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**OAK RIDGE  
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**MARTIN MARIETTA**

**Bulk Shielding Facility  
Quarterly Report  
October, November, and December 1985**

T. P. Hamrick  
F. E. Muggridge

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Operations Division  
Reactor Operations Section

**BULK SHIELDING FACILITY QUARTERLY REPORT  
OCTOBER, NOVEMBER, AND DECEMBER 1985**

T. P. Hamrick  
F. E. Muggridge

SPONSOR: J. H. Swanks  
Operations Division

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## CONTENTS

	<u>Page</u>
LIST OF FIGURES . . . . .	v
LIST OF TABLES . . . . .	vii
SUMMARY . . . . .	1
BULK SHIELDING FACILITY . . . . .	1
OPERATIONS . . . . .	1
Shutdowns . . . . .	3
Maintenance and Changes . . . . .	4
Operational Activities . . . . .	8
Experiments . . . . .	8
Fuel . . . . .	9
Experiment Facilities Assignments . . . . .	10
Demineralizer Performance . . . . .	11
SUMMARY OF SURVEILLANCE TESTS AT THE BSR . . . . .	11
POOL CRITICAL ASSEMBLY . . . . .	15
OPERATIONS . . . . .	15
MAINTENANCE AND CHANGES . . . . .	15
SURVEILLANCE TESTS AT THE PCA . . . . .	15
DISTRIBUTION . . . . .	17



LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1	Core loading 102, BSR . . . . .	2



## LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	Basic operating data (October-December 1985) . . . . .	3
2	Analysis of shutdowns . . . . .	4
3	Maintenance and changes, instrumentation and controls . .	5
4	Maintenance and changes, process system . . . . .	7
5	Maintenance and changes, mechanical system . . . . .	8
6	Operational activities . . . . .	8
7	Experiment facilities activity, NLTNIF . . . . .	9
8	Fuel and shim-safety rod status . . . . .	10
9	Experiment facilities assignments . . . . .	11
10	Demineralizer performance data . . . . .	12
11	Summary of surveillance tests at the BSR . . . . .	13



**BULK SHIELDING FACILITY QUARTERLY REPORT  
OCTOBER, NOVEMBER, AND DECEMBER 1985**

SUMMARY

The BSR operated at an average power level of 364 kW for 76.6 h 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.

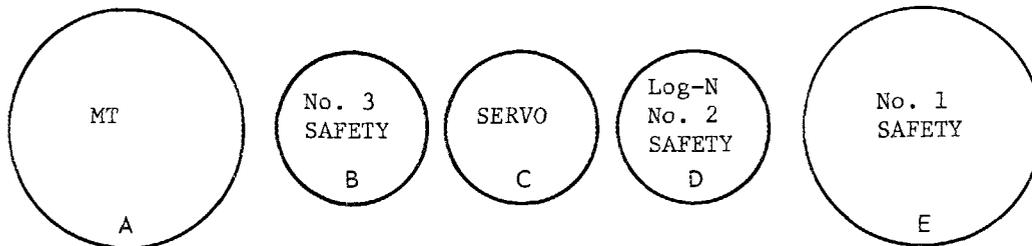
BULK SHIELDING FACILITY

OPERATIONS

The BSR remained down for most of the quarter due to no request to operate. The brief period of operation was used for personnel training, sample irradiation, functional testing, and two tour groups.

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

Core loading 102 is shown in Fig. 1.



### 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  $\approx$  1000 gpm.



81	82	83	84	FC	A1 Can	A1 Can	A1 Can	A1 Can
71	72	73	74	A1 Can	A1 Can	A1 Can	A1 Can	A1 Can
61	EAST	63	64	OR-98-F 200	BSF-S-17 64	BSF-A10 188	BSF-S-18 65	BSF-A9 178
51	D <sub>2</sub> O	53	54	BSF-T6 218	M-111-F 180	YZP-0049 204	BSF-T2 182	BSF-T5 215
41	TANK	43	44	BSF-S-T2 110	BSF-T1 173	BSF-S-T4 109	BSF-T3 198	A1 <sup>a</sup> Plug
31	32	33	34	M-110-F 181	M-59-H 202	M-102-F 198	M-104-F 202	BSF-T4 216
21	22	23	24	M-60-H 187	BSF-S-T1 85	M-95-F 185	BSF-S-T3 85	M-61-H 189
11	12	13	14	A1 Plug	A1 Plug	A1 Plug	A1 Plug	A1 Plug

<sup>a</sup>Core position for the National Low-Temperature Neutron Irradiation Facility.

Fig. 1. Core loading 102, BSR.

Table 1. Basic operating data  
(October-December 1985)

	This quarter	Last quarter	Year to date
Total energy, kWd	1162	23	4,076
Average operating power, kW	364	1,368	1,059
Time operating, %	3.6	0.02	4.2
Reactor availability, %	99.9	99.9	99.9
Reactor water radioactivity, cpm/ml(av)	BG	BG	1,475
Reactor water resistivity, ohm-cm (av)	1,871,000	1,818,000	1,605,000
Research samples	4	0	5 <sup>a</sup>

<sup>a</sup>Accumulated total.

### Shutdowns

The reactor experienced seventeen scheduled shutdowns during the quarter. 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)
<u>Scheduled</u>		
Experimenters:		
NLTNIF samples	4	584.517
Maintenance:		
Functional systems checks	6	750.133
Quarterly checks	1	120.532
Reactor Operations:		
Tours	2	123.635
Training	<u>5</u>	<u>552.551</u>
Subtotal:	18	2131.368
<u>Unscheduled</u>		
Experimenters:	0	0
Reactor Operations:	<u>0</u>	<u>0</u>
Subtotal:	0	0
TOTAL:	<u>18</u>	<u>2131.368</u>

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 3. Maintenance and changes, instrumentation and controls

Date	Components	Trouble/change	Reason for maintenance
10-2-85	FRCAS	Routine	Functional checks
10-3-85	CAM	Failure	Restored to service
10-14-85	Access/secure panel	Short	Lead chips fell into terminal board
10-16-85	No. 3 safety	Failure	Low recorder response
10-16-85 thru 10-24-85	$\Delta T$ sensor	Failure	No response, replaced sensor
10-18-85	$\Delta T$ recorder converter	Routine	Calibrated
10-21-85	Servo battery	Failure	Installed new battery
10-22-85	Thermocouple	Failure	Replaced heat exchanger outlet-temperature thermocouple
10-24-85	No. 3 safety	Failure	Replaced amplifier
10-24-85	Regulating rod recorder	Failure	Sticking switch
10-28-85 thru 10-29-85	No. 3 safety	Failure	Recorder driven downscale; verified that chamber had failed, and pulled chamber for decay and replacement
11-14-85	CAM	Failure	Repaired automatic tape advance
11-19-85 thru 11-21-85	Log-N	Nos. 1 and 2 rods dropped and fast scram occurred	Switch noise caused erratic operation
12-2-85 thru 12-3-85	Log-N	Fast scram occurred	Replaced log-N amplifier

Table 3. (Continued)

Date	Components	Trouble/change	Reason for maintenance
12-3-85	Monitrons	Routine	Calibration checks
12-5-85	Pump house monitron	Failure	Replaced relay
12-5-85 thru 12-18-85	West CAM	Failure	Electronic failure; repaired, and restored to service
12-5-85	East CAM	Failure	Repaired and restored to service
12-5-85	Log-N period recorder	Failure	Recorder pen stuck at infinity position
12-9-85 thru 12-19-85	Instruments	Routine	Quarterly checks
12-10-85	Conductivity meter	New	Calibrated and placed into service
12-19-85	Scram circuits	Change memo BSR-56	Disconnected scram circuits as per change memo BSR-56 and completed acceptance test
12-19-85	Misc. radiation recorder	Failure	Replaced chart drive motor

Table 4. Maintenance and changes, process systems

Date	Components	Trouble/change	Reason for maintenance
10-1-85 thru 10-14-85	Exit water line	Relocate shielding	Moved lead off process pipe and located on an independ- ently supported structure
10-15-85	Pool wall work station	Add shielding	Added two inches of lead shielding to pool wall to reduce personnel exposure during shim-safety rod inspection periods
12-9-85	Demineralizer	Routine	Changed spool piece for regeneration services
12-11-85	Skimmer filter	Routine	Removed lid for service then replaced
12-16-85	No. 2 north roof heating unit	Coil failure	Steam coil ruptured
12-17-85	Experiment NOG pressure	New	Installed a magnehelic gauge (0 to 50 in. H <sub>2</sub> O) at ATNIF NOG header
12-19-85	Cell vent filter	Routine	QD made element iodine and DOP tests

Table 5. Maintenance and changes, mechanical system

Date	Components	Trouble/change	Reason for maintenance
10-8-85	Overhead crane	Routine	Inspected, tested, and tagged
10-28-85 thru 10-29-85	No. 3 safety	Failed	Pulled up for decay and replacement
10-30-85	Bridge crane	Routine	Annual service check

#### Operational Activities

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

Table 6. Operational activities

Date	Remarks
11-6-85	Completed FRCAS checks
12-18-85	Completed cell vent quarterly checks

#### Experiments

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

Table 7. Experiment facilities activity, NLTNIF

Date	Remarks
10-4-85	Water pump switch box transformer burned
10-7-85 thru 10-14-85	Reinforced poolside jib crane and painted
10-21-85	Installed cryostat service pipe
10-21-85	Load tested poolside jib crane, crane certified for use
10-29-85	Installed nitrogen heat exchanger in pool at southwest corner
11-13-85	Helium compressor testing in progress using tower sump water for cooling
12-4-85	Operated helium compressors for functional testing
12-13-85	Moved dewar off 900-lb base to clear way for overhead bridge
12-17-85 thru 12-22-85	Irradiated 4 samples using the ATNIF in CP-49

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	0
Shim-safety rod fuel elements depleted	0	0	0
New fuel elements placed in service	0	0	1
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	1	1	1
New shim-safety rod fuel elements available	7	7	7
Partially depleted fuel elements available for use (includes core)	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

#### Experiment Facilities Assignments

Experiment facilities assignments are listed in Table 9. The tubes of the east D<sub>2</sub>O 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 <sub>2</sub> O tank	Operations
Wet thermal-neutron tubes (D-4-1 and -2, D-6-1, -2, -3, -4, and -5)	East D <sub>2</sub> O tank	Operations
National Low-Temperature Neutron Irradiation Facility <sup>a</sup> (NLTNIF)	Southwest corner of pool	Solid State

<sup>a</sup>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
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 <sup>a</sup>	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 <sup>a</sup>	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 <sup>a</sup>	9-22-84	8-30-83	1,900,000	527	59	5.2	5.4	1,180,000	2,034,000
71 <sup>b</sup>	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 <sup>a</sup>	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	--	--	--	--	--	--	--	--

<sup>a</sup>New resin in the demineralizer columns.

<sup>b</sup>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
<u>Biennial tests</u>		
Inspection of the shim-safety rods	9-23-85	8-28-84
<u>Annual tests</u>		
Core $\Delta T$ channel calibration	9-17-85	12-13-84
Primary coolant flow channel calibration	9-17-85	12-13-84
Pool-water level channel calibration	10-1-85	6-10-85
Maximum rate of reactivity addition by the shim-safety rods	12-12-85	9-30-85
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	6-7-85	3-7-85
<u>Semiannual</u>		
Cell-ventilation filter efficiency		
A. Elemental iodine	12-19-85	9-26-85
B. Dioctyl phthalate	12-19-85	9-26-85
Radiation monitoring equipment calibration	12-2-85	9-18-85
Stack radiation monitor calibration	10-8-85	6-6-85
<u>Quarterly</u>		
Safety channel No. 1 calibration	12-11-85	9-25-85
Safety channel No. 2 calibration	12-11-85	9-25-85
Safety channel No. 3 calibration	12-11-85	9-25-85
Log-N channel calibration	12-11-85	9-25-85

Table 11. (Continued)

Test	Most recent test	Previous test
<u>Quarterly</u> (continued)		
Fission chamber channel calibration	12-11-85	9-24-85
Flapper valve position channel functional test	12-19-85	9-30-85
Measurement of release time and time of flight for the shim-safety rods	12-12-85	9-30-85
Containment closure system functional test	12-18-85	9-27-85
In-leakage during containment mode	12-18-85	9-27-85
<u>Others</u>		
Calibration of shim-safety rods	3-22-85	9-12-83

## POOL CRITICAL ASSEMBLY

## OPERATIONS

The Pool Critical Assembly (PCA) is shutdown for shim-safety rod magnets and associated electronic components upgrading.

## MAINTENANCE AND CHANGES

No PCA maintenance activities are reported this quarter.

## 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.<sup>1</sup>

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



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