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TEST REACTOR AND ENGINEERING SERVICES MONTHLY REPORT
MAY 1965

AUTHOR

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REACTOR DEVELOPMENT - O₄ PROGRAMPLUTONIUM RECYCLE PROGRAMPlutonium Recycle Test ReactorOperation

Reactor output for May was 996 MWD for an experimental time efficiency of 59% and a critical efficiency of 53%. There were thirteen operating periods during the month, of which four were terminated manually and nine were terminated by scrams. A summary of the fuel irradiation program as of May 31, 1965, follows:

| | <u>Al-Pu</u> | | <u>UO₂</u> | | <u>UO₂-PuO₂</u> | | <u>Other</u> | | <u>Program Totals</u> | |
|----------------|--------------|------------|-----------------------|------------|---------------------------------------|------------|--------------|------------|-----------------------|------------|
| | <u>No.</u> | <u>MWD</u> | <u>No.</u> | <u>MWD</u> | <u>No.</u> | <u>MWD</u> | <u>No.</u> | <u>MWD</u> | <u>No.</u> | <u>MWD</u> |
| In-Core | | | 3 | 1240.1 | 76 | 18364.2 | | | 79 | 19604.3 |
| Maximum | | | | 437.2 | | 494.8 | | | | |
| Average | | | | 413.1 | | 241.6 | | | | |
| In Basin | 7 | 572.5 | 30 | 3806.2 | 65 | 10247.5 | | | 102 | 14626.2 |
| Buried | | | | | | | 1 | 7.3 | 1 | 7.3 |
| Chem. Process. | 68 | 5465.8 | 35 | 1965.8 | | | | | 103 | 7431.6 |
| Program Totals | 75 | 6038.3 | 68 | 7012.1 | 141 | 28611.7 | 1 | 7.3 | 285 | 41669.4 |

(Note: MWD/Element x 20 = MWD/TU for UO₂ - 1 w/o PuO₂.)

Heavy water loss and indicated helium loss for the month were 1181 pounds and 133,788 scf., respectively.

Equipment Experience

A total of 1363 craft manhours were utilized during the May reactor outage as follows:

| | |
|------------------------------|--------------|
| Repair | 729 manhours |
| Modification and Improvement | 206 manhours |
| Operations Assistance | 320 manhours |
| Preventive Maintenance | 108 manhours |

Total preventive maintenance effort for the month was 321 manhours, or 12.9% of available assigned manhours.

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Improvement Work Status (Significant Items)Work Completed

Flux Recorder Potentiometers Addition
TKA-1 Modification
Shipping Basket Stand Modification
Deaerator Platform - M&M Cell
Gas Chromatograph Modification
Modification to FRTR Warehouse 3718-C

Work Partially Completed

Corrosion Loop Installation
Additional Fuel Storage and Examination Facility
Flux Wire Scanning System
D₂O Cleanup Facility
Pneumatic Irradiation Facility
Boric Acid Prototype Facility

Design Work Completed

PSCD Sample Station
Shim Well Shielding

Design Work Partially Completed

Instrument Power Supply
FRTR Experimental and Building Facility Addition
FRTR Increased Power Level
FRTR Vacuum Deaerator

Process Engineering and Reactor Physics

The traveling wire flux monitor system was put into service during May. Several scans have been made in Monitor Location 1450. Insertion or removal of the wire caused a moderator level change of about 0.2 inches. A high level trip, at 110% P, was received on one linear flux channel when the wire was removed from the core. Integration of the axial profile yielded axial peak-to-average thermal flux ratios of 1.144 for the HPD element and 1.282 for standard elements.

Eight of the 58-inch UO₂ - 2 w/o PuO₂ elements are under irradiation, including #6500 (Salt Cycle) and #6004 (Defected). The maximum exposure of an HPD element as of May 31, 1965, was approximately 134 MWD (= 4000 MWD/TU). The exposure of the Salt Cycle element was = 30 MWD (= 1000 MWD/TU). The power generation of the standard HPD elements continued in the 1000 - 1350 KW range.

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Analytical work supporting the design basis document for the chemical shim system was concluded. The following parameters have been established: 1) Ion exchange process using existing columns; and 2) Enriched boric acid for the batch core experiment.

Recalculation of allowable tube powers for 58-inch 2 w/o PuO₂-UO₂ fuel elements based upon the new capacity of the low pressure LWI system was completed. Limiting tube powers from a LWI standpoint only are: 1) Element having 2 w/o PuO₂ at the ends of the fuel rods - 1400 KW; 2) Element having UO₂ at bottom or both ends - 1800 KW; and 3) Element having UO₂ and 1 w/o PuO₂ buffer zone at both ends - 1800 KW.

A calculation of the reactivity decrease from voiding the coolant of the UO₂ - 2 w/o PuO₂ HPD core was performed and the results sent to Nuclear Safeguards and Engineering.

Experimental Reactor Services

The status of the various test elements at the end of May 1965, is shown below. Those elements discharged prior to May 1, 1965, have been deleted from this table.

| Test Channel No. | Location | Element Number | Description | Date | | Approximate Accumulated MWD |
|------------------|----------|----------------|-----------------------|----------------|-----------------|-----------------------------|
| | | | | Initial Charge | Date Discharged | |
| 14 | 1956 | 5097 | Swaged-0.48% | 4/2/62 | -- | 305.2 |
| 48 | 1156 | 5150 | 0.48% (½" x ½" pads) | 8/1/62 | | 312.5 |
| 54 | 1647 | 5116 | 0.48% (clip-on pads) | 5/8/62 | | 314.6 |
| 54 | 1554 | 5118 | 0.48% (clip-on pads) | 5/8/62 | | 494.8 |
| 61 | Basin | 5192 | 0.48% - Physics | 6/13/63 | 5/24/65 | 341.2 |
| 67 | 1047 | 5117 | 0.48% (Repaired wire) | 10/20/63 | | 288.4 |
| 72 | 1253 | 5253 | 1% (Zr coupons) | 9/1/64 | | 205.6 |
| 85 | 1855 | 5230 | Vipac - 1% | 1/30/64 | | 261.0 |
| 108 | 1954 | 6501 | EBWR Cluster | 1/30/65 | | 33.4 |
| 118 | 1946 | 6500 | Salt Cycle, 2% | 3/16/65 | | 30.4 |

Twelve fuel elements were examined in the storage basin. Element #5192, a .48% instrumented physics element, had a defected area on a rod containing pelleted PuO₂-UO₂ fuel material. This rod, plus rods from fuel elements 1097 and 5237 were shipped to Radiometallurgy.

Ten examinations were made of nine process tubes, eight of which had increased flow rates. No significant increase in fretting corrosion occurred.

Fuel Element Rupture Testing Facility

FERTF Test #13, Irradiation of a 1600 KW thermocoupled HPD fuel element, was performed during May. Element #6502 was charged in the FERTF in location 1550. It was necessary to severely peak the flux in the center

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of the core to approach the desired test conditions. The element operated for about one week at a tube power of about 1525 KW, with the reactor effectively limited by tube outlet temperature limits.

Element #6004, an HPD element without graded enrichment in the ends, with an exposure of about 110 MWD (~ 3300 MWD/TU), was defected by drilling and punching a small hole through the cladding of one of the outer-ring rods. The element has been charged into the FERTF in location 1550 to begin FERTF Test #14.

Chemical Processing of Spent FRTF Fuels

The chemical processing campaign has been activated again and eight more fuel elements were included. The campaign, to be made in June, will produce ~10 Kg of plutonium containing 21% Pu²⁴⁰.

TECHNICAL SHOPS SECTION

A total of 18,577 hours of shop work was produced with a backlog at the end of the period totaling \$240,361 or 30,045 hours. To meet emergency requests for service, it was necessary to work 1,436 overtime hours or 6.4 of the total hours produced in Technical Shops.

LABORATORY MAINTENANCE SECTION

Total productive time was 23,116 hours of 24,548 potentially available. Craft overtime worked was 3.2% of available manhours. Manpower utilization (in hours) was as follows:

| | | |
|---|-------|--------|
| A. Shop Work | | 1 658 |
| B. Maintenance | | 7 303 |
| 1. Preventive Maintenance | 2 378 | |
| 2. Emergency or Unscheduled Maintenance | 1 332 | |
| 3. Normal Scheduled Maintenance | 3 593 | |
| C. R&D Assistance | | 14 155 |

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Manager, Test Reactor
and Engineering Services

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