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Bulk Shielding Facility Quarterly Report April, May, and June 1986

T. P. Hamrick
F. E. Muggridge

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Operations Division
Reactor Operations Section

BULK SHIELDING FACILITY QUARTERLY REPORT APRIL, MAY, AND JUNE 1986

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SPONSOR: J. H. Swanks
Operations Division

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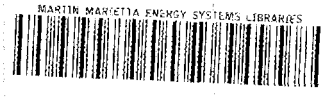

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BULK SHIELDING FACILITY QUARTERLY REPORT
APRIL, MAY, AND JUNE 1986

SUMMARY

The BSR operated at an average power level of 1575 kW for 11.2% of the time during April, May, and June. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory.

The PCA is shutdown for shim-safety rod magnets and associated electronic components upgrading. All PCA fuel elements were shipped during May to Savannah River Plant for reprocessing.

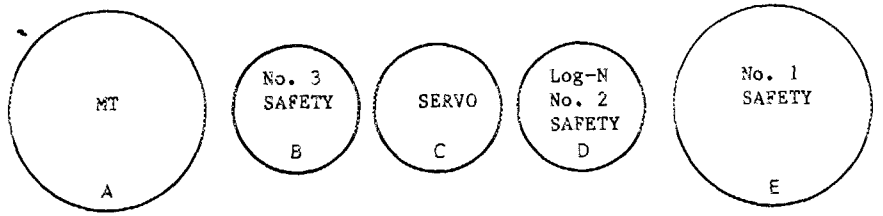
BULK SHIELDING FACILITY

OPERATIONS

The BSR remained down for most of the quarter due to no request to operate. The brief periods of operation were used for personnel training, tour groups, ATNIF sample irradiation, functional testing, and training university student groups.

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

Core loading 102 is shown in Fig. 1.



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	62	EAST 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	52	D_2O 53	54	BSF-T6 218 55	M-111-F 180 56	YZP-0049 204 57	BSF-T2 182 58	BSF-T5 215 59
41	42	TANK 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

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

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:

Rod calibrations made at 4 kW and core flow ~1000 gpm.

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Fig. 1. Core loading 102, BSR.

Table 1. Basic operating data
(April-June 1986)

	This quarter	Last quarter	Year to date
Total energy, kWd	16,001	5945	21,946
Average operating power, kW	1,575	958	1,267
Time operating, %	11.2	6.9	9.1
Reactor availability, %	99.9	99.9	99.9
Reactor water radioactivity, cpm/ml (av)	4,448	1,268	2,858
Reactor water resistivity, ohm-cm (av)	2,030,000	2,032,000	2,031,000
Research samples	6	3	9

Shutdowns

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

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.

Table 2. Analysis of shutdowns

Description of shutdown	Number
Scheduled	
Experimenters:	
ATNIF samples	4
Other samples	6
Maintenance:	
Sytems functional checks	1
Quarterly checks	1
Reactor Operations:	
University student groups (UT and MSU)	5
Training	7
Tour	1
Subtotal:	25
Unscheduled	
Experimenters:	0
Reactor Operations:	0
Subtotal:	0
TOTAL:	25

Table 3. Maintenance and changes, instrumentation and controls

Date	Components	Trouble/change	Maintenance Performed
4-2-86	Safety chamber	Zero out of tolerance	Adjusted chamber current
4-3-86	Miscellaneous temperature recorder	Thermocouple failed	Removed failed thermocouple and restored recorder to service
4-4-86 thru 4-10-86	pH probes	Intermittent out of range spikes	Cleaned probes
4-11-86	Pool exit water activity monitor	Intermittent out of range spikes	Replaced amplifier
4-14-86	Monitrons and CAMs	Routine	Calibration checks
4-14-86	Auxiliary fission chamber	New	Set up for UT students shielding experiments
4-15-86	pH meter	Failed	Replaced pH controller amplifier
4-15-86	Count rate meter	Spikes	Cleaned cables
4-17-86	Count rate meter	Failed	Repaired cable connection
4-18-86	Pool exit water activity monitor	Range adjustment failed	Installed lead shielding over probe to reduce range
4-22-86	AC undervoltage relay	Failed	Replaced
4-30-86 thru 5-1-86	Key switch and Log-N signal	New	Connected to ORNL shift office display
5-13-86	Log-N amplifier	Routine	Calibrated
5-22-86	Security panel	Routine	Performed service to panel

Table 3. (Continued)

Date	Components	Trouble/change	Maintenance Performed
5-28-86	No. 1 safety recorder	Routine	Cleaned and lubricated drive and switches
5-28-86	Monitrons and CAMs	Routine	Calibrated
6-3-86	Teletalk box	Failure	Reworked and installed in control room and south annex laboratory
6-4-86	FRCAS	Routine	Quarterly functional test
6-19-86	ΔP	Wire grounded on bridge	Repaired grounded wires
6-23-86 thru 6-27-86	Instruments	Routine	Performed quarterly checks

Table 4. Maintenance and changes, process systems

Date	Components	Trouble/change	Maintenance Performed
4-9-86	Acid check valve	Leak	Replaced
4-9-86	Demineralizer	Routine	Changed spool piece for regeneration
4-10-86	Acid tank	Routine	Installed coupling for rinsing
4-23-86	Skimmer pump motor	Burning odor	Service checks
5-8-86	Cell vent filters	Routine	Made iodine test on center bank, filters failed test
5-21-86 thru 5-23-86	Skimmer pump motor	Failed	Replaced motor bearings
6-11-86	Roof air damper	Failed	Replaced one of two solenoid valves

Table 5. Maintenance and changes, mechanical systems

Date	Components	Trouble/change	Maintenance Performed
4-2-86	South entry door latch	Failed	Replaced mechanical latch
4-7-86	Southwest fresh-air vent	No rodent proof screen	Installed a protective screen
4-14-86	Overhead crane	Routine	Inspection and service
4-24-86	Zircaloy-shield lifting tool	Routine	Modified for more effective lifting
5-12-86	Access ladder	New	Installed roof access ladder at northeast corner of Building 3010
6-27-86	Dewar platform, southeast	New	Modified platform for better fit

Operational Activities

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

Table 6. Operational activities

Date	Remarks
4-1-86	Completed the emergency electrical power quarterly test
4-2-86	Health physicist surveyed radiation level around pool with water level at normal +2 in. and then at normal -2 in.
4-2-86	Irradiated sample 86-04-01
4-9-86 thru 4-10-86	Regenerated demineralizer
4-10-86 thru 4-14-86	Irradiated sample 86-04-02
4-10-86	Installed wet tube in CP-17
4-12-86 thru 4-14-86	Irradiated sample 86-04-03
4-14-86 thru 4-18-86	Conducted shielding experiment for UT students
4-19-86 thru 4-21-86	Operated reactor to heat fuel in order to survey core for leaking fuel elements
4-21-86	Tested 18 fuel elements and 6 shim-safety rods for fission fragments leaks
4-23-86 thru 4-26-86	Conducted xenon experiment for UT students
5-2-86	Irradiated sample 86-05-01
5-2-86	Made a 4 point calibration check for each shim safety rod
5-2-86	Conducted operator training for 7 operators
5-7-86	Valved in center bank of cell vent filters and adjusted flow
5-10-86	Prepared BSF for scheduled power outages
6-10-86	Operated reactor at 24 W and made reactivity measurements on cryostat
6-19-86	Irradiated sample 86-06-03
6-30-86	Irradiated sample 86-05-03

Experiments

Work related to the National Low-Temperature Neutron Irradiation Facility, NLTNIF, is listed in Table 7.

Table 7. Experiment facilities activity, NLTNIF

Date	Remarks
4-22-86	Cryostat shielding tested for gamma, beta, and neutron leakage at 100 kW
5-6-86 thru 5-8-86	Installed new radiation shield in cryostat
5-9-86	Cryostat shield tested for gamma, beta, and neutron leakage at 100 kW
5-15-86	Made cryostat shield modifications
5-16-86	Cryostat shield tested for gamma, beta, and neutron leakage at 2000 kW
5-20-86	Received dewar ballast weight
5-22-86	Installed cryostat shield
6-10-86	Measured the cryostat reactivity
6-11-86	Installed stored energy mock-up in cryostat
6-12-86	Measured the cryostat reactivity

Fuel

Changes in the fuel inventory are reported in Table 8.

Table 8. Fuel and shim-safety rod status

	This quarter	Last quarter	Year to date
Fuel elements depleted	34*	0	34
Shim-safety rod fuel elements depleted	0	0	0
New fuel elements placed in service	0	0	0
New shim-safety rod fuel elements placed in service	0	0	0
Partially depleted shim-safety rod fuel elements	6	6	6
New fuel elements available for use	17	17	17
New shim-safety rod fuel elements available	7	7	7
Partially depleted fuel elements available for use (includes core)	28	28	28
New boron stainless steel shim-safety rods placed in service	0	0	0
Boron stainless steel shim-safety rods in service	6	6	6
Boron stainless steel shim-safety rods available for use	1	1	1

*PCA fuel elements shipped to Savannah River Plant for reprocessing.

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 (cpm/ml)		pH		Specific resistance (ohm-cm)	
				In	Out	In	Out	In	Out
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
75[a]	4-2-85	7-16-85	3,389,760	3,337	282	5.7	6.1	736,000	1,590,000
76	7-19-85	12-6-85	4,354,460	3,727	196	5.7	5.9	840,000	1,818,000
77	12-10-85	4-9-86	3,543,400	1,268	104	5.7	5.8	1,023,000	2,033,000
78	4-11-85	--	--	--	--	--	--	--	--

[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	9-23-85	8-28-84
Annual tests		
Core ΔT channel calibration	3-21-86	9-17-85
Primary coolant flow channel calibration	12-13-85	9-17-85
Pool water-level channel calibration	6-30-86	3-20-86
Maximum rate of reactivity addition by the shim-safety rods	3-20-86	12-12-85
Reactivity assigned to the servo-control system	5-2-86	3-22-85
Subcriticality with each shim-safety rod at its upper limit while all other shim-safety rods are fully inserted	6-30-86	3-13-86
Semiannual		
Cell-ventilation filter efficiency		
A. Elemental iodine	12-19-85	9-26-85
B. Dioctyl phthalate	6-2-86	12-19-85
Radiation monitoring equipment calibration	5-28-86	2-28-86
Stack radiation monitor calibration	4-30-86	10-8-85
Quarterly		
Safety channel No. 1 calibration	6-30-86	3-18-86
Safety channel No. 2 calibration	6-30-86	3-18-86
Safety channel No. 3 calibration	6-30-86	3-18-86
Log-N channel calibration	6-30-86	3-18-86

Table 11. (Continued)

Test	Most recent test	Previous test
Quarterly (continued)		
Fission chamber channel calibration	6-30-86	3-18-86
Flapper valve position channel functional test	6-30-86	3-20-86
Measurement of release time and time of flight for the shim-safety rods	6-30-86	3-20-86
Containment closure system functional test	3-20-86	12-18-85
In-leakage during containment mode	3-20-86	12-18-85
Others		
Calibration of shim-safety rods	5-2-86	3-22-85
NLTNIF, pool water level high, functional test	4-2-86	1-3-86

POOL CRITICAL ASSEMBLY

OPERATIONS

The Pool Critical Assembly (PCA) is shutdown for shim-safety rod magnets and associated electronic components upgrading. The operational activities for the quarter are listed in Table 12.

Table 12. Summary of PCA operational activities

Date	Remarks
4-1-86	Transferred 11 PCA fuel elements to ORR pool
4-7-86	Transferred 6 PCA fuel elements to ORR pool
4-8-86	Transferred 9 PCA fuel elements to ORR pool
4-9-86	Transferred 8 PCA fuel elements to ORR pool
4-10-86	Moved 4 shim-safety rods to pool storage racks
4-10-86	Moved 2 fission chambers to pool storage racks
4-10-86	Removed the BSR grid adapter and placed on pool floor (grid will now accept ORR fuel)
4-10-86	Replaced 4 shim safety rods and 2 fission chambers using BSR/ORR grid adapters into PCA grid
5-3-86	Shipped 17 PCA fuel elements to Savannah River plant
5-14-86	Pulled up 4 shim-safety rod fuel elements and measured the radiation of each
5-23-86	Shipped 17 PCA fuel elements to Savannah River plant

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 Specifications 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.

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