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.

1 of 1

HANFORD CODE C-65

DOCUMENT NO.

HW-74407

SERIES AND COPY NO.

15

DATE
July 25, 1962

GENERAL ELECTRIC

HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

XX

TRICTED

THIS DOCUMENT CONTAINS UNCLASSIFIED DATA
 OBTAINED IN THE ATOMIC ENERGY ACT OF 1954.
 ITS TRANSMITTAL OR THE DISCLOSURE OF ITS
 CONTENTS IN ANY MANNER TO AN UNAUTHORIZED
 PERSON IS PROHIBITED.

103

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.

TITLE

**FINAL REPORT: IRRADIATION PERFORMANCE OF A
COEXTRUDED, ZIRCALOY-2-CLAD THREE-ROD CLUSTER
FUEL ELEMENTS, PT-IP-186-A**

AUTHOR

R. L. Call

CIRCULATING COPY
RECEIVED 300 AREA

SEP 17 1962

RETURN TO

TECHNICAL INFORMATION FILES

THIS DOCUMENT IS NOT TO BE LEFT UNATTENDED OR WHERE AN UNAUTHORIZED PERSON MAY HAVE ACCESS TO IT. WHEN IN USE, IT MUST BE STORED IN AN APPROVED LOCKED CUSTODIARY WITHIN AN APPROVED GUARDED AREA. WHILE IT IS YOUR RESPONSIBILITY AND UNTIL YOU HAVE OBTAINED A SIGNED RELEASE FROM CLASSIFIED FILES, IT IS YOUR RESPONSIBILITY TO KEEP IT AND ITS CONTENTS WITHIN THE LIMITS OF THE PROJECT AND FROM AN UNAUTHORIZED PERSON. TRANSMITTAL TO, 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 OFFICE. ALL PERSONS READING THIS DOCUMENT ARE REQUESTED TO SIGN IN THE SPACE PROVIDED BELOW.

[illegible]

DECLASSIFIED

(CLASSIFICATION)

This document classified by:

G A Last

G. A. Last, Supervisor
Fuel Element Design

This document consists of
4 pages, No. 15 of
33 copies.

DECLASSIFIED

FINAL REPORT: IRRADIATION PERFORMANCE OF A
COEXTRUDED, ZIRCALOY-2-CLAD THREE-ROD CLUSTER
FUEL ELEMENTS, PT-IP-186-A

R. L. Call

July 25, 1962

Classification Cancelled and Changed To

DECLASSIFIED

By Authority of *RM Men*
CG PR-2, 3-17-94

By *O. E. Savely 3-30-94*
Verified By *Mc Hanson, 4-4-89*
PKA

DISTRIBUTION

1. F. W. Albaugh	16. J. E. Minor
2. W. K. Alexander	17. J. W. Nicholas
3. T. W. Ambrose/T. W. Evans	18. K. W. Norwood
4. J. A. Ayres	19. D. P. O'Keefe
5. J. H. Brown	20. J. W. Riches
6. S. H. Bush	21. D. R. Stenquist
7. J. J. Cadwell	22. J. T. Stringer
8. D. R. Dickinson	23. J. C. Tobin
9. R. L. Dillon	24. J. W. Weber
10. E. A. Evans	25. R. G. Wheeler/R. K. Marshall
11. S. M. Gill	26. O. J. Wick
12. J. W. Goffard/F. E. Young	27. 300 File
13. W. K. Kratzer	28. Record Copy
14. L. E. Kuhlken	29-33. Extra
15. G. A. Last	

[REDACTED]
[REDACTED]
[REDACTED] the Atomic Energy Act of 1954.
Its transmission or disclosure of its
contents in any manner to an unauthorized
person is prohibited.

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

[REDACTED]
[REDACTED]

[REDACTED]

FINAL REPORT: IRRADIATION PERFORMANCE OF A
COEXTRUDED, ZIRCALOY-2-CLAD THREE-ROD CLUSTER
FUEL ELEMENTS, PT-IP-186-A

R. L. Call

DECLASSIFIED

INTRODUCTION

One of the early candidate fuel elements for N Reactor use was the coextruded, Zircaloy-2-clad seven-rod cluster. As part of the program of evaluating the seven-rod cluster geometry, three-rod cluster fuel elements, two and three feet long, were irradiated. These long cluster fuel elements were irradiated to determine the distortion (or sag) which might occur at the center of the unsupported length during irradiation.

SUMMARY AND CONCLUSIONS

Two three-rod clusters made up of 0.630 inch diameter rods containing natural uranium cores were irradiated in KER Loop 3. The rods of one cluster were three feet long; the rods of the other were two feet long. The three-foot long rods were supported at their ends and at their midlengths, the two-foot long rods only at their ends. During the irradiation, the maximum core temperature was 435 C.

The fuel elements were discharged from the loop after they had reached an exposure of 1400 MWD/T. Following the discharge, the fuel elements were visually examined in the KE view pit. No sag was observed in any of the rods. The test demonstrated that two- and three-foot long rod cluster fuel elements can be irradiated without appreciable sag occurring in the rods.

DISCUSSION

Fabrication of Fuel Elements

The three-rod cluster fuel elements were made from 0.630-inch diameter, coextruded, Zircaloy-2-clad rod stock fabricated by Nuclear Metals, Inc. (NMI) of Concord, Massachusetts.⁽¹⁾ The cladding thickness on these rods was 0.020 inch. The process used in making the rod stock into cluster fuel elements has been described elsewhere⁽²⁾ and will not be repeated here. As can be seen in Figure 1, the rods were supported at their ends by triangular end supports. The three-foot long rods were also supported at their midlengths by "suitcase handle" supports.

Irradiation History

The two three-rod cluster fuel elements were irradiated under PT-IP-186-A⁽³⁾ along with four 12-inch long Zircaloy-2-clad UO₂ four-rod clusters and one 10-inch long Zircaloy-2-clad plutonium-aluminum four-rod cluster. These fuel elements were charged into KER Loop 3 in August 1958, and were discharged after they had reached an exposure of 1400 MWD/T. Loop conditions during the test were:

-3-

FIGURE 1

Three-Rod Cluster Fuel Elements Before Irradiation.

~ 0.2X

DECLASSIFIED

HM-74407

Inlet temperature	157 C
Outlet temperature	185 C
Flow	60 gpm
Loop pressure	850 psig
Water pH	7.0

DECLASSIFIED

The power and temperatures in the rods during the test were:

Specific power	23.0 kw/ft
Cladding surface temperature	190 C
Cladding-to-core interface temperature	290 C
Core center temperature	435 C

Postirradiation Examination

After the fuel elements were discharged from the loop, they were inspected in the KE view pit. There was a slight reddish brown film on all the rods, probably because of the low pH water. The rods of the three-rod clusters appeared to be straight and free from distortion or sag. No corrosion or defects were visible on any of the surfaces. No further examinations were made.

ACKNOWLEDGEMENT

The author wishes to acknowledge the contributions of G. T. Geering who prepared the fuel elements for irradiation and of W. K. Kratzer who supervised the irradiation testing.

REFERENCES

1. Sawyer, H. F., Development and Properties of Coextruded Zircaloy-Clad Uranium Fuel Elements with Integral End Seals, Terminal Report to Hanford Atomic Products Operation, General Electric Co., NMI-4710. November 1958.
2. Call, R. L., T. T. Claudson, and R. Teats, Final Report: Irradiation Performance of Enriched Zircaloy-2-Clad Seven-Rod Cluster Fuel Elements, Production Test IP-214-A (RM-295), HW-70659. May 1962. (██████████).
3. Kratzer, W. K. and N. R. Miller, Production Test IP-186-A, High Temperature Irradiation of Two- and Three-Foot Long Cluster Elements in the KER Loops, HW-56549. July 1958. (██████).

**DATE
FILMED**

10/18/94

END