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PRODUCTION TEST IP-168-A
LONG TERM CORROSION MONITORING AND EVALUATION OF OPERATING LIMITS FOR I & E CHARGES - REACTOR

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PRODUCTION TEST IP-168-A
LONG TERM CORROSION MONITORING AND EVALUATION OF
OPERATING LIMITS FOR I & E CHARGES - C-REACTOR

INTRODUCTION

The performance of I & E fuel elements under the original tests¹ was such that they are now being charged at C Reactor on a production basis. Data obtained from the original test, however, were not sufficient to indicate long term corrosion effects of the use of these elements, nor to accurately define their operating characteristics. It is the intent of this test, therefore, to provide for long term corrosion monitoring in tubes charged with and without water-mixing pieces; and to obtain the required operating data to refine the operating characteristics of this fuel upon which power limits are based.

OBJECTIVE

The objective of this test is to permit routine charging and monitoring of five tubes for long-term corrosion monitoring and to permit charging and monitoring of five additional tubes over the spectrum of corrosion indices for determination of operating limits.

BASIS AND JUSTIFICATION

Utilization of the 1.460" OD I & E fuel element in C-Reactor was determined to be necessary to evade operating limits based on top annular temperature unbalance ratios. Charging of this element was therefore initiated without the extensive testing program normally accompanying such a change. Conservative limits were established based on the operating data available and incorporating a fairly large safety factor. It has been estimated that if only the factor of conservatism can be removed from these limits by this testing, tube power increases of approximately 50 KW may be possible. This may be equivalent to approximately 80 MW pile level.

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1. HW-46452, "Production Test IP-19-A, Pilot Charging of I & E Fuel Elements - C-Reactor", Van Wormer, F. W., November 5, 1956, as supplemented.

HW-54764, "Production Test IP-141-A, Charging of I & E Fuel Elements with Thin Cans and Braze Layers - C-Reactor", Hall, R. E., January 29, 1958.

HW-54765, "Production Test IP 142-A, Pilot Charging of Column Containing Water Mixing Pieces - C-Reactor", Hall, R. E., January 29, 1958.

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or approximately five percent of production. Total outage time required to specially charge and discharge the five desired columns should not exceed two hours per tube. This would be a total of ten hours or only about 1.5 percent of one month's time. In essence then, if the expected results are obtained, the potential power level gains will repay the lost time in much less than one month's operation.

Long term tube corrosion monitoring programs established under previous tests¹ are of sufficient importance that it is desirable that they be continued after termination of tests in which they were included. It is, therefore, desirable to permit this testing to continue under the auspices of this test.

TEST DETAILS

a) Fuel Elements

Fuel elements are to be fabricated from the normal "C" size natural uranium cores, jacketed in aluminum cans and spires. The can is to be originally 40 mils thick, and the spire is that currently used. Final machined dimensions are to be as shown on H-3-7159, for the new 8 inch "C" size elements as modified by H-3-7209 describing the standardized Tru-line feature. Nominal canned fuel element dimensions are : 1.460" OD, 0.375" ID, and 8.963" length. All fuel elements shall meet normal I & E Process Specifications.

- b) All columns are to be probologged prior to charging, charged, and hand-seated against the downstream thermocouple probe.
- c) All monitor columns are to have pre-exposure measurements of weight, diameter, and warp.
- d) The five columns used to monitor operating conditions in an effort to more closely define the relationship between corrosion index and temperature unbalance ratios shall be charged into tubes with corrosion indices as indicated below chosen by mutual consent of personnel of Research and Engineering and C Processing Operation.

<u>Charge</u>	<u>Approximate Corrosion Index</u>
1	0
2	0
3	5
4	10
5	20

The long term corrosion monitoring columns shall remain the same as those currently in use., i.e.; as listed below.

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<u>Tube</u>	<u>Loading</u>
0973	31 regular I & E with one mixer
1074	31 regular I & E with one mixer
2464	32 regular I & E
2564	32 regular I & E

These tubes shall be routinely recharged with weighed and measured material with probolog measurements between each charge. Thermocouple probes shall be charged into alternate cycles of these loadings, using normal downstream dummy loadings for the remainder.

- e) Operating limits for these columns shall be identical for all tubes charged under this test with those in effect for the remainder of the 1.460" OD fuel charges in the reactor.
- f) Discharge exposure for all columns charged as part of this test shall be the same as that for normal production material unless early discharge is deemed necessary for safety or corrosion reasons.
- g) Daily temperature and flow data are required for all tubes charged under this test.
- h) Post-exposure measurements of weight, diameter, and warp and visual examination of all elements charged under this test are required, therefore, special pick-up and handling of these charges are required.

COSTS

All incremental costs incurred in direct relation to charging of these monitor columns may be charged to XXXX-5320-XXX.54.

Manhours and Elevator Time Required:

	<u>Manhours (Processing)</u>	<u>Elevator Time</u>
Probolog tubes	1/4 hour per tube	1/4 hour per tube
Install thermocouple probes	1/2 hour per tube	1/2 hour per tube
Charge column	3/4 hour per tube	1/4 hour per tube
Discharge and special pick-up	1/2 hour per tube	1/4 hour per tube

RESPONSIBILITIES

Fuel Preparation Department

Manufacturing Operation

The Manufacturing Operation will be responsible for canning all pieces by the "F" process, for normal quality control, for pre-irradiation weights and measurements, and for preparation of mixing pieces.

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Engineering Operation

The Engineering Operation will be responsible for liaison in the 300 Area phase of this test and for providing technical assistance.

~~Irradiation Processing Department~~

Research and Engineering Operation

Process Technology Operation will be responsible for assistance in pre-shutdown scheduling, and reporting of data as pertains to monitor columns.

Process and Reactor Development Operation shall be responsible for the analysis of all data procured from the monitor tubes and the preparation of reports detailing the technology so derived. In addition, it will be responsible for interim evaluations of the test data and for recommending to Process Technology power level or temperature limit bases derived from these data.

Component Testing Operation will be responsible for supplying to the Process and Reactor Development Operation post-irradiation measurements of tube condition, and for weights, measurement, and appearance of the monitor fuel elements.

Irradiation Testing Operation will be responsible for providing special thermocouple probes and the associated equipment necessary for the procurement of monitor tube data.

B-C Processing Operation will be responsible for:

1. Planning and scheduling the loadings of the test elements and probes.
2. The operating safety and production continuity of the reactor.
3. Collection of routine operating data from the tubes containing monitor charges.

Reactor Fuels Operation
Process & Reactor Development Operation
Irradiation Processing Department

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