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GENERAL ATOMIC

DIVISION OF **GENERAL DYNAMICS**

AEC RESEARCH AND
DEVELOPMENT REPORT

GA-5814

SUMMARY REPORT ON GENERAL ATOMIC IN-PILE
LOOP OPERATIONS AND MODIFICATIONS

Prepared under
Contract AT(04-3)-167
Project Agreement No. 16
for the
San Francisco Operations Office
U. S. Atomic Energy Commission

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October 20, 1964

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INTRODUCTION

The General Atomic In-Pile Loop (GAIL) facility was constructed at the General Electric Test Reactor as part of the research and development program for the Peach Bottom High-temperature, Gas-cooled Reactor. Two fuel elements were irradiated as part of that program. The in-pile loop program for the Peach Bottom reactor was completed on December 16, 1962. After that date, irradiation of the GAIL-III-B element in the loop was continued under Project Agreement 16 of Contract AT(04-3)-167.

GENERAL OPERATION

The GAIL facility operated continuously, except for periods of scheduled shutdown for reactor refueling, from October 1, 1963, to March 15, 1964. The GAIL III-B fuel element was removed from the loop on March 18, 1964. This fuel element had operated at full power a total of 10,482 hours at the time of removal and had generated 685 megawatt-hours of energy. A complete description of the GAIL III-B irradiation is presented in Ref. 1. The results of fission product plateout studies in the loop are presented in Refs. 2 and 3.

The GAIL facility was shut down for modifications and general repair from March 15 to August 10, 1964. Irradiation of a new fuel element, designated GAIL IV, was begun on August 10.

DESCRIPTION OF MODIFICATIONS

Considerable modification work was performed on the GAIL facility during the period March 15 to August 10, 1964. The primary items included in this work were the rebuilding of the fission product trapping system and the installation of ports for insertion of plateout probes into the main coolant circuit.

The work on design and construction of the liquid nitrogen cooled units in the new fission product trapping system is reported in Ref. 4. These units were manufactured at General Atomic and were installed by General Electric Company. The new units replaced the traps formerly used for normal operation. The former normal-operation traps were retained in the system for standby service, and the original standby traps were removed.

Other new units installed in the trapping system were a copper oxide bed, two flow rate meters, two diaphragm type pumps, a flow control valve, and a system for stopping flow in case of a line rupture. A new control panel was fabricated at the site for the fission product trapping system.

Ports were installed in the main coolant piping in order to study plateout conditions within the loop. Considerable alterations to the loop piping and to the local shielding were required in order to reach the desired locations in the main coolant circuit. The ports were installed immediately upstream of the main cooler, after the first pass of the three-pass main cooler, and downstream of the main circulators. During scheduled shutdowns from June to August 1963, ports had been installed in the coolant line upstream of the regenerative heat exchanger and at two points downstream of the main cooler. The pipe sections removed for installation of the ports were shipped to General Atomic for analysis and study. The analysis work is described in Refs. 2 and 3. At present there are six ports in the coolant circuit for studying plateout and particulate deposition.

In addition to the major modifications described above, a number of smaller items were repaired or modified. Several valves were removed and replaced, new thermocouple leads were installed between the fuel element facility tube and the control panel, and a new vacuum pump was installed for pumping down the vacuum chamber around the fuel element.

Piping and instrumentation drawings were prepared on the modified loop. In Figure 1 is shown an isometric drawing of the present main coolant circuit, including the locations of plateout cold finger probes. The main coolant piping and instrumentation diagram is shown in Figure 2. The fission product trapping system piping and instrumentation diagram is shown in Figure 3, and the auxiliary cooling systems are shown in Figure 4.

The modifications to the loop and the more advanced design of the GAIL IV fuel element required that the GETR license amendment for GAIL be revised and re-examined by the AEC Division of Reactor Licensing. Considerable analysis work was required to rewrite the GAIL hazards report and to satisfy all safety questions on this experiment.

OPERATION WITH GAIL IV

The GAIL IV fuel element was fabricated under the TARGET Program (Project Agreement 17 of Contract AT(04-3)-167), and was inserted in the GAIL facility during the week of August 3, 1964. A complete technical description of this fuel element is given in Ref. 5.

The GAIL IV element has a "telephone dial" shaped cross section. It contains pyrolytic carbon coated fuel particles packed in holes within the graphite body.

As of September 30, 1964, the GAIL IV fuel element had operated at full power for 902 hours and had generated 63 megawatt-hours of energy. To date, this element has shown very high retention of fission products during both purged and unpurged modes of operation.

REFERENCES

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Fig. 1

Fig. 2

Fig. 4