in preparation for calibrating ion chamber for I&C
2-28-85	Conducted requalification startup test
3-1-85	A nonskid entrace installed at northwest entrance to pool-room
3-5-85	Shut down primary pump for mode I startup training
3-5-85	Removed demineralizer from service due to a flow restriction
3-5-85	Conducted requalification startup training
3-6-85	Removed water and resin from anion column and discovered that the five plastic strainer heads had broken or cracked
3-7-85	Restarted pool primary flow, 1,000 gpm

Fig. 6. (continued)

Date	Remarks
3-8-85	Sent three drums of spent resin to burial ground
3-8-85	Conducted requalification training
3-11-85	Made NLTNIF reactivity measurement at 24-watts power level
3-12-85	Operating reactor at 2 MW to establish thermal equilibrium in preparation for the NLTNIF boiling verification test
3-14-85	Switched reactor controls from auto to manual for noise analysis testing
3-15-85	Installed shield and mockup and made NLTNIF run to verify nonboiling calculations
3-18-85	Removed NLTNIF mockup and shield from core to pool storage
3-18-85	Replaced a fuel element and relocated one fuel element to form core 102
3-18-85	Reactor operated for refueling critical run
3-18-85	Calibrated shim rods Nos. 1, 2, and 3 while at the 4-kW power level
3-22-85	Calibrated shim rods Nos. 4, 5, and 6 while at the 4-kW power level
3-22-85	Treated the secondary system
3-25-85	Conducted training for MSU students, ATC, and RC
3-25-85	Reactor operated at 2 MW to establish xenon equilibrium for MSU training
3-25-85	Loaded anion column with 21 ft^3 of IRA-400 resin
3-26-85	Backwashed and rinsed cation and anion column
3-26-85	Irradiated sample for M&C division at 2 MW for 100 min
3-27-85	Conducted training for MSU student performing the xenon override experiment while at the 4-kW power level
3-29-85	Transferred the M&C division irradiated sample from D3-2 to the west dry tubes for temporary storage

Experiments

Work relating to the National Low Temperature Neutron Irradiation Facilities, NLTNIF has been listed in Table 7.

Table 7. Experiment facilities activity, NLTNIF

Date	Remarks
1-2-85	Raised cryostat assembly and adjusted length 3/8 in. then reinstalled in pool
1-4-85	Attempted installing cryostat heat exchanger, found design error, and returned it to the shop for modifications
1-14-85	Installed core piece (shield) in CP-49. Installed cryostat into shield using underwater periscope to aid alignment. Marked bridge rails with scribe mark for convenience of aligning cryostat in the future
1-15-85	Removed cryostat and shield and stored them in pool
1-25-85	Fitted heat exchangers into cryostat, then removed them for final adjustment
1-30-85	Placed inside section of cryostat in position for clearance test, then removed it for minor alterations
2-4-85	Installed cryostat heat exchanger
3-11-85	Operations made reactivity measurements with shield and cryostat in core. Removed them from core and stored
3-15-85	Installed shield and cryostat mockup in CP-49 and made measurement to verify nonboiling calculations. After UT, test shield and cryostat were stored at poolside
3-21-85	Removed thermocouples from the NLTNIF mockup and shield
3-29-85	Installed flux monitor on mockup cryostat

Fuel

Changes in the fuel inventory are reported in Table 8.

Table 8. Fuel and shim rod status

	This quarter	Last quarter	Year to date
Fuel elements depleted	0	0	0
Shim-safety rod fuel elements depleted	0	0	0
New fuel elements placed in service	1	0	1
New shim-safety rod fuel elements placed in service	0	0	0
Partially depleted shim-safety rod fuel	6	6	6
New fuel elements available for use	1	2	1
New shim-safety rod fuel elements available	7	7	7
Partially depleted fuel elements available for use (includes core)	30	30	30
New boron stainless steel shim rods placed in service	0	0	0
Boron stainless steel shim rods in service	6	6	6
Boron stainless steel shim rods available for use	1	1	1

Experiment Facilities Assignments

Experiment facilities assignments are listed in Table 9. The tubes of the east D_2O tank are not permanently assigned; they have been used by various Laboratory personnel for short-term sample irradiations.

Table 9. Experiment facilities assignments

Facility	Location	Division or sponsor
Dry thermal-neutron tubes (D-3-1 and -2)	East D_2O tank	Operations
Wet thermal-neutron tubes (D-4-1 and -2, D-6-1, -2, -3, -4, and -5)	East D_2O tank	Operations
National Low-Temperature Neutron Irradiation Facility[a] (NLTNIF)	Southwest corner of pool	Solid State

[a]Construction in progress.

Demineralizer Performance

Table 10 gives detailed information on the condition of the primary water system for the preceding year and pertinent data on the performance of the bypass demineralizer.

SUMMARY OF SURVEILLANCE TESTS AT THE BSR

Table 11 is a tabulation of the completion dates of the surveillance tests required by the Technical Specifications. This table contains all the surveillance tests scheduled for frequencies of one test per month or longer. Other surveillance requirements which are not reported are satisfied by routine completion of daily and weekly check sheets, start-up checklists, hourly data sheets, the operating log book, and miscellaneous quality assurance tests.

Table 10. Demineralizer performance data

Run No.	Initiation date	Termination date	Throughput (gal)	Gross gamma (counts min^{-1} ml^{-1}) In	Gross gamma (counts min^{-1} ml^{-1}) Out	pH In	pH Out	Specific resistance (ohm-cm) In	Specific resistance (ohm-cm) Out
53	9-19-78	12-29-78	2,580,000	2,194	163	5.6	5.8	1,194,000	3,207,000
54	12-19-78	4-10-79	3,040,000	1,964	134	5.6	5.9	1,183,000	1.910,000
55	4-11-79	7-24-79	2,750,000	2,188	164	5.5	5.7	1,006,000	1.675,000
56	7-27-79	11-19-79	2,800,000	1,801	138	5.3	5.5	971,000	1,743,000
57	11-20-79	4-8-80	2,750,000	1,866	134	5.3	5.5	1,084,000	2,038,000
58	4-9-80	5-29-80	1,000,000	1.979	123	5.3	5.5	808,000	1,832,000
59	5-30-80	6-2-80	5,000	1,950	125	5.3	5.6	774,000	1,538,000
60[a]	6-3-80	8-4-80	1,750,000	1,929	106	5.4	5.6	1,278,000	3,466,000
61	8-5-80	10-30-80	1,850,000	1,824	118	5.4	5.6	1,148,000	2,600,000
62	11-4-80	2-26-81	2,600,000	1,587	110	5.4	5.6	1,368,000	4,319,000
63	3-2-81	6-20-81	2,200,000	1,271	151	5.5	5.7	1,233,000	3,960,000
64	6-29-81	8-11-81	1,250,000	1,941	141	5.4	5.7	896,000	2,258,000
65	8-12-81	9-8-81	425,000	2,163	142	5.2	5.4	445,000	1,126,000
66[a]	9-19-81	1-3-82	850,000	1,666	119	5.4	5.6	1,138,000	1,980,000
67	1-4-82	4-5-82	2,400,000	1,874	150	5.4	5.6	970,000	1,691,000
68	4-7-82	7-8-82	2,000,000	1,841	138	5.3	5.5	915,000	1,841,000
69	7-9-82	7-27-82	750,000	1,962	129	5.2	5.4	720,000	1,136,000
70[a]	9-22-84	8-30-83	1,900,000	527	59	5.2	5.4	1,180,000	2,034,000
71[b]	8-31-83	5-15-84	2,693,560	2,961	166	5.6	5.8	1,030,000	1,830,000
72	6-5-84	9-11-84	2,851,200	--	--	5.5	5.7	1,025,000	2,000,000
73	9-13-84	2-8-85	2,650,000	2,467	230	5.6	5.9	758,000	1,289,000
74	2-16-85	4-1-85	1,114,560	2,565	--	5.6	6.1	468,000	1,501,000

[a]New resin in the demineralizer columns.

[b]The demineralizer operated on low flow (approximately 7 gpm) from September 26, 1983, to January 17, 1984, due to a failure of the booster pump.

Table 11. Summary of surveillance tests at the BSR

Test	Most recent test	Previous test
Biennial tests		
Inspection of the shim-safety rods	8-28-84	8-4-83
Annual tests		
Core _T channel calibration	12-13-84	9-14-84
Primary coolant flow channel calibration	12-13-84	9-14-84
Pool-water level channel calibration	12-13-84	9-14-84
Maximum rate of reactivity addition by the shim-safety rods	3-7-85	12-12-84
Reactivity assigned to the servo-control system	3-22-85	12-13-84
Subcriticality with each shim-safety rod at its upper limit while all other shim-safety rods are fully inserted	3-7-85	12-12-84
Semiannual		
Cell-ventilation filter efficiency		
A. Elemental iodine	12-18-84	4-19-84
B. Dioctyl phthalate	12-26-84	6-13-84
Radiation monitoring equipment calibration	3-21-85	9-19-84
Stack radiation monitor calibration	12-18-84	9-18-84
Quarterly		
Safety channel No. 1 calibration	3-6-85	12-11-84
Safety channel No. 2 calibration	3-6-85	12-11-84
Safety channel No. 3 calibration	3-6-85	12-11-84
Log-N channel calibration	3-5-85	12-11-84
Fission chamber channel calibration	3-5-85	12-13-84
Flapper valve position channel functional test	3-7-85	12-12-84
Measurement of release time and time of flight for the shim-safety rods	3-7-85	12-12-84
Containment closure system functional test	3-8-85	12-28-84
In-leakage during containment mode	3-8-85	12-29-84
Others		
Calibration of shim-safety rods	3-22-85	9-12-83

POOL CRITICAL ASSEMBLY

OPERATIONS

The Pool Critical Assembly (PCA) was not used during the quarter. Operational activities are shown in Table 12.

Table 12. Operational activities

Date	Remarks
1-7-85	Removed pressure vessel mock-up assembly and base unit from PCA south core face to north poolside
1-9-85	Pressure vessel mock-up assembly sent to burial ground No. 6
1-9-85	Mock-up assembly base sent to warehouse for storage
1-22-85	Started a prestartup checkout in preparation for UT student training scheduled for 1-23-85; however, the No. 2 drive unit magnet shorted to ground. Since there was no spare magnet available, the UT student training was shifted to the BSR
1-24-85	Stored PCA No. 2 drive unit in Building 3001, 1st floor west at PCA storage bench

Maintenance and changes

The PCA maintenance activities are listed in Table 13.

SURVEILLANCE TESTS AT THE PCA

Shim-safety rod magnets and associated electronic components are being upgraded at the PCA. Until this work is completed, it will not be possible to make all the surveillance tests required at this facility by the technical specifications. Thus, a waiver of the PCA technical specification surveillance test requirements during the proposed modification and component replacement period was granted.[1]

[1]Letter to B. L. Corbett from K. H. Poteet, subject "Waiver of Surveillance Tests at the PCA," March 26, 1985.

Table 13. PCA maintenance

Date	Component	Trouble/change	Reason for maintenance
1-2-85 thru 1-3-85	Instrument	Routine	Quarterly checks
1-2-85	No. 3 shim rod	Routine	Cleaned seat switch controls
1-3-85	No. 3 shim rod	Failed seat switch	Installed new seat switch
1-4-85	Auxillary fission chamber	Failed	Removed fission chamber assembly and replaced motor drive gear and shaft. Changed out fission chamber. Installed a new connector. Installed a new shielded cable. Installed a new chain drive gear bearing then reinstalled in C-2 position
1-22-85	No. 2 magnet amplifier	Failed	Burned out two resistors when the magnet shorted to ground
1-22-85	No. 2 shim-rod drive assembly	Routine	Checked magnet and found electrical short to ground, i.e., magnet failure

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