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HW--34466

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January 17, 1955

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PRODUCTION TEST 105-8-MR, SUPPLEMENT A
URANIUM CHARGING DURING REACTOR OPERATION

References

- 1) HW-23906, "Production Test 105-1-MR, Poison Column Control During Reactor Operation"
- 2) HW-25082, "Final Report on Production Test 105-1-MR, Poison Column Control During Reactor Operation"
- 3) HW-25702, "Production Test 105-4-MR, Evaluation of Poison Column Control Facility"
- 4) HW-28609, "Production Test 105-4-MR, Supplement A, Evaluation of Poison Column Control Facility"
- 5) Letter, "Heat Transfer Aspects of Tube Charging During Pile Operation," M.W. Carbon to C.W. Botsford, November 20, 1953.
- 6) HW-29809, "Monthly Report, Process Sub-Section, Reactor Section, October 1953"
- 7) HW-29229-G, "Pile Technology Sub-Section Monthly Report, August 1953"
- 8) HW-28207, "Flow Laboratory Investigations of F-Type Pitting of Slugs and Tubes"
- 9) Letter, "Scale Deposits in Process Tubes," T.L. Deobald to R.R. Bloomstrand, October 1, 1953.
- 10) HW-30181, "Production Test 105-4-MR, Supplement B, Evaluation of Poison Column Control Facility"
- 11) HW-31016, "The Dependence of Pu 240 Concentration in Pile-Produced Plutonium on Neutron Flux Level"
- 12) HW-31819, "An Economic Evaluation of Reactor Outage Time for Charge-Discharge of Fuel Elements"
- 13) HW-31952, "Plutonium Product Quality"
- 14) HW-32088, "Interim Report, Production Test 105-4-MR, Supplement B, Evaluation of Poison Column Control Facility"
- 15) HW-32094, "Production Test 105-8-MR, Uranium Charging During Reactor Operation"
- 16) HW-32277, "Additional Studies on the Economics of Uranium Charge-Discharge During Operation"
- 17) HW-33793, "An Economic Evaluation of a Proposed System for Charge-Discharge of a Reactor During Operation"
- 18) HW-34465, "Interim Report, Production Test 105-8-MR, Uranium Charging During Reactor Operation"

INTRODUCTION

HW-32088(14) describes in detail the results of operationally charging uranium slugs into a low power tube in B Reactor authorized by HW-28609(4) and HW-30181(10). On the basis of this successful test, HW-32094(15) was issued authorizing charging and discharging high power tubes during operation in B Reactor. The results of these tests are presented in HW-34465(18). To date, slugs have been operationally charged into tubes of up to 660 KW and such slugs have been operated at tube powers up to 800 KW at exposures up to 800 MWD/T.

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May 1973
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INTRODUCTION (Contd.)

The equipment used for these tests had certain shortcomings which prevented the application of the equipment to routine charging. Based on the results of the slug testing to date, the equipment has been redesigned and fabrication of a new five tube test facility in C Reactor has begun under Project CG-609.

OBJECT

The purpose of this test is to demonstrate the feasibility of routinely charging uranium slugs during reactor operation into tubes of the highest available powers and to provide functional testing of the equipment necessary to reduce such charging to a routine operation on all tubes in the reactor. This test will authorize the installation and routine operation of improved equipment for charging and discharging uranium during reactor operation on five central process tubes at C Reactor.

BASIS AND JUSTIFICATION

The ability to charge and discharge fuel elements on a routine basis during reactor operation offers potential production gains and metal processing savings estimated at \$1,250,000 under present C Reactor operating conditions⁽¹⁶⁾. This return is derived from the elimination of outage time necessary at present for the discharge and recharge of uranium and from the reduction of uranium throughput by being able to discharge the metal at exactly goal concentration.

The techniques employed in this test will be basically similar to those used in previous operational charging experiments at B Reactor. These are discussed in detail in HW-30181⁽¹⁰⁾, HW-32088⁽¹⁴⁾, HW-32094⁽¹⁵⁾, and HW-34465⁽¹⁸⁾. However, certain design changes were necessary to allow routine charging by Operations personnel and to improve the safety and functioning of the equipment. It is necessary to evaluate these changes under reactor conditions before final design of the equipment for all tubes can be completed.

In addition to equipment changes, it is necessary to test tubes of higher specific power than was possible at B Reactor. Charging has been done at powers up to 660 KW, and operation of slugs so charged has been successful at 800 KW with exposures of 800 MWD/T. Charging tests in tubes above 1000 KW is now necessary to extend the experimental data into the current operating ranges.

SCHEDULE

This test will become effective upon approval. In order to meet project schedule commitments, it is necessary that this equipment be installed in February and that the initial results of operational testing be available in the first week of March. Therefore, this test will authorize the reactor outage time necessary to complete the reactor installation of the five tubes and associated equipment by February 21, 1955. After the initial installation, this test will authorize up to eight hours of reactor outage time per outage to make necessary adjustments, modifications, or repairs. Operation of the equipment on the reactor will not be begun until the signees have had an opportunity to view laboratory demonstrations of its functioning.

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SCHEDULE (Contd.)

This test will authorize the discharge of uranium slugs from the five test tubes at less than normal goal exposure if such action is deemed necessary to meet the required completion date for initial test results.

This test shall remain in effect until March 1, 1956.

EQUIPMENT

The equipment to be used in this test will be that designed and provided by Project CG-609. It consists of five grouped C Reactor process tubes equipped with ball valves on front and rear nozzles. The rear nozzle ball valves are operated by hydraulic actuators while the front ball valves are manually operated. Coordinate effluent water sampling will be provided on the tubes and will be monitored intermittently in the near sample room.

Charging will be done with a newly designed pressurized rotary-head charging machine which will supply the tube with additional cooling water during the charging operation. The flow will be monitored by an indicating flowmeter with a low flow alarm and by dual Mercoid safety circuit differential pressure switches. The effluent temperature of the tube will be monitored continuously by a separate indicator with high temperature warning alarms and will be connected to the safety circuit by a special Brown slidewire tripping mechanism.

The control of the entire operation will originate from a console in the control room. The design of the console is such that the use of communication between the charge face and the control room will be reduced to supplying information rather than procedural coordination.

All equipment will be demonstrated in the laboratory and during reactor outages before using during operation. This test will authorize the reactor operational testing of improved equipment after satisfactory demonstration in the laboratory.

EQUIPMENT OPERATION

Although it is one of the purposes of this test to demonstrate the routine operation of this equipment, it will be necessary to restrict the operation of the control console to Process Sub-Section personnel during initial reactor testing. Upon agreement with the Operations Superintendent, operation of the console will be by Operations personnel. It is expected that the operation of the charging machine can be turned over to Operations personnel after a brief training program. During initial testing however, the charging operation will be supervised by a Process Sub-Section representative.

Operational charging and discharging will be done only with the concurrence of the C Reactor Operations Superintendent.

PROCEDURE FOR CHARGING

The charging procedure for each tube is dictated by the control circuit interlocks. This procedure will be outlined in line diagram form on the face of the control

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PROCEDURE FOR CHARGING (Cont'd)

console so that no check list will be necessary except for unusual operation. However, complete instructions will be submitted for approval of Operations Sub-Section.

RESPONSIBILITIES

Operations Sub-Section will be responsible for the production continuity, operational safety of the reactor, supervision of the charging procedures, and coordination of the work. Process Sub-Section will be responsible for the operation of the control console until it is turned over to Operations, for the preparation of operating and maintenance instructions, supervision of initial charging procedures, recording of data, and preparation of all reports.

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