**High Flux Isotope
Reactor Quarterly Report
April, May, and June of 1976**

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MASTER

OAK RIDGE NATIONAL LABORATORY

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APRIL, MAY, AND JUNE OF 1976

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SUMMARY

Despite four end-of-cycle shutdowns this quarter, the reactor operated 95.6% of the time. This increased the on-stream time for the year to 95.3%. A test of the reactor bay in-leakage determined that an exhaust flow rate of 3,050 cfm is required to maintain a vacuum of 0.1 in. of water in this area.

OPERATIONS

Basic operating data for the quarter are listed in Table 1.

Table 1. HFIR Basic Operating Data
(April 1, 1976 through June 30, 1976)

	This Quarter	Last Quarter	Year To Date
Total energy, MWd	8,612	8,636	17,248
Average power, MW/operating hr	99.0	99.8	99.4
Time operating, %	95.6	95.0	95.3
Reactor availability, %	96.3	97.2	96.8
Reactor water radioactivity, $\frac{\text{c/min}}{\text{ml}}$ (av)	344,000	222,000	
Pool water radioactivity, $\frac{\text{c/min}}{\text{ml}}$ (av)	54	42	

The starting and ending dates for cycles 130, 131, 132, and 133 are presented in Table 2. Cycle 134 was still in progress at the end of the quarter and 1392 MWd had been accumulated.

Table 2. Cycles of Operation

Cycle No.	Date Started	Date Ended	Accumulated Power (MWd)
130	3-14-76	4-6-76	2324
131	4-7-76	4-30-76	2301
132	5-1-76	5-22-76	2040
133	5-24-76	6-16-76	2278
134	6-17-76	In progress	1392

The status of the HFIR fuel and control-plate inventory is indicated in Table 3.

Table 3. HFIR Material Inventory

Item	This Quarter	Last Quarter
New fuel elements placed in service	4	3
New fuel elements available for use	48	47
Spent fuel elements on hand	11	12
Spent fuel elements shipped	5	0
New sets of shim plates placed in service	0	0
New sets of shim plates available for use	2	2

SHUTDOWNS

A summary of the HFIR shutdowns for the quarter is presented in Table 4. Table 5 gives further details of the shutdowns.

Table 4. Summary of HFIR Shutdowns

Type	Number	Downtime (hr)
	Scheduled	
End of cycle	4	95.383
	Unscheduled	
Spurious trip	1	0.100

Table 5. Description of HFIR Shutdowns

Date	Downtime (hr)	Remarks
Scheduled		
4-6-76	21.500	Fuel cycle 130 was completed at 11:54 p.m. A total power generation of 2324 MWd was obtained on fuel elements 126-0 and 126-I. The shutdown was extended ~8 hours to complete a number of small maintenance items.
4-30-76	22.500	Fuel cycle 131 was completed at 11:12 p.m. A total power generation of 2301 MWd was obtained on fuel elements 127-0 and 127-I. The shutdown was extended ~8 hours to install an experiment.
5-22-76	38.183	Fuel cycle 132 was terminated at 8:00 a.m. A total power generation of 2040 MWd was obtained on fuel elements 128-0 and 128-I. The cycle was terminated early, and the shutdown was extended for ORNL Family Day activities.
6-16-76	13.200	Fuel cycle 133 was completed at 12:40 p.m. A total power generation of 2278 MWd was obtained on fuel elements 130-0 and 130-I.
Unscheduled		
5-12-76	0.100	Safety plates No. 2 and No. 4 dropped while a "heat power" test was being performed on the Channel No. 3 safety instrumentation.

OPERATIONAL NOTES AND SPECIAL TESTS

Reactor Bay In-Leakage

The HFIR Operating Safety Limits specify that during reactor operation the minimum exhaust rate from the reactor bay shall be sufficient to maintain in-leakage through all building openings but shall not be less than 6,000 cfm. Actually, a vacuum of ~0.3 in. of water and an exhaust flow rate of ~9,500 cfm is maintained during reactor operation.

To get an estimate of the minimum exhaust flow rate required to maintain a negative pressure in this area, after the end of cycle 130 the exhaust flow from the reactor bay was slowly throttled until the negative pressure dropped to 0.1 in. of water. It was determined that an exhaust flow of only 3,050 cfm was sufficient to maintain a vacuum of 0.1 in. of water in the reactor bay.

PLANT MAINTENANCE

Maintenance and changes in the various process systems are listed in Table 6.

INSTRUMENTATION AND CONTROLS

Maintenance and changes in the various instrumentation systems are listed in Table 7.

Table 6. Process System - Maintenance and Changes

Date	Component	Remarks
Primary System		
4-7-76	Pressure balance system	A leaking seal was replaced on the pressure balance system for the inner control cylinder. Oil was added to the reservoir, and the entire hydraulic system was degassed.
5-27-76	Cleanup pump	A new breaker was installed in the starting circuit of primary cleanup pump PU-2A.
Secondary System		
4-7-76	Makeup valve	A new 3-in. potable water makeup valve was installed at the cooling tower. The valve was removed in a few days because it was too small.
5-1-76	Flow control valve	Secondary flow control valve FCV-377A developed a sluggish control action. The valve operator was found disengaged from the valve stem.
6-16-76	Makeup valve	A new 4-in. potable water makeup valve was installed at the cooling tower.
Miscellaneous		
5-12-76	Air compressor	Inlet and exhaust valves were replaced in air compressor C-1B.

Table 7. Instrumentation - Maintenance and Changes

Date	Component	Remarks
Safety System		
5-25-76	Rod release timer circuit	A pulse generator was added to the rod release timer circuit as authorized by Reactor Instrument and Controls Design Change Memorandum No. 87.
6-1-76	ΔT subtractor	During a safety system test the No. 2 channel flux-to-flow ratio test would not trip the channel because of a faulty ΔT subtractor. The channel was manually tripped until the faulty component was found and replaced.
6-21-76	Temperature transmitter	An inlet temperature transmitter, which had been producing erratic readings on Channel No. 1, was replaced.
Servo System		
4-20-76	Servo motor	The Channel No. 3 servo motor was replaced because it was using an excessive amount of current.
Miscellaneous		
6-21-76	Computer	The computer printouts in the control room became inoperable. Repairs have not been completed.

SYSTEM SURVEILLANCE TESTS AND RESULTS

Vessel Head Studs

The accumulated number of tensioning cycles on the reactor vessel head studs is presented in Table 8. These studs were designed for a fatigue life of 40 cycles loading due to tensioning of the bolts and 730 full-pressure (1000 psig) cycles. Installation of new reactor vessel head studs was completed in June, 1972. The numbers in Table 8 represent the maximum cycles to which any new stud has been exposed.

Table 8. Vessel Head Stud-Tensioning Cycles

	This Quarter	Last Quarter	Total To Date
Head bolts tensioned	0	0	6
1500 psig			0
950 psig	0	0	7
650 psig	5	3	106

Stack Filters

Stack filtering systems in the special building hot exhaust (SBHE) and hot off-gas (HOG) systems were tested for particulate removal efficiency. Results of the most recent tests are tabulated in Table 9.

Table 9. Particulate and Iodine Removal Efficiency

Filter Bank	Methyl Iodide				Elemental Iodine				Filter Position	Particulate Retention			
	Last Test		Previous Test		Last Test		Previous Test			Last Test		Previous Test	
	Date	Eff., %	Date	Eff., %	Date	Eff., %	Date	Eff., %		Date	Eff., %	Date	Eff., %
SBHE, west	5-4-76	48	10-23-75	75	3-18-76	99.96	9-8-75	99.90	South	3-26-76	99.980	9-26-75	99.996
									North	3-26-76	99.000*	9-26-75	99.997
SBHE, center	5-11-76	80	10-29-75	88	3-30-76	99.98	9-11-75	99.97	South	3-26-76	99.988	9-26-75	99.995
									North	3-26-76	99.960	9-26-75	99.958
SBHE, east	5-6-76	47	10-28-75	59	3-23-76	99.97	10-9-75	99.91	South	3-26-76	99.956	9-26-75	99.992
									North	3-26-76	99.930*	9-26-75	99.960
HOG, west	5-13-76	73	10-30-75	90	4-6-76	99.95	10-20-75	99.93					
HOG, center	5-18-76	68	11-5-75	44	4-22-75	99.99	10-14-75	99.99					
HOG, east	5-20-76	98	11-4-75	92	4-14-76	99.90	10-15-75	99.99					

*Filters were replaced.

REACTOR EXPERIMENTS

Experimental Facilities

Usage of the various HFIR experiment facilities is tabulated in Table 10.

Table 10. Experiment Facility Usage

Facility	Description	Division
RB-1	Isotope production	Operations
RB-2	Isotope production	Operations
RB-3	Isotope production	Operations
RB-4	HFIR tensile specimens	Operations
RB-5	HTGR fuel irradiations	Reactor
RB-6	Isotope production	Operations
RB-7	HTGR fuel irradiations	Reactor
RB-8	Isotope production	Operations
CR-1	Isotope production	Operations
CR-2	Isotope production	Operations
CR-3	Californium production	Chemical Technology
CR-4	Californium production	Chemical Technology
CR-5	Isotope production	Operations
CR-6	Isotope production	Operations
CR-7	Isotope production	Operations
CR-8	Isotope production	Operations
VXF-1	HFIR corrosion specimen	Operations
VXF-7	Pneumatic tube	Analytical Chemistry
EF-2	Noise analysis studies	Instrumentation and Controls and Operations
HB-1	Neutron diffractometer	Solid State
HB-2	Neutron diffractometer	Chemistry
HB-3	Neutron diffractometer	Solid State
HB-4	Neutron diffractometer	Solid State

HFIR Target Loading

A description of the HFIR target loading for each of the operating cycles this quarter is presented in Figures 1, 2, 3, 4, and 5.

ORNL DWG 76-11557

TARGET TYPENUMBER

PLUTONIUM (Pu)

-

CURIUM (Cm)

29

STAINLESS STEEL (SST)

-

GRAPHITE (C)

1

ALUMINUM (Al)

-

HYDRAULIC TUBE (HT)

1

Fig. 1. HFIR Target Loading for Cycle 130 - March 14, 1976

<u>TARGET TYPE</u>	<u>NUMBER</u>
PLUTONIUM (Pu)	-
CURIUM (Cm)	29
STAINLESS STEEL (SST)	-
GRAPHITE (C)	1
ALUMINUM (Al)	-
HYDRAULIC TUBE (HT)	1

Fig. 2. HFIR Target Loading for Cycle 131 - April 7, 1976

TARGET TYPENUMBER

PLUTONIUM (Pu)

-

CURIUM (Cm)

29

STAINLESS STEEL (SST)

-

GRAPHITE (C)

1

ALUMINUM (Al)

-

HYDRAULIC TUBE (HT)

1

Fig. 3. HFIR Target Loading for Cycle 132 - May 1, 1976

<u>TARGET TYPE</u>	<u>NUMBER</u>
PLUTONIUM (Pu)	<u>-</u>
CURIUM (Cm)	<u>29</u>
STAINLESS STEEL (SST)	<u>-</u>
GRAPHITE (C)	<u>1</u>
ALUMINUM (Al)	<u>-</u>
HYDRAULIC TUBE (HT)	<u>1</u>

Fig. 4. HFIR Target Loading for Cycle 133 - May 23, 1976

TARGET TYPENUMBER

PLUTONIUM (Pu)

-

CURIUM (Cm)

29

STAINLESS STEEL (SST)

-

GRAPHITE (C)

1

ALUMINUM (Al)

-

HYDRAULIC TUBE (HT)

1

Fig. 5. HFIR Target Loading for Cycle 134 - June 17, 1976

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