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MARTIN MARIETTA

Bulk Shielding Facility Semiannual Report July–December 1990

D. L. Laughlin
G. H. Coleman

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Research Reactors Division
"B" Reactors Section

**BULK SHIELDING FACILITY SEMIANNUAL REPORT
JULY - DECEMBER 1990**

D. L. Laughlin
G. H. Coleman

SPONSOR: H. A. Glovier
Research Reactors Division

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ACRONYMS

AC	air conditioner
BG	background
BSR	Bulk Shielding Reactor
CAM	constant air monitor
DOE	Department of Energy
DOE-ORO	Department of Energy Oak Ridge Operations
DOP	dioctylphthalate
dP	difference of pressure
dT	difference of temperature
FR&CAS	Facility Radiation and Contamination Alarm System
HEPA	high-efficiency particulate, air
HEU	high-enriched uranium
HP	Health Physics
I&C	Instrumentation and Controls Division
LEU	low-enriched uranium
LTNIF	Low-Temperature Neutron Irradiation Facility
NOG	normal off-gas
P&E	Plant and Equipment Division
PCA	Pool Critical Assembly
QA&I	Quality Assurance & Inspection
RRD	Research Reactors Division
RORC	Reactor Operations Review Committee
SOI	Special Operating Instructions
SRO	Senior Reactor Operator

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**BULK SHIELDING FACILITY SEMIANNUAL REPORT
JANUARY through JUNE 1990**

SUMMARY

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

The Pool Critical Assembly (PCA) remains shut down.

BULK SHIELDING FACILITY

OPERATIONS

The BSR core is shown in Fig. 1. However, the shim-safety rod calibrations are not complete because of a reactor shutdown ordered by the Department of Energy (DOE) on March 26, 1987.

The BSR remained down during the period as ordered by the DOE. The basic operating data are shown in Table 1.

Shutdowns

The reactor remained shut down during the report period. 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.

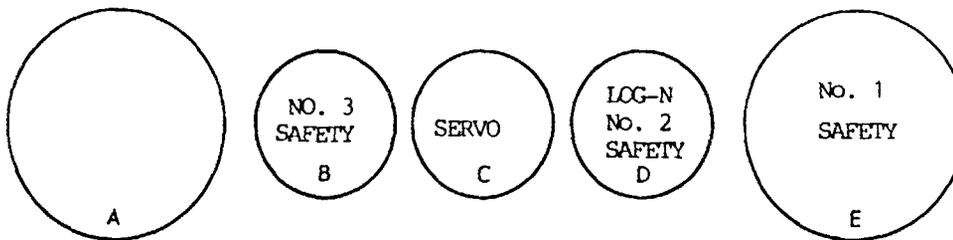
Maintenance and changes of the mechanical systems are listed in Table 5.

Operational Activities

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

Experiments

There was no work relating to the Low-Temperature Neutron Irradiation Facility (LTNIF).



ORNL/DWG 89-7898

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				BSF-S-17 63		BSF-S-18 64	
61	62	63	64	65	66	67	68	69
	D ₂ O							
51	52	53	54	55	56	57	58	59
	TANK			BSF-S-T2 107		BSF-S-T4 107		(a)
41	42	43	44	45	46	47	48	49
31	32	33	34	35	36	37	38	39
					BSF-S-T1 83		BSF-S-T3 83	
21	22	23	24	25	26	27	28	29
11	12	13	14	15	16	17	18	19

LOADING NO.	
DATE November 16, 1988	
EXCESS REACTIVITY (b)	
OPERATING MASS 507g	
ROD POSITIONS AT CRITICAL (With Operating Mass)	
ROD NO.	IN. WITHDRAWN ²
1	
2	
3	
4	
5	
6	
REMARKS: DOE mandated reactor to be shutdown 4 p.m., March 26, 1987	

- (a) Core position for the Low-Temperature Neutron Irradiation Facility.
- (b) Rod calibrations are not complete due to a DOE mandated reactor shutdown on March 26, 1987.
- (c) Fission chamber.

Fig. 1 BSR Core

Table 1. Basic operating data
(July - December 1990)

	This period	Last period
Total energy, kWd	0	0
Average operating power, kW	0	0
Time operating, %	0	0
Reactor availability, %	0	0
Reactor water radioactivity, cpm/mL (av)	BG	BG
Reactor water resistivity, ohm-cm (av)	762,497	730,716
Research samples	0	0

Table 2. Analysis of shutdowns^a

Description of shutdown	Number
Scheduled	0
Unscheduled	0
Total	0

^aThe 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
8/15/90	CAMs	Routine	I&C calibrated air flow.
8/27/90	CAMs	Routine	I&C changed out charts.
9/5/90	Quarterly checks	Routine	I&C performed third-quarter surveillance instrument functional tests.
9/28/90	FR&CAS	Routine	I&C performed bimonthly check.
10/5/90	Monitrons	No response	I&C repaired NW & SW monitrons.
10/12/90	Containment panel	Burned out lights	I&C relamped.
10/15/90	High bay monitron	Spiking	I&C retubed monitron.
11/13/90	FR&CAS	Routine	I&C performed quarterly check.
11/16/90	Resistance recorder	Routine	I&C calibrated demineralizer resistance recorder in control room.
11/29/90	Quarterly checks	Routine	I&C performed fourth-quarter surveillance instrument functional tests.
12/13/90	FR&CAS	Routine	I&C performed bimonthly check.

Table 4. Maintenance and changes - process systems

Date	Component	Trouble/change	Maintenance performed
7/3/90	Control room AC	Defective belt	Belt replaced.
7/17/90	Building 3117		P&E painted wooden steps with non-skid paint.
7/26/90	Truck doors	Broke lock hasp	P&E repaired.
7/31/90	Exit lights	Burned out	P&E relamped.
7/31/90	AC pump	Seal leak	P&E tightened packing.
8/1/90	CAMs	Routine	P&E performed programmed maintenance on building CAMs.
8/6/90	Acid tank	New	P&E installed new sulfuric acid tank in Building 3119.
8/15/90	Control room lights	Burned out	P&E relamped.
8/22/90	Acid pump	Routine	P&E performed programmed maintenance on secondary tower acid pump.
9/28/90	Safety shower	Leaking	P&E replaced valve on safety shower in Building 3119.
10/12/90	Truck doors	Routine	P&E performed programmed maintenance
10/16/90	Roof	Leaking	P&E repaired.
10/22/90	AC units	Routine	P&E performed programmed maintenance on Building 3010 AC units.

Table 4. Continued

Date	Component	Trouble/change	Maintenance performed
10/31/90	Electrical weatherhead	Height violation	P&E raised NE drop weatherhead for PCA power and replaced PCA clean power breaker panel.
11/6/90	Building lights	Burned out	P&E relamped in Buildings 3098 and 3119.
11/8/90	Building steam	Leaks	P&E repaired steam trap and leaks at Building 3117.
11/13/90	Control room lights	Burned out	P&E relamped.
11/20/90	Unit heaters	Routine	P&E performed programmed maintenance on four unit heaters in Building 3010 pool room.
11/29/90	Overhead crane	Routine	QA&I inspected and tagged.
12/4/90	Relief valves	Routine	QA&I tested Building 3009 air dryer and air separator relief valves.
12/12/90	CAMs	Routine	P&E performed programmed maintenance.
12/12/90	Cell vent	Routine	QA&I performed DOP test on HEPA filters.
12/17/90	Pumps and fans	Routine	P&E performed programmed maintenance on AC and secondary pumps, primary and demineralizer pump, acid pump, and N&S tower fans.
12/28/90	Skimmer pump	routine	P&E performed programmed maintenance.

Table 5. Maintenance and changes - mechanical systems

Date	Components	Trouble/change	Maintenance performed
	None	None	None

Table 6. Operational activities

Date	Remarks
7/2/90	Fire Department inspected Scott air packs in control room.
7/13/90	Building 3083 cleaned out. It will be used for storage of BSR I&C spare parts.
7/26/90	Posted tank air permit on Building 3117 sulfuric acid tank.
9/5/90	HP performed performance and functional test of building CAMs and monitrons.
9/5/90	Removed concrete shield from primary exit valve pit for I&C check of radiation probes and inspection of pit. Shield reinstalled after inspection.
9/6/90	Nuclear Materials Controls and Accountability personnel conducted annual audit of MBA-020.
9/10/90	Escorted W. C. Harris and Allan Lewis of RRD and two NUS personnel on a pre-OSHA survey and assessment of bay area.
9/11/90	Moved frisker from control room to SE exit door to permit frisking when leaving Building 3010.
9/12/90	Escorted Ed Kendall, Leonard Blankner, and two other DOE inspectors for BSR evaluation.

Table 6. Continued

Date	Remarks
9/18/90	Fire Department replaced the two spare air cylinders and the two in the Scott air packs in the control room.
9/18/90	Performed third-quarter containment system quarterly functional checks.
9/20/90	A 1-L sample of demineralizer inlet water sent to lab for gross alpha and beta analysis for Paul Taylor.
9/27/90	DOE subcontractor Jerry Cunningham met with Gary Coleman as a follow-up on containment of sources NE corner of bay area.
9/28/90	HP posted regulated area signs on doors to Building 3010.
10/2/90	HP performed performance and functional test of building CAMs and monitrons.
10/8/90	Jack Richard, Hal Glovier, Wilbur Harris, and Roger Stover inspected Buildings 3010, 3101, 3117, and 3119.
10/18/90	Posted a warning sign and checklist next to pool demineralized water makeup valve and the valve used to prime skimmer pump. Both valves locked with 3A locks. An operator and an SRO must be present when either valve is operated.
10/23/90	Telephone personnel repaired telephone 4-7004 in Building 3119.
10/26/90	Toured two Tiger Team members and Dick Rothrock of RRD through BSR on criticality safety.
10/30/90	T. Stone of Nuclear Materials Control and Accountability and three DOE-ORO auditors audited MBA-020.
10/30/90	Escorted Dr. Martin H. McBride and Leonard Blankner of DOE site office on routine inspection of BSR.
10/31/90	Toured Tiger Team whose specialty is drainage systems at BSR.
10/31/90	Weighed a BSR dummy fuel element for R. E. Schreiber. Weighed 11.5 pounds.
11/1/90	Met with Tiger Team members for personnel safety, radiological safety, maintenance and auxiliary systems at Building 3119.

Table 6. Continued

Date	Remarks
11/2/90	Posted Material Safety Data Sheets on chemical tanks at Building 3117 and 3119.
11/5/90	Turned on steam and heaters for BSR area.
11/5/90	HP performed functional and performance check of building monitrons and CAMs.
11/14/90	Fire Department inspected the Scott air packs in the control room.
12/3/90	HP performed functional and performance check of building monitrons and CAMs.
12/3/90	HP replaced frisker probe to correct spurious spiking to alarm setting.
12/13/90	Sample of pool water sent to Analytical Chemistry for radiochemical analysis.
12/18/90	Placed the "B" Reactor SOI Manual in the control room.
12/21/90	Performed fourth-quarter containment system quarterly functional checks.
12/31/90	Sampled secondary water system once a month during report period and sent to Industrial Hygiene for <i>Legionella</i> analysis.
12/31/90	Water quality during the report period: inlet resistivity 762,497 ohm-cm and water radioactivity c/m/mL BG.

Fuel

Changes in the fuel inventory are reported in Table 7.

Table 7. Fuel and shim-safety rod status

	This period	Last period
Fuel elements depleted	0	0
Shim-safety rod fuel elements depleted	0	0
New fuel elements placed in service	0	0
New shim-safety rod fuel elements placed in service	0	0
Partially depleted shim-safety rod fuel elements (HEU)	6	6
Partially depleted shim-safety rod fuel elements (HEU) for PCA	4	4
New fuel elements (HEU) available for use	15	15
New shim-safety rod fuel elements (HEU) available	7	7
Partially depleted fuel elements (HEU) available for use	30	30
Partially depleted fuel elements (LEU) for PCA	32	32
Partially depleted fuel elements (HEU) for PCA	1	1
New boron stainless steel shim-safety rods placed in service	0	0
Boron stainless steel shim-safety rods in service	6	6
Boron stainless steel shim-safety rods available for use	1	1

Experiment Facilities Assignments

Experiment facilities assignments are listed in Table 8. The tubes of the east D₂O tank are not permanently assigned; they have been used by various Laboratory personnel for short-term sample irradiations.

Table 8. Experiment facilities assignments

Facility	Location	Division or sponsor
Dry thermal-neutron tubes (D-3-1 and -2)	East D ₂ O tank	Research Reactors
Wet thermal-neutron tubes (D-4-1 and -2, D-6-1, -2, -3, -4 and -5)	East D ₂ O tank	Research Reactors
Low-Temperature Neutron Irradiation Facility (LTNIF)	Southwest corner of pool	Solid State

Gas Filter Status

Table 9 gives detailed information on the condition of both the cell vent and NOG filters.

SUMMARY OF SURVEILLANCE TESTS AT THE BSR

Table 10 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 that are not reported are satisfied by routine completion of daily and weekly checksheets, startup checklists, hourly data sheets, the operating log book, and miscellaneous quality assurance tests.

Table 9. Gas filter status

Filter system	Type filter	Bank designation	Filter segment	Date changed	Date of last test	Previous test	Type test	Efficiency (%)
Cell vent	HEPA	North (5857)	East West	9/17/89 8/17/83	12/12/90	6/13/90	DOP	99.996
Cell vent	HEPA	Center (5858)	East West	9/17/85 8/17/83	12/12/90	6/13/90	DOP	99.994
Cell vent	HEPA	South (5859)	East West	9/17/85 8/17/83	12/12/90	6/13/90	DOP	99.997
Cell vent	Charcoal	North (612)	Overall	10/8/87	7/27/88	1/6/88	Iodine	98.635
Cell vent	Charcoal	Center (613)	Overall	10/8/87	7/27/88	1/6/88	Iodine	98.652
Cell vent	Charcoal	South (614)	Overall	10/8/87	7/27/88	1/6/88	Iodine	99.184
NOG	HEPA	East (5650)	Overall	1/27/89	9/27/90	3/22/90	DOP	99.998
NOG	HEPA	West (5651)	Overall	1/27/89	9/27/90	3/22/90	DOP	99.998
NOG	Charcoal	East (610)	Overall	1/27/89	2/1/89	6/23/88	Iodine	99.883
NOG	Charcoal	West (609)	Overall	1/27/89	1/31/89	12/29/89	Iodine	99.900

Table 10. Summary of surveillance tests at the BSR

Test	Most recent test	Previous test
<i>Biennial tests</i>		
Inspection of the shim-safety rods	1/22/87 ^a	9/23/85 ^a
<i>Annual tests</i>		
Core dT channel calibration	9/27/88 ^a	9/25/87
Core dP channel calibration	9/28/88 ^a	9/30/87
Primary coolant flow channel calibration	9/28/88 ^a	9/30/87
Pool water-level channel calibration	9/29/88 ^a	9/30/87
Maximum rate of reactivity addition by the shim-safety rods	3/26/87 ^b	12/16/86 ^b
Reactivity assigned to the servo-control system	3/26/87 ^b	5/2/86 ^b
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
<i>Semiannual</i>		
Cell ventilation filters		
HEPA filters:		
North	12/12/90	6/13/90
Center	12/12/90	6/13/90
South	12/12/90	6/13/90
Charcoal filters:		
North	7/27/88 ^a	1/6/88
Center	7/27/88 ^a	1/6/88
South	7/27/88 ^a	1/6/88
Continuous air monitor	12/4/90	5/15/90
Radiation monitor	12/3/90	5/15/90
Stack radiation monitor calibration	9/4/90	3/27/90

Table 10. Continued

Test	Most recent test	Previous test
<i>Semiannual (continued)</i>		
NOG filter system efficiency		
Elemental iodine test - east bank	2/1/89 ^a	6/23/88
Elemental iodine test - west bank	1/31/89 ^a	12/19/88
Diocetyl phthalate test - east bank	9/27/90	3/22/90
Diocetyl phthalate test - west bank	9/27/90	3/22/90
<i>Quarterly</i>		
Safety channel No. 1 calibration	9/19/88 ^a	6/7/88
Safety channel No. 2 calibration	9/20/88 ^a	6/7/88
Safety channel No. 3 calibration	9/20/88 ^a	6/7/88
Log-N channel calibration	9/19/88 ^a	6/7/88
Fission chamber channel calibration	9/22/88 ^c	5/26/88 ^c
Flapper valve position channel functional test	9/29/88 ^a	6/14/88
Measurement of release time and time of flights for the shim-safety rods	9/22/88 ^a	6/13/88
Containment closure system functional test	12/21/90	9/18/90
In-leakage during containment mode	12/21/90	9/18/90
<i>Ten-year</i>		
Siphon break system functional test	7/17/86	3/11/82
Reactor containment inspection	9/22/83	1/3/75

Table 10. Continued

Test	Most recent test	Previous test
<i>Ten-year (continued)</i>		
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
<i>Others</i>		
Calibration of shim-safety rods	3/26/87 ^b	5/2/86
Emergency electrical power test	9/28/88 ^a	7/12/88
LTNIF, pool water level, functional test	6/23/88 ^a	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 ^a	

^aThese items will be checked prior to startup.

^bRod calibrations are not complete because of the DOE-ordered shutdown on March 26, 1987.

^cCounts were not sufficient to make a calibration check. This will be done prior to reactor startup.

POOL CRITICAL ASSEMBLY

OPERATIONS

The PCA is shut down for shim-safety rod magnets and associated electronic components to be upgraded.

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

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

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