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KER-1 OPERATING REPORT - TEST K-1-23
PT IP-601 AND PT IP-601, SUPPLEMENTS A AND B

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PT IP-601 AND PT IP-601, SUPPLEMENTS A AND B

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KER-1 OPERATING REPORT
TEST K-1-23, PT IP-601 AND PT IP-601, SUPPLEMENTS A AND B

EVALUATION OF CRUD FORMING CHARACTERISTICS OF KER LOOP
COOLANT CONTAINING AMMONIUM HYDROXIDE FOR pH CONTROL

I. INTRODUCTION

The charge consisted of three NIEL fuel elements, two lithium-aluminum target elements, and front and rear crud probe train assemblies containing four ceramic fueled crud probes as authorized by PT IP-601. The objectives of these tests were to evaluate the crud forming characteristics of loop coolant containing ammonium hydroxide for pH control by operating at conditions generally regarded to induce high crud concentrations and to provide lithium-aluminum samples which may be used to determine production and extraction information.

II. SUMMARY

- A. Date Charged - September 8, 1964.
- B. Fuel Elements - The tube was charged with three 17-inch NIEL fuel assemblies
- C. Exposure - The fuel elements were charged a total of 1660 hours. The test was at desired operating conditions 1299 hours or 91 per cent of reactor equilibrium operating time.
- D. Date Discharged - November 16, 1964.
- E. Reason for Discharge - The tube was discharged after objectives of the test had been achieved.

III. TEST DETAILS

A. Tube Charge Order

<u>Position from Downstream End</u>	<u>Description</u>
1	Instrumented crud probe
2	Non-instrumented crud probe
3	8-inch coupon holder
4	8-inch triangular perf
5	8-inch modified triangular perf
6	NIEL fuel element No. X-58-3
7	NIEL fuel element No. X-57-6
8	NIEL fuel element No. X-58-7
9	8-inch triangular perf
10	17-inch target assembly
11	8-inch coupon holder
12	Non-instrumented crud probe
13	Instrumented crud probe

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B. Fuel Elements

The fuel elements consisted of nominally 1.249 inch OD, 0.438 inch ID single tube elements with 0.040 inch Zr-2 jackets on the outer surfaces and 0.025 inch jackets on the inner surfaces.

C. Operating Conditions

Desired operating conditions for the test were:

Pressure	1310 psig
Temperature	261°C
Flow	35,000 lbs/hr
pH	6.2 to 10.2

D. Secondary Testing¹

1. Mockup Tube - All tests were terminated and the mockup tube was discharged on November 23, 1964.
2. Determination of the effects of non-standard operating conditions on the films formed on the fuel element surfaces and on general coolant quality.

The non-standard conditions test consisted of operating under conditions generally held to induce high crud concentrations in pressurized water cooled reactor systems. The effects of this type of operation on general coolant quality and film deposition on fuel element surfaces were determined by analyzing coolant samples and monitoring the temperature of the instrumented crud detectors.

On September 9, the loop was conditioned to a pH of 10.0 with the use of ammonium hydroxide.

On September 24, the ammonium hydroxide addition was terminated, however, feed-and-bleed was continued to permit pH to drift down.

On October 1, the pH was increased to 10.0 with the addition of ammonium hydroxide.

On October 2, oxygen-saturated deionized feed water was used.

On October 14, ammonium hydroxide addition was again terminated. Feed-and-bleed with oxygen saturated water was continued to present "worst condition" water quality.

On October 22, the loop temperature was cycled from 260 C to 154 C at a rate of 15 degrees per hour.

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TABLE I
LOOP OPERATING HISTORY, TEST K-1-23

<u>Loop Operating Condition</u>	<u>Total Hours</u>	<u>Percent Total Time Tube Charged</u>
At specified run condition	1299	78
Single-pass, reactor not operating	89	6
Raising or lowering temperature following reactor startup or shutdown	88	5
Recirculation operation, reactor not operating	145	9
Recirculation at other than specified conditions	*39	2

*The loop was operated at other than specified conditions to clean up loop coolant water.

The in-reactor portion of the loop received two decontaminations using the Sulfam-3 process prior to charging the tube.

IV. OPERATING HISTORY

A. Water Quality

Water samples were taken periodically for wet chemical analysis. The results ranged as follows:

Chlorides	.05 ppm to	.21 ppm
Silicate	.16 ppm to	3.29 ppm
Ammonium	.15 ppm to	19.25 ppm
Iron	.2 ppm to	6.0 ppm
Oxygen	.005 ppm to	.4 ppm
Total solids	.5 ppm to	11.0 ppm
Turbidity	.2 ppm to	18.0 ppm
Specific Resistance	37,000 (ohm-cm) to 2,100,100 (ohm-cm)	

B. Equipment Experience

The upper and lower tube bundles in the secondary heat exchanger were replaced because of leaks.

REFERENCE

- (1) Letter, TF Demmitt to LV Barker, Operation of KER-1 Loop, August 4, 1964.

H. A. Dallas

Coolant Testing

HA Dallas:bmr

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