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September 1, 1959

M. E. Jackson, Supervisor
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ALUMINUM TESTING IN KER LOOP 3
FROM MAY 23, 1959 TO JULY 26, 1959

The tube was charged with 20, X-8001 and C-810 Doe elements on May 23. Recirculation was started at 1600 psi with the pH controlled at 4.55 with H_3PO_4 high pressure bomb addition and adjusted flow through the ion exchange columns.

The #1 ion exchange column was charged with XE-150 low pH resin and the #2 ion exchange column was charged with XE-150 neutral pH resin.

The loop mockup tube was charged with an 8" tubular coupon holder containing Zr_2 , S/S, and Al 8001 coupons.

Excessive radioactivity of the water developed upon startup. The loop temperature was reduced to minimum, then raised in increments of $10^\circ C/8$ hrs to normal operating temperature.

On June 14, an instrument malfunction resulted in a sudden drop of $50^\circ C$ in the loop temperature. This was immediately followed by very high gamma activity at the loop strainer, apparently the result of a crud burst. The loop was reduced to low temperature and the activity slowly fell to normal.

On June 15, while still at low temperature an even greater burst of activity occurred, then slowly fell back to normal. On two occasions during the next week the loop temperature was raised at the normal rate, rather than in slow steps as previously, without precipitating any crud bursts.

After a reactor scram from another loop, on June 28 a highly radioactive crud burst occurred. High gamma activities, particularly at the strainers and valves, made it impossible to enter the cell for several hours. Fortunately, most of the activity had a half-life of only a few hours.

In an attempt to reduce the amount of radioactive crud, the loop was discharged on June 29. Observation showed about half of the discharged Doe elements were covered with a deeply rust colored deposit. The others were white and later were found to be in good condition. The aluminum tubulars were also deeply rust colored.

Conditions during the test from May 23 to June 29 were:

528 hours at temperatures over $200^\circ C$ at a normal $233^\circ C$ effluent temperature and $202^\circ C$ influent temperature, giving an average tube differential temperature of $31^\circ C$.

The flow was 60 gpm.

The clean-up flow was varied considerably during the test due to high activity in the loop water.

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Normal mockup tube flow was 18 gpm.

Effluent pressure was held at 1600 psi.

The boiling point suppression was held at 85°C.

The normal tube differential pressure was 42.5 psi.

The delayed neutron monitor was by-passed during this test as authorized by the PT, since these Doe elements, if ruptured, would not cause tube or reactor damage.

On June 29, the tube was charged with a similar charge of 20 Doe elements clad in X-8001 and C-810 aluminum.

The loop was again brought up to operating conditions on July 1. On July 10, the loop activity started a gradual rise and on July 11, the loop strainer activity rose to full scale and the delayed neutron monitor activity increased to 85%. The reactor was then manually scrambled by unby-passing the delayed neutron monitor trip.

The tube was then discharged. Personnel preparing the rear face components for discharge of the rupture were exposed to a 3 hr. exposure rate..

The test conditions were approximately the same as the previous test with operation for 245 hours with a normal effluent temperature of 245°C.

Upon discharge of the tube and subsequent flushing of the loop and tube, activity levels decreased to normal.

Examination of the Doe elements revealed that the 6th and 7th slugs (from the downstream end of the charge) had ruptured at several spots where the supports had been spot welded to the jacket. In a few places slight swelling had occurred, but no serious deformation of the slugs had taken place. The 4th and 5th slugs had serious corrosion at the same points. These four elements were near the maximum power level of this loading. All the affected pieces were clad in X-8001 aluminum. All of the C-810 elements were at the upstream end of the charge. Except for the spot welded regions of these elements, the corrosion was generally slight.

The loop was charged July 12 with 20 Doe elements clad in X-8001 aluminum. At this time it had not been determined that the previously discharged Doe elements had actually ruptured. A thermocouple train was installed in the downstream end of the tube but had to be removed because of a nozzle cap leak. A second thermocouple train was tried, but the cap still leaked. As a final recourse, triangular spacers were used as the downstream charge.

The loop was operated at low temperature during the entire time this charge was in pile. This loading was to have run as a long term corrosion test. However, inability to charge the thermocouple slug and uncertainty as to the integrity of these elements in view of the recent rupture of similar elements, made it desirable to discharge these pieces.

The tube was discharged July 26 and recharged with dummies.

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