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MARTIN MARIETTA

**Bulk Shielding Facility
Quarterly Report
October, November, and December 1988**

D. L. Laughlin
T. P. Hamrick

OAK RIDGE NATIONAL LABORATORY

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Research Reactors Division
Reactor Operations Section

**BULK SHIELDING FACILITY QUARTERLY REPORT
OCTOBER, NOVEMBER, AND DECEMBER 1988**

D. L. Laughlin
T. P. Hamrick

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Research Reactors Division

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BULK SHIELDING FACILITY QUARTERLY REPORT OCTOBER, NOVEMBER, AND DECEMBER 1988

SUMMARY

The Bulk Shielding Reactor (BSR) remained shut down during October, November, and December. 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

The BSR core 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.

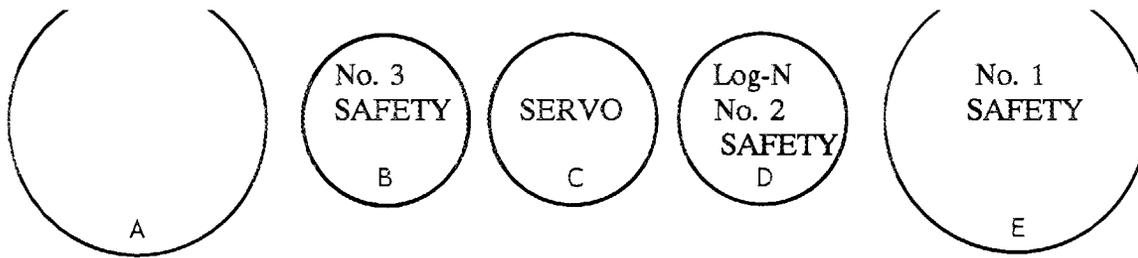
Maintenance and changes of the mechanical systems are listed in Table 5.

Operational Activities

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

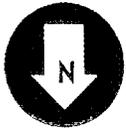
Experiments

There was no work relating to 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

507 g

ROD POSITIONS AT CRITICAL
(With Operating Mass)

| ROD NO. | IN. WITHDRAWN |
|---------|---------------|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |

REMARKS:

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

^aCore position for the Low-Temperature Neutron Irradiation Facility.

^bRod calibrations are not complete due to a DOE mandated reactor shutdown on March 26, 1987.

^cFission chamber.

Fig. 1. BSR core.

Table 1. Basic operating data
(October-December 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) | 1,187,000 | 963,000 | 1,075,000 |
| Research samples | 0 | 0 | 0 |

Table 2. Analysis of shutdowns*

| Description of shutdown | Number |
|-------------------------|--------|
| Scheduled: | 0 |
| Unscheduled: | 0 |
| TOTAL: | 0 |

*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 |
|----------|------------------------------|----------------|--|
| 10-6-88 | Valve TCV-13 | Routine | I&C performed functional check of secondary control valve |
| 10-12-88 | FRCAS | Routine | Quarterly checks |
| 10-17-88 | pH meter | Routine | I&C calibrated in-line meter |
| 10-18-88 | Seismic | Failed | Replaced annunciator can |
| 11-10-88 | CAMs and monitrons | Routine | Changed code identifiers and calibrated |
| 11-21-88 | CAMs | Routine | Programmed maintenance |
| 11-28-88 | Decay tank radiation monitor | Failed | Replaced probe and part of cable |
| 12-6-88 | Monitrons | Routine | Quarterly calibration |
| 12-19-88 | pH probe | Failed | Replaced probe |
| 1-19-88 | Quarterly checks | Routine | I&C completed fourth quarter surveillance functional tests |

Table 4. Maintenance and changes, process systems

| Date | Components | Trouble/change | Maintenance performed |
|----------|-------------------------------------|----------------|---|
| 10-19-88 | Demineralizer | Routine | Changed spool piece for regeneration |
| 11-2-88 | H ₂ SO ₄ tank | Leak | Welded small hole in line, and replaced inlet valve, drain valve and sight glass gasket |
| 11-7-88 | Demineralizer | Routine | Returned spool piece to normal operate position |
| 12-28-88 | Air dryer system | Routine | Removed, tested, and reinstalled two relief valves |

Table 5. Maintenance and changes, mechanical systems

| Date | Components | Trouble/change | Maintenance performed |
|----------|----------------|----------------|--|
| 10-27-88 | Overhead crane | Routine | Inspection Engineering checked all lifting equipment |
| 11-17-88 | Rod drives | Routine | Disconnected and removed all six shim rod drive assemblies |

Table 6. Operational activities

| Date | Remarks |
|----------|--|
| 10-21-88 | Opened secondary tower bypass valve HCV-94 for cold weather operation of A/C pump |
| 10-24-88 | For electrical conservation turned pool room lights off. Newly installed sodium vapor light will be used for surveillance and routine checks |
| 10-26-88 | Drained secondary tower basin for cleaning |
| 10-31-88 | Cleaned secondary screens |
| 11-1-88 | Cleaned secondary basin |
| 11-3-88 | Regenerated cation and anion columns |
| 11-7-88 | Installed secondary screens and filled tower basin |
| 11-7-88 | Completed rinse of demineralizer and placed in service |
| 11-16-88 | Placed ORR fuel rack VI in pool east side of PCA |
| 11-16-88 | Transferred three fuel elements from rack No. I to rack No. VI to provide space for unloading BSR core |
| 11-16-88 | Transferred 18 fuel elements from BSR core to rack No. I |
| 11-17-88 | Transferred and tied off to instrument bridge all six shim rod assemblies |
| 12-31-88 | Treated and ran secondary water system twice a week during quarter |
| 12-31-88 | Water quality during quarter: Inlet resistivity ohm-cm 656,500, exit resistivity ohm-cm 1,187,000, and water radioactivity cpm/ml BG |

Fuel

Changes in the fuel inventory are reported in Table 7.

Table 7. 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 | 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 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 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 9. 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 | 12-14-88 | 6-2-88 | DOP | 99.997 |
| Cell vent | HEPA | Center (5858) | East West | 9-17-85 8-17-83 | 12-14-88 | 6-2-88 | DOP | 99.993 |
| Cell vent | HEPA | South (5859) | East West | 9-17-85 8-17-83 | 12-14-88 | 6-2-88 | DOP | 99.987 |
| 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 | 3-2-88 | I | 99.940 |
| NOG | Charcoal | West (609) | Overall | 3-29-88 | 12-29-88 | 6-21-88 | I | 99.960 |

Table 10. 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 | 12-14-88 | 6-2-88 |
| Center | 12-14-88 | 6-2-88 |
| South | 12-14-88 | 6-2-88 |
| 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 | 11-10-88 | 8-5-88 |
| Radiation monitor | 12-6-88 | 9-6-88 |
| Stack radiation monitor calibration | 11-21-88 | 7-5-88 |

Table 10. (Continued)

| | Most recent test | Previous test |
|--|------------------|---------------|
| <u>Semiannual</u> (continued) | | |
| NOG filter system efficiency | | |
| Elemental iodine test - east bank | 6-23-88 | 3-2-88 |
| Elemental iodine test - west bank | 12-29-88 | 6-21-88 |
| 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 10. (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.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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