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PROCESS IMPROVEMENT TRANSITION AUTHORIZATION
IP-10-I, IRRADIATION OF ALLOYED DINGOT
URANIUM FUEL ELEMENTS

AUTHOR

R. D. Shimer

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IRRADIATION PROCESSING DEPARTMENT

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January 21, 1960

PROCESS IMPROVEMENT TRANSITION AUTHORIZATION IP-10-I
IRRADIATION OF ALLOYED DINGOT URANIUM FUEL ELEMENTS

OBJECTIVE

The objective of this document is to authorize large-scale irradiations of alloyed, low hydrogen, dingot uranium fuel elements in order to evaluate their suitability as a reactor fuel.

BASIS AND JUSTIFICATION

Although purer than standard ingot uranium, the dingot uranium produced in the past by Mallinckrodt Chemical Plant has demonstrated inferior dimensional stability⁽¹⁾ during irradiation. This instability has been manifest as warp and as swelling at the center of the fuel elements. To reduce this instability 150 ppm iron and 100 ppm silicon have been added to refine the grain structure of the uranium. Destructive examination of grain structure and nondestructive examination of apparent core quality have indicated that this material is equivalent or superior to ingot material.

In light of forecasted metal requirements, the Mallinckrodt Chemical Plant must be brought on stream as rapidly as possible. This PITA schedule will meet the programmed metal delivery requirements⁽²⁾ with a minimum of risk potential while accelerating the evaluation of dingot uranium as to its suitability as a reactor fuel.

Completed irradiation performance data from small scale testing⁽³⁾ will not be available before dingot material is charged under this PITA. Therefore, the possibility exists that unforeseen dingot uranium properties will result in poor performance. Low gas discharging might be required to alleviate this problem.

TEST DETAILS

Fuel Elements

1. Cores shall be of alloyed, low hydrogen, dingot uranium with approximately 100 ppm silicon and 150 ppm iron added as a grain refiner. Cores will be heat treated in solid blank form in chloride salt and finish machined at Fernald to O-II-N dimensions.
2. Cladding shall be that normally utilized in D-DR Reactors during the test period.

(1) HW-59444 RD, Stewart, KB, "Analysis of Data From IP-56-A-86 MT: Evaluation of Dimensional Stability Characteristics of Low Hydrogen Uranium I and E Fuel Elements," 4/9/59, (Secret).

(2) JW Talbott, "Utilization of Dingot Uranium," Undocumented letter to AT Gifford, 3/4/59, Unclassified.

(3) HW-61619 C, Hall, RE, "Production Test IP-280-A-FP, "Irradiation of Alloyed Dingot Uranium Fuel Elements," (Secret).

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3. All normal quality control and standards⁽⁴⁾⁽⁵⁾ will be applied during fabrication of this material unless otherwise specified in this PITA.

Charging Schedule

After approximately a two month lapse following the final charging of PT-IP-280-A-FP, (3) 60 tons of dingot material per month for six months will be charged into D and DR Reactors. This PITA authorizes the charging of 360 tons of dingot material. Any further charging will be done under separate authorization or upon acceptance of dingot material as normal production material.

Lot Charging

All fuel elements charged shall be utilized as normal production fuel and will have one monitor column per lot. Monitor charges will be handled under the provisions of the Quality Certification Program.⁽⁶⁾

Goal Exposures

Normal ingot material fuel element exposure goals will apply, initially, to the dingot material. Changes in exposure goals are authorized as deemed necessary based on rupture experience and other available information.

Limits

All limits as specified in the Process Standards are applicable to the dingot material.

COSTS

Discharge and special pick-up of monitor columns will involve some outage time loss. This loss should not exceed ten minutes per tube and may be charged as specified in the Quality Certification Program.⁽⁶⁾ No costs are chargeable to this PITA because all metal is to be utilized as normal production metal.

RESPONSIBILITY

General

Responsibility for the monitor columns will be in accordance with the provisions of the Quality Certification Program.⁽⁶⁾ Responsibilities for the remainder of the test will be as outlined below.

- (4) HW-48444, Fuels Preparation Department, "Material Specifications, Fuel, Target and Cladding Materials," (Confidential).
- (5) HW-47029, Fuels Preparation Department, "Process Specifications, Fuel Element Manufacturing Processes," (Confidential).
- (6) HW-58271, Hall, RE, and RR Bloomstrand, "Production Test IP-216-A, Evaluation of Performance of Normal Production I & E Fuel Elements," 1/6/69, (Secret).

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Irradiation Processing Department

Research and Engineering Section

Process Technology Sub-Section will be responsible for:

1. Overall coordination of the test.
2. Analysis of the test data.
3. Reporting of in-reactor performance of the dingot material.
4. Recommending goal exposure changes if necessary.

Process and Reactor Development Sub-Section will be responsible for:

1. Providing technical assistance.
2. Liaison contacts with the Fuels Preparation Department.

Manufacturing Section

D and DR Processing Operation will be responsible for:

1. Operational continuity of the reactors.
2. Reactor safety.

Production Operation will be responsible for:

1. Scheduling charging and discharging.
2. Specifying goal exposure.

R. D. Shimer

R. D. Shimer
Process Analysis Unit
Research and Engineering Section
IRRADIATION PROCESSING OPERATION

RDS:mf

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