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INTERIM REPORT I - PRODUCTION TEST IP-581-A
HALF-PLANT HIGH FLOCCULATION pH
TEST AT B REACTOR

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INTERIM REPORT I - PRODUCTION TEST IP-581-A

HALF-PLANT HIGH FLOCCULATION pH TEST AT B REACTOR

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By Authority of CG-PR-2

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October 31, 1963

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HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

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INTRODUCTION

A half-plant high flocculation pH test⁽¹⁾ began at B Reactor on September 24, 1963. The purpose of the test was to determine whether operation of the water plant flocculation basins and filters at a pH higher than 7.0 with subsequent coolant pH adjustment to 6.6 is beneficial as far as radioactivity in the effluent is concerned. It is planned to increase the flocculation basin pH in steps to a maximum of 7.6. Although primarily an effluent activity test, fuel discharged after a metal cycle at each water plant condition will be monitored by visual examination. Thus, it will be possible to determine whether the frequency of occurrence of localized corrosion is influenced by the various modes of operation. This report discusses the results obtained from a 20 column fuel discharge, obtained prior to the start of the test.

SUMMARY

The 20 columns of fuel elements discharged as representative of pretest conditions at B Reactor had been charged June 6, 1963, and discharged September 20, 1963. The fuel columns were selected so that the near side fuel had been exposed under more stringent irradiation conditions than the far side fuel. Visual examination data from the 601 fuel elements, 292 from the near side and 309 from the far side, gave the following results:

1. The over-all incidence of ledge and groove corrosion was low indicating a moderate corrosion environment.
2. The incidence of ledge and groove corrosion was only slightly higher on the near side indicating that the more severe irradiation conditions did not produce a substantial effect.

DISCUSSION

Water Treatment

In order to determine whether or not operating the water plant flocculation basins and filters at a higher pH would be beneficial as far as the concentration of radioisotopes in the reactor effluent is concerned, a half-plant test was started at B Reactor. For one metal cycle (6/6/63 - 9/20/63) both sides of the water plant operated at the following conditions:

Dichromate, ppm	1.8 (1.5 9/6 - 9/20)
Alum, ppm	18
Flocculation pH	7.0
Reactor pH	6.6

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After the outage of September 20, conditions were changed to:

	Control Side (Far)	Test Side (Near)
Dichromate, ppm	1.5	1.5
Alum, ppm	18	10-12
Flocculation pH	7.0	7.3
Reactor pH	6.6	6.6

After one metal cycle, the water plant conditions will become:

	Control Side (Far)	Test Side (Near)
Dichromate, ppm	1.5	1.5
Alum, ppm	18	6-8
Flocculation pH	7.0	7.6
Reactor pH	6.6	6.6

Fuel Element Characteristics

Twenty columns of fuel elements, ten from each side of the reactor, which had been charged during the outage of June 6, 1963, were discharged during the outage of September 20, 1963. The average irradiation conditions are shown in the following table.

	<u>Far Side</u>	<u>Near Side</u>
Exposure, MWD/T	630	705
Tube Power, kw	950	1050
Tube Inlet Temp., °C	19	19
Tube Outlet Temp., °C	91	100
Tube Flow, gpm	49	49.5
Calendar Days in Reactor	106	106
Operating Days	82	82
Tube Age, Month	27	17
Fuel Charge	31 OIIIN+WM	31 OIIIN+WM

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As previously mentioned both sides of the water plant operated identically during the irradiation, and the fuel was to be used to establish a base case. In addition, it was decided that the discharge would offer a good opportunity to determine the influence of irradiation variables on the incidence of ledge and groove corrosion. It is apparent that the fuel dis-charged from the near side had higher tube outlet temperature, exposure, and tube power than did the far side fuel.

Visual Examination

1. Definitions

Visual fuel element examination identifies the serious type of corrosion attack as well as recognizing the presence of secondary effects. A fuel element may exhibit pitting, uniform, ledge or groove corrosion. Both 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.

The severity of corrosion is categorized as follows:

Code 2 - Corrosion judged to be 10 mils deep.

Code 3 - Penetration to the Al-Si.

2. Results

The analysis of the visual examination data from 601 fuel elements, 292 from the near side and 309 from the far side of B Reactor, produced the results shown below.

Localized Corrosion Frequency

Per Cent of Pieces

	<u>Near</u>	<u>Far</u>	<u>Over-all</u>
Primary Ledge	1.7	0.3	1.0
Secondary Ledge	0.0	0.0	0.0
Primary Groove	2.7	0.0	1.3
Secondary Groove	0.0	0.0	0.0
Severity - Code 2	2.1	1.9	2.0
Severity - Code 3	0.0	0.0	0.0

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Of the eight pieces from the near side which exhibited groove corrosion, five were silver colored indicating an upstream location and showed signs of mechanical damage. Whether or not they are included in considering the results, it can be concluded that:

- (1) The corrosion environment at B Reactor with respect to ledge and groove corrosion is very mild. Fuel discharged from F Reactor which had been irradiated from June 19 to September 9 under similar condition to the near side B Reactor fuel although showing no groove corrosion, did show 20 per cent ledge attack.
- (2) The more severe irradiation conditions imposed on the near side fuel produced very little increase in ledge and groove corrosion.

REFERENCES

- (1) HW-76996, "Production Test IP-581-A - Half-Plant High Flocculation pH Test at B Reactor," R. G. Geier, May 1, 1963.
- (2) HW-76528 E, "Interim Report V, Production Test IP-549-A - Half-Plant Low Alum Feed Water Treatment at F Reactor," R. G. Geier, October 18, 1963.

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