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.

DECLASSIFIED

HW-79056

This document classified by

H. S. Spencer

This document consists of 10
pages, [REDACTED]

FINAL REPORT ON THE EVALUATION OF
HARVEY ALUMINUM COMPONENTS
UNDER PITA-IP-12-I

By

R. V. Hubert
Process Analysis Unit
Process Technology Subsection
Research and Engineering Section
IRRADIATION PROCESSING DEPARTMENT

Classification [REDACTED] To

DECLASSIFIED

By Authority of CG-PR-2
RM Dtn, 3-30-94
By Jerry Maley 4-8-94
Verified By J. E. Sawley 4-15-94

September 26, 1963

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

NOTICE

This report was prepared for use within General Electric Company in the course of work under Atomic Energy Commission Contract AT(45-1) - 1350, and any views or opinions expressed in the report are those of the author only. This report is subject to revision upon collection of additional data.

LEGAL NOTICE

MASTER

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

DECLASSIFIED

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

870

DECLASSIFIED

DISTRIBUTION

1. AEC-RLOO: RL Plum	28. PJ Hollifield
2. AEC-RLOO: PM Midkiff	29. RV Hubert
3. AEC-RLOO: CN Zangar	30. FW Knight
4. TW Ambrose	31. CG Lewis
5. ER Astley	32. AR Maguire
6. JT Baker	33. WW McIntosh
7. JW Baker	34. WN Mobley
8. HE Berg	35. HC Money
9. RS Bell	36. JE Morrissey
10. WA Blanton	37. WI Neef
11. RR Bloomstrand	38. R Nilson
12. RW Bown	39. EV Padgett
13. MA Clinton	40. CA Priode
14. RG Clough	41. T Prudich
15. RF Corlett	42. WH Radtke
16. BR Cremer	43. RW Reid
17. RE Dunn	44. OC Schroeder
18. WJ Ferguson	45. HG Spencer
19. EJ Filip	46. RE Spicka
20. GC Fullmer	47. JT Stringer
21. DK George	48. HF Tew
22. SM Graves	49. AP Vinther
23. OH Greager	50. EA Weakley
24. AB Greninger	51. SA Wood
25. CN Gross	52. PJ Zimmerman
26. CM Heeb	53. 300 Files,
27. KL Hladak	54. Record Center

FINAL REPORT ON THE EVALUATION OF
HARVEY ALUMINUM COMPONENTS
UNDER PITA-IP-12-I

INTRODUCTION

Several evaluations of Harvey "O" size natural I&E aluminum components have been made. The performance¹ of components received prior to May, 1961, was unsatisfactory.^{2,3} To improve component quality, Harvey made major process modifications. Components processed at HAPCO after July 1, 1961, were received subsequent to Harvey's modifications, and met specifications. Procurement and evaluation of an additional 150,000 Harvey OIIN components was authorized.⁴ Evaluation of the first 150,000 Harvey OIIN improved components suggested partial qualification.⁵

This document reports and makes recommendations based on the test data for Harvey improved components as of August 31, 1963.

SUMMARY AND RECOMMENDATIONS

Finished fuel elements canned for the Harvey test and Alcoa control components to complete the initial and extended evaluation programs are summarized in Table I. Conformance to the procedure to obtain minimum bias of test results from canning was good. Over-all nondestructive and destructive test data did not indicate any significant differences in test and control clad elements that could be attributed to component quality.⁵

The irradiation of the combined test program as of August 31, 1963, is 98 per cent completed. There have been seven Harvey nonbumper ruptures and five Alcoa (control) nonbumper ruptures. Also experienced were three Harvey bumper and seven Alcoa (control) bumper ruptures. Refer to Table II for the summary of these ruptures. The combined irradiation data obtained supports the conclusions, at the 90 per cent confidence level, that the performance of Harvey OIIN components was equal to that of the Alcoa control components (see Figure 2). Therefore, it is recommended that the Harvey Aluminum Company be considered a qualified vendor of all fuel component models. This evaluation has been confined to the OIIN component model; potential risks associated with the use of all Harvey component models should be minimized by:

1. Rejecting marginal or substandard components and returning them to the vendor. Depending on the extent and seriousness of any failure to meet component specifications, temporary or permanent cancellation of qualification may be justified.
2. Considering adverse irradiation performance of one or more component models as cause for loss of qualification until the restoration of quality.
3. Expediting limited amounts of initial quantities of other Harvey component models for irradiation.

DISCUSSION

The sequential test procedure was constructed to eliminate bias due to fuel assembly, uranium and reactor variables. Pre-irradiation tests of component quality for test and control materials indicated no significant difference, chemical or metallurgical, in random component samples. Canning yields for the test and control material were also comparable.⁵

DECLASSIFIED

HW-79056

The irradiation of the test and control elements is 98 per cent completed. In all, 22 ruptures were sustained during the evaluation period (see Table II). The accumulated rupture index of the test and control components was determined. The near equality of the test and control rupture index values substantiates that the test and control components were subjected to about the same irradiation experience (see Table III).

The test of Harvey bumper to the control bumper components indicated that the materials were equal; but, the test of Harvey nonbumper components failed to substantiate any decision (see Figure I). A large amount of additional testing would be required to obtain a significant result for Harvey nonbumper components. It is believed that the combined result would justify, for practical reasons, the concluding of the Harvey Aluminum evaluation. The combined analysis indicates that the Harvey materials (bumper and nonbumper together) were equal to the control materials.

Richard V. Hubert

Process Analysis Unit
Process Technology Subsection
RESEARCH AND ENGINEERING

RV Hubert:mf

APPROVED BY:

H. R. Spencer

Supervisor, Process Analysis Unit
Process Technology Subsection
RESEARCH AND ENGINEERING

¹⁵
DECLASSIFIED

HW-79056

BIBLIOGRAPHY

1. Shimer, R.D., Process Improvement Transition Authorization IP-12-I, Evaluation of Aluminum Components From Alternate Vendors, HW-66830, September 20, 1960, [REDACTED].
2. Bloomstrand, R.R., Analysis of Harvey-Alcoa Test, January 31, 1962, [REDACTED].
3. Shimer, R.D., Current Status of Aluminum Component Vendor Evaluation, HW-70311, March 14, 1962, [REDACTED].
4. Shimer, R.D., Supplement A to Process Improvement Transition Authorization IP-12-I, Evaluation of Aluminum Components From Alternate Vendors, HW-66830 SUP A, September 3, 1962, Unclassified.
5. Blanton, W. A., Status of Harvey Aluminum Component Evaluation, Production Test IP-12-A, HW-76563, February 13, 1963, [REDACTED].

DECLASSIFIED

HW-79056

TABLE I
CANNING SUMMARY*

	<u>Nonbumper</u>	<u>Bumper</u>	<u>Totals</u>
<u>INITIAL PROGRAM</u>			
Alcoa control	75,200	35,400	110,600
Harvey test	75,400	38,900	114,300
<u>EXTENDED PROGRAM</u>			
Alcoa control	59,400	65,300	124,700
Harvey test	72,400	47,900	120,300
<u>COMBINED PROGRAMS</u>			
Alcoa control	134,600	100,700	235,300
Harvey test	147,800	86,800	234,600
CANNED TOTALS	282,400	187,500	469,900

*For more detailed canning history consult reference 4 of the bibliography.
Includes improved Harvey components, only; Harvey components processed at
HAPO prior to July 1, 1961, are excluded.

TABLE II

RUPTURE SUMMARY

<u>Date of Failure</u>	<u>Tube and Reactor</u>	<u>Exposure MWD/Ton</u>	<u>Tube Power at Failure (kw)</u>	<u>Rupture Type</u>	<u>Canning Date</u>	<u>Lot No.</u>	<u>Core</u>
<u>NONBUMPER RUPTURES</u>							
<u>Harvey Test</u>							
12/14/61	3264 DR	780	1229	Side Hot Spot	7/14/61	HZ 036H	Dingot
1/7/62	2088 B	208	1195	Unclassified	9/5/61	UZ 057H	Dingot
3/11/62	1078 DR	469	1123	Side Hot Spot	10/17/61	KZ 152H	Ingot
3/15/62	1584 DR	486	1056	Side-Unclassified	10/17/61	CZ 884H	Unknown
5/12/62	1068 B	627	1166	Unclassified	11/29/61	KZ 142H	Ingot
9/8/62	2068 B	385	1018	Side Hot Spot	6/14/62	CZ 019H	Unknown
10/24/62	1677 F	416	1018	Side Hot Spot	7/30/62	KZ 444H	Ingot
<u>Alcoa Control</u>							
3/9/62	2378 B	289	1234	End (Defect)	10/20/61	UZ 060A	Dingot
11/22/62	3867 F	591	1085	Side Groove Corr.	7/12/62	KZ 440A	Ingot
12/23/62	3162 B	459	1134	End-Unclassified	7/31/62	KZ 446A	Ingot
1/29/63	1362 F	569	1263	Side Hot Spot	9/4/62	KZ 092A	Ingot
4/16/63	2681 B	551	1201	Side-Unclassified	7/31/62	KZ 446A	Ingot
<u>BUMPER RUPTURES</u>							
<u>Harvey Test</u>							
2/2/63	1475 DR	756	969	Hole Groove Corr.	9/13/62	KZ 493G	Ingot
2/26/63	5759 D	1030	1263	Hole Groove Corr.	8/8/62	KZ 456G	Ingot
7/12/63	2468 D	843	1085	Side-Unclassified	11/1/62	KZ 533G	Ingot
<u>Alcoa Control</u>							
11/27/62	2777 D	783	1214	Hole Groove Corr.	6/25/62	KZ 418D	Ingot
12/27/62	1077 D	657	1240	Side Groove Corr.	8/6/62	KZ 453D	Ingot
1/2/63	3786 D	672	1177	Side Groove Corr.	9/4/62	KZ 473D	Ingot
1/28/63	1468 DR	724	1102	Hole Groove Corr.	8/2/62	KZ 443D	Ingot
2/14/63	2079 DR	999	1226	Hole Groove Corr.	8/6/62	KZ 452D	Ingot
2/19/63	0682 D	878	1189	Side Groove Corr.	8/7/62	KZ 455D	Ingot
4/14/63	0661 D	1062	925	Side Groove Corr.	8/6/62	KZ 453D	Ingot

DECLASSIFIED

HM-79056

DECLASSIFIED

TABLE III
IRRADIATION SUMMARY
COMBINED PROGRAM

	<u>Nonbumper</u> x 10 ⁻³⁶	<u>Bumper</u> x 10 ⁻³⁶	<u>Weighted</u> <u>Total</u> x 10 ⁻³⁶
Control ΔRI	25.8	71.5	117.9
Test ΔRI	26.3	76.5	123.8

NOTE: Rupture Index (RI) was calculated for each tube charge of test and control material by:

$$RI = E^5 P^{3.3} T^{8.7}$$

Where (E) charge exposure

(P) tube power

(T) tube outlet temperature

Delta Rupture Index (ΔRI) represents irradiation experience by a balance, thus:

$$\Delta RI = \Sigma RI \text{ (discharges)} + \Sigma RI \text{ (inventory)} - \Sigma RI \text{ (initial)}$$

From "a" value experience (see monthly Rupture Reports), the rupture index for nonbumper materials is 1.8 times as significant in indicating actual number of ruptures as the index for the bumper material. Hence, the ΔRI totals were weighted thus:

$$\Delta RI \text{ (total)} = \Delta RI \text{ (bumper)} + 1.8 \Delta RI \text{ (nonbumper)}$$

DECLASSIFIED

SEQUENTIAL TEST

HARVEY BUMPER AND NONBUMPER

FIGURE 1

SEQUENTIAL TEST

COMBINED HARVEY (BUMPER + NONBUMPER)

FIGURE 2

**DATE
FILMED**

6 / 30 / 94

END