1 of 1

(CLASSIFICATION)

RL-REA-2250 J
Hanford Code C-65

DATE _____

HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

X

THIS DOCUMENT CONTAINS RESTRICTED DATA AS
DEFINED BY THE ATOMIC ENERGY ACT OF 1946.
IT IS THE POLICY OF THE UNITED STATES GOVERNMENT
TO LIMIT THE DISSEMINATION OF THIS INFORMATION
TO PERSONS AUTHORIZED BY THE AEC.

TITLE

MONTHLY RESEARCH AND DEVELOPMENT REPORT
SEPTEMBER 1965
IRRADIATION PROCESSING DEPARTMENT

☐ OTHER OFFICIAL CLASSIFIED INFORMATION

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U. S. C., SECS. 793 AND 794, THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

AUTHOR

T. W. Ambrose

ISSUING FILE

THIS DOCUMENT MUST NOT BE LEFT UNATTENDED OR WHERE AN UNAUTHORIZED PERSON MAY HAVE ACCESS TO IT. IN NO CASE, MUST IT BE STORED IN AN APPROVED LOCKED DEPOSITORY WITHIN AN APPROVED GARAGE OR REMOVED WHILE YOUR SESSION IS IN PROGRESS. UNTIL YOU HAVE OBTAINED A RECEIPT FROM THE ISSUING OFFICE, IT IS YOUR RESPONSIBILITY TO KEEP IT IN THE SAME PLACE. IT IS THE POLICY OF THE FBI TO PROTECT THIS DOCUMENT FROM AN UNAUTHORIZED PERSON. IT IS TRANSFERRED TO THE HOME OF THE AGENT OR TO THE PLACE OF RESIDENCE OF THE AGENT. IT IS NOT TO BE REPRODUCED. IF ADDITIONAL COPIES ARE REQUESTED, OBTAIN THEM FROM THE RELATED ISSUING OFFICE. ALL PERSONS READING THIS DOCUMENT ARE REQUESTED TO SIGN IN THE SPACE PROVIDED BELOW.

MASTER

(CLASSIFICATION)

DECLASSIFIED

DECLASSIFIED

RL-REA-2250 J
Hanford Code C-65
October 6, 1965

MONTHLY RESEARCH AND DEVELOPMENT REPORT
IRRADIATION PROCESSING DEPARTMENT

By

T. W. Ambrose

SEPTEMBER 1965

DISTRIBUTION

1. Battelle-Northwest - Attn: FW Albaugh
2. Battelle-Northwest - Attn: ER Irish
3. TW Ambrose
4. LV Barker
5. RS Bell
6. HE Berg
7. WA Blanton
8. CE Bowers
9. PA Carlson
10. JR Carrell
11. RE Dunn
12. JH Ferguson
13. WJ Ferguson
14. SM Graves
15. CN Gross
16. HW Heacock
17. DW Hovorka
18. GA Huff
19. PC Jerman
20. RT Jessen
21. FE Kruesi, DuPont Co.,
Savannah River

Classification Cancelled and Changed To
DECLASSIFIED

By Authority of DS Lewis,
CG-NMP-1, 4-29-94
By DK Hanson, 5-17-94
Verified By Jerry Maley,
5-18-94

22. MC Leverett
23. CG Lewis
24. AR Maguire/JM Fouts
25. WW McIntosh
26. PC McMahon
27. HC Money
28. RV Myers
29. SL Nelson
30. R Nilson
31. GF Owsley
32. EV Padgett
33. RW Reid
34. LH Rice
35. JT Stringer
36. AR Sullivan
37. HF Tew
38. OA Towler, DuPont Co.,
Savannah River
39. 700 Area File
40. Record File
- 41-45. Extra Copies

This document contains information that is classified as [REDACTED] in the [REDACTED] of [REDACTED] 19[REDACTED]. The transmission, disclosure, or release of this information in any manner to an unauthorized person is prohibited.

This document consists of
6 pages.

12873

DECLASSIFIED

RESEARCH AND DEVELOPMENT

RESEARCH AND ENGINEERING

Ribbed Zircaloy Process Tubes

The three full-length ribbed Zircaloy process tubes fabricated by Electron Beam Techniques have been received at the White Bluffs tube shop and are being evaluated.

Uranium Oxide Program

Additional enriched uranium oxide for blending with natural uranium was released in August. This additional quantity of oxide is sufficient for fabrication of three columns of fuel elements for irradiation tests. Welding problems have delayed completion of the elements, so that the test will not be charged during the mid-September outage at KW Reactor as originally scheduled.

Plutonium-Aluminum Irradiations

The initial charge of two plutonium-aluminum alloy fuel elements was charged into B Reactor on September 7. These fuel elements are being used to evaluate the effect of the lower density and higher specific power upon graphite temperature and are the forerunners of more tests.

Neptunium Irradiation Tests

Battelle-Northwest is currently making trial runs to develop a satisfactory method for canning neptunium oxide for irradiation in a K Reactor. No particular problems are being experienced in these runs, and it is expected to have twelve target elements available for charging during an October outage of one of the K Reactors.

Code Development

EXTERMINATOR, a fast, two-dimensional diffusion theory code, was adapted to the local IBM 7090. The example problem supplied with the code was successfully evaluated. A problem which has been previously evaluated with 9-ANGIE (also a two-dimensional diffusion theory code) was set up on EXTERMINATOR for comparison of computation time and convergence of the eigenvalue.

DECLASSIFIED

Irradiated IPD Fuel Examination, 105-C Facility

Examinations were completed on fuel elements from 70 tubes requiring 9008 individual examinations.

Production Test Material

<u>No. of Tubes</u>	<u>Production Test</u>	<u>Title</u>
39	IP-216	Evaluation of Performance of Normal Production I&E Fuel Elements.
7	IP-781	Comparison Test Between Hot-Die-Sized and AlSi Fuel Elements.
5	IP-PITA-32	Use of Semi-Production Quantities of Hot-Die-Sized Fuel Elements.

Other Material

<u>No. of Tubes</u>	<u>Purpose of Examination</u>
4	Visual examination of overbore fuel elements to determine the cause of discharge problem.
10	Visual examination of enriched fuel elements from D Reactor to determine extent and severity of groove and ledge-type corrosion attack.
5	Visual examination of normal production fuel elements from KE Reactor to determine extent and severity of groove and ledge-type corrosion attack.

Photographs were taken of one ruptured fuel element from C Reactor and one from D Reactor.

Water Treatment Test Facility Operation - 1706-KE

<u>Tube</u>	<u>PT</u>	<u>Water Supplied</u>	<u>Corrosion Inhibitors & Chemical Additions</u>	<u>pH</u>
WT-1 (2952)	604	Service	2.0 ppm dichromate	7.0*
WT-2 (3050)	604	Service	2.0 ppm dichromate	7.0*
WT-3 (4355)	520	WTPP**	1.8 ppm dichromate	6.6**
WT-4 (4456)	520	WTPP**	1.8 ppm dichromate	6.6**
WT-5 (4557)	604	Service	10.0 ppm sodium sulfite	6.6
WT-6 (4863)	604	Service	10.0 ppm sodium sulfite	6.6
WT-7 (4963)	449	Process	10.0 ppm activated silica	6.6
WT-8 (5063)	449	Process	10.0 ppm activated silica	6.6

*pH controlled with sodium hydroxide.

**Water Treatment Pilot Plant product. The flocculating agent is aluminum nitrate and is supplied in sufficient quantity to maintain the zeta potential near zero. The pH control is maintained with nitric acid addition.

FACILITIES ENGINEERING

Uncooled Horizontal Control Rods

Two composite samples of uncooled control rod material have been on test in a K Reactor since the first of March 1965. Both have dysprosium oxide-nickel ($\text{Dy}_2\text{O}_3\text{-Ni}$) cermet cores and one is clad in 19-9DL, while the other is clad in Inconel 600. The 19-9DL clad sample has been scheduled for removal in September. Although the 19-9DL is of diminishing interest as a cladding material based on current laboratory test information, examination of this specimen will provide vital data on the short term reaction of the $\text{Dy}_2\text{O}_3\text{-Ni}$ cermet to actual reactor conditions. The Inconel clad sample will remain on test for approximately six more months.

Examination of composite samples of $\text{Dy}_2\text{O}_3\text{-Ni}$ cermet encased in Inconel 600 after 5,000 hours of environmental testing indicates that a 0.060-inch thick cladding withstands the environment significantly better than a 0.020-inch cladding. Planned continuation of these tests to 10,000 hours will provide further insight into the effect of thickness on long term cladding durability.

Nuclear Materials and Propulsion Operation's (NMPO) anticipated need for additional funds to complete development and design work on the uncooled HCR has been reviewed and the funds approved. This increases the total authorization to \$84,580.

Dose Rate Telemetry

The prototype dose rate telemetry equipment has been installed in KE Reactor and utilized in a two-day field test during a recent outage. No major deficiencies were noted in the equipment during this test program. Following the successful completion of the tests the equipment was returned to the laboratory for additional bench testing. The equipment vendor, Tracerlab, is currently reviewing the equipment circuitry to determine what changes in the equipment or circuitry can be made to provide compensation or calibration adjustment for long term component shift or drift. This equipment deficiency has been previously reported.

DECLASSIFIED

PRODUCTION FUELSThoria

Regression analyses were run on the analytical data obtained from every third lot of thoria received from Mallinckrodt Chemical Works during the last target element production campaign. Statistically significant but not strong correlations were observed between thoria particle density and compaction density, particle density and surface area, surface area and loss-on-ignition.

The engineering process specifications for thoria target element fabrication were revised. Major revisions included changes in can wall thickness, weld closure, and helium leak testing.

A study was initiated to compare the integrity of thoria target element closures produced by AC and DC tungsten inert-gas welding, inertia friction welding, and a cold forming point-closure method.

Alternate Process

Two hot-die-sized fuel elements failed in a production test (IP-781) being irradiated in D Reactor to compare the rupture resistance of hot-die-sized and AlSi bonded 0.947 per cent enriched fuel. Both failures were caused by severe "groove" corrosion of the cladding at 26 to 32 per cent of normal goal exposure. Irradiation of the remaining test columns is continuing without incident.

Side corrosion of the cladding also caused two hot-die-sized overbore fuel failures in C Reactor during the month. Damage to the fuel support rails appears to have been a contributing factor.

Examination of natural self-supported hot-die-sized fuel elements exposed to about 50 per cent of goal in KE Reactor, and to goal exposure in KW Reactor, shows groove corrosion on the outer cladding up to 20 mils in depth or about twice as severe and at a much higher frequency than observed on AlSi bonded fuel irradiated under comparable irradiation conditions. As a result of this behavior, unrestricted charging of hot-die-sized fuel in the downstream process tube positions in which the severe corrosion was observed has been terminated. An extensive program has been initiated to determine the cause of the observed difference in groove corrosion resistance between hot-die-sized and AlSi bonded fuel. Analytical studies of the cladding include:

- 1) Grain size and second phase dispersion
- 2) Hardness
- 3) Chemical composition

Preliminary examination of finished fuel element samples has reconfirmed that the cladding grain size on hot-die-sized fuel is larger near the ends and is less uniform than on AlSi bonded fuel. Second phase dispersion does not differ in the two types of fuel. Surface hardness of hot-die-sized

fuel samples is less uniform. Spectrographic analysis shows that the copper content of hot-die-sized cladding samples ranges from 0.06 to 0.16 weight per cent, as compared to less than 0.02 weight per cent in the AlSi cladding samples. Both are well within the specified maximum of 0.15 weight per cent.

Fabrication of five columns each of 1.25 per cent enriched hot-die-sized and AlSi bonded fuel elements was completed for a production test (IP-797) to compare corrosion resistance at high tube power in a K Reactor. The schedule for reactor charging this material has been deferred pending an investigation of the susceptibility of hot-die-sized fuel to groove corrosion.

Resistance of nickel-plated uranium to penetration by 170 C water vapor was compared using H_2SO_4 -HCl and H_3PO_4 -HCl electrolytic etches on cylindrical specimens. Comparing samples with both 0.8 to 1.1 mil and 1.7 to 2.1 mil plate thickness, the H_2SO_4 -HCl etch produced a smoother uranium surface which exhibited cracking of the nickel plate and exposure of the uranium. The H_3PO_4 -HCl etch provided a rougher uranium surface, which blistered in an autoclave at about one and one-half times the exposure time, but did not expose the uranium. Tests will be repeated at lower temperatures to determine the effect of uranium thermal expansion on plate integrity.

Manager, Research and Engineering

AIM

Association for Information and Image Management

1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910

301/587-8202

Centimeter

Inches

MANUFACTURED TO AIM STANDARDS
BY APPLIED IMAGE, INC.

DATE

FILMED

1 / 3 / 95

END