ornl

OAK RIDGE NATIONAL LABORATORY

UNION CARBIDE

ORNL/TM-8147



# High Flux Isotope Reactor Quarterly Report January, February, and March of 1981

B. L. Corbett
K. H. Poteet

ORNL/TM--8147

DE82 007134

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

## DISCLAIMER

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: A02; Microfiche A01

ORNL/TM-8147

Contract No. W-7405-eng-26

Operations Division

# HIGH FLUX ISOTOPE REACTOR QUARTERLY REPORT JANUARY, FEBRUARY, AND MARCH OF 1981

B. L. Corbett and K. H. Poteet

Sponsor: J. H. Swanks, Director
Operations Division



Date Published - January 1982

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

# HIGH FLUX ISOTOPE REACTOR QUARTERLY REPORT
# JANUARY, FEBRUARY, AND MARCH OF 1981

B. L. Corbett and K. H. Poteet

## SUMMARY

Routine reactor operation with four end-of-cycle shutdowns and two unscheduled shutdowns resulted in an on-stream time of 94.9% for the quarter.

## OPERATIONS

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

Table 1. HFIR Basic Operating Data
(January 1, 1981 through March 31, 1981)

| | This Quarter | Last Quarter | Year to Date |
|---|---|---|---|
| Total energy, MWd | 8,537 | 8,189 | 8,537 |
| Average power, MW/operating hr | 99.9 | 99.9 | 99.9 |
| Time operating, % | 94.9 | 89.1 | 94.9 |
| Reactor availability, % | 95.3 | 91.5 | 95.3 |
| Reactor water radioactivity, $\frac{c/min}{ml}$ (av) | 238,000 | 244,000 | |
| Pool water radioactivity, $\frac{c/min}{ml}$ (av) | 57 | 64 | |

The starting and ending dates for Cycles 202, 203, 204, 205, and 206 are presented in Table 2.

Table 2. Cycles of Operation

| Cycle No. | Date Started | Date Ended | Accumulated Power (MWd) |
|---|---|---|---|
| 202 | 12-15-80 | 1-6-81 | 2162 |
| 203 | 1-7-81 | 1-24-81 | 2171 |
| 204 | 1-30-81 | 2-22-81 | 2214 |
| 205 | 2-22-81 | 3-17-81 | 2211 |
| 206 | 3-18-81 | In progress | 1387 |

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 | 38 |
| Spent fuel elements on hand | 14 | 13 |
| Spent fuel elements shipped | 3 | 4 |
| 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 two unscheduled midcycle shutdowns for a total downtime of 109.732 hrs. Table 4 gives further details.

Table 4. Description of HFIR Shutdowns

| Date | Downtime (hrs) | Remarks |
|---|---|---|
| | | Scheduled |
| 1-6-81 | 26.800 | Fuel Cycle 202 was completed at 1:02 PM. A total power generation of 2162 MWd was obtained on fuel element 203 O&I. |
| 1-29-81 | 37.933 | Fuel Cycle 203 was completed at 9:10 AM. A total power generation of 2171 MWd was obtained on fuel element 204 O&I. The shutdown was extended for experiment removal. |
| 2-22-81 | 20.083 | Fuel Cycle 204 was completed at 3:00 AM. A total power generation of 2214 MWd was obtained on fuel element 205 O&I. |
| 3-17-81 | 24.700 | Fuel Cycle 205 was completed at 1:55 AM. A total power generation of 2211 MWd was obtained on fuel element 206 O&I. |
| | | Unscheduled |
| 2-4-81 | 0.133 | While switching heat exchanger-pump combinations to isolate a leak, a misvalving operation was made which resulted in a cold slug and resultant false heat power scram (UOR No. OP-81-3). |
| 3-27-81 | 0.083 | An unscheduled shutdown occurred at 8:45 AM while safety tests were being performed on Channel 3. |

## 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 |
| 2-5-81 | Heat Exchanger | The Cell 112 primary heat exchanger developed a primary-to-secondary leak. Two tubes were found leaking and were plugged. |
| 2-16-81 | Heat Exchanger | The Cell 111 primary heat exchanger developed a primary-to-secondary leak. One tube was found leaking and was plugged. |
| 2-16-81 | Valve Motor | The valve motor for FCV-551 developed a shorted winding. The motor was overhauled and reinstalled. |
| 3-4-81 | Pump Seal | The final seal on primary pump PU-1A was replaced because of leakage. |
| 3-10-81 | Heat Exchanger | The Cell 112 primary heat exchanger developed a primary-to-secondary leak. One tube was found leaking and was plugged. |
| | | Miscellaneous |
| 1-20-81 | Demineralizer | The interface flow distributer in the plant demineralizer collapsed and the unit became ineffective. A new flow distributer and new resin were installed. |
| 1-29-81 | Fan Gearbox | Cooling tower fan 4B-2 was replaced with a spare for gearbox overhauling. |
| 2-25-81 | Batteries | The 17 year old nickle-cadmium batteries for pony motor PU-1E were replaced with new ones. |
| 3-16-81 | Filters | Absolute particulate filters in the center bank SBHE were replaced after they failed a routine efficiency test. |

## 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 |
|---|---|---|
| 3-13-81 | Signal Converter | The dual signal converter for channel No. 1 period failed and was replaced with a spare. |
| 3-16-81 | Electrometer | The Stack High Level Radiation electrometer which had failed was replaced with a new one and the system returned to service. |

## 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 | 84 |
| 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

| | Methyl Iodide | | | | Elemental Iodine | | | | | Particulate Retention | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Last Test | | Previous Test | | Last Test | | Previous Test | | Filter | Last Test | | Previous Test | |
| Filter Bank | Date | Eff., % | Date | Eff., % | Date | Eff., % | Date | Eff., % | Position | Date | Eff., % | Date | Eff., % |
| SBHE, west | 10-23-80 | 95.6 | 4-22-80 | 97.5 | 3-31-81 | 99.99 | 10-14-80 | 99.99 | South | 3-19-81 | 99.995 | 9-16-80 | 99.995 |
| | | | | | | | | | North | 3-3-81 | 99.972 | 9-16-80 | 99.993 |
| SBHE, center | 10-30-80 | 40 | 4-15-80 | 42 | 4-2-81 | 99.93 | 10-16-80 | 99.90 | South | 3-16-81 | 99.996 | 9-16-80 | 99.988 |
| | | | | | | | | | North | 3-16-81 | 99.995 | 9-16-80 | 99.953 |
| SBHE, east | 10-28-80 | 84.5 | 4-17-80 | 93.6 | 4-7-81 | 99.98 | 10-21-80 | 99.95 | South | 3-16-81 | 99.991 | 9-16-80 | 99.997 |
| | | | | | | | | | North | 3-3-81 | 99.996 | 9-16-80 | 99.916 |
| HOG, west | 10-7-80 | 92.6 | 5-21-80 | 93.9 | 3-19-81 | 99.95 | 9-30-80 | 99.99 | | | | | |
| HOG, center | 10-9-80 | 99.9 | 5-13-80 | 99.9 | 3-17-81 | 99.99 | 10-1-80 | 99.99 | | | | | |
| HOG, east | 10-8-80 | 99.9 | 5-22-80 | 70 | 3-26-81 | 99.99 | 10-2-80 | 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 checklists, hourly data sheets, the operating logbooks, 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 | 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 | 5-14-80 | 4-6-79 | 9-14-78 |
| Pressure vessel head studs | 7-23-80 | 9-4-79 | 9-14-78 |
| 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 | 12-15-80 | 6-29-80 | 12-18-79 |
| Safety channel A calibration | 12-16-80 | 6-9-80 | 10-2-79 |
| Safety channel B calibration | 12-16-80 | 6-10-80 | 10-4-79 |
| Safety channel C calibration | 12-16-80 | 6-12-80 | 10-5-79 |
| Servo channel A calibration | 12-2-80 | 5-20-80 | 10-2-79 |
| Servo channel B calibration | 12-2-80 | 5-20-80 | 10-2-79 |
| Servo channel C calibration | 12-2-80 | 5-20-80 | 10-2-79 |
| Speed of shim and regulating drives | 7-23-80 | 9-4-79 | 9-14-78 |
| Switchgear battery load test | 12-15-80 | 12-18-79 | 1-4-79 |

Table 9. (continued)

| Test | Most Recent Test | Previous Test | Previous Test |
|---|---|---|---|
| Semiannual Tests | | | |
| Main pump low pressure cutoff | 12-15-80 | 7-25-80 | 3-9-80 |
| Pony motor battery E | 3-16-81 | 11-19-80 | 8-17-80 |
| Pony motor battery F | 12-12-80 | 9-8-80 | 6-5-80 |
| Pony motor battery G | 10-1-80 | 6-26-80 | 3-5-80 |
| Pony motor battery H | 10-25-80 | 7-22-80 | 3-29-80 |
| Radiation monitoring equipment | 11-10-80 | 9-11-80 | 7-14-80 |
| SBHE filter efficiency | 3-16-81 | 10-16-80 | 5-1-80 |
| Monthly Tests | | | |
| Cadmium nitrate tests | 3-14-81 | 2-14-81 | 1-10-81 |
| Diesel run test, No. 1 | 3-17-81 | 2-17-81 | 1-13-81 |
| Diesel run test, No. 2 | 3-17-81 | 2-17-81 | 1-13-81 |

## 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-81-3) 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.

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-5 | Isotope production | Operations |

Table 10. (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 |
| HB-1 | Neutron diffractometer | Solid State |
| HB-2 | Neutron diffractometer | Chemistry |
| HB-3 | Neutron diffractometer | Solid State |
| HB-4 | Neutron diffractometer | Solid State |

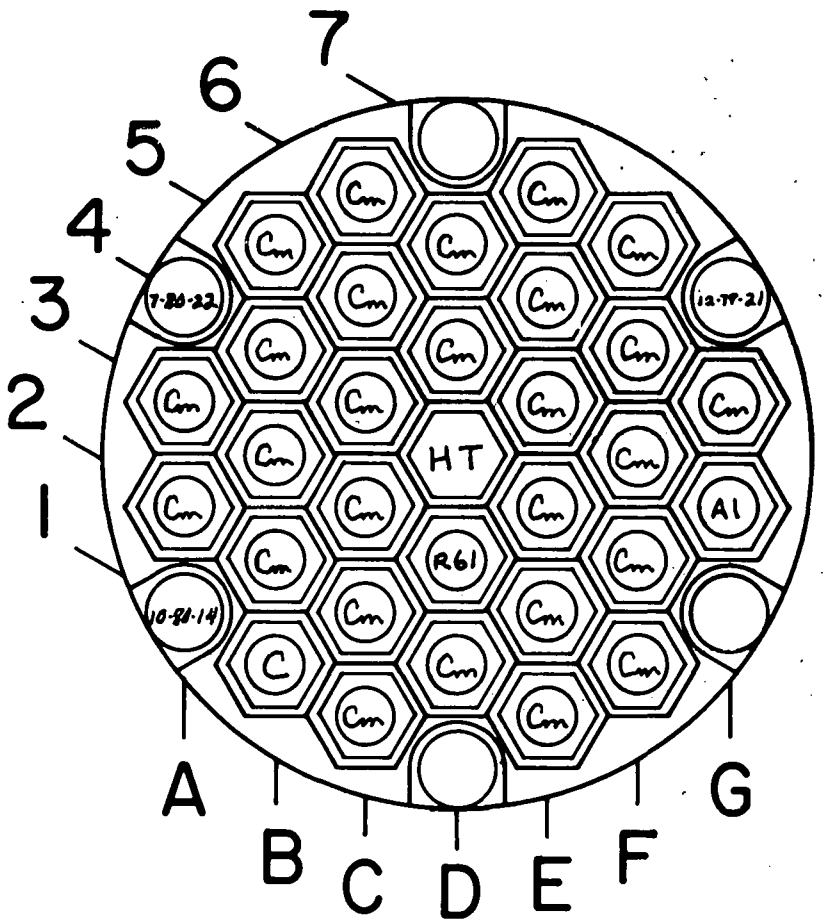
## HFIR Target Loading

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 81-12005

# HFIR TARGET LOADING

CYCLE NO. 202 DATE 12-15-80



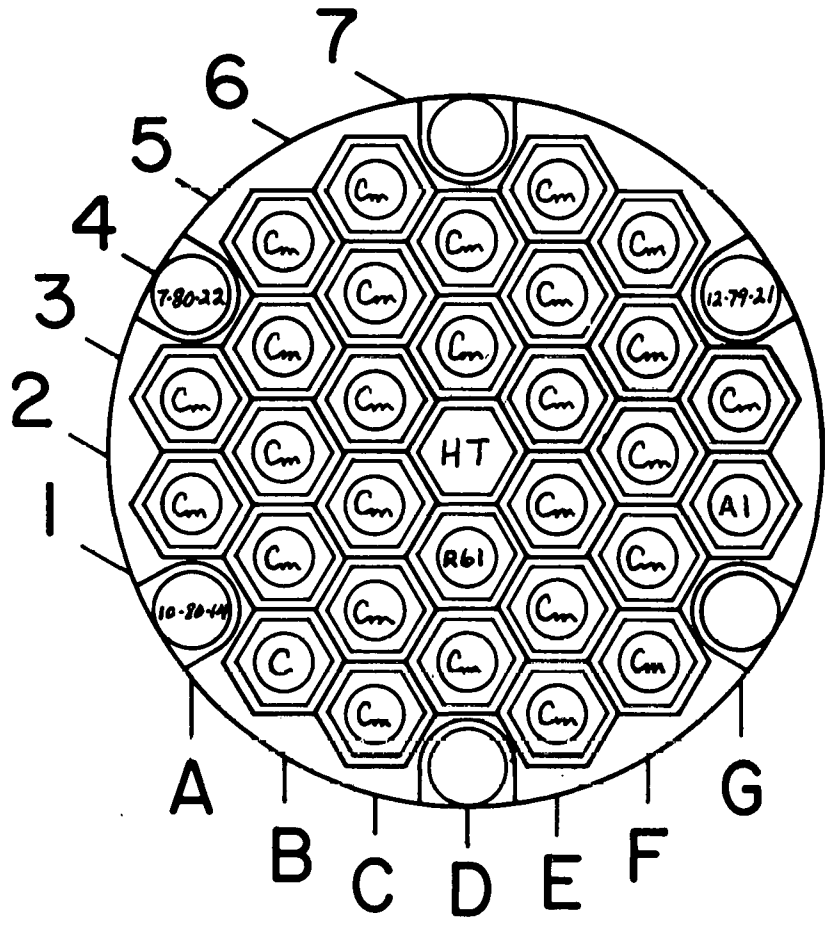

| TARGET TYPE | NUMBER |
|---|---|
| PLUTONIUM (Pu) | |
| CURIUM (Cm) | 27 |
| STAINLESS STEEL (SST) | |
| GRAPHITE (C) | 1 |
| ALUMINUM (Al) | 1 |
| HYDRAULIC TUBE (HT) | 1 |

UCN-12912
(3 1-78)

ORNL-DWG 81-22955

# HFIR TARGET LOADING

CYCLE NO. 203 DATE 1-7-81



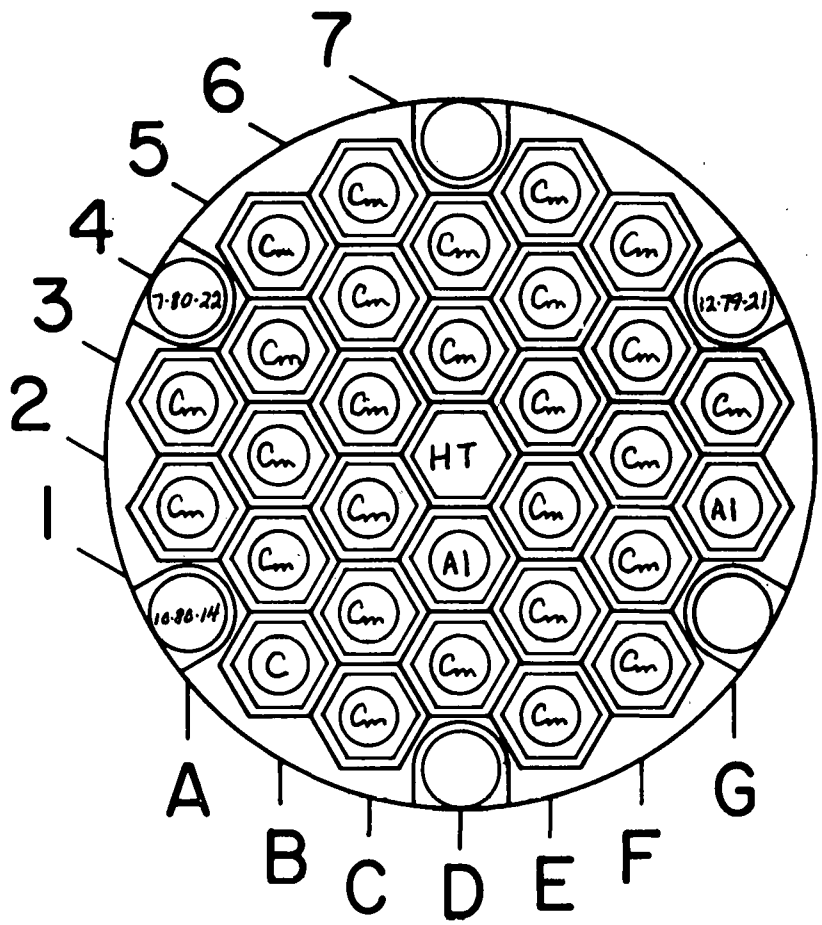

| TARGET TYPE | NUMBER |
|---|---|
| PLUTONIUM (Pu) | |
| CURIUM (Cm) | 27 |
| STAINLESS STEEL (SST) | |
| GRAPHITE (C) | 1 |
| ALUMINUM (Al) | 1 |
| HYDRAULIC TUBE (HT) | 1 |

UCN-12912
(3 1.78)

ORNL-DWG 81-22956

# HFIR TARGET LOADING

CYCLE NO. 204 DATE 1-30-81



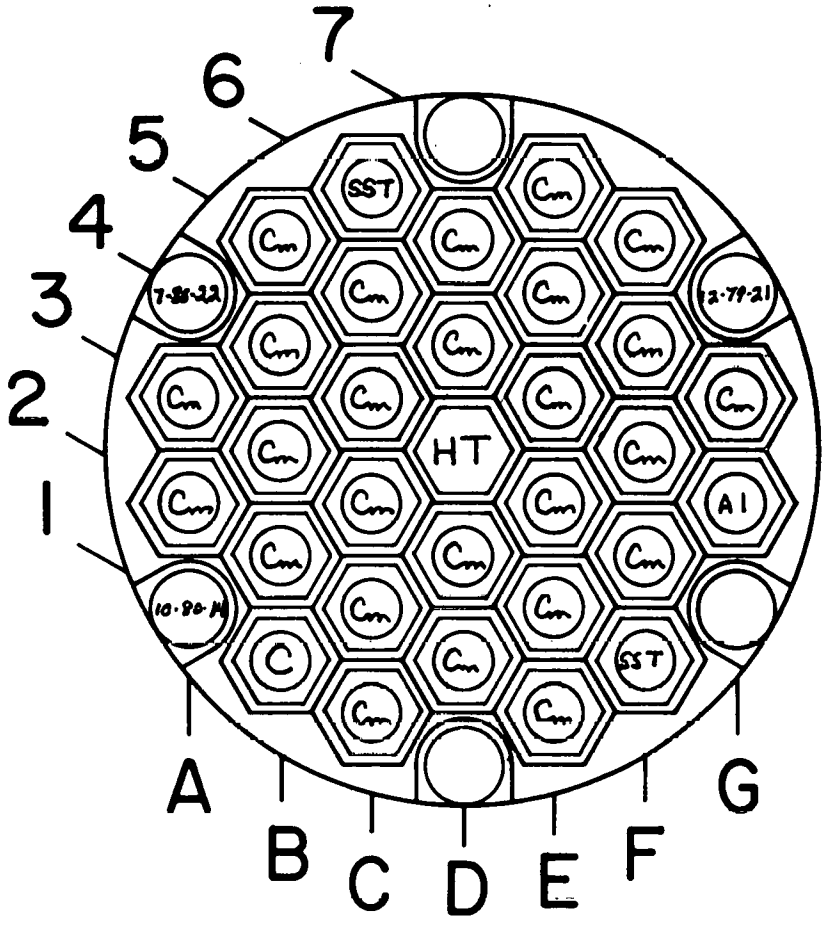

| TARGET TYPE | NUMBER |
|---|---|
| PLUTONIUM (Pu) | |
| CURIUM (Cm) | 27 |
| STAINLESS STEEL (SST) | |
| GRAPHITE (C) | 1 |
| ALUMINUM (Al) | 2 |
| HYDRAULIC TUBE (HT) | 1 |

UCN-12912
(3 1-78)

ORNL-DWG 81-22957

# HFIR TARGET LOADING

CYCLE NO. 205 DATE 2-22-81



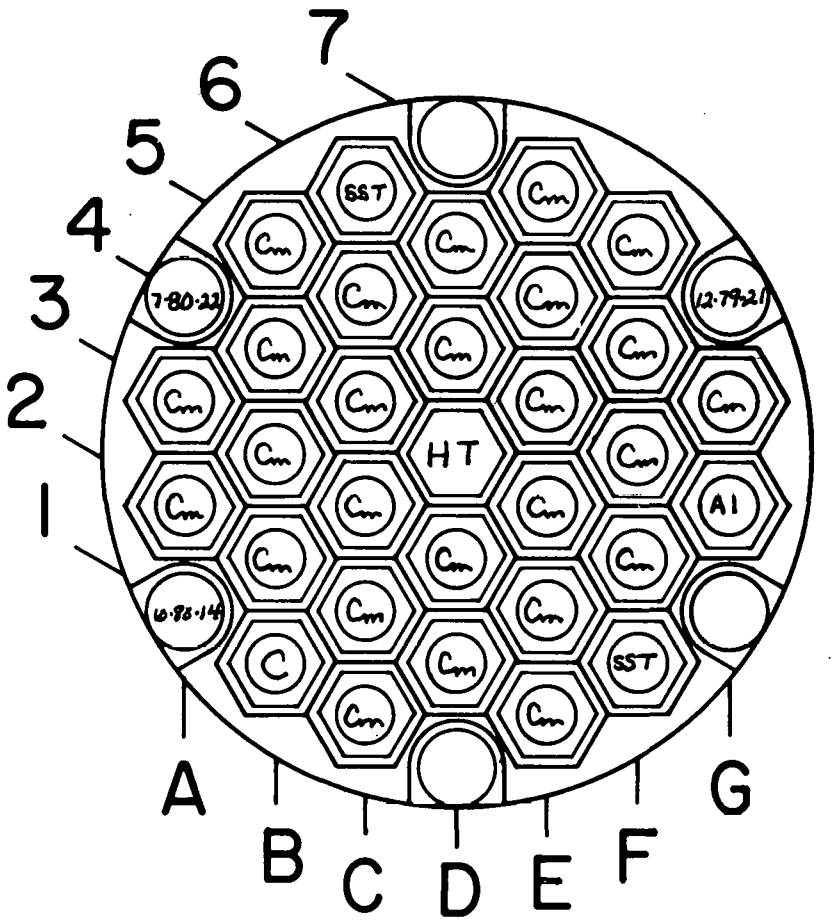

| TARGET TYPE | NUMBER |
|---|---|
| PLUTONIUM (Pu) | |
| CURIUM (Cm) | 26 |
| STAINLESS STEEL (SST) | 2 |
| GRAPHITE (C) | 1 |
| ALUMINUM (Al) | 1 |
| HYDRAULIC TUBE (HT) | 1 |

UCN-12912
(3 1-78)

ORNL-DWG 81-22958

# HFIR TARGET LOADING

CYCLE NO. 206 DATE 3-18-80




| TARGET TYPE | NUMBER |
|---|---|
| PLUTONIUM (Pu) | |
| CURIUM (Cm) | 26 |
| STAINLESS STEEL (SST) | 2 |
| GRAPHITE (C) | 1 |
| ALUMINUM (Al) | 1 |
| HYDRAULIC TUBE (HT) | 1 |

UCN-12912
(3 1-78)

ORNL/TM-8147

## INTERNAL DISTRIBUTION

1. D. S. Asquith
2. S. J. Ball
3. K. S. Belitz
4. J. E. Bigelow
5. F. T. Binford
6. G. H. Burger
7. C. D. Cagle
8. W. R. Casto
9. J. A. Conlin
10-11. B. L. Corbett
12. J. L. Cotter
13. W. H. Culbert
14. M. B. Farrar
15. T. P. Hamrick
16. C. H. Helton
17. S. S. Hurt, III
18. G. H. Jenks
19. O. L. Keller
20. R. W. Knight
21. W. C. Koehler
22-25. R. V. McCord
26. J. R. McGuffey
27. L. C. Oakes
28. K. H. Poteet
29. T. M. Sims
30. K. W. Sommerfeld
31. J. H. Swanks
32. D. B. Trauger
33. T. E. Welch
34. K. W. West
35. F. W. Wiffen
36. M. K. Wilkinson
37. A. Zucker
38-39. Central Research Library
40. Document Reference Section
41-42. Laboratory Records Department
43. Laboratory Records, ORNL R.C.
44. ORNL Patent Office

## EXTERNAL DISTRIBUTION

45-71. Technical Information Center, Oak Ridge
72. J. A. Lenhard, Office of Assistant Manager for Energy Research and Development, DOE, Oak Ridge
73. J. L. Burnett, Division of Chemical Sciences, Office of Basic Energy Sciences, ER-162, G-256, GTN, U.S. Department of Energy, Washington, DC 20545
74. M. Jacquemain, Head, Technical Department ILL, Institute Max von Laue-Paul Langevin, CEDEX 156, 38 Grenoble-Gare, France
75. W. A. Johnson, Branch Chief, Facilities and System Safety Branch, Safety Division, DOE, Oak Ridge
76. J. S. Kane, Associate Director, Office of Basic Energy Sciences, G-256, GTN, U.S. Department of Energy, Washington, DC 20545
77. A. C. Wood, Australian AEC, Nuclear Science and Technology Branch, Private Mail Bag, Sutherland 2232, New South Wales, Australia