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Bulk Shielding Facility Quarterly Report October, November, and December 1986

T. P. Hamrick
F. E. Muggridge

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Operations Division
Reactor Operations Section

BULK SHIELDING FACILITY QUARTERLY REPORT OCTOBER, NOVEMBER, AND DECEMBER 1986

T. P. Hamrick
F. E. Muggridge

SPONSOR: J. H. Swanks
Operations Division

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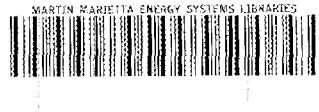

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BULK SHIELDING FACILITY QUARTERLY REPORT
OCTOBER, NOVEMBER, AND DECEMBER 1986

SUMMARY

The BSR operated at an average power level of 1564 kW for 22.3% of the time during October, November, and December. 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.

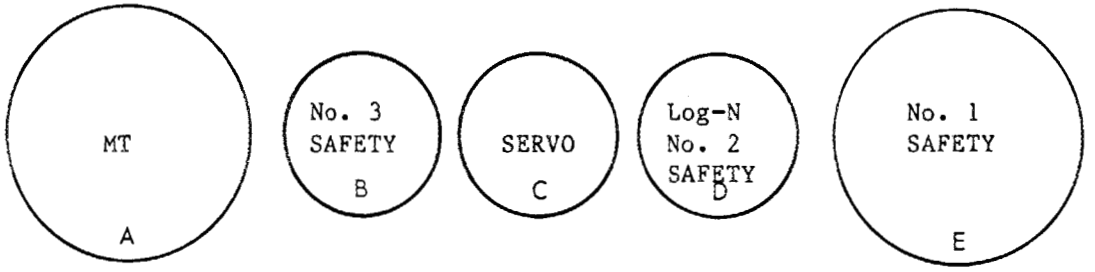
BULK SHIELDING FACILITY

OPERATIONS

The BSR remained down for most of the quarter due to no request to operate. The basic operating data are shown in Table 1. The periods of operation were used for personnel training, ATNIF sample irradiation, functional testing, LTNIF functional testing and first experiment run, and student training.

The preliminary work for the Low-Temperature Neutron Irradiation Facility (LTNIF) installation continues.

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 Low-Temperature Neutron Irradiaiton Facility.

BSR CORE

LOADING NO.	102
DATE	March 21, 1985
EXCESS REACTIVITY	4.95% $\Delta k/k$
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
(October-December 1986)

	This quarter	Last quarter	Year to date
Total energy, kWd	32,137	12,767	66,850
Average operating power, kW	1,564	1,934	1,508
Time operating, %	22.3	7.2	11.9
Reactor availability, %	99.9	99.9	99.9
Reactor water radioactivity, cpm/ml (av)	309	1,675	1,925
Reactor water resistivity, ohm-cm (av)	1,485,000	1,198,000	1,686,250
Research samples	8	8	25

Shutdowns

The reactor experienced twenty scheduled shutdowns and four unscheduled shutdowns during the quarter. The first unscheduled shutdown occurred when a noise spike from the micromicroammeter caused a reverse driving the rods to the seats. The second unscheduled shutdown occurred when Waste Operations Control Center experienced a high inert gas activity level entering the stack and requested that the BSR shut down. The third unscheduled shutdown occurred when the facility was discovered operating with only one CAM in the FRCAS. The fourth unscheduled shutdown occurred as a result of a log-N amplifier failure which caused a scram. Table 2 gives an analysis of the scheduled and unscheduled 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	8
Other samples	3
Maintenance:	
Functional systems checks	1
Quarterly checks	1
Reactor Operations:	
Training	7
Subtotal:	20
Unscheduled	
Experimenters:	0
Reactor Operations:	4
Subtotal:	4
TOTAL:	24

Table 3. Maintenance and changes, instrumentation and controls

Date	Components	Trouble/change	Maintenance performed
10-2-86	Servo module	Failure	Replaced the A/D converter
10-2-86	FRCAS	Routine	Made functional test
10-3-86	Connectors	Worn	Replaced three cable connectors on the servo module
10-7-86	Servo controller	Servo oscillation	Replaced software with an updated version
10-13-86	Nos. 1 and 2 safety channels	Zero shift	Adjusted
10-14-86	No. 3 safety chamber	Out of range	Repositioned chamber
10-14-86	Micromicroammeter	Noise	Replaced
10-22-86	Sigma amplifier	Failed	Replaced tube, calibrated, and returned to service
10-23-86 thru 10-24-86	Southwest CAM	Modified	The southwest CAM amlifier modified to include a slave recorder located in control room
10-23-86 thru 11-3-86	Southeast CAM	Chart drive failure	The southeast CAM chart drive repaired, calibrated, restored to service
10-29-86 thru 10-30-86	TV camera	New	Tested new TV cameras for remote monitoring
11-5-86	Signal for Emergency Response Center	New	Repaired and returned to service
11-14-86 thru 11-17-86	Log-N amplifier	Failed	Replaced amplifier, calibrated, and returned to service

Table 3. (Continued)

Date	Components	Trouble/change	Maintenance performed
12-1-86 thru 12-16-86	Instruments	Routine	Completed quarterly checks
12-1-86	Multipoint recorder	New	Installed a YEW multiple point recorder to replace two obsolete recorders
12-1-86	Chart drive motor	Failed	Replaced the No. 3 safety chart drive motor
12-1-86	Pool water level sensor	Upgrade	Installed additional relays to indicate either high or low pool water level
12-2-86	No. 6 rod lower limits contacts	Worn	Replaced
12-4-86	Auxillary fission chamber	New	Installed on instrument bridge for use by students
12-9-86	Servo controller	Servo oscillating	Adjusted servo deadband for smooth control
12-11-86	Cell ventilation radiation monitor	Zero shift	Adjusted set point for containment
12-11-86	Servo controller	Routine	Set algorithm for 2-MW operations
12-16-86	Power supply	Failure	Replaced bin No. 1 module power supply
12-17-86	Thermocouple	Failed	Replaced the heat exhcange outlet thermocouple (TT-13)
12-18-86	No. 2 sigma amplifier	Worn	Replaced chassis connector (input signal)

Table 3. (Continued)

Date	Components	Trouble/change	Maintenance performed
12-29-86	No. 3 safety recorder	Routine	Calibrated and aligned mechanical stop
12-30-86	Log-N amplifier	Failed	Replace tubes, calibrated, and returned to service
12-31-86	No. 2 sigma amplifier	Failed	Replaced

Table 4. Maintenance and changes, process systems

Date	Components	Trouble/change	Maintenance performed
10-3-86	Exit water control valve	Need additional shielding	Installed lead box over valve controller in valve pit
10-14-86	Phosphate pump	Failed	Repaired and returned to service
10-17-86 thru 10-20-86	Skimmer vent and NOG water trap	New	Installed new skimmer vent NOG line with water trap
11-4-86	Demineralizer	Routine	Oriented spool piece for backwashing, then re-oriented for service
11-9-86 thru 11-14-86	Demineralizer	Routine	Oriented spool piece for regeneration, then re-oriented for service
11-17-86	Filter	Routine	Cleaned demineralizer feed water filter
12-16-86	Demineralizer	Routine	Oriented spool piece for regeneration
12-19-86	Process sink	New	Open trench to receive drain line

Table 5. Maintenance and changes, mechanical systems

Date	Components	Trouble/change	Maintenance performed
10-3-86	Relay	Worn	Replaced relay K-53 on the servo demand
10-3-86	Control room air conditioner system	Belt worn	Replaced belt
10-29-86	Tower fan coupling	Coupling failure	Replaced the stainless steel shot in coupling and returned fan to service
11-2-86	Tower fan coupling	Coupling failure	Replaced stainless steel shot in the north and south couplings
12-1-86 thru 12-3-86	Relay contacts	Dirty	Cleaned all electrical contacts

Operational Activities

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

Table 6. Operational activities

Date	Remarks
10-3-86	Completed sweeping and brushing pool floor and walls
10-3-86	Operated the reactor for I&C personnel to make functional checks
10-6-86	Operated reactor for experiment LTNIF-1
10-8-86 thru 10-9-86	Operated reactor and irradiated sample 86-09-04
10-15-86	Operated reactor and irradiated sample 86-09-01
10-19-86	Completed irradiation of sample 86-09-02
10-22-86	Moved ATNIF to storage, installed flying bridge and zircaloy shield.
10-23-86	Removed zircaloy shield to storage, and installed ATNIF
10-25-86	Operated reactor and irradiated sample 86-09-03
10-3-86 thru 10-26-86	Conducted startup training for 10 operators
10-30-86	Operated reactor for experiment LTNIF-4
11-3-86	Operated reactor for visitors and photography
11-4-86	Operated reactor for experiment LTNIF-4
11-5-86	Operated reactor and irradiated sample 86-11-01
11-10-86	Operated reactor and irradiated sample 86-11-02
11-13-86	Moved ATNIF to storage, installed shield, removed bridge, and engaged core with dryostat
11-14-86 thru 11-17-86	Operated reactor experiment LTNIF-1

Table 6. (Continued)

Date	Remarks
11-21-86	Operated reactor for experiment LTNIF-3
11-21-86 thru 11-26-86	Operated reactor and irradiated sample 86-11-03
11-3-86 thru 11-26-86	Conducted startup training for 8 operators
12-4-86	Measured water depth in three pool deep wells, SE = 17.5 ft, SW = 15.5 ft, and NW = 20.0 ft (Ref. 830 ft normal pool water level)
12-5-86	Conducted training for students (ATC, RC, NAW, and SU) during off shift
12-5-86 thru 12-7-86	Maintained data log for LTNIF laboratory
12-7-86	Completed quarterly containment checks
12-8-86 thru 12-11-86	Operated reactor for experiments LTNIF-1
12-11-86 thru 12-12-86	Operated reactor and irradiated sample 86-12-01
12-12-86	Backwashed demineralizer cation
12-5-86 thru 12-14-86	Conducted startup training for 6 operators
12-16-86 thru 12-19-86	Regenerated cation
12-20-86	Completed quarterly emergency electrical power test

Experiments

Work relating to the Low-Temperature Neutron Irradiation Facility, LTNIF, is listed in Table 7.

Table 7. Experiment facilities activity, LTNIF

Date	Remarks
10-6-86	Operated reactor about 78 h for first stored energy run, LTNIF-1
10-30-86	Operated reactor about 4.7 h for experiment LTNIF-4
11-4-86	Operated reactor about 1.7 h for experiment LTNIF-4
11-11-86	Installed LTNIF-1 into cryostat
11-14-86 thru 11-17-f86	Operated reactor about 70 h for experiment LTNIF-1
11-21-86	Operated reactor 3.4 h for experiment LTNIF-3
12-2-86	Installed replacement experiment for LTNIF-1
12-8-86 thru 12-11-86	Operated reactor 70 h for experiment LTNIF-1

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	0	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
Low-Temperature Neutron Irradiation Facility (LTNIF)	Southwest corner of pool	Solid State

Demineralizer Performance

Table 10 gives detailed information on the condition of the primary water system for the preceding quarters 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
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	4-11-86	9-15-86	4,521,600	3,238	365	5.9	6.2	686,000	1,613,000
79	9-17-86	--	--	--	--	--	--	--	--

[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	6-29-86	3-21-86
Primary coolant flow channel calibration	9-30-86	12-13-85
Pool water-level channel calibration	9-30-86	6-30-86
Maximum rate of reactivity addition by the shim-safety rods	12-16-86	9-25-86
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	12-16-86	9-25-86
Semiannual		
Cell-ventilation filter efficiency		
A. Elemental iodine	7-23-86	12-19-85
B. Dioctyl phthalate	12-12-86	6-2-86
Radiation monitoring equipment calibration	12-1-86	8-28-86
Stack radiation monitor calibration	9-5-86	5-6-86
NOG filter system efficiency		
Elemental iodine test - east bank	9-23-86	5-15-86
Elemental iodine test - west bank	10-28-86	5-20-86
Dioctyl phthalate test - east bank	9-23-86	3-7-86
Dioctyl phthalate test - west bank	10-28-86	9-23-86

Table 11. (Continued)

Test	Most recent test	Previous test
Quarterly		
Safety channel No. 1 calibration	12-15-86	9-24-86
Safety channel No. 2 calibration	12-15-86	9-24-86
Safety channel No. 3 calibration	12-15-86	9-24-86
Log-N channel calibration	12-4-86	9-24-86
Fission chamber channel calibration	12-4-86	9-24-86
Flapper valve position channel functional test	12-16-86	9-30-86
Measurement of release time and time of flight for the shim-safety rods	12-16-86	9-25-86
Containment closure system functional test	12-7-86	9-28-86
In-leakage during containment mode	12-7-86	9-28-86
Others		
Calibration of shim-safety rods	5-2-86	3-22-85
Emergency electrical power test	12-20-86	7-16-86
LTNIF, pool water level, 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 to be upgraded. The fuel elements have been shipped to Savannah River for reprocessing.

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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