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HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

TITLE

INTERIM REPORT I, PRODUCTION TEST IP-560-A,
HALF-PLANT LOW DICHROMATE - LOW pH WATER
TREATMENT AT C REACTOR

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HALF-PLANT LOW DICHROMATE - LOW pH WATER
TREATMENT AT C REACTOR

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

April 10, 1963

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RICHLAND, WASHINGTON

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INTRODUCTION

A half-plant low dichromate - low pH test⁽¹⁾ was started at C Reactor on March 1, 1963. The test will demonstrate whether 1.0 ppm sodium dichromate provides adequate corrosion inhibition when the reactor coolant pH is 6.6. One evaluation technique to be used will be the visual examination of fuel elements from each side of the reactor to determine the frequency and severity of localized corrosion attack. This report discusses the results obtained from the examination of fuel discharged from each side of C Reactor prior to the establishment of test conditions to provide information on the pre-test corrosion environment.

SUMMARY

Visual examination from 600 fuel elements, 300 discharged from the near side and 300 from the far side, showed the following results:

1. Primary ledge corrosion was evident on 26 per cent of the fuel pieces, 21 per cent on the near side and 30 per cent on the far side.
2. Primary groove corrosion was evident on 3 per cent of the fuel pieces, 6 per cent on the near side and 1 per cent on the far side.
3. None of the fuel pieces exhibited severe localized corrosion.

The above results are in general agreement with similar results obtained in previous studies⁽²⁾ indicating little change in corrosion environment.

DISCUSSION

A. Water Treatment

Prior to March 1, 1963, C Reactor had been operating under a production test⁽³⁾ specifying the following water treatment conditions:

	<u>Near Side</u>	<u>Far Side</u>
pH	7.0 $\pm$ 0.1	7.0 $\pm$ 0.1
Dichromate, ppm	2.0 $\pm$ 0.2	1.0 $\overset{-0}{+0.1}$
Alum, ppm	18	18

On March 1, 1963 water treatment conditions were changed to conform to PT-IP-560-A⁽¹⁾ as follows:

	<u>Near Side</u>	<u>Far Side</u>
pH	6.6	7.0 $\pm$ 0.1 / RAB
Dichromate, ppm	2.0 $\pm$ 0.2	1.0 $\pm$ 0.1
Alum, ppm	18	18

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B. Visual Fuel Examination

Four types of corrosion attack on fuel elements can be identified in visual examination. These are groove corrosion, ledge corrosion, pitting corrosion, and uniform corrosion. While a fuel element may contain several types, only primary and secondary are reported, according to the following definitions:

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

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

C. Fuel Examination

In order to determine the pre-test corrosion environment in terms of localized corrosion of fuel elements, 600 fuel elements, 300 from each side, were picked up randomly from the C Reactor enriched metal discharge of March 26, 1963 for visual examination. Because of the random pickup, detailed operating conditions were not available. However, the approximate average tube outlet temperature of the tubes discharged was 80 C and the average exposure was 770 MWD/T. All of the fuel came from tubes containing mixers.

D. Results

Analysis of the visual examination data with respect to the frequency of localized groove and ledge corrosion produced the results presented below.

LEDGE AND GROOVE CORROSION FREQUENCY

<u>Type</u>	<u>Per Cent of Elements</u>			<u>Over-all from Previous Data (2)</u>
	<u>Near Side</u>	<u>Far Side</u>	<u>Over-All</u>	
Primary Ledge	21.3	29.7	25.6	11.6
Primary Groove	6.0	1.0	3.5	11.6
Secondary Ledge	3.7	1.3	2.5	6.2
Secondary Groove	5.0	2.7	3.8	1.4
Total Occurrence	36.0	34.7	35.4	30.8

Usually fuel elements exhibiting primary ledge attack also exhibit secondary groove attack and vice-versa. In the present analysis, this was not the case. The groove and ledge corrosion, occurred in the presence of other types attack. It is also significant that none of the fuel pieces showed corrosion attack classified as severe or as a penetration to the AISI.

Comparing the results with those obtained in a previous study, it is apparent that there has been somewhat of a shift from groove attack to ledge attack. However, the total occurrence of both types of attack is approximately the same as in the past and is of a magnitude sufficient to make changes in corrosion environment readily detectable.

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The next group of fuel to be examined will be discharged from C Reactor about the end of April. This fuel will have experienced a blend of high and low pH water.

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REFERENCES

- (1) HW-76078, "Production Test IP-560-A, Half-Plant Low Dichromate - Low pH Water Treatment at C Reactor", by R. G. Geier, dated February 18, 1963.
- (2) HW-77196, "An Analysis of the Frequency of Groove Corrosion Attack Observed on Fuel Elements", by R. G. Geier, dated April 4, 1963.
- (3) HW-65189, "Reduction of the Amount of Dichromate Added to Reactor Cooling Water, Production Test IP-321-A", by E. J. Nesselson, dated May 11, 1960.

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