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**High Flux Isotope Reactor
Quarterly Report
April, May, and June of 1981**

B. L. Corbett
K. H. Poteet

OPERATED BY
UNION CARBIDE CORPORATION
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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HIGH FLUX ISOTOPE REACTOR QUARTERLY REPORT
APRIL, MAY, AND JUNE OF 1981

B. L. Corbett and K. H. Poteet

Sponsor: J. H. Swanks, Director
Operations Division

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CONTENTS

	<u>Page</u>
SUMMARY	1
OPERATIONS	1
SHUTDOWNS	2
PLANT MAINTENANCE	3
INSTRUMENTATION AND CONTROLS	4
SYSTEM SURVEILLANCE TESTS AND RESULTS	5
Vessel Head Studs	5
Stack Filters	6
Summary of Surveillance Tests	6
REVISIONS TO THE HFIR OPERATING MANUAL	6
UNUSUAL OCCURRENCES	6
REACTOR EXPERIMENTS	6
Experiment Facilities	6
HFIR Target Loading	6
DISTRIBUTION	15

HIGH FLUX ISOTOPE REACTOR QUARTERLY REPORT
APRIL, MAY, AND JUNE OF 1981

B. L. Corbett and K. H. Poteet

SUMMARY

Routine reactor operation with four end-of-cycle shutdowns resulted in an on-stream time of 92.3% for the quarter. The outer control pates were changed and a semi-annual core component inspection made.

OPERATIONS

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

Table 1. HFIR basic operating data
(April 1 through June 30, 1981)

	This Quarter	Last Quarter	Year to date
Total energy, MWd	8373	8537	16,910
Average power, MW/operating hr	99.7	99.9	99.8
Time operating, %	92.3	94.9	93.6
Reactor availability, %	92.7	95.3	94.0
Reactor water radioactivity, $\frac{\text{c/min}}{\text{ml}}$ (av)	237,000	238,000	
Pool water radioactivity $\frac{\text{c/min}}{\text{ml}}$ (av)	52	57	

The starting and ending dates for Cycles 206, 207, 208, 209, and 210 are presented in Table 2.

Table 2. Cycles of operation

Cycle No.	Date started	Date ended	Accumulated Power (MWd)
206	3-18-81	4-9-81	2210
207	4-10-81	5-2-81	2195
208	5-3-81	5-25-81	2189
209	5-28-81	6-19-81	2188
210	6-21-81	In progress	978

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	4
New fuel elements available for use	37	37
Spent fuel elements on hand	14	14
Spent fuel elements shipped	4	3
New sets of shim plates placed in service	0	0
New sets of shim plates available for use	5	5

SHUTDOWNS

There were four end-of-cycle shutdowns for a total downtime of 168.350 h. There were no unscheduled shutdowns. Table 4 gives further details.

Table 4. Description of HFIR shutdowns

Date	Downtime (h)	Remarks
<u>Scheduled</u>		
4-9-81	35.550	Fuel cycle 206 was completed at 5:30 AM. A total power generation of 2210 MWd was obtained on fuel element 207 O&I.
5-2-81	23.333	Fuel cycle 207 was completed at 5:25 PM. A total power generation of 2195 MWd was obtained on fuel element 208 O&I.
5-25-81	77.017	Fuel cycle 208 was completed at 2:20 PM. A total power generation of 2189 MWd was obtained on fuel element 209 O&I. The shutdown was extended for reactor maintenance.
6-19-81	32.450	Fuel cycle 209 was completed at 6:00 PM. A total power generation of 2188 MWd was obtained on fuel element 210 O&I.
<u>Unscheduled</u>		
There were no unscheduled shutdowns during the quarter.		

PLANT MAINTENANCE

Maintenance and changes in the various process systems are listed in Table 5.

Table 5. Process systems — maintenance and changes

Date	Component	Remarks
<u>Primary system</u>		
4-10-81	Letdown valve	The Cell 113 letdown valve was replaced because of seat erosion.
5-11-81	Heat exchanger	The Cell 112 heat exchanger developed a primary-to-secondary leak of $\frac{1}{4}$ lpm (1 gpm). The leaking tube was plugged.
5-26-81	Letdown valve	The Cell 112 letdown valve was replaced because of seat erosion.
5-29-81	Letdown valve	The Cell 110 letdown valve was replaced because of seat erosion.
6-3-81	Demineralized resin	The east primary demineralizer resin was replaced because of resin deterioration.
6-4-81	Letdown valve	The Cell 111 letdown valve was replaced because of seat erosion.
6-5-81	Heat exchanger	The Cell 113 heat exchanger developed a primary-to-secondary leak of less than 4 lpm (1 gpm). The leaking tube was plugged.
<u>Miscellaneous</u>		
4-9-81	Drive rod	The No. 1 control plate drive rod was replaced as routinely scheduled.
5-5-81	Batteries	The 17-year-old nickle-cadmium batteries for pony motor PU-1G were replaced.
5-12-81	Batteries	The 17-year-old nickle-cadmium batteries for pony motor PU-1H were replaced.
5-19-81	Air compressor	Instrument air compressor C-1C was overhauled because of its deteriorating condition.

INSTRUMENTATION AND CONTROLS

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

Table 6. Instrumentation — maintenance and changes

Date	Component	Remarks
5-26-81	Pressure controller	The primary system pressure controller, PRC-127, became insensitive to pressure changes. Replacement of leaking O-ring seals in the letdown valve positioners, which allowed supply pressure to leak back to the controller, corrected the problem.
6-25-81	Fission chamber	The channel No. 1 fission chamber was replaced because of signal failure.
6-26-81	Fission chamber	The channel No. 2 fission chamber drive motor failed because of drive rack binding. A new motor was installed and the drive rack lubricated.

SYSTEM SURVEILLANCE TESTS AND RESULTS

Vessel Head Studs

The accumulated number of tensioning cycles on the reactor vessel head studs is presented in Table 7. These studs were designed for a fatigue life of 40 cycles loading due to tensioning of the bolts and 730 full-pressure 6.9 MPa (1000 psig) cycles. Installation of new reactor vessel head studs was completed in June 1972. The numbers in Table 7 represent the maximum cycles to which any new stud has been exposed.

Table 7. Vessel head stud-tensioning cycles

	This Quarter	Last Quarter	Total to Date
Head bolts tensioned	0	0	6
10.3 MPa (1500 psig)			0
6.5 MPa (950 psig)	0	0	7
5.2 MPa (750 psig)	4	5	88
4.5 MPa (650 psig)	0	0	1.17

Stack Filters

Stack filtering systems in the special building hot exhaust (SBHE) and hot off-gas (HOG) systems were tested for particulate and iodine removal efficiency. Results of the most recent tests are tabulated in Table 8.

Summary of Surveillance Tests

Table 9 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 month or longer. Other surveillance requirements which will not be reported are satisfied by the routine completion of daily and weekly check sheets, startup checklists, hourly data sheets, the operating logbooks, and miscellaneous quality assurance tests.

REVISIONS TO THE HFIR OPERATING MANUAL

There were no revisions or additions to the HFIR operating manual during this quarter.

UNUSUAL OCCURRENCES

One unusual occurrence (OP-81-8) was issued in final form at the HFIR during this quarter. All outstanding Unusual Occurrence Reports have been completed in final form.

REACTOR EXPERIMENTS

Experiment Facilities

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

HFIR Target Loading

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

Table 8. Particulate and iodine removal efficiency

Filter tank	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	4-28-81	93.3	10-23-80	95.6	3-31-81	99.99	10-14-80	99.99	South	3-3-81	99.995	9-16-80	99.99
									North	3-3-81	99.97	9-16-80	99.99
SBHE, center	5-5-81	15	10-30-80	40	4-2-81	99.9	10-16-80	99.9	South	3-16-81	99.996	9-16-80	99.99
									North	3-16-81	99.995	9-16-80	99.95
SBHE, east	4-30-81	84	10-28-80	84.5	4-7-81	99.98	10-21-80	99.95	South	3-19-81	99.991	9-16-80	99.997
									North	3-3-81	99.996	9-16-80	99.92
HOG, west	4-9-81	99.99	10-7-80	92.6	3-19-81	99.95	9-30-80	99.99					
HOG, center	4-21-81	99.99	10-9-80	99.9	3-17-81	99.99	10-18-80	99.99					
HOG, east	4-14-81	99.9	10-8-80	99.9	3-26-81	99.99	10-2-80	99.99					

Table 9. Summary of surveillance tests

Test	Most Recent Test	Previous Test	Previous Test
Annual Tests			
Count rate channel A calibration	1-8-81	6-3-80	10-29-79
Count rate channel B calibration	1-8-81	6-19-80	10-30-79
Count rate channel C calibration	1-9-81	6-17-80	11-1-79
Normal-emergency systems	3-17-81	12-15-80	2-12-80
Poison injection system	12-15-80	12-18-79	1-4-79
Pressurizer pump high pressure cutoff	10-6-80	9-27-79	9-19-78
Pressure relief valves	5-21-81	5-14-80	4-6-79
Pressure vessel head studs	5-21-81	7-23-80	9-4-79
Radiation block valve test	12-15-80	12-18-79	1-4-79
Reactor bay in-leakage test	12-15-80	12-18-79	1-4-79
Reactor components	5-25-81	12-15-80	6-29-80
Safety channel A calibration	5-27-81	12-16-80	6-9-80
Safety channel B calibration	5-27-81	12-16-80	6-10-80
Safety channel C calibration	5-27-81	12-16-80	6-12-80
Servo channel A calibration	4-24-81	12-2-80	5-20-80
Servo channel B calibration	4-24-81	12-2-80	5-20-80
Servo channel C calibration	4-24-81	12-2-80	5-20-80
Speed of shim and regulating drives	5-21-81	7-23-80	9-4-79
Switchgear battery load test	12-15-80	12-18-79	1-4-79
Semi-annual Tests			
Main pump low pressure cutoff	5-21-81	12-15-80	7-25-80
Pony motor battery E	3-16-81	11-19-80	8-17-80
Pony motor battery F	5-3-81	12-12-80	9-8-80
Pony motor battery G	5-26-81	10-1-80	6-26-80
Pony motor battery H	6-19-81	4-9-81	2-22-81
Radiation monitoring equipment	5-13-81	1-14-81	11-10-80
SDHE filter efficiency	3-16-81	10-16-80	5-1-80
Monthly Tests			
Cadmium nitrate tests	6-13-81	5-9-81	4-11-81
Diesel run test, No. 1	6-16-81	5-12-81	4-14-81
Diesel run test, No. 2	6-16-81	5-12-81	4-14-81

Table 10. Experiment facility usage

Facility	Description	Division
PTP-A1	Materials studies	Fusion Energy
PTP-A4	Materials studies	Fusion Energy
PTP-D1	Materials studies	Fusion Energy
PTP-D7	Materials studies	Fusion Energy
PTP-G4	Materials studies	Fusion Energy
PTP-G7	Materials studies	Fusion Energy
RB-1	Isotope production	Operations
RB-2	Isotope production	Operations
RB-3	Isotope production	Operations
RB-4	Isotope production	Operations
RB-5	Isotope production	Operations
RB-6	Isotope production	Operations
RB-7	HTGR fuel irradiations	Engineering Technology
RB-8	Isotope production	Operations
CR-1	Isotope production	Operations
CR-2	Isotope production	Operations
CR-3	Isotope production	Operations
CR-4	Isotope production	Operations
CR-5	Isotope production	Operations
CR-6	Isotope production	Operations
CR-7	Isotope production	Operations
CR-8	Isotope production	Operations
VXF-1	Isotope production	Operations
VXF-3	HFIR corrosion specimen	Operations
VXF-7	Pneumatic tube	Analytical Chemistry
VXF-9	Isotope production	Operations
VXF-13	Isotope production	Operations
VXF-18	Isotope production	Operations
VXF-22	Isotope production	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

CYCLE NO. 206DATE 3-18-81

TARGET TYPE

NUMBER

PLUTONIUM (Pu)

CURIUM (Cm)

STAINLESS STEEL (SST)

GRAPHITE (C)

ALUMINUM (Al)

HYDRAULIC TUBE (HT)

262111

HFIR TARGET LOADING

CYCLE NO. 207DATE 4-10-81

TARGET TYPE

NUMBER

PLUTONIUM (Pu)

26

CURIUM (Cm)

2

STAINLESS STEEL (SST)

2

GRAPHITE (C)

1

ALUMINUM (Al)

HYDRAULIC TUBE (HT)

HFIR TARGET LOADING

CYCLE NO. 208DATE 5-3-81

TARGET TYPE

NUMBER

PLUTONIUM (Pu)

CURIUM (Cm)

STAINLESS STEEL (SST)

GRAPHITE (C)

ALUMINUM (Al)

HYDRAULIC TUBE (HT)

271121

HFIR TARGET LOADING

CYCLE NO. 209DATE 5-28-81

TARGET TYPE

NUMBER

PLUTONIUM (Pu)

27

CURIUM (Cm)

1

STAINLESS STEEL (SST)

2

GRAPHITE (C)

1

ALUMINUM (Al)

HYDRAULIC TUBE (HT)

HFIR TARGET LOADING

CYCLE NO. 210DATE 6-21-81

TARGET TYPE

NUMBER

PLUTONIUM (Pu)

CURIUM (Cm)

STAINLESS STEEL (SST)

GRAPHITE (C)

ALUMINUM (Al)

HYDRAULIC TUBE (HT)

29111

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