27
246 NTIS

ornl

ORNL/TM-7451

MASTER

**OAK
RIDGE
NATIONAL
LABORATORY**

**High Flux Isotope Reactor
Quarterly Report
October, November, and December
of 1979**

B. L. Corbett
K. H. Poteet

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

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Printed in the United States of America. Available from
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road, Springfield, Virginia 22161
NTIS price codes—Printed Copy: A03; Microfiche A01

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Contract No. W-7405-eng-26

Operations Division

HIGH FLUX ISOTOPE REACTOR QUARTERLY REPORT
OCTOBER, NOVEMBER, AND DECEMBER OF 1979

B. L. Corbett and K. H. Poteet

Sponsor: J. A. Cox
Director, Operations Division

DISCLAIMER

This book was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute, or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Date Published - August 1980

NOTICE This document contains information of a preliminary nature. It is subject to revision or correction and therefore does not represent a final report.

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37830
operated by
UNION CARBIDE CORPORATION
for the
DEPARTMENT OF ENERGY

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

**THIS PAGE
WAS INTENTIONALLY
LEFT BLANK**

CONTENTS

	<u>Page</u>
SUMMARY	1
OPERATIONS	1
SHUTDOWNS	2
PLANT MAINTENANCE	3
INSTRUMENTATION AND CONTROLS	4
SYSTEM SURVEILLANCE TESTS AND RESULTS	4
Vessel Head Studs	4
Stack Filters	5
Summary of Surveillance Tests	7
REVISIONS TO THE HFIR OPERATING MANUAL	8
UNUSUAL OCCURRENCES	8
REACTOR EXPERIMENTS	9
Experiment Facilities	9
HFIR Target Loading	10
DISTRIBUTION	17

HIGH FLUX ISOTOPE REACTOR QUARTERLY REPORT
OCTOBER, NOVEMBER, AND DECEMBER OF 1979

B. L. Corbett and K. H. Poteet

SUMMARY

Routine reactor operation with four end-of-cycle shutdowns and one scheduled midcycle shutdown resulted in an on-stream time of 93.6% for the quarter. This gave the HFIR an on-stream time for the year of 91.3%. The outer control plates were replaced, and the annual core components inspection was made.

OPERATIONS

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

Table 1. HFIR Basic Operating Data
 (October 1, 1979 through December 31, 1979)

	This Quarter	Last Quarter	Total for 1979
Total energy, MWd	8,606	8,253	33,270
Average power, MW/operating hr	99.9	99.8	99.9
Time operating, %	93.6	89.9	91.3
Reactor availability, %	96.3	89.9	92.0
Reactor water radioactivity, c/min (av) ml	295,000	277,000	
Pool water radioactivity, c/min (av) ml	108	73	

The starting and ending dates for Cycles 183, 184, 185, 186, and 187 are presented in Table 2.

Table 2. Cycles of Operation

Cycle No.	Date Started	Date Ended	Accumulated Power (MWd)
183	9-27-79	10-19-79	2184
184	10-20-79	11-11-79	2188
185	11-12-79	12-4-79	2187
186	12-5-79	12-28-79	2133
187	12-29-79	In progress	235

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	43	41
Spent fuel elements on hand	14	13
Spent fuel elements shipped	3	5
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 and one scheduled midcycle shutdown for a total downtime of 142.216 hrs. There were no unscheduled shutdowns. Table 4 gives further details.

Table 4. Description of HFIR Shutdowns

Date	Downtime (hrs)	Remarks
10-19-79	21.133	Fuel Cycle 183 was completed at 3:06 PM. A total power generation of 2184 MWd was obtained on fuel elements 184 O&I.
11-11-79	30.166	Fuel Cycle 184 was completed at 8:40 AM. A total power generation of 2188 MWd was obtained on fuel elements 185 O&I. The shutdown was extended to install an experiment facility.
12-4-79	17.634	Fuel Cycle 185 was completed at 12:00 noon. A total power generation of 2187 MWd was obtained on fuel elements 186 O&I.
12-17-79	53.333	Fuel Cycle 186A was ended at 4:00 AM for target rod removal. The outer control plates were replaced and the semiannual core inspection was made while awaiting xenon decay.
12-28-79	19.950	Fuel Cycle 186B was completed at 7:27 PM. A total power generation of 2133 MWd was obtained on fuel elements 187 O&I.

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
Primary System		
11-1-79	Letdown valve	A new letdown valve with a smaller opening was installed in Cell 112 for test and evaluation.
12-17-79	Letdown valve	Another newly modified letdown valve was installed in Cell 110 for test and evaluation.
12-18-79	Pony motor	The Cell 112 pony motor armature was machined down and new brushes installed to correct an arcing problem.

Table 5. (continued)

Date	Component	Remarks
Secondary System		
10-15-79	Gearbox	Cooling tower fan 4-B1 was removed for overhauling and replaced with a spare.

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
11-5-79	Fission chamber	An integrated circuit chip was replaced in the No. 2 fission chamber preamplifier after it failed.
11-13-79	pH meter	All circuit boards in the pH meter system 331 were replaced to correct a failure.
12-7-79	pH controller	The controller operated by the pH 1200 system was replaced after it failed.
12-19-79	Power supply	The power supply for Channel No. 2 safety flow transmitter was replaced after its failure caused a flux/flow ratio trip.

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)	5	5	62
4.5 MPa (650 psig)	0	0	117

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.

Table 8. 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	10-11-79	95.6	5-8-79	99.9	10-9-79	99.99	5-3-79	99.99	South	9-5-79	99.996	3-9-79	99.998
									North	9-17-79	99.999	3-9-79	99.995
SBHE, center	10-23-79	35	4-5-79	49	10-4-79	99.99	3-20-79	99.92	South	9-5-79	99.990	3-9-79	99.991
									North	9-5-79	99.989	3-9-79	99.992
SBHE, east	10-18-79	92.5	4-3-79	99.6	10-3-79	99.99	3-13-79	99.99	South	9-5-79	99.990	3-9-79	99.993
									North	9-5-79	99.998	3-9-79	99.978
HOG, west	10-25-79	99.9	4-19-79	99.8	10-10-79	99.99	4-11-79	99.99					
HOG, center	4-26-79	50	10-18-78	78	4-12-79	99.97	10-10-78	99.99					
HOG, east	4-24-79	23	10-17-78	94	4-17-79	99.97	10-11-78	99.99					

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 check lists, hourly data sheets, the operating log books, and miscellaneous quality assurance tests.

Table 9. Summary of Surveillance Tests

Test	Most Recent Test	Previous Test	Previous Test
Annual Tests			
Count rate channel A calibration	10-29-79	3-22-79	9-15-78
Count rate channel B calibration	10-30-79	4-3-79	9-15-78
Count rate channel C calibration	11-1-79	4-10-79	9-15-78
Normal-emergency systems	4-30-79	9-14-78	1-10-78
Poison injection system	12-18-79	1-4-79	2-1-78
Pressurizer pump high pressure cutoff	9-27-79	9-19-79	3-1-78
Pressure relief valves	4-6-79	9-14-78	10-5-77
Pressure vessel head studs	9-4-79	9-14-78	10-5-77
Radiation block valve test	12-18-79	1-4-79	2-1-78
Reactor bay in-leakage test	12-18-79	1-4-79	2-28-78
Reactor components	12-18-79	5-1-79	9-14-78
Safety channel A calibration	10-2-79	4-18-79	9-27-78
Safety channel B calibration	10-4-79	6-6-79	9-29-78
Safety channel C calibration	10-5-79	6-7-79	10-12-78
Servo channel A calibration	10-2-79	3-20-79	9-15-78
Servo channel B calibration	10-2-79	3-20-79	9-15-78
Servo channel C calibration	10-2-79	3-20-79	9-15-78
Speed of shim and regulating drives	9-4-79	9-14-78	10-6-77
Switchgear battery load test	12-18-79	1-4-79	2-1-78

Table 9. (continued)

Test	Most Recent Test	Previous Test	Previous Test
Semiannual Tests			
Main pump low pressure cutoff	9-3-79	4-30-79	9-14-78
Pony motor battery E	10-19-79	5-29-79	2-19-79
Pony motor battery F	11-11-79	6-21-79	3-14-79
Pony motor battery G	12-4-79	7-14-79	4-5-79
Pony motor battery H	12-18-79	10-19-79	4-28-79
Radiation monitoring equipment	9-18-79	5-14-79	1-10-79
SBHE filter efficiency	10-4-79	3-20-79	9-7-78
Monthly Tests			
Cadmium nitrate tests	12-16-79	11-18-79	10-14-79
Diesel run test, No. 1	12-16-79	11-11-79	10-14-79
Diesel run test, No. 2	12-16-79	11-11-79	10-14-79

REVISIONS TO THE HFIR OPERATING MANUAL

Revisions and additions to the HFIR operating manual which have been published this quarter are tabulated in Table 10.

Table 10. HFIR Manual Revisions

Date	Section No.	Subject	General Description
10-5-79	4 (Vol. II)	Rod Drive Maintenance	Changes to control rod drive maintenance procedures to conform with existing practices.

UNUSUAL OCCURRENCES

There were no unusual occurrences at the HFIR during this quarter, and 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 11.

Table 11. Experiment Facility Usage

Facility	Description	Division
PTP-A1	Materials studies	Metals and Ceramics
PTP-A4	Materials studies	Metals and Ceramics
PTP-D1	Materials studies	Metals and Ceramics
PTP-D7	Materials studies	Metals and Ceramics
PTP-G4	Materials studies	Metals and Ceramics
PTP-G7	Materials studies	Metals and Ceramics
RB-1	Isotope production	Operations
RB-2	Isotope production	Operations
RB-3	Isotope production	Operations
RB-4	Isotope production	Operations
RB-5	HTGR fuel irradiations	Engineering Technology
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-5	Isotope production	Operations

Table 11. (continued)

Facility	Description	Division
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
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, 5, and 6.

HFIR TARGET LOADING

CYCLE NO. 183DATE 9/27/79

TARGET TYPE

NUMBER

PLUTONIUM (Pu)

CURIUM (Cm)

STAINLESS STEEL (SST)

GRAPHITE (C)

ALUMINUM (Al)

HYDRAULIC TUBE (HT)

2911

Fig. 1

HFIR TARGET LOADING

CYCLE NO. 184DATE 10/20/79

TARGET TYPE

NUMBER

PLUTONIUM (Pu)

CURIUM (Cm)

STAINLESS STEEL (SST)

GRAPHITE (C)

ALUMINUM (Al)

HYDRAULIC TUBE (HT)

2911

Fig. 2

HFIR TARGET LOADING

CYCLE NO. 185DATE 11/12/79

TARGET TYPE

NUMBER

PLUTONIUM (Pu)

CURIUM (Cm)

STAINLESS STEEL (SST)

GRAPHITE (C)

ALUMINUM (Al)

HYDRAULIC TUBE (HT)

2911

Fig. 3

HFIR TARGET LOADING

CYCLE NO. 186ADATE 12/5/79

TARGET TYPE

NUMBER

PLUTONIUM (Pu)

29

CURIUM (Cm)

STAINLESS STEEL (SST)

GRAPHITE (C)

1

ALUMINUM (Al)

HYDRAULIC TUBE (HT)

1

Fig. 4

HFIR TARGET LOADING

CYCLE NO. 186BDATE 12/19/79

TARGET TYPE

NUMBER

PLUTONIUM (Pu)

CURIUM (Cm)

29

STAINLESS STEEL (SST)

GRAPHITE (C)

1

ALUMINUM (Al)

HYDRAULIC TUBE (HT)

1

Fig. 5

HFIR TARGET LOADING

CYCLE NO. 187DATE 12/29/79

TARGET TYPE

NUMBER

PLUTONIUM (Pu)

CURIUM (Cm)

STAINLESS STEEL (SST)

GRAPHITE (C)

ALUMINUM (Al)

HYDRAULIC TUBE (HT)

28111

Fig. 6

INTERNAL DISTRIBUTION

1. D. S. Asquith	21-26. R. V. McCord
2. J. E. Bigelow	27. J. R. McGuffey
3. F. T. Binford	28. L. C. Oakes
4. G. H. Burger	29. H. Postma
5. C. D. Cagle	30. K. H. Poteet
6. W. R. Casto	31. M. E. Ramsey
7-8. J. A. Conlin	32. T. M. Sims
9-10. B. L. Corbett	33. M. J. Skinner
11. J. A. Cox	34. J. H. Swanks
12. W. H. Culbert	35. D. B. Trauger
13. T. P. Hamrick	36. K. W. West
14. R. W. Hobbs	37. F. W. Wiffen
15. C. C. Hopkins	38. M. K. Wilkinson
16. S. S. Hurt, III	39. A. Zucker
17. G. H. Jenks	40-41. Central Research Library
18. O. L. Keller	42. Document Reference Section
19. R. W. Knight	43-44. Laboratory Records Department
20. W. C. Koehler	45. Laboratory Records, ORNL R.C.
	46. ORNL Patent Section

EXTERNAL DISTRIBUTION

- 47-73. Technical Information Center, Oak Ridge
- 74. Assistant Manager, Office of Energy Research and Development, DOE, Oak Ridge
- 75. J. L. Burnett, Division of Physical Research, DOE, Washington, D.C. 20545
- 76. M. Jacquemain, Head, Technical Department ILL, Institute Max von Laue-Paul Langevin, CEDEX 156, 38 Grenoble-Gare, France
- 77. W. A. Johnson, DOE, Oak Ridge
- 78. G. L. Rogosa, Division of Physical Research, DOE, Washington, D.C. 02545
- 79. A. C. Wood, Australian AEC, Nuclear Science and Technology Branch, Private Mail Bag, Sutherland 2232, New South Wales, Australia