



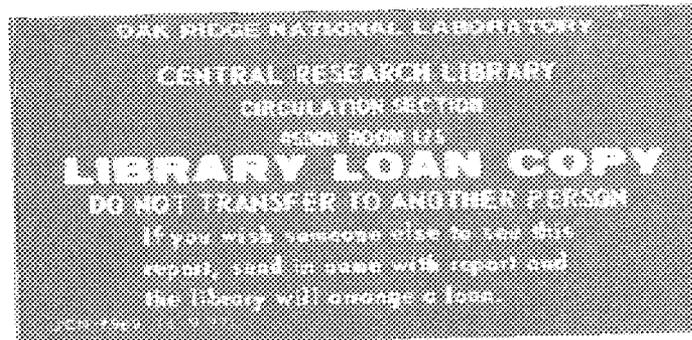
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**OAK RIDGE  
NATIONAL  
LABORATORY**

**MARTIN MARIETTA**

**Bulk Shielding Facility  
Quarterly Report  
July, August, and September 1988**

D. L. Laughlin  
F. E. Muggridge



OPERATED BY  
MARTIN MARIETTA ENERGY SYSTEMS, INC.  
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DEPARTMENT OF ENERGY

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Research Reactors Division  
Reactor Operations Section

**BULK SHIELDING FACILITY QUARTERLY REPORT  
JULY, AUGUST, AND SEPTEMBER 1988**

D. L. Laughlin  
F. E. Muggridge

SPONSOR: A. L. Lotts  
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# BULK SHIELDING FACILITY QUARTERLY REPORT JULY, AUGUST, AND SEPTEMBER 1988

## SUMMARY

The Bulk Shielding Reactor (BSR) remained shut down during July, August, and September. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory.

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

## BULK SHIELDING FACILITY

### OPERATIONS

Core loading 103 is shown in Fig. 1. However, the shim-safety rod calibrations are not complete due to a reactor shutdown ordered by the Department of Energy on March 26, 1987.

The BSR remained down during the quarter as ordered by the Department of Energy. The basic operating data are shown in Table 1.

The Low-Temperature Neutron Irradiation Facility (LTNIF) functional testing and facility upgrading continues.

### Shutdowns

The reactor remained shut down during the quarter. 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.

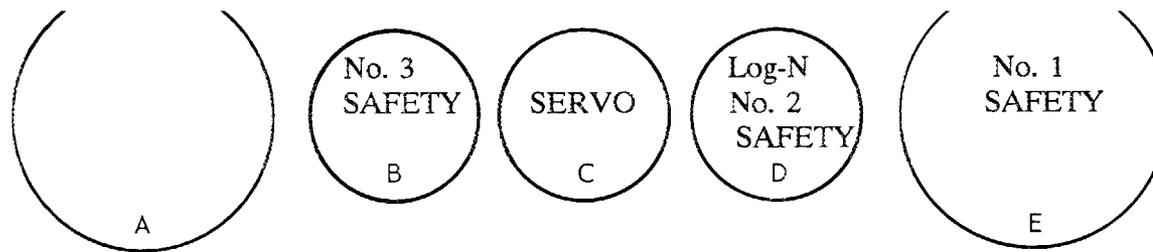
Maintenance and changes of the mechanical systems are listed in Table 5.

### Operational Activities

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

### Experiments

Work relating to LTNIF is listed in Table 7.



ORNL/DWG 87-10730

**BSR CORE**



				(C)	AL	AL	AL	AL
81	82	83	84	85	86	87	88	89
				AL	AL	AL	AL	AL
71	72	73	74	75	76	77	78	79
	EAST			OR-98-F	BSF-S-17	BSF-A10	BSF-S-18	B-83-1
61	62	63	64	193	63	182	64	201
	D <sub>2</sub> O			BSF-T6	M-111-F	YZP-0049	BSF-T2	BSF-T5
51	52	53	54	211	174	196	176	211
	TANK			BSF-S-T2	BSF-T3	BSF-S-T4	B-83-2	(a)
41	42	43	44	107	190	107	201	
				M-110-F	M-59-H	M-102-F	M-104-F	BSF-T4
31	32	33	34	176	194	190	195	211
				M-60-H	BSF-S-T1	M-95-F	BSF-S-T3	M-61-H
21	22	23	24	184	83	180	83	186
11	12	13	14	15	16	17	18	19

LOADING NO. 103

DATE March 24, 1987

EXCESS REACTIVITY (b)

OPERATING MASS 3958 g

ROD POSITIONS AT CRITICAL  
(With Operating Mass)

ROD NO.	IN. WITHDRAWN	
1	10.05	11.75
2	10.05	11.75
3	10.05	11.75
4	10.05	11.75
5	23.00	11.75
6	23.00	11.75

REMARKS:

DOE mandated reactor to be shut down 4 p.m., March 26, 1987

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

<sup>b</sup>Rod calibrations are not complete due to a DOE mandated reactor shutdown on March 26, 1987.

<sup>c</sup>Fission chamber.

Fig. 1. Core loading 103, BSR.

Table 1. Basic operating data  
(July-September 1988)

	This quarter	Last quarter	Year to date
Total energy, kWd	0	0	0
Average operating power, kW	0	0	0
Time operating, %	0	0	0
Reactor availability, %	99.9	99.9	99.9
Reactor water radioactivity, cpm/ml (av)	BG	BG	BG
Reactor water resistivity, ohm-cm (av)	963,000*	787,000	1,186,000
Research samples	0	0	0

\*Demineralizer system was shut off August 1, 1988.

Table 2. Analysis of shutdowns\*

Description of shutdown	Number
Scheduled:	0
Unscheduled:	0
<b>TOTAL:</b>	<b>0</b>

\*The Department of Energy ordered the reactor to be shut down on March 26, 1987. The reactor did not operate during the report period.

Table 3. Maintenance and changes, instrumentation and controls

Date	Components	Trouble/change	Maintenance performed
7-14-88 thru 7-20-88	PCA monitron	Failed	I&C retubed and recalibrated
8-5-88	PA	Water in conduit	Repaired
8-15-88 thru 8-22-88	Instruments	Routine	I&C performed annual checks
8-18-88	FRCAS	Routine	Bimonthly checks
8-21-88	Electrical power	Outage	Electrical power outage due to failed insulators at substation
9-8-88 thru 9-21-88	Primary flow transmitters	Failed on calibration	Replaced
9-13-88 thru 9-29-88	Instruments	Routine	Quarter checks
9-17-88	East CAM	Inoperative	I&C repaired

Table 4. Maintenance and changes, process systems

Date	Components	Trouble/change	Maintenance performed
7-11-88	Skimmer filter	Routine	Cover removed for servicing, then returned to normal use
7-18-88 thru 8-3-88	AC NO. 7	Upgrade	Replaced worn out unit and insulated duct
7-18-88 thru 7-20-88	Control room AC	Failed	Repaired
7-26-88	Scott air-packs	New	Placed in area for Fire Department's use during emergencies
7-27-88	Cell vent filters	Routine	QA&I made iodine test
8-25-88	Radio transformer	Failed	Radio sent to Salvage
8-29-88	Acid tank relief valve	Routine	QA&I tested relief valve

Table 5. Maintenance and changes, mechanical systems

Date	Components	Trouble/change	Maintenance performed
7-19-88 thru 7-22-88	Dry tube	Upgrade	Modified dry tube by reducing length and mounted in pool
7-28-88	CAM	Routine	P&E made quarterly inspection
8-26-88	PCA monitron	New	P&E installed electrical plug
9-29-88	Emergency light	New	Installed so that overhead bay lights could be turned off

Table 6. Operational activities

Date	Remarks
7-11-88	Replaced skimmer filters
7-12-88	Made quarterly functional test on confinement system
7-12-88	Made quarterly functional test on emergency electrical power system
7-13-88	Transferred dry tube from ORR storage to the BSR bay area
8-1-88	Shut down demineralizer system for routine regeneration
8-3-88	Transferred duplicate engineering drawing to BSR files
8-18-88	Transferred fuel catch basket from ORR storage to the BSR bay area
8-24-88	Transferred six LEU type fuel elements from the ORR to the BSR pool
8-25-88	Reported fire which was due to a failed radio transformer
8-25-88	Transferred eight LEU fuel elements from the ORR to the BSR pool
8-26-88	Transferred ten LEU fuel elements from the ORR to the BSR pool
8-29-88	Transferred eight LEU fuel elements from the ORR to the BSR pool
9-1-88	Rebagged stored equipment using yellow bags
9-1-88	Returned the fuel catch basket to the ORR tool storage area
9-6-88	Measured a Co <sup>60</sup> source strength using an ORNL Q2818H chamber (at one foot source measured 73,000 R/h)
9-14-88	Installed experiment for gamma irradiation life test (75,000 R/h) using Co <sup>60</sup> source
9-15-88	Experiment microprocessor failed, removed experiment, repaired and repositioned experiment for life test at about 25,000 R/h
9-22-88	Transferred the radium-boron source to the reactor core for making adjustment to fission chambers, then returned the source to storage
9-28-88	Made confinement quarterly tests
9-28-88	Completed the emergency electrical power quarterly test

Table 7. Experiment facilities activity, LTNIF

Date	Remarks
9-20-88	Equipment transferred from reactor bay storage to LTNIF room storage

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	0
New shim-safety rod fuel elements placed in service	0	0	0
Partially depleted shim-safety rod fuel elements (HEU)	6	6	6
New fuel elements (HEU) available for use	15	15	15
New shim-safety rod fuel elements (HEU) available	7	7	7
Partially depleted fuel elements (HEU) available for use (includes core)	30	30	30
Partially depleted fuel elements (LEU) for PCA	32	0	32
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	Research Reactors
Wet thermal-neutron tubes (D-4-1 and -2, D-6-1, -2, -3, -4, and -5)	East D <sub>2</sub> O tank	Research Reactors
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.

### Gas Filter Status

Table 11 gives detailed information on the condition of both the cell vent and NOG filters.

## SUMMARY OF SURVEILLANCE TESTS AT THE BSR

Table 12 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
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	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	11-1-86	1,094,400	1,122	141	5.8	5.9	939,000	2,165,000
80	11-14-86	1-26-87	530,000	1,910	162	6.0	6.4	641,000	1,583,000
81 <sup>a</sup>	1-30-87	9-3-87	4,665,600	374	47	5.6	5.7	922,000	1,708,000
82	9-8-87	8-1-88	9,388,800	--	--	5.5	5.6	1,612,000	3,224,000

<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. Gas filter status

Filter system	Type filter	Bank designation	Filter segment	Date changed	Date of last test	Date of previous test	Type test	Efficiency (%)
Cell vent	HEPA	North (5857)	East West	9-17-85 8-17-83	6-2-88	12-15-87	DOP	99.980
Cell vent	HEPA	Center (5858)	East West	9-17-85 8-17-83	6-2-88	12-15-87	DOP	99.980
Cell vent	HEPA	South (5859)	East West	9-17-85 8-17-83	6-2-88	12-15-87	DOP	99.975
Cell vent	Charcoal	North (612)	Overall	10-8-87	7-27-88	1-6-88	I	98.635
Cell vent	Charcoal	Center (613)	Overall	10-8-87	7-27-88	1-6-88	I	98.652
Cell vent	Charcoal	South (614)	Overall	10-8-87	7-27-88	1-6-88	I	99.184
NOG	HEPA	East (5650)	Overall	3-29-88	9-20-88	3-29-88	DOP	99.996
NOG	HEPA	West (5651)	Overall	3-29-88	9-20-88	3-29-88	DOP	99.996
NOG	Charcoal	East (610)	Overall	3-29-88	6-23-88	12-21-87	I	99.940
NOG	Charcoal	West (609)	Overall	3-29-88	6-21-88	12-21-87	I	99.972

Table 12. Summary of surveillance tests at the BSR

	Most recent test	Previous test
<u>Biennial tests</u>		
Inspection of the shim-safety rods	1-22-87	9-23-85
<u>Annual tests</u>		
Core dT channel calibration	9-27-88	9-25-87
Core dP channel calibration	9-28-88	9-30-87
Primary coolant flow channel calibration	9-28-88	9-30-87
Pool water-level channel calibration	9-29-88	9-30-87
Maximum rate of reactivity addition by the shim-safety rods	3-26-87*	12-16-86*
Reactivity assigned to the servo-control system	3-26-87*	5-2-86*
Subcriticality with each shim-safety rod at its upper limit while all other shim-safety rods are fully inserted	9-22-88	6-13-88
<u>Semiannual</u>		
Cell ventilation filters		
HEPA filters:		
North	6-2-88	12-15-87
Center	6-2-88	12-15-87
South	6-2-88	12-15-87
Charcoal filters:		
North	7-27-88	1-6-88
Center	7-27-88	1-6-88
South	7-27-88	1-6-88
Continuous air monitor	8-5-88	5-5-88
Radiation monitor	9-6-88	6-3-88
Stack radiation monitor calibration	7-5-88	2-26-88

Table 12. (Continued)

	Most recent test	Previous test
<u>Semiannual (continued)</u>		
NOG filter system efficiency		
Elemental iodine test - east bank	6-23-88	3-2-88
Elemental iodine test - west bank	6-21-88	12-21-87
Diocetyl phthalate test - east bank	9-20-88	3-29-88
Diocetyl phthalate test - west bank	9-20-88	3-29-88
<u>Quarterly</u>		
Safety channel No. 1 calibration	9-19-88	6-7-88
Safety channel No. 2 calibration	9-20-88	6-7-88
Safety channel No. 3 calibration	9-20-88	6-7-88
Log-N channel calibration	9-19-88	6-7-88
Fission chamber channel calibration	9-22-88**	5-26-88**
Flapper valve position channel functional test	9-29-88	6-14-88
Measurement of release time and time of flights for the shim-safety rods	9-22-88	6-13-88
Containment closure system functional test	9-28-88	7-12-88
In-leakage during containment mode	9-28-88	7-12-88
<u>Ten year</u>		
Syphon break system functional test	7-17-86	3-11-82
Reactor containment inspection	9-22-83	1-3-75

Table 12. (Continued)

	Most recent test	Previous test
<u>Ten year (continued)</u>		
Support structure inspection	9-22-83	1-3-75
Reactor bridge inspection	8-30-85	10-12-72
Primary piping (in-pool) inspection	6-16-87	1-3-75
Primary piping (pump house) inspection	9-4-85	10-12-72
Primary piping (valve pit) inspection	8-26-85	10-12-72
Primary pump (when accessible) inspection	3-19-81	5-5-80
<u>Others</u>		
Calibration of shim-safety rods	3-26-87*	5-2-86
Emergency electrical power test	9-28-88	7-12-88
LTNIF, pool water level, functional test	6-23-88	6-5-87
Flying bridge structure inspection	1-27-88	--
Work platforms (southeast and southwest) structure inspection	1-27-88	--
BSR heat exchanger internal inspection	5-13-87	--

\*Rod calibrations are not complete due to the DOE-ordered shutdown on March 26, 1987.

\*\*Counts not sufficient to make calibration check. This will be done prior to reactor start-up.

## POOL CRITICAL ASSEMBLY

## OPERATIONS

The PCA is shut down for shim-safety rod magnets and associated electronic components to be upgraded. The HEU type fuel elements have been shipped to Savannah River for reprocessing. During August, thirty-two partially spent LEU type fuel elements were transferred from the ORR pool to the BSR pool.

## 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>

---

<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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