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POST-IRRADIATION DATA ON FUEL ELEMENTS
FROM KER LOOP 4

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~~J. W. Loffard~~

12922

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POST-IRRADIATION DATA ON FUEL ELEMENTS FROM KER LOOP-4

January 10, 1963

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

MASTER

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POST-IRRADIATION DATA ON FUEL ELEMENTS FROM KER LOOP-4

Fourteen NAE1 fuel elements were discharged from KER Loop-4 on September 25, 1962. These elements had been irradiated to an average exposure of 1250 MWD, at prototype N-Reactor conditions of coolant temperature and pressure. Production Test IP-477A⁽¹⁾ specifies these conditions.

After discharge, the elements were disassembled and measured in the KE Fuel Examination Facility. This report includes all measurements except the profilometer data, which is recorded on EDP punch tape for analysis by computer programs. The profilometer data will be distributed to interested parties by Fuels Design Operation, HLO.

The weasel readings give relative values only. They are not quantitative measurements of the radiation from the fuel elements. The warp angles are measured clockwise with respect to the index point on the fuel element. The minimum warp is the least deflection measured around the circumference of the element, regardless of the angle at which it occurs. This procedure gives data comparable to the current pre-irradiation measurements, but the double-throw warp indicated by the difference between the maximum and minimum deflections does not necessarily lie on a plane through the center line of the element. Outside diameter measurements were taken at the center of each individual fuel element.

E. C. Bennett

Component Testing

E. C. Bennett/rch

1) - Kratzer, W. K., Production Test IP-477A, Irradiation of N-Reactor Fuel Elements In KER Loops 3 and 4; HW-72269. Dated January 9, 1962.

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Un-charged

POST IRRADIATION

Tube Number

3865-KE

Production Test

IP-477A

FPP meas.	Part Number	Pres. To Part, psi	Range: 3 x 10 Weasel		Length (Standard + ΔL) Inches	Maximum Warp		Minimum Warp		Change in Weight grams	SNAP GAUGE OD at center		
			Date	Value		Angle Degrees	Warp Mils	Angle Degrees	Warp Mils				
	Stanford (HS-1106-12)				22.896						1.248	P ~ FPP	Δ
5	H-1037-12	+ 30°	9-30-62	.41	23.119	110	34	17	+ 5	- 0.10	1.248	1.244	+ 4
4	H-1045-2	60°	9-30-62	.61	23.272	100	22	11	+ 12	- 1.30	1.251	1.248	+ 3
6	H-1115-11	- 145	9-30-62	.70	22.878	220	37	18	+ 8	- 1.75	1.253	1.248	+ 5
3	H-1053-6	+ 20	9-30-62	.99	23.037	280	22	11	+ 11	- 1.95	1.252	1.247	+ 5
17	H-1055-8	- 05	9-30-62	1.18	22.980	100	51	25	+ 9	- 1.75	1.253	1.248	+ 5
8	H-1049	+ 100	9-30-62	1.28	22.911	10	39	19	+ 11	- 1.80	1.255	1.248	+ 7
18	H-1049	- 70	9-30-62	1.29	22.906	290	33	16	+ 14	- 2.20	1.254	1.248	+ 6
16	H-1049	- 20	9-30-62	1.34	23.193	170	29	05	+ 18	- 2.50	1.252	1.248	+ 4
11	H-1018-4	- 110	9-30-62	1.41	23.035	350	30	15	+ 7	- 2.80	1.251	1.245	+ 6
15	HS-1115-16	- 15	9-30-62	1.41	22.930	135	32	08	+ 16	- 2.05	1.253	1.248	+ 5
22	H-1045-7	0	9-30-62	1.34	22.980	70	38	16	+ 6	- 1.80	1.252	1.248	+ 4
16	H-1103-1	- 170	9-30-62	1.14	22.821	350	47	14	+ 12	- 1.40	1.254	1.249	+ 5
26	H-1057-6	- 15	9-30-62	.77	22.981	160	36	12	+ 13	- 0.95	1.254	1.249	+ 5
06	H-1037-12	+ 10	9-30-62	.34	22.857	10	26	05	+ 15	- 0.30	1.248	1.245	+ 3

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Warp degree readings, ± 10°

Inventor
Order

Date Discharged

9-25-62

FUEL ELEMENT DATA - POST IRRADIATION

Tube Number
3865-KE

Production Test
IP-477A

Element Number	Pres. To Part, psi	Range: 3 x 10 ⁻⁷ Weasel		Length (Stand. + ΔL) Inches	Maximum Warp		Minimum Warp Angle Degrees	Warp Δ Mills		Change in Weight grams	SNAP GAUGE O.D. INCHES	FRP Δ
		Date	Value		Angle Degrees	Warp Mills		Angle Degrees	Warp Mills			
Standard (H-2113-11) <i>slight</i>				23.203							2.403	
25 H-2057-10	+10	9-30-62	1.15	23.219 + .036 23.181	130 130	+ 42	300	16 +33 14	- 2.45		2.404	2.404
08 H-2060-2 to R.M.	-05	9-30-62	1.69	23.209 + .021 23.188 + .008 23.196	160	+ 23	10 140	8 +7 14	- 3.50		2.406	2.404 +2
02 H-2101-10	+70	9-30-62	2.01	23.208 + .014 23.194	180 180	+ 23	290	7 +7 14	- 4.03		2.404	2.402 +2
15 H-2087-6	+15	9-30-62	2.75	23.207 + .007 23.200	180	+ 19	10 140	4 -1 14	- 4.50		2.407	2.405 +2
15 H-2087-7 R.M.	-10	9-30-62	3.36	23.203 - .003 23.206	180	+ 42	280	6 +21 14	- 4.70		2.406	2.403 +2
07 H-2088-2	+110	9-30-62	3.70	23.209 + .016 23.193	10 170	+ 33	160	9 +17 14	- 5.83		2.409	2.405 +2
06 H-2089-6	-05	9-30-62	3.77	23.206 + .009 23.197	255	+ 28	60 140	0 +22 14	- 6.00		2.407	2.404 +2
10 H-2100-2	+175	9-30-62	3.75	23.227 + .047 23.180	340	+ 26	130 140	9 +7 14	- 5.00		2.407	2.405 +2
10 H-2099-6	-80	9-30-62	3.96	23.204 + .001 23.203 + .031 23.234	100 180	+ 23	290	8 +5 14	- 7.03		2.408	2.403 +2
07 H-2103-9	-40	9-30-62	4.01	23.207 + .010 23.197	120 180	+ 26	330	5 +4 14	- 6.05		2.403	2.402 +2
15 H-2097-2	+40	9-30-62	3.87	23.209 + .017 23.192	180	+ 28	20 140	8 +5 14	- 5.75		2.407	2.405 +2
17 H-2100-6	+65	9-30-62	3.16	23.208 + .016 23.192	210 140	+ 27	330	6 +4 14	- 3.25		2.407	2.406 +2
06 H-2100-3	10	9-30-62	2.12	23.200 + .005 23.195	150 140	+ 31	350	14 +7 14	- 2.80		2.406	2.406 0
25 H-2042-9	-45	9-30-62	.99	23.177 - .017 23.194	140	+ 63	10 140	34 +6 14	- 3.05		2.405	2.404 +2

Insert 0.10

Warp degree readings, ± 10°

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Warp
+ = ...
- = ...

Discharged
9-25-62

FUEL ELEMENT DATA - POST IRRADIATION
VISUAL EXAMINATION

3865-KE

PT-IP-477

Element No.	Cylindrical Surface		Ends		Attachments	
	Film (Color, Extent, Location, Thickness)	Surface Deformation	Film Color, Location	Damage	Supports Film, Damage	Locking Clips
HS-1037-12	Dull gray, over-all, <1 mil	Light scattered pitting.	White, weld bends.	None	Dull gray; Four supports broken, three at 0°, one at 90°, male end. Probably occurred on disassembly.	Locked; Disassembler used, assembly parts easily.
H-1045-2	Dull gray, over-all, 1 mil.	Light scattered pitting.	White, weld beads.	None	Dull gray; one support broken (male end 270°) at inboard buggy spring.	None; separate by shaking in vertical position.
H-1115-11	Surface was shiny dark gray.	Light scattered pitting.	Tan, male end. 50% white, female end. Weld beads.	None	No film. Two supports broken at male end, 0° and 270°. One missing at center, 270°, one twisted at center, 0°.	Locked; Disassembler used, assembly parts easily.
H-1053-6	Dull gray, over-all.	Light scattered pitting.	Tan and white. Inner weld bead tan, outer weld bead white.	None	Dull gray; end supports at 0° appear to be cracked in buggy spring.	None; separate by shaking in vertical position.
H-1055-8	Dull gray, over-all, < 1 mil.	Light scattered pitting. Medium striations at 250°, male end to center.	White and tan; outside weld male end 50% white oxide, rest tan.	None	Dull gray; No damage.	None; separate by shaking in vertical position.
H-1049-2	Dull gray, over-all, < 1 mil.	Light scattered pitting.	Tan and white. White oxide on outer weld, both ends.	None	Dull gray; three supports appear to be cracked at buggy spring; both end supports at 0°, male end at 90°.	Present but not locked. Separated by shaking in vertical position.

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Discharged
9-25-62

FUEL ELEMENT DATA - POST IRRADIATION
VISUAL EXAMINATION

3865-KE

PT-IP-477

Element No.	Cylindrical Surface		Ends		Attachments	
	<u>Film</u> (Color, Extent, Location, Thickness)	<u>Surface</u> Deformation	<u>Film</u> Color, Location	Damage	<u>Supports</u> Film, Damage	<u>Locking</u> Clips
H-1084-8	Dull gray, over-all, < 1 mil.	Light scattered pitting.	Tan and white; white oxide on outer welds.	None.	Dull gray; three supports cracked in buggy spring, female end at 0° and each end support at 270°.	None; separate by shaking in vertical position.
H-1057-4	Dull gray; over-all, < 1 mil.	Light scattered pitting.	Tan and white; weld beads.	None	Dull gray; outboard end of support broken, female end, 0°.	Present but not locked; separated by shaking in vertical posi- tion.
HS-1018-4	Dull gray; over-all, < 1 mil.	Light scattered pitting.	White; weld beads.	None	Dull gray; no damage.	None; separate by shaking in vertical posi- tion.
HS-1115-16	Dull gray, over-all	Light scattered pitting.	Tan; weld beads.	None	Dull gray; one end support at 0° broken off at buggy spring, tabs left.	Present but n locked. Sepa- rated by shaking in vertical posi- tion.
H-1045-7	Dull gray, over-all, < 1 mil.	Light scattered pitting.	Tan; weld beads. Few spots of white on outer bead, male end.	None.	Dull gray; no damage.	Present but n locked. Separated by shaking in vertical posi- tion.
H-1103-4	Light brown film over dull gray surface. Over-all. 1 mil.	Light scattered pitting.	White; weld beads.	None.	Dull gray; no damage.	Present but n locked. Sepa- rated by shaking in vertical posi- tion.

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Discharged
9-25-62

FUEL ELEMENT DATA - POST IRRADIATION
VISUAL EXAMINATION

3065-KE

PT-IP-4771

Element No.	Cylindrical Surface		Ends		Attachments	
	Film (Color, Extent, Location, Thickness)	Surface Deformation	Film Color, Location	Damage	Supports Film, Damage	Locking Clips
H-1103-4	Light brown film over dull gray surface; over-all; 1 mil.	Light scattered pitting.	White; weld beads.	None	Dull gray; no damage.	Present but not locked. Separated by shaking in vertical position.
H-1057-6	Medium brown film over dull gray surface; over-all; 1 mil.	Light scattered pitting.	Tan; weld beads.	None	Dull gray; no damage.	None; separated by shaking in vertical position.
H-1033-5	Medium brown film over dull gray surface; over-all; 2 mils.	Light scattered pitting.	Light brown; weld beads.	None	Light brown; one support missing at center, 90°.	Locked. Disassembler used, assembly parts easily.
H-2057-101	Dull gray; over-all coating. < 1 mil.	Light scattered pitting.	White and tan. Weld beads.	None	Red rust on support shoes. No damage.	Disassembler used, assembly parted easily.
H-2060-2	Dull gray; over-all. < 1 mil.	Light pitting in striations, center area. Striations appear to be mechanical in origin, not from extrusion.	White. Weld beads.		Red rust on support shoes. No damage.	None. Separated by shaking in vertical position.
H-2101-101	Dull gray; over-all; < 1 mil.	Light scattered pitting.	White; weld beads.	None	Red rust on support shoes.	Disassembler used, assembly parted easily.
H-2087-6	Dull gray; over-all; < 1 mil.	White; weld beads.	White; weld beads.	None	Red rust on support shoes. One support missing, female end at 90°.	None. Separated by shaking in vertical position.

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Discharged
9-25-62

FUEL ELEMENT DATA - POST IRRADIATION
VISUAL EXAMINATION

3865-KE

PT-IP-477A

Element No.	Cylindrical Surface		Ends		Attachments	
	Film (Color, Extent, Location, Thickness)	Surface Deformation	Film Color, Location	Damage	Supports Film, Damage	Locking Clips
H-2087-7	Dull gray; over-all; < 1 mil.	Scattered, very light pitting in center area.	White; weld beads.	None	Red rust on support shoes. One support missing at male end, 180°.	None; separated by shaking in vertical position.
H-2088-21	Dull gray; over-all; < 1 mil.	Light scattered pitting.	White; weld beads.	None	Red rust on support shoes. One shoe missing at female end, 0°.	Present but not locked. Separated by shaking in vertical position.
H-2089-6	Dull gray; over-all; < 1 mil.	Very light scattered pitting.	White; weld beads.	None	Red rust on support shoes. No damage.	None. Separated by shaking in vertical position.
H-2100-21	Dull gray; over-all; < 1 mil.	Light scattered pitting.	White; weld beads.	None	Red rust on support shoes. Support shoes missing at male end, 0° and 90°.	Present but not locked. Separated by shaking in vertical position.
H-2099-6	Dull gray; over-all; 1 mil.	None.	Light tan; weld beads.	None	Red rust on support shoes. Two supports missing at male end, 90° and 180°. Appear to have been scraped off.	None. Separated by shaking in vertical position.
H-2103-9	Dull gray; over-all; 1 mil.	None.	White, female end; light tan, male end. Weld beads.	None	Red rust on support shoes. No damage.	Present but not locked. Separated by shaking in vertical position.

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Discharged
9-25-62

FUEL ELEMENT DATA - POST IRRADIATION
VISUAL EXAMINATION

3865-KE

PT-IP-477A

Element No.	Cylindrical Surface		Ends		Attachments	
	Film (Color, Extent, Location, Thickness)	Surface Deformation	Film Color, Location	Damage	Supports Film, Damage	Locking Clips
H-2097-2 1	Dull gray; over-all; 1 mil.	None.	Tan; weld beads.	None	Red rust on support shoes. No damage.	Present but not locked. Separated by shaking in vertical position.
H-2100-6 1	Dull gray; over-all; 1 mil.	None.	Tan with white spots. Weld beads.	None	Red rust on support shoes. One support missing at male end, 90°. Outside tube loose at female end, 90°.	Present but not locked. Separated by shaking in vertical position.
H-2100-3	Medium brown film over dull gray. Over-all; 2 mils.	Light scattered pitting.	Tan with small white patches; weld beads.	None	Red rust on support shoes. No damage.	None. Separated by shaking in vertical position.
H-2042-9 1	Medium brown over dull gray. Over-all. 2 mils.	None.	Tan. Weld beads.	None	Red rust on support shoes. No damage.	Locked. Disassembler used, assembly parted easily.

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END