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

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

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RICHLAND, WASHINGTON

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INTRODUCTION

A half-plant low alum water treatment test⁽¹⁾ began at F Reactor on January 16, 1963 at startup from the scheduled January 3 tube replacement outage. The test, which was prompted by results obtained from a statistical analysis of fuel ledge corrosion attack⁽²⁾, will demonstrate whether or not high alum feed is responsible for increasing the frequency of ledge corrosion attack on fuel element surfaces. The effect will be evaluated by comparing visual examination results obtained from normal production fuel irradiated in two different alum treated process waters. This report discusses the results obtained from twenty fuel charges, ten from each side of F Reactor, which were discharged prior to the reduction in alum feed to establish the pre-test corrosion environment.

SUMMARY

Visual examination data from 644 fuel elements, 327 discharged from the far side and 317 from the near side, were analyzed in this report with the following results:

1. Over-all ledge corrosion frequency was 16 per cent with 18 per cent recorded on the far side and 13 per cent from the near side; where as 12 per cent was expected.⁽²⁾
2. Over-all groove corrosion frequency was 9 per cent with 8 per cent occurring on the far side fuel sample and 9 per cent on the near side fuel sample. Expected frequency was 6 per cent.
3. Combining one and two above, some 24 per cent of the fuel elements exhibited localized groove and ledge corrosion attack (26 per cent from far and 22 per cent from near). About 9 per cent of the fuel was classified as containing severe groove and/or ledge attack with 1 per cent exhibiting groove penetration to the AlSi bonding layer.

The good agreement between the present results and those previously obtained indicates little change in the localized corrosion environment.

DISCUSSION

Data contained in the PDQ (Production Test Data Processing Quality Certification System) system lags the existing reactor environment by six to eight months; therefore, a fuel sample representing the current corrosion environment in both sides of F Reactor was required to provide a current basis for evaluating any changes resulting from the reduction in alum feed to one side of the reactor. The twenty columns, ten from each side, selected to establish the pre-test corrosion environment had the following average characteristics:

- (1) HW-75541, "Production Test IP-549-A. Half-Plant Low Alum Feed Water Treatment at F Reactor", M. A. Clinton, R. G. Geier, 11-8-62, (Secret).
- (2) HW-75368, "Analysis of the Frequency of Ledge Corrosion Attack Observed on Fuel Elements", M. A. Clinton, 10-24-62.

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<u>CHARACTERISTIC</u>	<u>NEAR</u>	<u>FAR</u>
Exposure (MWD/T)	564	565
Tube Power (KW)	1140	1110
Tube Outlet Temperature (°C)	103.5	101.5
Tube Inlet Temperature (°C)	14	14
Tube Flow (gpm)	48.3	48.1
Calendar Days In-Reactor	78	80
Process Tube Age (Mo.)	9	9
Fuel Charge (no water mixer)	32 pcs. OIIIN	32 pcs OIIIN

Visual corrosion examination identifies the most serious type of corrosion attack as well as recognizing the presence of secondary effects. While a fuel element may exhibit several types of corrosion, 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, may be a potential cause of future corrosion problems.

Annalysis of the visual examination data obtained from the 644 fuel elements, 317 and 327 representing the near and far side respectively, and discharged during the outages of 12-30-62 (17 columns) and 1-3-63 (3 columns), produced the following results with respect to localized groove and ledge corrosion attack:

Primary Corrosion Frequency

<u>Type</u>	<u>Per Cent of Pieces</u>		<u>Over-All</u>	<u>Over-All From Previous Data</u>
	<u>Near Side</u>	<u>Far Side</u>		
Groove	9.2	7.7	8.4	6.2
Ledge	12.9	18.3	15.7	12.4

Secondary Corrosion Frequency

<u>Type</u>	<u>Per Cent of Pieces</u>		<u>Over-All</u>
	<u>Near Side</u>	<u>Far Side</u>	
Groove	9.2	7.7	8.4
Ledge	4.4	4.3	4.3

About 46 per cent of the fuel elements exhibiting either primary groove or ledge attack also contained secondary groove or ledge attack; i.e., an element with primary groove may contain secondary ledge and vice versa. The remainder contain either primary groove or ledge alone or the groove and ledge are coupled with secondary general or pitting corrosion. A few pieces have primary general or pitting corrosion and secondary groove or ledge.

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The visual fuel element data analyzed earlier for groove and ledge corrosion frequency covered the period August, 1961 to February, 1962. The good agreement in the frequency of primary groove and ledge corrosion between that period and the present indicates little if any change in localized corrosion environment.

Severe corrosion attack is defined as a penetration of more than 10 mils. About 9 per cent of the elements had severe primary groove or ledge attack, 11 per cent of the near side and 7 per cent of the far side elements. Some 2- $\frac{1}{2}$ per cent of the fuel elements contain both severe groove and ledge attack and 1 per cent, some from both sides, exhibited groove corrosion attack to the AlSi bonding layer.

The next group of fuel will be discharged from F Reactor about the end of February, 1963. The material from the far side will have experienced a blend of high and low alum treated water and that from the near side only high alum treated water. No difference in frequency of attack is expected; however, there may be a difference in severity of attack on the far side elements.

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