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**Bulk Shielding Facility
Quarterly Report
January, February, and
March 1981**

S. S. Hurt
E. D. Lance
J. R. Thomas

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OPERATIONS DIVISION

BULK SHIELDING FACILITY QUARTERLY REPORT
JANUARY, FEBRUARY, AND MARCH 1981

S. S. Hurt
E. D. Lance
J. R. Thomas

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BULK SHIELDING FACILITY QUARTERLY REPORT
JANUARY, FEBRUARY, AND MARCH 1981

S. S. Hurt, E. D. Lance, J. R. Thomas

SUMMARY

The BSR operated at an average power level of 1954 kW for 59.3% of the time during January, February, and March. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory.

The PCA was used in training programs and was operated on nine occasions. Nuclear engineering students from the University of Tennessee actively participated in training laboratories. The PCA was also operated on thirteen occasions for the Pressure Vessel Simulator Benchmark experiment.

BULK SHIELDING REACTOR

Operations

During this quarter, the reactor operated primarily for the irradiation of research experiments. Basic operating data for this period are given in Table 1.

Table 1. Basic Operating Data
January, February, and March of 1981

	This Quarter	Last Quarter	Year To Date
Total energy, kWd	104,684	125,952	104,584
Average operating power, kW	1,954	1,927	1,954
Time operating %	59.53	71.02	59.53
Reactor availability, %	69.26	78.13	69.26
Reactor water radioactivity, counts min ⁻¹ ml ⁻¹ (av)	1,458	1,809	1,458
Reactor water resistivity, ohm-cm (av)	1,397,000	1,312,000	1,397,000
Research samples	13	20	13

Core loading 81 (Fig. 1) had previously been temporarily converted to core loading 82 (Fig. 2) for Low Temperature Irradiation Facility (LTIF) experiment irradiations. Core loading 81 was reestablished after completion of the LTIF run.

Core loading 81 was converted to core loading 83 (Fig. 3) on January 13, 1981, to provide excess reactivity for versatile operation. The initial operating mass (4912 g U-235) of core loading 81 had been reduced to 4790 g due to burnup, thereby reducing the excess reactivity from 4.60% $\Delta k/k$ to 3.10% $\Delta k/k$ (0.55% $\Delta k/k$ above xenon equilibrium).

Core loading 83 was accomplished by replacing one depleted fuel element with one new 221 g fuel element. Core loading 83 had an initial operating mass of 4879 g which provided an excess reactivity of 4.25% $\Delta k/k$ (1.70% $\Delta k/k$ excess reactivity above xenon equilibrium).

Core loading 83 was converted to core loading 84 (Fig. 4) on January 21, 1981, to provide excess reactivity for versatile operation. Core loading 84 was accomplished by replacing one depleted fuel element with one new 220 g fuel element. Core loading 84 had an initial operating mass of 4963 g which provided an excess reactivity of 4.40% $\Delta k/k$ (1.85% $\Delta k/k$ excess reactivity above xenon equilibrium).

Core loading 84 was temporarily converted to core loading 85 (Fig. 5) on January 28, 1981, for LTIF experiment irradiations. Core loading 85 was accomplished by replacing the 177 g fuel element in CP-55 with an aluminum core piece. Core loading 85 had an initial operating mass of 4786 g which, when against the LTIF, had an excess reactivity of 4.80% $\Delta k/k$ (2.25% $\Delta k/k$ excess reactivity above xenon equilibrium). Core loading 85 was converted back to core loading 84 on January 30, 1981 after completion of the LTIF irradiations.

Core loading 84 was converted to core loading 86 (Fig. 6) on March 11, 1981, to provide excess reactivity for versatile operation. The initial operating mass (4963 g U-235) of core loading 84 had been reduced to 4876 g due to burnup thereby reducing the excess reactivity from 4.40% $\Delta k/k$ to approximately 3.40% $\Delta k/k$ (0.85% $\Delta k/k$ excess reactivity above xenon equilibrium).

Core loading 86 was accomplished by replacing two depleted shim-rod fuel elements with two new 110 g U-235 shim-rod fuel elements. Core 86 had an initial operating mass of 5001 g which provided an excess reactivity of 5.20% $\Delta k/k$ (2.65% $\Delta k/k$ excess reactivity above xenon equilibrium).

The shim rods were calibrated after core loading 86 had been established.

After the shim rods were calibrated, core loading 86 was converted to core loading 87 (Fig. 7) on March 19, 1981, to meet the "Minimum Positions of the Shim Rods at Critical" requirement. Core loading 87 was accomplished by switching the position of two fuel elements in the core. Core loading 87 had an initial operating mass of 5001 g U-235 which provided an excess reactivity of 5.60% $\Delta k/k$ (3.05% $\Delta k/k$ excess reactivity above xenon equilibrium).

BSR CORE

				FC	A1 CAN	A1 CAN	A1 CAN	M-57-H 196
81	82	83	84	85	86	37	88	89
				A1 CAN	A1 CAN	A1 CAN	BSF A-7 201	M-58-H 195
71	72	73	74	75	76	77	78	79
	EAST			M-50-H 185	B-198-C 48	BSF A-5 175	B-199-C 51	M-51-H 187
61	62	63	64	65	66	57	68	69
	D ₂ O TANK			YZP 0042 156	M-12-H 141	M-18-H 149	YZP 0047 145	YZP 0046 161
51	52	53	54	55	56	57	58	59
				BSF A-1 182	BSF-S-17 83	BSF A-6 181	BSF-S-18 84	YZP 0034 136
41	42	43	44	45	46	47	48	49
				BSF A-2 171	YZP 0040 150	YZP 0048 143	YZP 0041 153	BSF A-3 177
31	32	33	34	35	36	37	38	39
				YZP 0043 194	BSF-S-15 69	YZP 0034 189	BSF-S-16 69	M-52-H 201
21	22	23	24	25	26	27	28	29
				A1 Plug	BSF A-9 211	BSF A-4 188	BSF A-8 207	M-5-H 134
11	12	13	14	15	16	17	18	19

LOADING NO.

81

DATE

November 18, 1980

EXCESS REACTIVITY

4.60% $\Delta k/k$

OPERATING MASS

~4912 g

ROD POSITIONS AT CRITICAL (With Operating Mass)

ROD NO.	IN. WITHDRAWN
1	9.50
2	9.50
3	9.50
4	9.50
5	23.00
6	23.00

REMARKS:

Fig. 1 Core Loading 81 BSR

				FC	A1 CAN	A1 CAN	A1 CAN	M-57-H 196
81	82	83	84	85	86	87	88	89
				A1 CAN	A1 CAN	A1 CAN	BSF A-7 201	M-51-H 195
71	72	73	74	75	76	77	78	79
	EAST			M-50-H 185	B-198-C 48	BSF A-5 175	B-199-C 51	M-51-H 187
61	62	63	64	65	66	67	68	69
	D ₂ O TANK			A1 CAN	M-12-H 141	M-18-H 149	YZP 0047	YZP 0046 161
51	52	53	54	55	56	57	58	59
				BSF A-1 182	BSF-S-17 83	BSF A-6 181	BSF-S-18 84	YZP 0034 136
41	42	43	44	45	46	47	48	49
				BSF A-2 171	YZP 0040 150	YZP 0048 143	YZP 0041 153	BSF A-3 177
31	32	33	34	35	36	37	38	39
				YZP 0043 194	BSF-S-15 69	YZP 0045 189	BSF-S-16 69	M-52-H 201
21	22	23	24	25	26	27	28	29
				A1 Plug	BSF A-9 211	BSF A-4 188	BSF A-8 207	M-5-H 134
11	12	13	14	15	16	17	18	19

BSR CORE

LOADING NO.
82
DATE
December 4, 1980
EXCESS REACTIVITY
4.55% $\Delta k/k$
OPERATING MASS
~4756 g

ROD POSITIONS AT CRITICAL (With Operating Mass)

ROD NO.	IN. WITHDRAWN
1	9.55
2	9.55
3	9.55
4	9.55
5	23.00
6	23.00

REMARKS:

LTIF experiment core

Fig. 2 Core Loading 82 BSR

BSR CORE

LOADING NO.
83
DATE
January 13, 1981
EXCESS REACTIVITY
4.25% $\Delta k/k$
OPERATING MASS
4879 g

ROD POSITIONS AT CRITICAL (With Operating Mass)

ROD NO.	IN. WITHDRAWN
1	10.25
2	10.25
3	10.25
4	10.25
5	23.00
6	23.00

REMARKS:

				FC	A1 CAN	A1 CAN	A1 CAN	M-57-H 193
81	82	83	84	85	86	87	88	89
				A1 CAN	A1 CAN	A1 CAN	BSF A-7 197	M-58-H 192
71	72	73	74	75	76	77	78	79
	EAST			M-50-H 181	B-198-C 47	BSF A-5 171	B-199-C 49	M-51-H 182
61	62	63	64	65	66	67	68	69
	D ₂ O TANK			YZP 0042 153	M-12-H 136	B-18-H 144	YZP 0047 140	YZP 0046 157
51	52	53	54	55	56	57	58	59
				BSF A-1 177	BSF-S-17 80	BSF A-6 174	BSF-S-18 81	BSF A-8 204
41	42	43	44	45	46	47	48	49
				BSF A-2 167	YZP 0040 145	YZP 0048 138	YZP 0041 148	BSF A-3 173
31	32	33	34	35	36	37	38	39
				YZP 0043 190	BSF-S-15 67	YZP 0045 184	BSF-S-16 67	M-52-H 197
21	22	23	24	25	26	27	28	29
				A1 Plug	BSF A-9 207	BSF A-4 185	BSF A-10 221	M-5-H 132
11	12	13	14	15	16	17	18	19

Fig. 3 Core Loading 83 BSR

BSR CORE

LOADING NO.
84
DATE
January 21, 1981
EXCESS REACTIVITY
4.40% $\Delta k/k$
OPERATING MASS
~4963 g

ROD POSITIONS AT CRITICAL (With Operating Mass)

ROD NO.	IN. WITHDRAWN	
1	9.75	11.50
2	9.75	11.50
3	9.75	11.50
4	9.75	11.50
5	23.00	11.50
6	23.00	11.50

REMARKS:

81	82	83	84	85	86	87	88	89
				FC	A1 CAN	A1 CAN	A1 CAN	M-57-H 193
71	72	73	74	75	76	77	78	79
				A1 CAN	A1 CAN	A1 CAN	BSF A-7 197	M-58-H 192
61	62	63	64	65	66	67	68	69
	EAST			M-50-H 181	B-198-C 47	BSF A-5 171	B-199-C 49	M-51-H 182
51	52	53	54	55	56	57	58	59
	D ₂ O TANK			BSF A-1 177	YZP 0042 153	M-18-H 144	YZP 0046 157	YZP 0047 140
41	42	43	44	45	46	47	48	49
				BSF T-1 220	BSF-S-17 80	BSF A-6 174	BSF-S-18 81	BSF A-8 204
31	32	33	34	35	36	37	38	39
				BSF A-2 167	YZP 0040 145	YZP 0048 133	YZP 0041 148	BSF A-3 173
21	22	23	24	25	26	27	28	29
				YZP 0043 190	BSF-S-15 67	YZP 0045 184	BSF-S-16 67	M-52-H 197
11	12	13	14	15	16	17	18	19
				A1 Plug	BSF A-9 207	BSF A-4 185	BSF A-10 221	M-5-H 132

Fig. 4 Core Loading 84 BSR

				FC	A1 CAN	A1 CAN	A1 CAN	M-57-H 193
81	82	83	84	85	86	87	88	89
				A1 CAN	A1 CAN	A1 CAN	BSF A-7 197	M-58-H 192
71	72	73	74	75	76	77	78	79
	EAST			M-50-H 181	B-198-C 47	BSF A-5 171	YZP 0046 157	YZP 0047 140
61	62	63	64	65	66	67	68	69
	D ₂ O TANK			A1 CAN	YZP 0042 153	M-18-H 144	YZP 0046 157	YZP 0047 140
51	52	53	54	55	56	57	58	59
				BSF T-1 220	BSF-S-17 80	BSF A-6 174	BSF-S-18 81	BSF A-8 204
41	42	43	44	45	46	47	48	49
				BSF A-2 167	YZP 0040 145	YZP 0048 138	YZP 0041 148	BSF A-3 173
31	32	33	34	35	36	37	38	39
				YZP 0043 190	BSF-S-15 67	YZP 0045 184	BSF-S-16 67	M-52-H 197
21	22	23	24	25	26	27	28	29
				A1 Plug	BSF A-9 207	BSF A-4 185	BSF A-10	M-5-H 132
11	12	13	14	15	16	17	18	19

BSR CORE

LOADING NO:	85
DATE	January 28, 1981
EXCESS REACTIVITY	4.80% $\Delta k/k$
OPERATING MASS	~4786 g

ROD POSITIONS AT CRITICAL (With Operating Mass)

ROD NO.	IN. WITHDRAWN
1	9.07
2	9.07
3	9.07
4	9.07
5	23.00
6	23.00

REMARKS:

Core 85 used for
LTF Experiment

Fig. 5 Core Loading 85 BSR

BSR CORE

LOADING NO.
86
DATE
March 11, 1981
EXCESS REACTIVITY
5.20% $\Delta k/k$
OPERATING MASS
~5001 g

ROD POSITIONS AT CRITICAL (With Operating Mass)

ROD NO.	IN. WITHDRAWN	
1	8.41	10.30
2	8.41	10.30
3	8.41	10.30
4	8.41	10.30
5	23.00	10.30
6	23.00	10.30

REMARKS:

				FC	A1 CAN	A1 CAN	A1 CAN	M-57-H 191
81	82	83	84	85	86	87	88	89
				A1 CAN	A1 CAN	A1 CAN	BSF A-7 194	M-58-H 189
71	72	73	74	75	76	77	78	79
	EAST			M-50-H 179	BSF-S-15 66	BSF A-5 168	BSF-S-16 66	179
61	62	63	64	65	66	67	68	69
	D ₂ O TANK			M-52-H 194	YZP 0042 149	M-18-H 141	YZP 0046 153	YZP 0047 138
51	52	53	54	55	56	57	58	59
				BSF T-1 216	BSF-S-T1 110	BSF A-6 170	BSF-S-T3 110	BSF A-8 200
41	42	43	44	45	46	47	48	49
				BSF A-2 164	YZP 0040 142	YZP 0048 134	YZP 0041 144	BSF A-3 169
31	32	33	34	35	36	37	38	39
				YZP 0043 187	BSF-S-17 79	YZP 0045 181	BSF-S-18 79	BSF A-1 174
21	22	23	24	25	26	27	28	29
				A1 Plug	BSF A-9 205	BSF A-4 182	BSF A-10 218	M-5-H 130
11	12	13	14	15	16	17	18	19

Fig. 6 Core Loading 86 BSR

BSR CORE

LOADING NO.

87

DATE

March 19, 1981

EXCESS REACTIVITY

5.60% $\Delta k/k$

OPERATING MASS

~5001 g

ROD POSITIONS AT CRITICAL
(With Operating Mass)

ROD NO.	IN. WITHDRAWN	
1	9.20	11.05
2	9.20	11.05
3	9.20	11.05
4	9.20	11.05
5	23.00	11.05
6	23.00	11.05

REMARKS:

81	82	83	84	85	86	87	88	89
				FC	A1 CAN	A1 CAN	A1 CAN	M-57-H 191
71	72	73	74	75	76	77	78	79
				A1 CAN	A1 CAN	A1 CAN	BSF A-7 194	M-58-H 189
61	62	63	64	65	66	67	68	69
	EAST			M-50-H 179	BSF-S-15 66	BSF A-5 168	BSF-S-16 66	M-51-H 179
51	52	53	54	55	56	57	58	59
	D ₂ O TANK			M-52-H 194	YZP 0042 149	M-18-H 141	YZP 0046 153	YZP 0047 138
41	42	43	44	45	46	47	48	49
				BSF T-1 216	BSF-S-T1 110	BSF A-6 170	BSF-S-T3 110	BSF A-8 200
31	32	33	34	35	36	37	38	39
				BSF A-2 164	YZP 0042 142	YZP 0048 134	YZP 0041 144	BSF A-3 169
21	22	23	24	25	26	27	28	29
				YZP 0043 187	BSF-S-17 79	M-5-H	BSF-S-18 79	BSF A-1 174
11	12	13	14	15	16	17	18	19
				A1 Plug	BSF A-9 205	BSF A-4 182	BSF A-10 218	YZP 0045 181

Fig. 7 Core Loading 87 BSR

Shim-Rod Calibrations

The BSR shim rods were calibrated after core loading 86 had been established. The total worth of all six rods is 11.361% $\Delta k/k$. The operating limit requirement that the reactor be operated with the ganged rods (all six) withdrawn at least 50% of their worth, thus requires that the rods be greater than 10.35 in. withdrawn when the reactor becomes critical for power operation. With rods 5 and 6 at 23 in. withdrawn, rods 1, 2, 3, and 4 can be withdrawn to 8.90 in. to comply with the same operating limit.

Shutdowns

There was one unscheduled shutdown during the quarter caused by the primary pump breaker kicking out. Table 2 gives an analysis of both scheduled and unscheduled shutdowns.

Table 2. Analysis of Shutdowns

Description of Shutdown	Number	Downtime (h)
<u>Scheduled</u>		
Experimenters:		
No request to operate	4	200.800
Experiment insertion, removal or data taking	3	204.700
Repositioning of the reactor	4	5.400
Reactor Operations:		
Decay for refueling and shim rod work	1	66.000
Refueling critical runs	5	5.583
Shim-rod calibrations	2	17.950
BSR quarterly shutdown and maintenance	6	372.900
Subtotal:	25	873.333

Table 2. Analysis of Shutdowns (Cont'd)

Description of Shutdown	Number	Downtime (h)
<u>Unscheduled</u>		
Reactor Operations:	<u>1</u>	<u>0.733</u>
Subtotal:	1	0.733
TOTAL:	<u>26</u>	<u>874.066</u>

Maintenance and Changes

Maintenance or changes to the instrumentation and mechanical components in the complex are listed in Tables 3, 4, and 5.

Table 3. Maintenance and Changes, Instrumentation and Controls

Date	Component	Trouble or Change	Reason or Maintenance
1-13-81	Counting-rate channel	Would not calibrate.	Replaced the count-rate recorder slide wire contacts.
1-13-81	Log-N channel	Readout spiking	Replaced the Log-N amplifier.
1-13-81	Servo channel	Unsteady	Replaced the servo amplifier.
1-23-81	Dual ionization chamber PCP III-106-5N66-6 in position C	The saturation characteristic checks did not meet specifications. The chamber was removed.	The chamber was being used for servo and No. 3 safety.
1-28-81	Ionization chamber RS-C1-1210-201 Serial X-5918	The new compensated ionization chamber was installed in position C.	The chamber is being used for servo.
1-28-81	Servo channel	I&C Design Change Memo BSR-2MW-52	To upgrade the system, the vacuum tube type compensated ion chamber power supply was replaced with a solid state unit.
2-25-81 and 2-26-81	Ionization chamber RS-C1-1210-135 Serial W-1151	The new ionization chamber was installed in position B.	The chamber is being used as No. 3 safety.
3-3-81	No. 1 TV system	Intermittent picture loss	Replaced the faulty signal lead connector.

Table 3. Maintenance and Changes (Cont'd)

Date	Component	Trouble or Change	Reason or Maintenance
3-9-81 through 3-15-81	Instrumentation	Routine	Quarterly checks
3-10-81	Counting-rate channel	Scalar inoperative	The scalar was replaced.
3-11-81	Servo channel	Sluggish recorder response	The recorder balance motor was replaced.
3-12-81	Nos. 1, 2, and 3 sigma amplifiers	Did not meet specifications.	The preamps were retubed.
3-18-81	Secondary pH recorder	Erratic readout	The recorder amplifier and constant voltage unit were replaced.
3-19-81	No. 3 safety channel	Sensitivity switch erratic	Resoldered two bad connections on the switch.

Table 4. Maintenance and Changes, Mechanical System

Date	Component	Trouble or Change	Reason or Maintenance
1-13-81	Shim-rod drive assemblies 1, and 3	Sluggish action of the clutch switches	Cleaned the magnet face and clutch switch push rod of each assembly.
1-13-81	No. 5 shim-rod assembly	The No. 5 shim rod failed to drop.	The assembly was removed for inspection. An accumulation of corrosion product was observed and cleaned from between the magnet and armature. The malfunction was apparently caused by the corrosion product. The rod drive was reinstalled and checks of the drop current, release time, and time of flight were satisfactory.
2-18-81	Primary pump	The primary pump breaker kicked out.	The primary pump and breaker were checked. Nothing abnormal was found.
3-9-81 through 3-11-81	Shim-rod assemblies 2, 3, and 4	Routine inspection	The shim-rod assemblies were removed to the work platform for inspection as follows: Visual inspection - no evidence of cracks; results satisfactory; gauged, using 0.010 in. and 0.020 in. oversized gauges and feeler gauges, results satisfactory. New armatures were installed on the shim rods. New shim rod fuel was installed in positions 3 and 4. A new seat switch activator cable was installed on No. 3 shim-rod assembly. New magnets and swivel joints were installed on Nos. 2 and 3 drive assemblies.

Table 5. Maintenance and Changes, Process System

Date	Component	Trouble or Change	Reason or Maintenance
3-10-81 and 3-11-81	Heat exchanger	Routine	The secondary side was cleaned.
3-9-81 and 3-10-81	Secondary tower basin	Routine	The tower basin and screens were cleaned.
3-11-81 and 3-12-81	Secondary tower fans	Preventive maintenance	The stainless steel shot in the Dodge Flexidyne couplings were replaced. The oil was changed in the gear boxes.
3-17-81 through 3-19-81	Primary pump	Noisy	New pump bearings were installed.
3-19-81	Secondary cooling tower	Blowdown line valve body leaking	A new valve was installed.

Fuel

Changes in the fuel inventory are reflected in Table 6.

Table 6. Fuel and Shim Rod Status

	This Quarter	Last Quarter	Year To Date
Fuel elements depleted	2	3	2
Control-rod fuel elements depleted	2	0	2
New fuel elements placed in service	2	1	2
New control-rod fuel elements placed in service	2	0	2
New fuel elements available for use	16	18	16
New control-rod fuel elements avail- able for use	4	6	4
Partially depleted fuel elements avail- able for use (includes core)	29	29	29
New shim rods placed in service	0	0	0
Boron stainless steel shim rods in service	6	6	6
Boron stainless steel shim rods available for use	1	1	1

Experiment Facilities Assignment

Facility assignments are listed in Table 7. The tubes of the east D₂O tank are not permanently assigned; they are used by various laboratory personnel for short-term sample irradiations.

Table 7. Facilities Assignment

Facility	Location	Division or Sponsor
Liquid helium cryostat (LTIF)	Southwest corner of pool	Solid State
Heavy Section Steel experiment	North and west face of core	Metals and Ceramics
Fast-neutron tube	Core position 15	Solid State
Water-cooled tube	Core position 15	Solid State
Dry thermal-neutron tubes ^a (D-3-1 and -2)	East D ₂ O tank	Operations
Wet thermal-neutron tubes ^a (D-4-1 and -2, D-6-1, -2, -3, -4, and -5)	East D ₂ O tank	Operations

^aThese facility tubes are for sample irradiations and are used by personnel of several divisions, primarily Analytical Chemistry and Solid State Divisions.

Demineralizer Performance

Table 8 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.

Table 8. Demineralizer Performance Data

Run No.	Initiation Date	Termination Date	Throughput (gallons)	Gross Gamma (Counts min ⁻¹ ml ⁻¹)		pH		Specific Resistance (ohm-cm)	
				In	Out	In	Out	In	Out
42 ^a	12-17-74	4-15-75	3,850,000	2,116	119	5.8	6.0	1,018,000	1,611,000
43	4-16-75	7-7-75	2,550,000	2,712	174	5.7	5.8	937,000	1,823,000
44	7-10-75	11-5-75	2,750,000	2,528	144	5.7	5.9	968,000	1,428,000
45	11-5-75	4-29-76	2,325,000	2,146	154	5.3	5.5	902,000	1,593,000
46	4-30-76	9-2-76	2,800,000	1,430	124	5.4	5.6	1,085,000	1,808,000
47	9-2-76	1-27-77	3,450,000	1,700	126	5.4	5.6	975,000	1,548,000
48	2-1-77	4-22-77	2,000,000	2,026	146	5.6	5.7	1,052,000	1,971,000
49	4-25-77	9-21-77	2,700,000	2,005	140	5.6	5.8	1,054,000	1,815,000
50	9-22-77	3-6-78	2,950,000	1,585	134	5.5	5.7	1,191,000	1,953,000
51	3-8-78	8-2-78	2,350,000	2,112	122	5.6	5.8	1,030,000	1,634,000
52 ^a	8-15-78	9-18-78	950,000	2,077	157	5.7	5.9	1,363,000	2,209,000
53	9-19-78	12-19-78	2,580,000	2,194	163	5.6	5.8	1,194,000	3,207,000
54	12-19-78	4-10-79	3,040,000	1,964	134	5.6	5.9	1,183,000	1,910,000
55	4-11-79	7-24-79	2,750,000	2,188	164	5.5	5.7	1,006,000	1,675,000
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	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	1,924	118	5.4	5.6	1,148,000	3,600,000
62	11-4-80	2-26-81	2,600,000	1,492	110	5.4	5.6	1,368,000	4,319,000
63	3-2-81	In Service	750,000	1,389	111	5.4	5.7	1,456,000	5,271,000

^aNew resin in the demineralizer columns.

Operational Activities

The operational activities for the quarter are reflected in Table 9.

Table 9. Operational Activities

Date	Remarks
1-14-81	The skimmer filters were changed.
3-9-81	The emergency electrical power quarterly test was completed with satisfactory results.
3-11-81	All fuel elements including shim-rod fuel elements were visually inspected with satisfactory results.
3-12-81	The containment system quarterly functional checks were performed with satisfactory results.
3-13-81	The inspection of the reactor control cables and messengers were completed.
3-26-81	The valve pit was inspected and remains dry.

In-Service Inspection

Inspection of the BSR Heat Exchanger, Building 3119

The BSR heat exchanger was visually inspected by personnel from the Quality Assurance and Inspection Department. Following is their report.

"A visual inspection was performed on the BSR heat exchanger on March 11, 1981. This inspection was performed with both heads removed. The tube sheets, tube-to-tube sheet welds, a portion of the tube ID surfaces, and the inside surface of both heads were examined on both ends of the heat exchanger. None of these surfaces revealed any evidence of damage or corrosion worthy of comment. The exterior surfaces including the nozzles, flanges, and attendant piping appeared to be satisfactory except the exit flanged connection on the secondary side (shell side) showed evidence of leakage. Judging from the corrosion product on the edges of the flanges, it appeared that the leak rate had been small but had been leaking for a considerable amount of time. The cause of the leak was not determined. The Reactor Operations Division was informed of the leak. The bolting around the flange tightened. The interior of the shell side of the heat exchanger was not inspected at this time."

The conditions noted are not considered to be of any significance; therefore the vessel is considered satisfactory for continued operation.

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 will not be reported are satisfied by routine completion of daily and weekly check sheets, startup check lists, hourly data sheets, the operating log book, and miscellaneous quality assurance tests.

Table 10. Summary of Surveillance Tests at the BSR

Test	Most Recent Test	Previous Test
<u>Biennial Tests</u>		
Inspection of the shim-safety rods	9-12-80	5-3-79
<u>Annual Tests</u>		
Calibration of shim-safety rods	3-19-81	9-16-80
Core ΔT channel calibration	9-15-80	8-9-79
Primary coolant flow channel calibration	9-10-80	8-9-79
Pool water level channel calibration	12-4-80	6-19-80
Maximum rate of reactivity addition by the shim-safety rods	3-13-81	12-4-80
Reactivity assigned to the servo-control system	3-11-81	3-5-80
Subcriticality with each shim-safety rod at its upper limit while all other shim-safety rods are fully inserted	3-13-81	12-5-80

Table 10. Summary of Surveillance Tests (Cont'd)

Test	Most Recent Test	Previous Test
<u>Semiannual</u>		
Cell ventilation filter efficiency		
A. Methyl Iodide	12-11-80	7-31-80
B. Elemental Iodine	11-21-80	7-29-80
C. Dioctyl Phthalate	12-5-80	7-28-80
Radiation monitoring equipment calibration	2-5-81	12-10-80
Stack radiation monitor calibration	3-17-81	12-17-80
<u>Quarterly</u>		
Safety channel No. 1 calibration	3-12-81	12-3-80
Safety channel No. 2 calibration	3-12-81	12-3-80
Safety channel No. 3 calibration	3-12-81	12-3-80
Log-N channel calibration	3-10-81	12-2-80
Fission chamber channel calibration	3-10-81	12-2-80
Flapper valve position channel functional test	3-13-81	12-4-80
Measurement of release time and time of flight for the shim-safety rods	3-13-81	12-4-80
Containment closure system functional test	3-12-81	12-3-80
In-leakage during containment mode	3-12-81	12-3-80

POOL CRITICAL ASSEMBLY

Operations

The Pool Critical Assembly (PCA) was used 64.3 hours as an experiment facility for the benefit of nuclear engineering students from the University of Tennessee. The PCA was used 98.7 hours for the Pressure Vessel Simulator Benchmark experiment. Operational activities in preparing the facility for use included a checkout of the reactor control instrumentation and preparation of the required loadings. The operational activities are listed in Table 11 (Usage of Pool Critical Facility). The PCA maintenance is listed in Table 12.

Table 11. Usage of Pool Critical Facility

Date	Operational Activity	Purpose	Hours Used
1-5-81 through 1-9-81	Pressure Vessel Simulator Benchmark experiment	Experiment data	35.6
1-12-81 through 1-14-81	Pressure Vessel Simulator Benchmark experiment	Experiment data	24.9
1-20-81 through 1-23-81	Established cores 294, 295, and 296 to obtain a critical mass following the standard approach-to-critical procedure.	Training lab for the University of Tennessee Nuclear Engineering students	31.5
1-26-81 through 1-28-81	Established core 77 to permit calibration of the regulating rod.	Training lab for the University of Tennessee Engineering students	17.1
2-2-81 through 2-6-81	Pressure Vessel Simulator Benchmark experiment	Experiment data	38.2
2-16-81 2-17-81 2-30-81	Used core 77 to perform the Importance Function experiment.	Training lab for the University of Tennessee Nuclear Engineering students	15.7

Table 12. PCA Maintenance

Date	Component	Trouble or Change	Action
1-12-81	Log-N channel	Unsteady	The Log-N amplifier was replaced.
3-24-81 through 3-31-81	Instrumentation	Routine	Quarterly checks
3-25-81	Log-N channel	Unsteady	The Log-N amplifier was replaced.
3-30-81	Primary counting-rate channel	Did not meet speci- fications.	The count-rate meter was retubed.

Summary of Surveillance Tests at the PCA

Table 13 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, startup check lists, hourly data sheets, the operating log book, and miscellaneous quality assurance tests.

Table 13. Summary of Surveillance Tests at the PCA

Test	Most Recent Test	Previous Test
<u>Annual</u>		
Reactivity assigned to the servo-control system	1-28-81	12-12-80
Subcriticality with each shim-safety rod at its upper limit and all other shim-safety rods fully inserted	3-13-81	12-29-80
<u>Semiannual</u>		
Radiation monitoring equipment calibration	2-5-81	12-10-80
Monitron calibration	2-17-81	12-8-80
<u>Quarterly</u>		
Safety channel No. 1 calibration	3-30-81	12-29-80
Safety channel No. 2 calibration	3-30-81	12-29-80
Safety channel No. 3 calibration	3-30-81	12-29-80
Log-N channel calibration	3-30-81	12-29-80
Fission chamber channel calibration	3-27-81	12-19-80
Measurement of release time and time of flight for the shim-safety rods	3-31-81	12-29-80

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