1 of 1

(CLASSIFICATION)

HW-63630

SERIES AND COPY NO.

DATE January 22, 1960

HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

THIS DOCUMENT CONTAINS RESTRICTED DATA AS
DEFINED IN THE ATOMIC ENERGY ACT OF 1954.
ITS TRANSMISSION OR THE DISCLOSURE OF ITS
CONTENT IN ANY MANNER TO AN UNAUTHORIZED
PERSON IS PROHIBITED.

PRODUCTION TEST IP-300-A, IRRADIATION OF TWENTY
INCH NATURAL URANIUM TUBE AND TUBE ELEMENTS WI
HOT-HEADED INNER TUBES

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.

W. K. Kratzer

TECHNICAL INFORMATION FILES

THIS DOCUMENT MUST NOT BE LEFT UNATTENDED OR IN THE HANDS OF AN UNAUTHORIZED PERSON MAY NOT HAVE ACCESS TO IT. WHEN NOT IN USE, IT MUST BE STORED IN AN APPROVED LOCKED REPOSITORY. WHEN IN AN APPROVED GUARDED AREA, WHILE IT IS YOUR RESPONSIBILITY AND UNTIL YOU HAVE OBTAINED A SIGNED RECEIPT FROM CLASSIFICATION OFFICIALS, IT IS YOUR RESPONSIBILITY TO KEEP IT AND ITS CONTENTS WITHIN THE LIMITS OF THE SUBJECT AND FROM ANY UNAUTHORIZED PERSON. ITS TRANSMISSION, COPIES, AND STORAGE AT YOUR PLACE OF RESIDENCE IS PROHIBITED. IT IS NOT TO BE DUPLICATED. IF ADDITIONAL COPIES ARE REQUIRED, OBTAIN THEM FROM THE RELATED ISSUING FILE. ALL PERSONS READING THIS DOCUMENT ARE REQUESTED TO SIGN IN THE SPACE PROVIDED BELOW.

[illegible]

54-3000-340 (3-57) AEC-GE RICHLAND, WASH

(CLASSIFICATION)

DECLASSIFIED

DISTRIBUTION

1-2. AEC-HOO: Att: AT Gifford	30. WK Kratzer
3. AEC-HOO: Att: PM Midkiff	31. GA Last
4. FW Albaugh	32. EE Leitz
5. WK Alexander	33. CG Lewis
6. GS Allison	34. GL Madsen
7. TW Ambrose	35. NR Miller
8. JA Ayres	36. JE Minor
9. RS Bell	37. MR Moon
10. WA Blanton	38. WI Neef
11. RW Bown	39. SL Nelson
12. JH Brown	40. R Nilson
13. SH Bush	41. WA Oldham
14. JJ Cadwell	42. GF Owsley
15. TL Deobald	43. CA Priode/AG Albert
16. RL Dickema	44. T Prudich/RE McGrath
17. RV Dulin	45. RW Reid
18. JM Fouts	46. RJ Shields
19. FC Franklin	47. HG Spencer
20. GC Fullmer	48. JT Stringer
21. GT Geering	49. JW Talbott
22. SM Gill	50. P Thompson
23. SM Graves	51. RE Trumble
24. OH Greager	52. LD Turner
25. RE Hall	53. FW Van Wormer
26. TM Hall	54. FW Woodfield
27. WR Hamilton	55. 300 Files
28. ME Jackson	56. Record Copy
29. PC Jerman	

Classification Cancelled and Changed To

DECLASSIFIED

By Authority of WA Snyder

CG-PR-2, 1-10-94

By DK Hanson, 1-13-94

Verified By J E Sawley 2-3-94

This document classified by

W Ambrose

This document contains restricted data as defined in Atomic Energy Act of 1954. Transmittal of this document in any manner to an unauthorized person is prohibited.

This document consists of
6 pages, No. 1 of
56 copies, [redacted]

January 22, 1960

PRODUCTION TEST IP-300-A, IRRADIATION OF TWENTY-INCH NATURAL URANIUM TUBE-AND-TUBE ELEMENTS WITH HOT-HEADED INNER TUBES

OBJECTIVE

The objective of this production test is to evaluate the behavior during irradiation of tubular fuel elements with hot-headed end closures.

SUMMARY

Eight natural uranium twenty-inch tube-and-tube elements will be irradiated to a goal of 2500 MWD/T in the KER loops. The inner tubes will be closed by the hot-heading technique and the outer tubes will have normal welded closures.

DECLASSIFIED

BASIS AND JUSTIFICATION

The hot-headed end closure on coextruded Zircaloy-2 jacketed tubular fuel elements provides a closure in which the jacket is bonded over most of the end of the tube and two projection welds are employed between the uranium and the coolant. In contrast the current end closure method uses an unbonded end cap and a single fusion weld.

The hot-headed closure method was developed first for coextruded Zr-2 jacketed rods, and seven seven-rod cluster elements with hot-headed closures are being irradiated in KER Loop 3.⁽¹⁾ Only the inner tubes of the tube-and-tube elements will have the improved end closure. Adaptation of hot-heading to the thinner walled outer tubes has proven more difficult, and no hot-headed outer tubes are available for testing.

TEST DETAILS

1. Fuel Elements

The eight natural uranium tube and tube elements consist of a 1.050 inch O.D., 0.500 inch I.D. inner tube mounted concentrically in a 1.820 inch O.D., 1.450 inch I.D. outer tube. The elements are 20.2 inches long with about 19.9 inches of uranium in each tube. All elements have 0.020 inch coextruded Zircaloy-2 jackets. The outer tubes have normal welded end closures and the inner tubes have hot-headed closures, as shown in SK-3-9365. Both tubes are supported at the ends by welded Zircaloy-2 semi-flexible supports.

Elements prepared from tubular stock from two different sources will be irradiated. Some of the elements were extruded by NMI from Fernald ingot uranium and some were extruded by FPD personnel from dingot uranium.

2. Loading

The tube loading is shown in Table 1. Coupon holders of a design approved by Coolant Testing Operation and Process and Reactor Development Operation may be substituted for any of the spacers in positions 2 to 21 and may be included in positions upstream of the loading given in the table.

3. Irradiation Facility

The fuel elements for this production test may be irradiated in KER high temperature recirculating loops 2, 3, or 4. Irradiation is also authorized in KER Loop 1 provided revised operating conditions applicable to this loop are provided by Process and Reactor Development Operation.

4. Operating Conditions

The coolant will be pressurized water with the pH adjusted to 10.0 $\pm$ 0.5 by the addition of LiOH. The desired operating flow is 60 gpm with a low flow trip of 48 gpm. The low pressure trip will be set at 1500 psig. The desired operating outlet temperature is 288°C with a high outlet temperature trip of 303°C and a boiling point suppression trip of 25°C.

(1) Kratzer, W. K., "Production Test IP-288-A, Evaluation of Seven-Rod Cluster Elements With Modified End Closures", HW-62416, October 16, 1959 (SECRET).

DECLASSIFIED

Operating Conditions (cont'd)

If recirculation with system pressures less than 1500 psig is required, the outlet temperature will be reduced and maintained at least 100°C below the system saturation temperature.

5. Power and Temperature Limits

The operating conditions have been chosen so that surface boiling will not occur on the fuel elements during normal operation, burnout will not occur at the limiting trip conditions, and the maximum uranium temperature will not exceed 600°C.

6. Exposure

The maximum exposure authorized by this production test is 2500 MWD/T for the tube-and-tube elements.

7. Special Procedures

The fuel elements from this production test will be discharged into a special tray according to procedures developed by the KE Maintenance Operation.

8. Priority

Additional down-time is authorized if charging or discharging cannot be accomplished during a normal outage.

9. Costs

a. Cost Code - XXX.5320-XXX.09

b. Time

	<u>Elevator Time, Hours</u>		<u>Manhours</u>
	<u>Front</u>	<u>Rear</u>	
Charge	1	1	4
Discharge	2	4	10
	<u>3</u>	<u>5</u>	<u>14</u>

c. Reactivity change: The test loading will have a reactivity intermediate between that of a dummy charge and a standard charge of normal fuel elements.

10. Data Desired

Routine operating data, including coolant flow, inlet and outlet temperature and pressure, system pressure, and operating time at temperature, will be taken during irradiation.

11. Hazards

The tubular elements authorized by this production test incorporate a new closure which has not been irradiation tested. Hot-headed seven-rod cluster elements are now being irradiated, but these have a projection weld and a fusion weld, rather than two projection welds. Although the closure modification is intended to produce a weld and end cap less susceptible to failure than those used in previous tubular element irradiations, there is always the possibility that the untried closure will fail. Detection and characterization of such operational difficulties is the basic purpose of this test.

DECLASSIFIED

The geometry, fabrication (other than end caps and welds), and testing procedures of the fuel elements in this test were sufficiently similar to those of previous tubular element tests to give no basis to assume that the probability of failure or severity of failure will be any different for these elements than for other tubular elements that have been irradiated.

RESPONSIBILITIES

Hanford Laboratories Operation

Reactor and Fuels Research and Development Operation

Fuels Development Operation

Fuels Fabrication Development is responsible for the fabrication of the tubular elements, analysis of data, and issuance of technical reports.

Irradiation Processing Department

Research and Engineering Operation

Component Testing Operation is responsible for post-irradiation examination and testing of components in the test charge.

Coolant Testing Operation is responsible for:

- a. Operation of the KER Loops.
- b. Taking basic operating data.
- c. Scheduling the loop charge with the concurrence of KE Processing Operation.
- d. Reactor safety and production continuity as they are affected by loop operation.

Process and Reactor Development Operation is responsible for:

- a. Technical aspects of the fuel element irradiation.
- b. Termination of the production test and issuance of the final report.

KE-KW Reactor Operation

KE Processing Operation is responsible for:

- a. Operational safety.
- b. Production continuity, except where inconsistent with provisions of this test.
- c. Special discharges.

Reactor Fuels Unit
Process and Reactor Development Sub-Section
IRRADIATION PROCESSING DEPARTMENT

WK Kratzer:gb

DECLASSIFIED

TABLE 1

Fuel Element Loading from the Downstream End of the Process Tube

<u>Position</u>	<u>Number of Pieces</u>	<u>Material</u>
1	1	eight-inch perf
2-21	20	eight-inch spacers
22	1	eight-inch stainless steel triangular perf
23	1	tube-and-tube element
24	1	eight-inch stainless steel triangular perf
25	1	tube-and-tube element
26	1	eight-inch stainless steel triangular perf
27	1	tube-and-tube element
28	1	eight-inch stainless steel triangular perf
29	1	tube-and-tube element
30	1	eight-inch stainless steel triangular perf
31	1	tube-and-tube element
32	1	eight-inch stainless steel triangular perf
33	1	tube-and-tube element
34	1	eight-inch stainless steel triangular perf
35	1	tube-and-tube element
36	1	eight-inch stainless steel triangular perf
37	1	tube-and-tube element
38	1	eight-inch stainless steel triangular perf.

DECLASSIFIED

APPROVALS

J. H. Brown

J. H. Brown, Manager
Process and Reactor Development
IRRADIATION PROCESSING DEPARTMENT

H. R. Spencer Acting

R. W. Reid, Manager
Process Technology
IRRADIATION PROCESSING DEPARTMENT

C. G. Lewis

~~and~~ C. G. Lewis, Manager
Testing Operation
IRRADIATION PROCESSING DEPARTMENT

O. H. Greager

O. H. Greager, Manager
Research and Engineering
IRRADIATION PROCESSING DEPARTMENT

S. L. Nelson

^{1st} S. L. Nelson, Manager
KE Processing Operation
IRRADIATION PROCESSING DEPARTMENT

R. S. Bell

R. S. Bell, Manager
KE-KW Reactor Operation
IRRADIATION PROCESSING DEPARTMENT

R. L. Dickeman

R. L. Dickeman, Manager
Manufacturing Section
IRRADIATION PROCESSING DEPARTMENT

DECLASSIFIED

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**

12 / 7 / 94

END