1 of 1

(CLASSIFICATION)

DECLASSIFIED

DOCUMENT NO.

HW-76528 C

SERIES AND COPY NO.

GENERAL ELECTRIC

HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

June 11, 1963

TITLE

INTERIM REPORT III, PRODUCTION TEST IP-549-
HALF-PLANT LOW ALUM FEED WATER TREATMENT
AT F REACTOR

☐ 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 TRANS-
MISSION OR REVELATION OF WHICH IN ANY MANNER
TO AN UNAUTHORIZED PERSON IS PROHIBITED BY
LAW.

AUTHOR

R. G. Geier

ISSUING FILE
CIRCULATING COPY
RECEIVED 100 D AREA
JUN 13 1963
RETURN TO

NOT IN USE. MUST BE STORED IN AN APPROVED LOCKED CONTAINER WITHIN THE
GUARD AREA. WHILE IN YOUR POSSESSION AND WHILE YOU HAVE OBTAINED A SIGNED RECEIPT FROM
PROJECT AND FROM ANY UNAUTHORIZED PERSON. ITS TRANSFER TO, AND STORAGE AT YOUR PERSONAL
RESIDENCE IS PROHIBITED. IT IS NOT TO BE REPRODUCED OR REPRODUCED FOR ANY OTHER PURPOSE.

ROUTE

PAYROLL NO.

LOCATION

FILES ROUTE
DATE

SIGNATURE AND DATE

JUN 13 1963

R. Geier 1-31-68

DECLASSIFIED

DECLASSIFIED

HW-76528 C
Page 1

This document consists of
8 pages,

INTERIM REPORT III, PRODUCTION TEST IP-549-A
HALF-PLANT LOW ALUM FEED WATER TREATMENT AT F REACTOR

By

R. G. Geier
Process and Reactor Development Subsection
Research and Engineering Section

June 11, 1963

Classification Cancelled and Changed To

DECLASSIFIED

By Authority of CG PR-2,

R M Iten 3-21-94

By Querry Miley 3-31-94

Verified By JK Hanson

4-4-94

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

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

HW-76528 C
Page 2

DISTRIBUTION

1. AEC-RLOO: Attn: R. L. Plum
2. AEC-RLOO: Attn: C. N. Zangar
3. W. G. Albert
4. T. W. Ambrose
5. E. R. Astley
6. J. A. Ayres
7. J. W. Baker
8. R. R. Bloomstrand
9. M. A. Clinton
10. N. E. Fuller/C. G. Hough
11. R. G. Geier
12. O. H. Greager
13. A. B. Greninger
14. C. N. Gross
15. L. D. Gustafson
16. A. K. Hardin
17. K. L. Hladek
18. P. C. Jerman/W. N. Koop
19. M. P. Johnson
20. C. G. Lewis
21. A. J. Low
22. J. E. Morrissey
23. J. M. Nielsen
24. R. W. Pitman
25. R. W. Reid
26. R. B. Richman
27. O. C. Schroeder
28. W. B. Silker
29. H. G. Spencer
30. F. W. VanWormer
31. J. R. Young
32. Records Center
33. 300 Files

DECLASSIFIED

HW-76528 C
Page 3

INTRODUCTION

A half-plant low alum treatment test⁽¹⁾ began at F Reactor on January 16, 1963. The test, which had been prompted by results obtained from a statistical analysis of fuel element ledge corrosion attack⁽²⁾, will demonstrate whether or not high alum feed is responsible for increasing the frequency of ledge and groove⁽³⁾ corrosion attack on fuel element surfaces. The effect will be evaluated by comparing visual examination results obtained from normal production fuel irradiated in process water treated with two different alum feed rates. This report presents the results from 20 fuel charges, ten from each side of F Reactor, which were discharged such that the near side fuel pieces had been exposed for 75 days to water treated with 18 ppm alum and the far side pieces had been exposed 75 days to water treated with 8 ppm alum.

SUMMARY

Visual examination data from 640 fuel elements, 320 from each side, which had been charged February 19, 1963 and discharged May 6, 1963, were analyzed and the following results obtained:

1. The over-all frequency of primary ledge corrosion attack was 1.4 per cent with no difference between the two sides.
2. The over-all frequency of primary groove corrosion attack was 0.2 per cent.
3. Corrosion classified as severe occurred on 1.9 per cent of the fuel pieces.

The significant thing about the fuel is the almost complete absence of ledge and groove corrosion. This is indicative of a change in one or more variables so as to produce a substantially reduced corrosion environment. As far as alum feed is concerned, one of two conclusions can be drawn:

1. There is no alum effect.
2. If there is an alum effect, it is of minor importance compared to the effect of other variables.

DISCUSSION

In order to determine whether high alum feed in the water treatment process was responsible for an increased frequency in the types of localized corrosion described as groove and ledge, the following half-plant test conditions were established at F Reactor on January 16.

	Control Side (Near)	Test Side (Far)
pH	7.0	7.0
Dichromate, ppm	1.0	1.0
Alum, ppm	18	6

DECLASSIFIED

HW-76528 C
Page 4

The actual alum feed rate used on the test side from the inception of the test to date is shown in Figure 1. It can be seen that it was necessary to increase the feed rate above 6 ppm on numerous occasions in order to produce coolant of acceptable quality. During the irradiation period of the fuel discussed in this report (February 19 - May 7), the alum feed rate to the test side was maintained at 6 ppm for 29 of the 66 days and averaged 8 ppm. Such a feed rate is considered satisfactorily below the 18 ppm on the control side to demonstrate alum effects, if any.

Fuel Element Characteristics

Twenty columns of fuel elements, ten from each side of F Reactor, were discharged during the outage of May 6, 1963. The average irradiation conditions are shown in the following table.

	Control Side (Near)	Test Side (Far)
Exposure, Mwd/t	646	643
Tube Power, kw	1160	1160
Tube Outlet Temperature, °C	98	99
Tube Inlet Temperature, °C	7	7
Tube Flow, gpm	47.9	47.6
Calendar Days In Reactor	75	75
Operating Days	66	66
Process Tube Age, Months	14	11
Fuel Charge (with water mixer)	31 pc. OIIIN	31 pc. OIIIN
High Alum Feed Coolant, Days	66	0
Low Alum Feed Coolant, Days	0	66

The similarity of the average conditions on the two sides of the reactor is obvious.

For comparative purposes, the irradiation conditions of the three fuel discharges made to date under this production test are tabulated below.

	Pretest Fuel	First Test	Present
Exposure, Mwd/t	565	940	645
Tube Power, kw	1125	1140	1160
Tube Outlet Temperature, °C	102.5	98	98.5
Tube Inlet Temperature, °C	14	7	7
Tube Flow, gpm	48.2	47.6	47.8
Process Tube Age, Months	9	11.5	12.5
Fuel Charge	32	31+ WM	31+ WM

Visual Fuel Element Examination

1. Definitions

Visual fuel element examination identifies the serious type of corrosion attack as well as recognizing the presence of secondary effects. While a fuel element

DECLASSIFIED

HW-76528 C
Page 5

may exhibit several types of corrosion (pitting, uniform, ledge or groove), only primary and secondary are reported, according to the following definitions:

Primary - Type of corrosion considered most detrimental to fuel survival.

Secondary - Type of corrosion, although less important than primary, which may be a potential cause of future corrosion problems.

2. Results

Analysis of the visual examination data from 640 fuel elements, 320 from each side, produced the results shown below.

	<u>Localized Corrosion Frequency</u>		
	<u>Per Cent of Pieces</u>		
	<u>Near</u>	<u>Far</u>	<u>Over-all</u>
Primary Ledge	1.6	1.3	1.4
Secondary Ledge	0.0	0.0	0.0
Primary Groove	0.3	0.0	0.2
Secondary Groove	0.3	0.0	0.2
Severe*	2.2	1.6	1.9

* Corrosion judged to be greater than 10 mils deep.

These data can be compared to the previous data shown in the following table.

	<u>Localized Corrosion Frequency</u>		
	<u>Per Cent of Pieces</u>		
	<u>First Test Data (5)</u>	<u>Pretest Data (4)</u>	<u>PT-216 Data (3)</u>
	<u>Over-all</u>	<u>Over-all</u>	<u>Over-all</u>
Primary Ledge	8.0	15.7	10.5
Primary Groove	0.5	8.4	6.2
Secondary Ledge	1.2	4.3	4.5
Secondary Groove	1.9	8.4	3.6
Severe*	2.5	9	4

* Corrosion judged to be greater than 10 mils deep.

There has been since the start of the test a continued decrease in the frequency of localized corrosion. The first test fuel although showing the expected

DECLASSIFIED

HW-76528 C
Page 6

frequency of ledge corrosion showed no groove corrosion. The present fuel shows no significant amount of either groove or ledge corrosion. An examination of the irradiation conditions for the three groups of fuel does not appear to show any reason for the decrease in localized corrosion.

As far as the effect of alum feed on localized corrosion is concerned, one of two conclusions can be reached. Either: (1) there is no alum effect, or (2) if there is an alum effect, it is of minor importance when compared to other as yet undefined variables.

One more fuel discharge will be obtained prior to the termination of the test.

Effluent Activity

The average concentrations of P^{32} and As^{76} in the F Area effluent from January 16 to May 3 are shown below.

	P^{32} (pc/ml)	As^{76} (pc/ml)
Test Side	11.5	158
Control Side	8.6	74
Old Reactor Average	6.4	68

The results continue to show the test side P^{32} concentration to be 30 per cent above the control side and 90 per cent above the old reactor average. Similarly, the As^{76} concentration in the test side effluent is about double both the control side and the old reactor average concentration.

Process and Reactor Development Subsection
Research and Engineering Section

RG Geier:nmd

DECLASSIFIED

HW-76528 C
Page 7

REFERENCES

- (1) Clinton, M. A. and R. G. Geier. Production Test IP-549-A, Half-Plant Low Alum Feed Water Treatment at F Reactor, HW-75541. November 8, 1962.
- (2) Clinton, M. A. Analysis of the Frequency of Ledge Corrosion Attack Observed on Fuel Elements, HW-75368. October 24, 1962.
- (3) Geier, R. G. An Analysis of the Frequency of Groove Corrosion Attack Observed on Fuel Elements, HW-77196. April 4, 1963.
- (4) Geier, R. G. and M. A. Clinton. Interim Report I, Production Test IP-549-A, Half-Plant Low Alum Feed Water Treatment at F Reactor, HW-76528. February 11, 1963.
- (5) Geier, R. G. Interim Report II, Production Test IP-549-A, Half-Plant Low Alum Feed Water Treatment at F Reactor, HW-76528 B. April 26, 1963.

DECLASSIFIED

HW-76528 C
Page 8

FIGURE 1

ALUM FEED RATE - TEST HALF OF F REACTOR

DATE

FILMED

9/29/94

END