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**Bulk Shielding Facility Quarterly Report
April, May, and June of 1977**

S. S. Hurt, III
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J. R. Thomas

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OPERATIONS DIVISION

BULK SHIELDING FACILITY QUARTERLY REPORT
APRIL, MAY, AND JUNE OF 1977

S. S. Hurt, III
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SUMMARY

The BSR operated at an average power level of 1,821 kW for 39.82% of the time during April, May, and June. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory.

The BSR was operated at low and variable power during this quarter for 91.517 hours as part of the training programs for nuclear reactor operator trainees from Memphis State University and nuclear engineering students from the University of Tennessee.

The PCA was also used in the above-mentioned training programs and was operated on twelve occasions when Central Florida Community College, the University of Kentucky, and Memphis State University students actively participated in training laboratories.

BULK SHIELDING REACTOR

Operations

During this quarter, the reactor operated 39.82% of the time primarily for the irradiation of research experiments. It was operated at low and variable power (10.53% of the operating time) to enable nuclear reactor operator trainees from Memphis State University and nuclear engineering students from the University of Tennessee to perform training labs described elsewhere in this report. Basic operating data for this period are given in Table 1.

Table 1. Basic Operating Data
(April, May, and June of 1977)

	This Quarter	Last Quarter	Year To Date
Total energy, kWd	65,947	134,173	200,120
Average power, kW/operating hr	1,821	1,975	1,898
Time operating, %	39.82	75.47	57.64
Reactor availability, %	72.09	90.81	81.45
Reactor water radioactivity, counts min ⁻¹ ml ⁻¹ (av)	1,948	1,917	1,932

Table 1. (continued)

	This Quarter	Last Quarter	Year To Date
Reactor water resistivity, ohm-cm (av)	1,067,000	1,072,000	1,069,500
Standard fuel elements, depleted	0	0	0
Control fuel elements, depleted	0	0	0
Research samples	70	60	130

Core loading 33 (Figure 1) was converted to core loading 34 (Figure 2) on May 23, 1977, to provide excess reactivity for versatile operation. The initial operating mass (4,772 g ^{235}U) of core loading 33 had been reduced to 4,604 g due to burnup, thereby reducing the excess reactivity from 5.50% $\Delta k/k$ to 3.57% $\Delta k/k$ (1.02% $\Delta k/k$ excess reactivity above xenon equilibrium).

Core loading 34 was accomplished by replacing one BSF series and two MTR series partially depleted fuel elements with three new MTR series fuel elements. Core loading 34 had an initial operating mass of 4,772 g which provided an excess reactivity of 5.35% $\Delta k/k$ (2.80% $\Delta k/k$ excess reactivity above xenon equilibrium). At the end of the quarter, the excess reactivity was 4.90% $\Delta k/k$ (2.35% $\Delta k/k$ excess reactivity above xenon equilibrium).

The calibration of all six shim rods was spot checked after core loading 34 had been established and compared satisfactorily with the last shim rod calibration curves issued on December 2, 1976.

Shutdowns

There were no unscheduled shutdowns during the quarter. Tables 2 gives an analysis of the scheduled shutdowns.

BSR CORE

33
LOADING NO.
January 27, 1977
DATE
Excess Reactivity 5.50%
CRITICAL MASS
4772 gm
OPERATING MASS

ROD POSITIONS AT CRITICAL (With Operating Mass)

ROD NO.	IN. WITHDRAWN	
1	10.77	9.01
2	10.77	9.01
3	10.77	9.01
4	10.77	9.01
5	10.77	23.00
6	10.77	23.00

REMARKS:

M-15-H 201 81	F.C. 82	Al. 83	Al. 84	Al. 85	86	87	88	89
M-6-H 182 71	M-7-H 181 72	Al. 73	Al. 74	Al. 75	76	77	78	79
M-1-H 169 61	BSF-S-9 62 62	BSF-36 128 63	BSF-S-10 62 64	M-2-H 167 65	66	67	68	69
M-13-H 190 51	M-194-D 140 52	M-3-H 166 53	M-14-H 188 54	M-195-D 141 55	56	57	58 D ₂ O	59
BSF-39 139 41	BSF-S-13 84 42	M-17-H 202 43	BSF-S-14 83 44	BSF-40 136 45	46	47	48 TANK	49
M-4-H 166 31	M-10-H 184 32	M-16-H 195 33	M-11-H 182 34	M-S-H 164 35	36	37	38	39
M-196-D 161 21	BSF-S-11 64 22	BSF-37 125 23	BSF-S-12 64 24	M-323-A 161 25	26	27	28	29
BSF-28 126 11	M-9-H 181 12	M-12-H 192 13	M-8-H 186 14	Plug 15	16	17	18	19

Figure 1. Core loading 33 - BSR

M-15H 199 81	F. C. 82	Al. 83	Al. 84	Al. 85				
M-6-H 179 71	M-7-H 178 72	Al. 73	Al. 74	Al. 75				
M-1-H 163 61	BSF-S-9 59 62	BSF-36 123 63	BSF-S-10 59 64	M-2-H 162 65				
M-13-H 183 51	M-194-D 133 52	M-3-H 159 53	M-14-H 180 54	M-195-D 135 55			D.O 2	
BSF-39 134 41	BSF-S-13 81 42	M-17-H 191 43	BSF-S-14 80 44	BSF-40 130 45			Tank	
M-20-H 201 31	M-10-H 175 32	M-16-H 184 33	M-11-H 174 34	M-19-H 202 35				
M-196-D 156 21	BSF-S-11 61 22	M-12-H 188 23	BSF-S-12 62 24	M-323-A 155 25				
BSF-28 11	M-9-H 177 12	M-18-H 203 13	M-8-H 180 14	Plug 15				

BSR CORE

34	
LOADING NO.	
May 23, 1977	
DATE	
Excess Reactivity 5.35%	
CRITICAL MASS	
4772 gm	
OPERATING MASS	
ROD POSITIONS AT CRITICAL (With Operating Mass)	
ROD NO.	IN. WITHDRAWN
1	9.23 10.73
2	9.23 10.73
3	9.23 10.73
4	9.23 10.73
5	23.00 10.73
6	23.00 10.73
REMARKS:	

Figure 2. Core Loading 34 BSR

Table 2. Analysis of Shutdowns

Description of Shutdown	Number	Downtime (hrs)
Scheduled		
Experimenters:		
No request to operate	10	667.102
Repositioning of the reactor	3	1.367
Experiment insertion, removal, or data taking	4	27.484
Reactor Operations:		
Xenon decay for refueling	1	74.700
Refueling critical runs	2	3.850
Quarterly and annual checks and maintenance	1	530.650
University nuclear reactor operator training	<u>46</u>	<u>8.617</u>
Subtotal	67	1,313.770
Unscheduled		
Experimenters	0	0.000
Reactor Operations	<u>0</u>	<u>0.000</u>
Subtotal	<u>0</u>	<u>0.000</u>
TOTAL	67	1,313.770

Maintenance and Changes

Changes made in the reactor control instrumentation to improve operating conditions are documented by the BSR control-change-memoranda system. Those changes which were made during this report period are listed in Table 3. Maintenance or changes on the instrumentation and mechanical components in the complex are listed in Tables 4, 5, and 6.

Table 3. Instrumentation and Controls Change Memoranda
Completed During This Report Period

Change Memo No.	Subject	General Description
BSR-2MW-47	Replacement of the BSR shim-rod position indicators	The present BSR shim-rod position indicators have analog displays with two pointers, one indicating coarse position and the other fine position. The associated transmitting gear boxes are becoming aged, and the backlash is causing an imprecise indication of the rod position. The change provides a more reliable and accurate position read-out of the rods by replacing the six analog displays with six digital displays by using synchro-to-digital techniques. The resolution of the digital display is 0.01 in. To help detect an erroneous display due to lamp failure, there is a lamp test feature at the local and remote control console.

Table 4. Maintenance and Changes, Instrumentation and Controls

Date	Component	Trouble or Change	Reason or Maintenance
4-4-77 through 4-22-77	Shim-rod position indicators on Nos. 2, 3, 4, 5, and 6 shim-rod drives	Replacement of the analog displays with digital displays for the BSR rod position indicators in accordance with Reactor Instru- ment and Controls Design Change Memo No. BSR-2MW-47	The new units were installed after satisfactory com- pletion of test and evalua- tion of this type unit which was installed for shim rod No. 1 indicator on 4-22-76.
4-6-77	Facility radiation and contamination monitoring system	Routine	Bimonthly checkout.
4-19-77 through 4-26-77	Instrumentation	Routine	Quarterly checks.
5-12-77	No. 3 safety channel	Recorder readout erratic	The recorder amplifier was replaced to correct the trouble.
6-30-77	Facility radiation and contamination monitoring system	Routine	Bimonthly checkout.

Table 5. Maintenance and Changes, Mechanical System

Date	Component	Trouble or Change	Reason or Maintenance
4-18-77 and 4-19-77	Shim-rod assemblies Nos. 1, 2, 3, 4, 5, and 6	Routine inspection	The shim-rod assemblies were removed to the underwater work platform for inspection as follows: Visual inspection - no evidence of cracks; Straight edge inspection - results satisfactory; Gauged, using 0.010 in. and 0.020 in. oversized gauges and feeler gauges - results satisfactory. Rust was cleaned from the armatures and magnets. The clutch switches were cleaned and the guide tubes brushed. See Appendix A for a detailed inspection report.
4-19-77	Shim-rod drive assembly No. 1	Defective clutch switch	The clutch switch was replaced.

Table 6. Maintenance and Changes, Process System

Date	Component	Trouble or Change	Reason or Maintenance
4-11-77	Secondary tower basin	Routine cleaning and inspection	The secondary tower basin was drained, cleaned, and refilled.
4-11-77	Air-conditioning pump	Excessive packing gland water leak	New packing was installed and the packing gland adjusted.
5-6-77	Secondary water system	Faulty pressure gauges	New pressure gauges were installed on the secondary pump outlet, heat exchanger inlet, and heat exchanger outlet lines.
6-20-77 through 6-26-77	Heat exchanger (secondary side)	Reduction of efficiency	The heads of the secondary side of the heat exchanger were removed and the following work was completed before reinstalling: brushed and flushed the tubes, cleaned the heads, and installed new head gaskets.

Fuel

Changes in the fuel inventory are reflected in Table 7.

Table 7. Fuel and Shim Rod Status

	This Quarter	Last Quarter	Year To Date
Fuel elements depleted	0	0	0
Control-rod fuel elements depleted	0	0	0
New fuel elements placed in service	3	1	4
New control-rod fuel elements placed in service	0	0	0
New fuel elements available for use	14	17	14
New control-rod fuel elements available for use	6	6	6
Partially depleted fuel elements available for use	9	6	9
New shim rods placed in service	0	0	0
Boron stainless steel shim rods in use	6	6	6
Boron stainless steel shim rods available for use	2	2	2

Experiment Facilities Assignment

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

Table 8. Facilities Assignment

Facility	Location	Division or Sponsor
Liquid helium cryostat	Southwest corner of pool using west D ₂ O tank	Solid State
Liquid nitrogen cryostat	On instrument bridge	Solid State
Ambient temperature facility	North face of core	Solid State
Front-face tube	North face of core	Solid State
Heavy section steel experiment	North and east face of core	Metals and Ceramics
Fast-neutron tube	Core position 15	Solid State
Water-cooled tube	Core position 11	Solid State
Dry thermal-neutron tubes* (N-4 and S-3)	Stationary D ₂ O tank	Operations
Dry thermal-neutron tubes* (east, center, southwest, and northwest)	Stationary D ₂ O tank	Operations

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

Demineralizer Performance

Table 9 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 9. 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
33	1-4-73	3-5-73	1,614,000	1,280	115	5.7	5.8	1,008,000	1,430,000
34	3-6-73	4-30-73	1,393,200	1,848	181	5.7	5.7	873,000	1,363,000
35	5-2-73	7-2-73	2,060,000	2,072	120	5.8	5.8	896,000	1,209,000
36	7-3-73	9-4-73	1,900,000	1,672	116	5.8	5.8	792,000	1,270,000
37	9-4-73	11-12-73	1,300,000	2,021	107	5.9	6.0	682,000	1,144,000
38	11-14-73	1-7-74	1,692,000	1,353	98	5.7	5.7	738,000	1,102,000
39	1-9-74	3-13-74	1,320,000	1,931	101	6.2	6.0	666,000	908,000
40*	3-15-74	7-30-74	1,400,000	9	0	6.2	6.0	364,000	1,132,000
41	8-16-74	12-4-74	1,500,000	2,316	385	5.8	5.8	630,000	895,000
42**	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	In Service	1,500,000	1,948	126	5.5	5.7	1,067,000	1,829,000

*The reactor was shut down during the entire run.

**New resin in the demineralizer columns.

Special Tests

Efficiency Tests

Tests were performed by Quality Assurance and Inspection Department personnel on the cell ventilation filters. Details are given in Table 10.

Table 10. Efficiency Tests Results, Filters

Date	Unit	Type Test	Efficiency (%)
6-7-77	North bank	Elemental iodine	99.99
6-7-77	Center bank	Elemental iodine	99.96
6-14-77	South bank	Elemental iodine	99.96
6-16-77	North bank	Methyl iodide	82.98
6-16-77	Center bank	Methyl iodide	59.64
6-16-77	South bank	Methyl iodide	61.00
6-20-77	North bank	DOP	99.988
6-20-77	Center bank	DOP	99.990
6-20-77	South bank	DOP	99.992

Special Programs

The University Nuclear Engineering Department Experiments

The BSR was used for a training lab for university nuclear engineering students and trainees as described below:

Xenon Buildup and Decay Experiment -- On April 1, 1977, May 6, 1977, and June 4, 1977, following operation at 2 MW to achieve xenon equilibrium, the power level of the BSR was reduced to 4 kW to begin an experiment for students from Memphis State University or the University of Tennessee to study the buildup and decay of xenon in the BSR core. The students performed all activities associated with the experiment under the direct supervision of an Operations Division supervisor. The experiment, performed on a 24-hr day schedule until completion, was an exercise in: (1) maintaining the reactor critical at 4 kW; (2) determining the reactivity worth

of a shim rod under varying concentrations of xenon; and (3) determining the reactivity worth of xenon in the core as a function of time.

Operational Activities

Date	Remarks
4-12-77	All fuel elements including shim-rod fuel elements were visually inspected with satisfactory results.
4-19-77	The emergency electrical power quarterly test was completed with satisfactory results. The test was performed by turning the emergency power transfer switch (circuit 18 in electrical power panel DP-1) to "OFF", thereby starting the ORR diesel generator which supplied electrical power to designated circuits in the control and pool rooms.
4-22-77	The containment system quarterly functional checks were performed with satisfactory results.
4-25-77	The annual reactor control cables and messengers were inspected with satisfactory results.

In-Service Inspection

Inspection of the BSR Heat Exchanger, Bldg. 3119

The BSR heat exchanger was visually inspected June 27, 1977, by personnel from the Quality Assurance and Inspection Department. Following are the results:

1. The internal surface of the tubes appeared to be in fair to good condition--very little corrosion or pitting was noted.
2. The vessel heads had scattered pitting of a shallow depth.
3. The tube sheet to shell weld areas had moderate corrosion and pitted conditions, more severe on the north end.

The conditions noted are not considered to be of any significance at this time; therefore, the vessel is considered satisfactory for continued operations.

POOL CRITICAL ASSEMBLY

Operations

The PCA was used 118.5 hours as an experiment facility for the benefit of nuclear engineering students from Central Florida Community College, the University of Kentucky, and Memphis State University. 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.

Experiments

Experiments were conducted at the PCA by students from the Nuclear Engineering Departments of Central Florida Community College, the University of Kentucky, and Memphis State University, as indicated in Table 11. These experiments are described briefly and were directly supervised by the training supervisor of the Operations Division.

Approach-to-Critical

To demonstrate the technique of assembling a reactor core, a critical mass was loaded by the nuclear engineering students following the standard approach-to-critical procedure.

Regulating-Rod Calibration

A technique used in calibrating reactor control rods was demonstrated by using the period method in calibrating the regulating rod. The exercise was performed by the nuclear engineering students.

Statistical Weight

An experiment was performed to determine the effect of absorbers on the reactivity as a function of position in a special fuel element located in the reactor core. Using guidelines provided by the Operations supervisor, the experiment was performed by the nuclear engineering students.

Table 11. Usage of Pool Critical Facility

Date	Operational Activity	Purpose	Hours Used
4-4-77	Established Core No. 207 to obtain a critical mass following the standard approach-to-critical procedure.	Training lab for Central Florida Community College nuclear engineering students	11.5
4-5-77	Established Core No. 77 to permit calibration of the regulating rod and the performance of the importance function experiment.	Training lab for Central Florida Community College nuclear engineering students	7.1
4-6-77	Established Core No. 208 to obtain a critical mass following the standard approach-to-critical procedure. Established Core No. 209 to permit calibration of the regulating rod.	Training lab for the University of Kentucky nuclear engineering students	11.9
4-7-77	Established Core No. 210 to obtain a critical mass following the standard approach-to-critical procedure. Established Core No. 211 to permit calibration of the regulating rod.	Training lab for the University of Kentucky nuclear engineering students	12.3
5-31-77 and 6-1-77	Established Cores Nos. 212 and 213 to obtain a critical mass following the standard approach-to-critical procedures.	Training lab for Memphis State University nuclear reactor operator trainees	21.7
6-2-77 and 6-3-77	Established Core No. 77 to permit calibration of the regulating rod and the performance of the importance function experiment.	Training lab for Memphis State University nuclear reactor operator trainees	16.0
6-6-77 and 6-7-77	Established Cores Nos. 214 and 215 to obtain a critical mass following the standard approach-to-critical procedures.	Training lab for Memphis State University nuclear reactor operator trainees	20.3
6-8-77 and 6-9-77	Established Core No. 77 to permit calibration of the regulating rod and the performance of the importance function experiment.	Training lab for Memphis State University nuclear reactor operator trainees	17.7

APPENDIX A

BSR SHIM ROD INSPECTION

I. Shim-rod identity BS-1, core position CP-62, shim rod No. 5.

A. Measurements previous to installation of new shim rod, January 4, 1967.

1. Micrometer readings (out of water).

	<u>Flat Side</u>	<u>Edge Side</u>
Bottom	0.864 in.	2.228 in.
Middle	0.867 in.	2.228 in.
Top	0.867 in.	2.238 in.

2. Straight edge inspection (out of water) - irregular surface to 0.010 in.

B. Underwater inspection and measurements using oversized gauges along with feeler gauges and a straight edge, April 19, 1977.

1. 0.885 in. gauge minus feeler gauge (flat side); 2.260 in. minus feeler gauge (edge side).

	<u>Flat Side</u>	<u>Edge Side</u>
Bottom	0.875 in.	2.246 in.
Middle	0.873 in.	2.248 in.
Top	0.873 in.	2.250 in.

2. Straight edge inspection of flat side - irregular surface to 0.012 in.

3. Straight edge inspection of edge side - irregular surface to 0.010 in.

4. Visual inspection using magnifying glass - no evidence of cracks.

II. Shim-rod identity BS-2, core position CP-64, shim rod No. 6.

A. Measurements previous to installation of new shim rod, January 4, 1967.

1. Micrometer readings (out of water).

	<u>Flat Side</u>	<u>Edge Side</u>
Bottom	0.873 in.	2.226 in.
Middle	0.871 in.	2.229 in.
Top	0.873 in.	2.235 in.

2. Straight edge inspection (out of water) - irregular surface to 0.005 in.

B. Underwater inspection and measurements using oversized gauges along with feeler gauges and a straight edge, April 18, 1977.

1. 0.895 in. gauge minus feeler gauge (flat side); 2.270 in. gauge minus feeler gauge (edge side).

	<u>Flat Side</u>	<u>Edge Side</u>
Bottom	0.885 in.	2.258 in.
Middle	0.881 in.	2.252 in.
Top	0.881 in.	2.252 in.

2. Straight edge inspection of flat side - irregular surface to 0.008 in.
3. Straight edge inspection of edge side - irregular surface to 0.008 in.
4. Visual inspection using magnifying glass - no evidence of cracks.

III. Shim-rod identity BS-3, core position CP-42, shim rod No. 3.

A. Measurements previous to installation of new shim rod, January 4, 1967.

1. Micrometer readings (out of water).

	<u>Flat Side</u>	<u>Edge Side</u>
Bottom	0.861 in.	2.236 in.
Middle	0.866 in.	2.235 in.
Top	0.866 in.	2.243 in.

2. Straight edge inspection (out of water) - irregular surface to 0.005 in.

B. Underwater inspection and measurements using oversized gauges along with feeler gauges and a straight edge, April 19, 1977.

1. 0.885 in. gauge minus feeler gauge (flat side); 2.260 in. gauge minus feeler gauge (edge side).

	<u>Flat Side</u>	<u>Edge Side</u>
Bottom	0.877 in.	2.252 in.
Middle	0.873 in.	2.252 in.
Top	0.875 in.	2.250 in.

2. Straight edge inspection of flat side - irregular surface to 0.012 in.
3. Straight edge inspection of edge side - irregular surface to 0.004 in.
4. Visual inspection using magnifying glass - no evidence of cracks.

IV. Shim-rod identity BS-4, core position CP-44, shim rod No. 4.

A. Measurements previous to installation of new shim rod, January 4, 1967.

1. Micrometer readings (out of water):

	<u>Flat Side</u>	<u>Edge Side</u>
Bottom	0.860 in.	2.233 in.
Middle	0.861 in.	2.234 in.
Top	0.862 in.	2.231 in.

2. Straight edge inspection (out of water) - irregular surface to 0.003 in.

B. Underwater inspection and measurements using oversized gauges along with feeler gauges and a straight edge, April 18, 1977.

1. 0.885 in. gauge minus feeler gauge (flat side); 2.260 in. gauge minus feeler gauge (edge side).

	<u>Flat Side</u>	<u>Edge Side</u>
Bottom	0.873 in.	2.248 in.
Middle	0.870 in.	2.248 in.
Top	0.870 in.	2.245 in.

2. Straight edge inspection of flat side - irregular surface to 0.012 in.
3. Straight edge inspection of edge side - irregular surface to 0.012 in.
4. Visual inspection using magnifying glass - no evidence of cracks.

V. Shim-rod identity BS-5, core position CP-22, shim rod No. 1.

A. No measurements were made previous to installation of new shim rod.

B. Underwater inspection and measurements using oversized gauges along with feeler gauges and a straight edge, April 19, 1977.

1. 0.895 in. gauge minus feeler gauge (flat side); 2.270 in. gauge minus feeler gauge (edge side).

	<u>Flat Side</u>	<u>Edge Side</u>
Bottom	0.887 in.	2.260 in.
Middle	0.881 in.	2.260 in.
Top	0.887 in.	2.260 in.

2. Straight edge inspection of flat side - irregular surface to 0.008 in.
3. Straight edge inspection of edge side - irregular surface to 0.014 in.
4. Visual inspection using magnifying glass - no evidence of cracks.

VI. Shim-rod identity BS-6, core position CP-24, shim rod No. 2.

A. No measurements were made previous to installation of new shim rod.

B. Underwater inspection and measurements using oversized gauges along with feeler gauges and a straight edge, April 18, 1977.

1. 0.885 in. gauge minus feeler gauge (flat side); 2.260 in. gauge minus feeler gauge (edge side).

	<u>Flat Side</u>	<u>Edge Side</u>
Bottom	0.885 in.	2.250 in.
Middle	0.873 in.	2.245 in.
Top	0.877 in.	2.250 in.

2. Straight edge inspection of flat side - irregular surface to 0.006 in.
3. Straight edge inspection of edge side - irregular surface to 0.012 in.
4. Visual inspection using magnifying glass - no evidence of cracks.

REMARKS: The shim rods, when inspected prior to installation in the reactor, were found to vary considerably in thickness and width. It is very difficult to measure the rods underwater (micrometer versus oversized gauges and feeler gauges); however, it is apparent that the dimensions have not changed more than a few thousandths of an inch.

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