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OAK RIDGE NATIONAL LABORATORY

MARTIN MARIETTA

High Flux Isotope Reactor Quarterly Report April through June 1985

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OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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

ORNL/TM-9766

Operations Division

HIGH FLUX ISOTOPE REACTOR QUARTERLY REPORT APRIL THROUGH JUNE 1985

B. L. Corbett and M. B. Farrar

Manuscript Completed - August 28, 1985
Date Published - September 1985

Sponsor: J. H. Swanks, Director
Operations Division

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

Prepared by the
OAK RIDGE NATIONAL LABORATORY
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Martin Marietta Energy Systems, Inc.
for the
U.S. DEPARTMENT OF ENERGY
under Contract No. DE-AC05-84OR21400

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HIGH FLUX ISOTOPE REACTOR QUARTERLY REPORT
APRIL THROUGH JUNE 1985

SUMMARY

Operation of the reactor was routine with four end-of-cycle shutdowns. There was a total of six scheduled shutdowns and seven unscheduled shutdowns resulting in an on-stream time of 85.1% for the quarter.

OPERATIONS

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

Table 1. HFIR basic operating data
(April 1 - June 30, 1985)

	This quarter	Last quarter	Year to date
Total energy, MWd	7704	8488	16,192
Time operated, h	1857.918	2039.401	3897.319
Average power, MW/operating h	99.5	99.9	99.7
Time operating, %	85.1	94.4	89.8
Reactor availability, %	85.1	94.4	89.8
Reactor water radioactivity, cpm/ml (av)	260,584	235,140	
Pool water radioactivity cpm/ml (av)	72	57	

The starting and ending dates for Cycles 264, 265, 266, and 267 are presented in Table 2.

Table 2. Cycles of operation

Cycle No.	Fuel assembly	Date started	Date ended	Accumulated power (MWd)
264	262	3/20/85	4/14/85	2201
265	265	4/15/85	5/7/85	2236
266	264	5/8/85	5/29/85	1944
267	266[a]/264[b]	5/29/85	6/29/85	2441

[a]2209 MWd were accumulated on fuel assembly 266 during Cycle 267.

[b]232 MWd were accumulated on fuel assembly 264 during Cycle 267.

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

Table 3. HFIR material inventory

Item	This quarter	Last quarter
New fuel assemblies placed in service	3	4
New fuel assemblies available for use at end of quarter	13	11
Spent fuel assemblies on hand	12	14
Spent fuel assemblies shipped	6	1
New sets of shim plates placed in service	0	0
New sets of shim plates available for use	4	4

SHUTDOWNS

There were four end-of-cycle shutdowns. In all, there was a total of six scheduled shutdowns and seven unscheduled shutdowns for a total downtime of 325.749 hours. Table 4 gives further details.

Table 4. Description of HFIR shutdowns

Date	Downtime, h	Remarks
		Scheduled
4/14	27.685	End of Cycle No. 264. The total energy accumulated on fuel assembly 262 during this cycle was 2201 MWd.
5/7	25.133	End of Cycle No. 265. The total energy accumulated on fuel assembly No. 265 was 2236 MWd.
5/9	0.233	The reactor was intentionally shut down to allow for a reactor operator startup certification test.
5/9	0.133	The reactor was intentionally shut down to allow for a reactor operator startup certification test. Following the startup, reactor power was held at 40 MW for 1 h and 45 min in accordance with the programmed restart requirements.
--	--	End of Cycle 266. See unscheduled shutdown description.
6/20	16.300	End of Sub-cycle No. 267-C. The energy accumulated on fuel assembly 264 during sub-cycle 267-C was 232 MWd. The total energy accumulated on fuel assembly 264 was 2176 MWd.
6/29	24.500	End of Sub-cycle No. 267-E and the end of Cycle 267 et al. The total energy accumulated on fuel assembly No. 266 during irradiation Cycle 267 was 2209 MWd. The total energy accumulated by the irradiation targets during irradiation Cycle 267 was 2441 MWd. (This includes 232 MWd accumulated on the targets from fuel assembly No. 264 during sub-cycle 267-C.)
		Unscheduled
4/5	59.166	A momentary surge in TVA power during an electrical storm tripped all 2.4-kV equipment. This caused a reactor power demand setback and subsequent 1.1 flux/flow fast reverse. Xenon poisoning precluded a reactor restart. The reactor remained down until xenon had decayed sufficiently from the core to allow a restart.

Table 4. (Continued)

Date	Downtime, h	Remarks
5/29	29.583	The reactor shut down upon a loss of TVA power. Xenon poisoning precluded a reactor restart. The decision was made to designate this shutdown as the end of Cycle No. 266. The reactor was refueled and the targets were worked. The total energy accumulated on fuel assembly No. 264 for this cycle was 1944 MWd.
5/31	0.200	The reactor shut down from a two-plate drop initiated by electrical noise in the safety channel electronics. This noise was attributed to work being performed on a failed channel No. 2 ion chamber high-voltage supply. Channel No. 2 was manually tripped and the reactor was restarted.
6/4	0.250	The reactor was shut down by a low-pressure scram while attempting to switch primary heat exchangers at power. The pressure excursion was attributed to a faulty letdown valve controller.
6/7	68.933	The reactor was shut down by a low-pressure scram upon a momentary loss of incoming TVA power. The alignment of the channel No. 2 servo instrumentation for maintenance precluded a reactor restart. The reactor remained shutdown until xenon had decayed sufficiently to allow a restart.
6/17	10.267	Noise in the safety channels caused a four-plate drop during maintenance on the channel No. 1 FFED circuitry. The reactor was refueled using fuel assembly No. 264 instead of waiting for xenon to decay in fuel assembly No. 266.
6/21	63.366	The reactor was shut down upon a loss of TVA power. Xenon poisoning precluded a reactor restart. The reactor remained shutdown until xenon had decayed sufficiently to allow a restart.

PLANT MAINTENANCE

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

Table 5. Process systems - maintenance and changes

Date	Component	Remarks
		Primary system
4/29	Primary heat exchanger 1A	Leaking heat exchanger tube No. 17 in row No. 1 was plugged.
5/1	Primary heat exchanger 1D	Leaking heat exchanger tubes Nos. 24 and 27 in row No. 11 were plugged.
5/8	Hydraulic tube U-bend	Burrs were removed and new O-rings were installed on the U-bend to hatch-latching mechanism.
5/28	Primary heat exchanger 1D	Leaking heat exchanger tubes No. 41 in row No. 1 and No. 42 in row No. 2 were plugged.
5/29	Vibration transducer mounts	Vibration transducer mounts were installed in cell 111 for future heat exchanger vibration analysis.
5/29	Cleanup system valve HCV-1017	The diaphragm and operator were replaced.
6/5	Primary heat exchanger 1B	Leaking heat exchanger tube No. 5 in row No. 1 was plugged.
6/7	Primary heat exchanger 1B	Leaking heat exchanger tube No. 42 in row No. 2 was plugged.
6/10	Letdown valve	The letdown valve in cell 110 was replaced with spare valve No. 76-4.
6/10	Primary heat exchanger 1B	Leaking heat exchanger tube No. 40 in row No. 1 was plugged. Cracks discovered in the tube sheet cladding in the vicinity of this tube were repaired.
		Secondary system
4/9	FCV-325 tower blowdown valve	A filter was installed in the air supply line to FCV-325 to help preclude future controller failures.
4/16	FCV-325 tower blowdown valve	The dp cell for the valve controller was replaced.

Table 5. (Continued)

4/26	FCV-325 tower blowdown valve	The dp cell for the valve controller was again replaced.
5/7	Primary heat exchanger 1A	The secondary (shell) side of the heat exchanger was cleaned with sulfamic acid to reduce scale deposits.
5/15	FCV-325 tower blowdown valve	The dp cell for the valve controller was again replaced.
5/29	Cooling tower	Damaged and missing fill was replaced.
6/27	Primary heat exchanger 1D	The secondary (shell) side of the heat exchanger was cleaned with sulfamic acid to reduce scale deposits.
6/27	Cell coolers	Burned wiring to the cell cooler for motors was replaced.
		Miscellaneous
4/19	Instrument air dryer No. 1	A faulty valve was replaced.
5/6	PDP-1160 computer	A faulty power source was replaced, and the computer was returned to service.
5/14	Air compressor C-1B	A cooling water flow switch was replaced.
6/10	Sulfuric acid addition system	Additional concrete diking was poured around the acid pumps and storage tank. Corroded piping is being replaced.

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
4/8	WRCC channel No. 2	A 0.1-hp servo amplifier was replaced in the fission chamber drive circuit.
5/10	Safety channel No. 3	The position of the ion chamber was adjusted from 8 1/4 in. to 8 5/8 in.
5/30	Safety channel No. 3	The XWM-100-3 heat-power multiplier was replaced due to a high output signal. The output of the channel No. 3 inverter was also raised 2 V.
6/10	Safety channel No. 3	The FX-100-3 flow repeater was calibrated.
6/11	Safety channel No. 2	The ion chamber was replaced with a spare. The chamber was positioned at 8 5/8 in. withdrawn.
6/20	Safety channel No. 1	The FFED rotating-shield limit switches were replaced.
6/20	Pressure block controller	The pressure block-valve set points were raised after being found low.
6/21	Safety channel No. 2	The flux conditioner module was replaced.
6/24	WRCC channel No. 1	The 100-s fast trip comparator was replaced.
6/24	WRCC channel No. 1	The fission chamber drive motor was replaced.

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. In November 1983, stud 72-1 was replaced by stud 73-9 because of a small anomaly discovered during previous ultrasonic inspections. The numbers in Table 7 represent the maximum cycles to which any stud has been exposed.

Table 7. Vessel head stud-tensioning cycles

	This quarter	Last quarter	Total to date
Head bolts tensioned	0	0	8
10.3 MPa (1500 psig)	0	0	0
6.5 MPa (950 psig)	0	0	11
5.2 MPa (750 psig)	7	5	174
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 efficiencies. 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 for one month or longer. Other surveillance requirements, which are not 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.

Table 8. Particulate and iodine removal efficiencies

Filter bank	Elemental iodine				Filter position	Particulate retention			
	Last test		Previous test			Last test		Previous test	
	Date	Eff.,%	Date	Eff.,%		Date	Eff.,%	Date	Eff.,%
SBHE, west	1/15/85[a]	99.91	5/2/84	99.93	South	3/26/85	99.99	9/24/84	99.99
					North	3/26/85	99.99	9/24/84	99.99
SBHE, center	2/5/85[a]	99.95	5/17/84	99.98	South	3/26/85	99.99	9/24/84	99.66
								10/17/84	99.99
					North	3/26/85	99.99	9/24/84	99.09[b]
								10/17/84	99.99
SBHE, east	2/7/85[a]	99.91	5/3/84	99.95	South	3/26/85	99.99	9/24/84	99.98
					North	3/26/85	99.93[c]	9/24/84	99.98
						4/19/85	99.99		
HOG, west	2/15/85	99.95	8/8/84[d]	99.96					
HOG, cent	2/20/85	99.99	5/24/84	99.97					
HOG, east	2/28/85	99.99	5/22/84	99.99					

[a]The period between this test and the previous test exceeds the 8-month limit imposed on semi-annual tests. This constitutes a Technical Specification violation.

[b]The center bank of SBHE filters was removed from service for the replacement of HEPA filters. Both sets of HEPA filters were replaced and tested on 10/17/84.

[c]The East bank of SBHE filters was removed from service for the replacement of HEPA filters. The North bank of HEPA filters was replaced and tested on 4/19/85.

[d]The West HOG filters were replaced after water backed up into the pit and damaged the filters. This test was for the new filter bank.

Table 9. Summary of surveillance tests

Test	Most recent test	Previous test	Previous test
Decennial tests			
Pressure boundary components	11/83	7/75	NA
Annual tests			
Count rate channel A calibration	2/6/85	3/20/84	9 20/83
Count rate channel B calibration	2/8/85	3/22/84	9 20/83
Count rate channel C calibration	2/19/85	3/27/84	9/20/83
Normal emergency systems	5/29/85	10/4/84	7/5/84
Poison injection system	10/29/84	12/8/83	11/19/82
Pressurizer pump high-pressure cutoff	2/22/85	3/6/84	8/9/83
Pressure relief valves	10/3/84	1/6/84	10/24/83
Pressure-vessel head studs	10/4/84	10/1/83	2/22/83
Radiation block valve test	10/29/84	12/12/83	11/19/82
Reactor bay in-leakage test	10/28/84	12/12/83	10/27/82
Reactor components	10/4/84	12/12/83	2/22/83
Safety channel A calibration	2/28/85	3/11/84	7/19/83
Safety channel B calibration	3/1/85	3/11/84	7/20/83
Safety channel C calibration	3/4 85	3/11/84	7/21/83
Servo channel A calibration	2/5/85	2/9/84	6/8/83
Servo channel B calibration	2/5/85	2/9/84	6/8/83
Servo channel C calibration	2/5/85	2/9/84	6/8/83
Speed of shim and regulating drives	11/19/84	12/20/83	2/22/83
Switchgear battery load test	5/8/85	4/30/84	5/5/83
Semiannual tests			
Main pump low-pressure cutoff	6/30/85	2/24/85	7/5/84
Pony motor battery E	5/28/85	2/1/85	11/23/84
Pony motor battery F	6/17/85	2/24/85	12/15/84
Pony motor battery G	6/30/85	12/28/84	10/29/84
Pony motor battery H	6/30/85	1/9/85	11/17/84
Radiation monitoring equipment	5/14/85	1/16/85	11/12/84
Monthly tests			
Cadmium nitrate tests	6/29/85	5/26/85	4/28/85
Diesel run test, No. 1	6/25/85	5/22/85	4/30/85
Diesel run test, No. 2	6/25/85	5/22/85	4/30/85

REVISIONS TO THE HFIR OPERATING MANUAL

There were no HFIR Operating Manual revisions this quarter.

UNUSUAL OCCURRENCES

Seven unusual occurrence reports were issued this quarter:

ORNL-85-7-HFIR-85-3	Unscheduled Reactor Shutdown
ORNL-85-13-HFIR-85-4	Unscheduled Reactor Shutdown
ORNL-85-14-HFIR-85-5	Unscheduled Reactor Shutdown
ORNL-85-15-HFIR-85-6	Unscheduled Reactor Shutdown
ORNL-85-16-HFIR-85-7	Unscheduled Reactor Shutdown
ORNL-85-18-HFIR-85-8	Unscheduled Reactor Shutdown
ORNL-85-19-HFIR-85-9	Unscheduled Reactor Shutdown

REACTOR EXPERIMENTS

EXPERIMENT FACILITIES

Assignments of the various HFIR experiment facilities are tablulated 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, and 4.

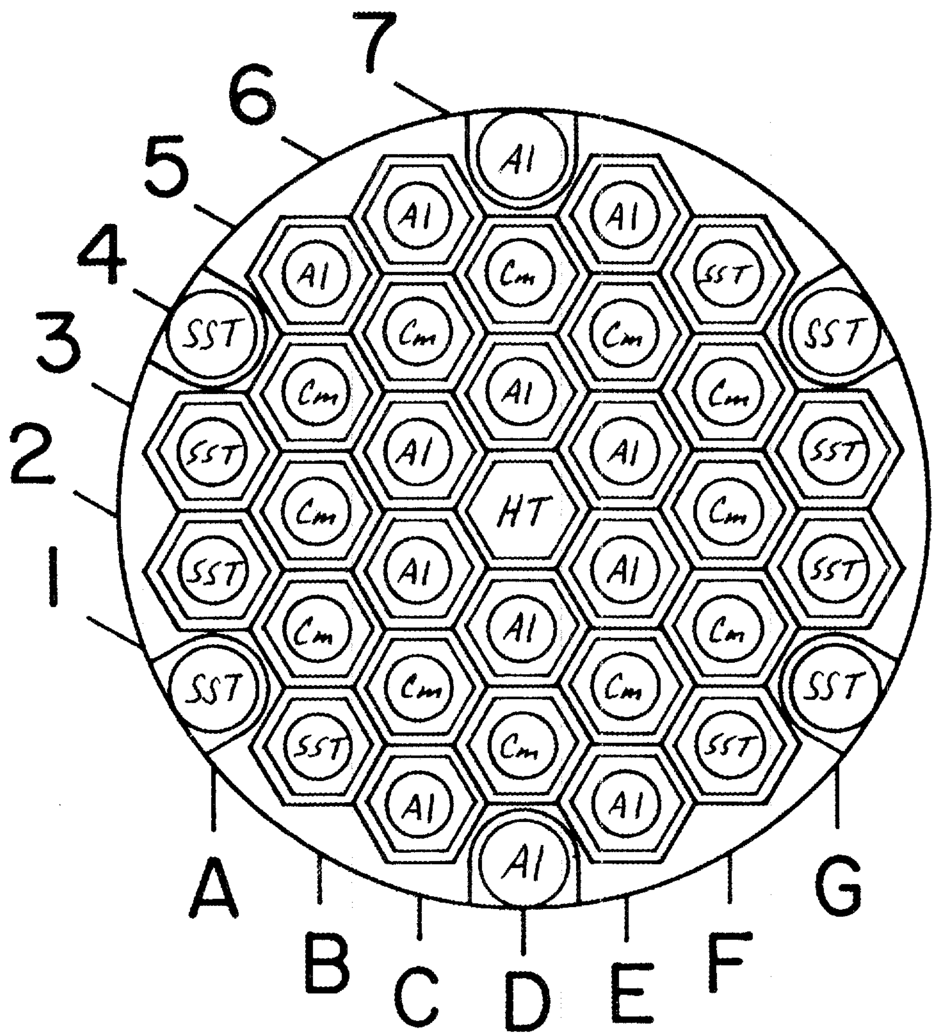
Table 10. Experiment facility assignments

Facility	Description	Sponsor
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	Isotope production	Operations
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	Isotope production	Operations
VXF-4	HFIR corrosion specimen	Operations
VXF-5	Isotope production	Operations
VXF-7	Pneumatic tube	Analytical Chemistry
VXF-9	Isotope production	Operations
VXF-11	Isotope production	Operations
VXF-13	Isotope production	Operations
VXF-15	Isotope production	Operations
VXF-18	Isotope production	Operations
VXF-20	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. 264 DATE 3/20/85

ORNL/DWG. 85-15455



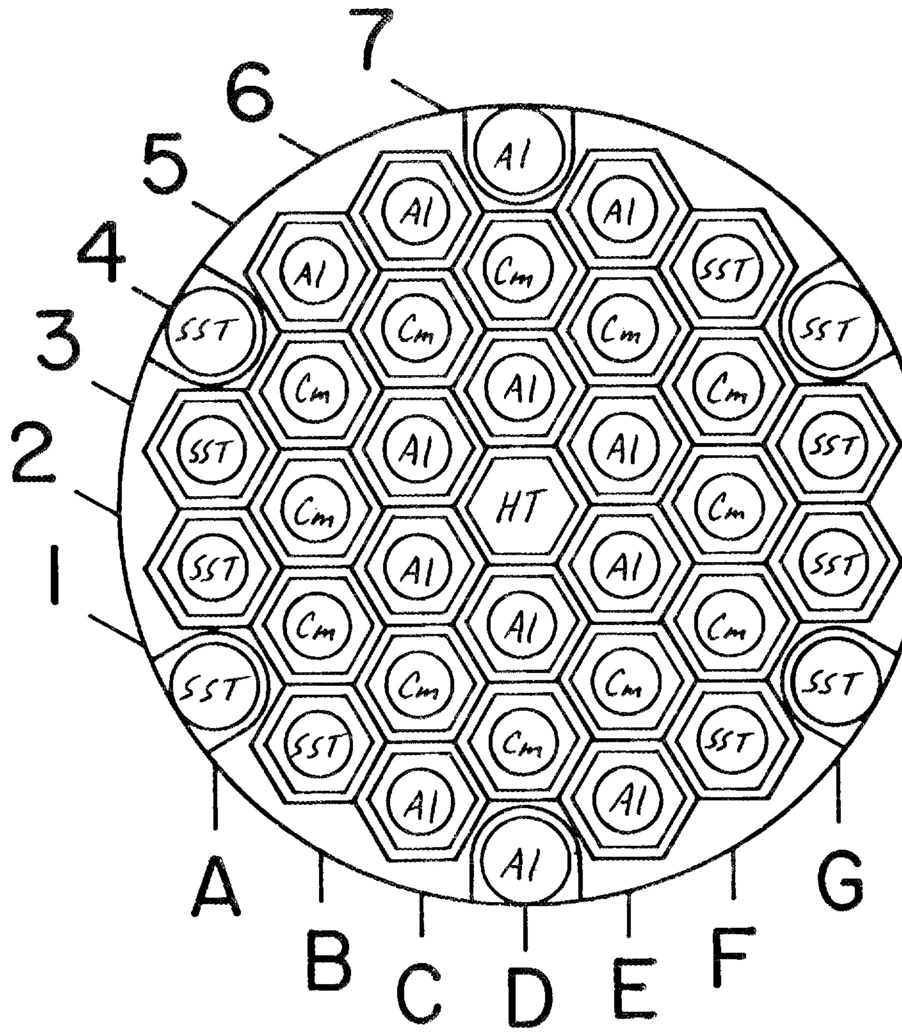
TARGET TYPE	NUMBER
PLUTONIUM (Pu)	
CURIUM (Cm)	12
COBALT (Co)	
TIN (Sn)	
NICKEL (Ni)	
STAINLESS STEEL (SST)	7
GRAPHITE (C)	
ALUMINUM (Al)	11
HYDRAULIC TUBE (HT)	1

Fig. 1.

HFIR TARGET LOADING

CYCLE NO. 265 DATE 4/14/85

ORNL/DWG. 85-15456



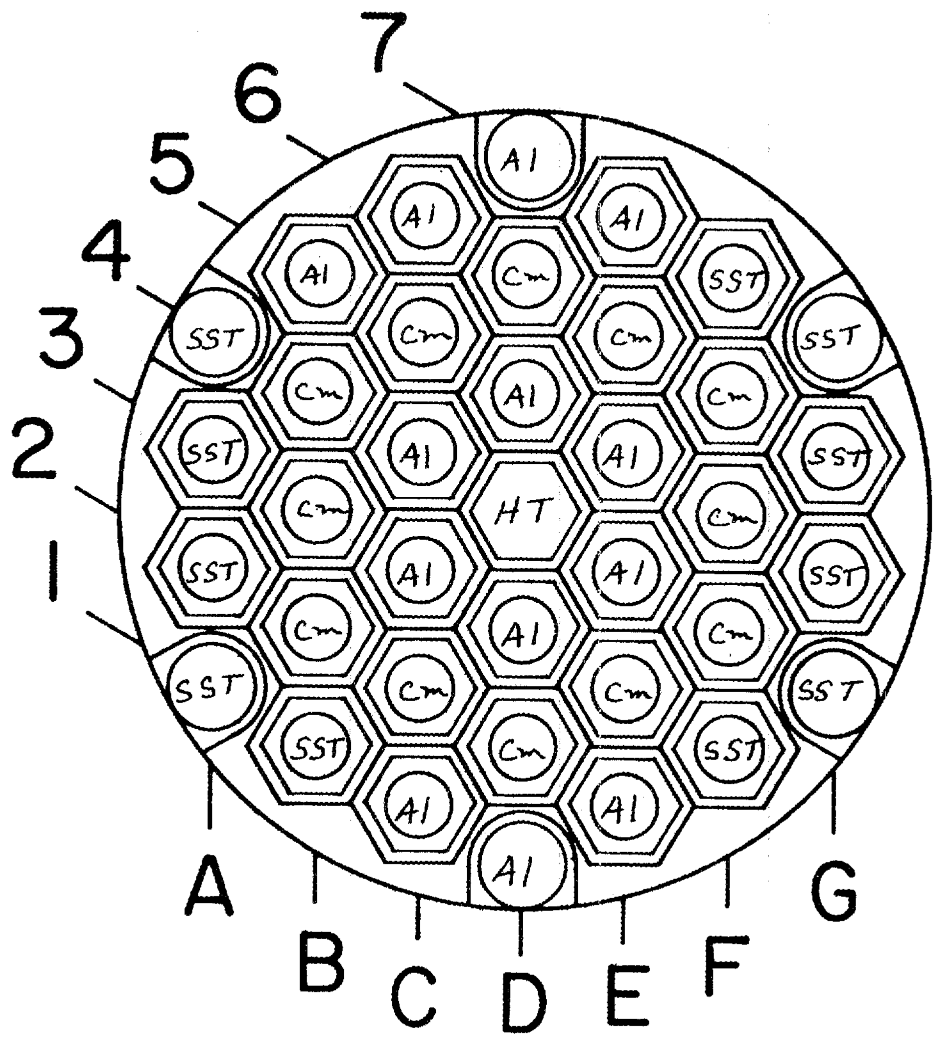
TARGET TYPE	NUMBER
PLUTONIUM (Pu)	
CURIUM (Cm)	12
COBALT (Co)	
TIN (Sn)	
NICKEL (Ni)	
STAINLESS STEEL (SST)	7
GRAPHITE (C)	
ALUMINUM (Al)	11
HYDRAULIC TUBE (HT)	1

Fig. 2.

HFIR TARGET LOADING

CYCLE NO. 266 DATE 5/7/85

ORNL/DWG. 85-15457



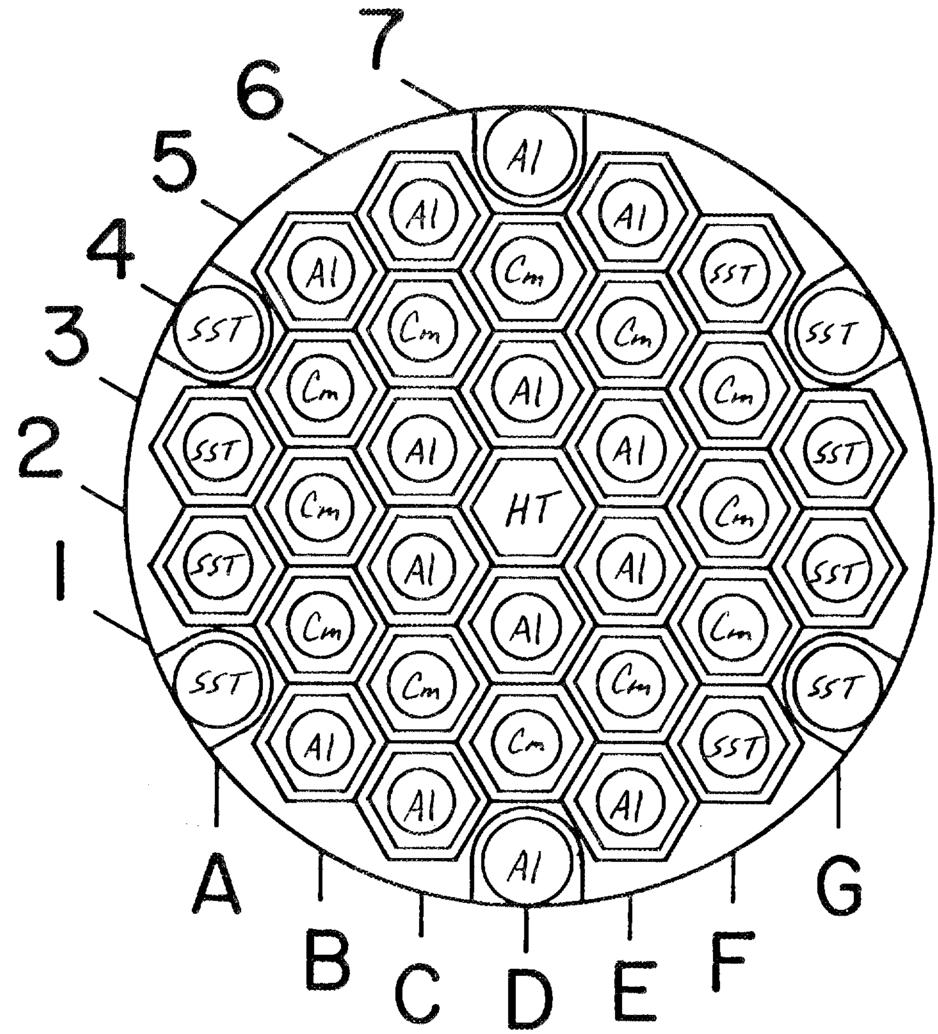
TARGET TYPE	NUMBER
PLUTONIUM (Pu)	
CURIUM (Cm)	12
COBALT (Co)	
TIN (Sn)	
NICKEL (Ni)	
STAINLESS STEEL (SST)	7
GRAPHITE (C)	
ALUMINUM (Al)	11
HYDRAULIC TUBE (HT)	1

Fig. 3.

HFIR TARGET LOADING

CYCLE NO. 267 DATE 5/29/85

ORNL/DWG. 85-15458



TARGET TYPE	NUMBER
PLUTONIUM (Pu)	
CURIUM (Cm)	12
COBALT (Co)	
TIN (Sn)	
NICKEL (Ni)	
STAINLESS STEEL (SST)	6
GRAPHITE (C)	
ALUMINUM (Al)	12
HYDRAULIC TUBE (HT)	1

Fig. 4.

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