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August 31, 1959

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PRODUCTION TEST AUTHORIZATION IP-217-A-
SUPPLEMENT, URANIUM SAMPLE IRRADIATION
(HAF-218)

G. E. Zima

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August 31, 1959

PRODUCTION TEST AUTHORIZATION IP-217-A-SUPPLEMENT
URANIUM SAMPLE IRRADIATION (HAPO-218)

OBJECTIVE

The object of this production test is to authorize the irradiation of samples of natural uranium for use in the fission product volatilization program.

BASIS AND JUSTIFICATION

The fission product volatilization program, being conducted by the Chemical Effluent Technology Operation of HLO, has two basic objectives, namely: (a) determining the

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influence of metal (uranium) properties - such as exposure level, temperature and physical state - on the type, quantity and physical state of the fission products released; (b) attaining data on various filters and absorbers which will contribute to the knowledge of practicable containment techniques. With the completion of test facilities for handling high activity specimens, the fission product program will be expanded to study the characteristics of fission product release from high activity uranium. This supplement to PT IP-217-A (Ref. 1) authorizes the irradiation of test specimens for this work at high activity levels and, in addition, extends the duration of the IP-217-A authorization for the irradiation of low activity specimens.

REACTOR AREA AND FACILITIES

Any empty central zone PCCF and/or process tube at B, D, DR, or H Reactors will meet the requirements of this authorization. Exposures of less than or equal to 100 MWD/T will be obtained in PCCF tubes, while exposures of greater than 100 MWD/T will require process tubes.

SCHEDULE

- 1) Starting Date: Irradiation of samples may begin as soon as this authorization is approved.
- 2) Duration: An unspecified number of specimen exposures is authorized for a period of two years, dating from the issuance of this production test. The specimen requirements are tabulated below. Irradiations will be scheduled so as to insure a satisfactory supply rate of specimens to the test program. The authorization for PT IP-217-A (Ref.1) is extended for one year, to November 13, 1960.

EXPOSURE

The schedule of exposures, exposure facilities, and number of test specimens applicable to this production test is as follows:

<u>Exposure (MWD/T)</u>	<u>Facility</u>	<u>Specimens</u>
0.1	PCCF	2
1.0	"	2
10.0	"	2
100.0	"	2
300.0	Process tube	4
600.0	"	18
1000.0	"	4

Holders containing the specimens will be flushed from the PCCF tubes at times appropriate to their goal exposures, the discharge time to be specified at time of charging. Holders containing samples for process tube exposure will be charged along with regular metal. The positioning of holders in the process tubes will be specified at time of charging. Charging and discharging of these holders will be done according to regular production schedules.

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PROCESS STANDARDS

The provisions of Process Standard F-050, Sections 50.01 and 50.02 are revoked for this irradiation. Section 50.01 prohibits valved connections on tubes containing uranium or uranium alloys. Section 50.02 prohibits charging uranium or uranium alloys during reactor operation. Process Standard F-011, describing acceptable kinds of slugs to be used in process and PCCF tubes, and Process Standard F-020, describing acceptable charging patterns for PCCF and process tubes, will be revised to permit: (a) use of the holders containing the uranium test specimens, (b) whatever positioning of holder slugs in the tubes will be needed to secure goal exposures. Process Standard F-050, Section 50.04, prohibiting flow reduction in tubes containing fissionable material, is revoked for this production test in the event it is deemed desirable to perform discharge from the PCCF tube under reduced pressure conditions.

The Panellit gauge will be by-passed during charge-discharge operations on the PCCF tubes as permitted by Process Standard F-050, Section 50.03. Process Standard A-050, Section 50.01, requiring a #1 safety circuit connection for Panellit gauges monitoring tubes containing fissionable material, will be in effect during the irradiation phase of this production test.

REACTIVITY LOSS

There will be no significant reactivity loss from the irradiations authorized by this production test.

MANPOWER COSTS

- 1) Operations: Approximately 4 manhours for each PCCF tube charge-discharge and sample pickup.
Approximately 1 manhour for each process tube pickup.
- 2) Maintenance: None

COST CODE

XXX-5320-XX.08

DESCRIPTIVE DETAILS

Natural uranium pellets, 1/4" diameter by 3/4" long and 1/4" diameter by 1/8" long will be irradiated within aluminum holders. Each holder contains up to three uranium pellets, aggregating not more than 25 grams weight of uranium. A maximum of two holders will be charged in a given process tube. A schematic drawing of the holders to be used for the PCCF and process tube irradiations is given in Figure 1. Cuts on the holders are to facilitate the decanning operation. Each aluminum assembly will be stamped on the upstream end with the symbol HAP0-218-X, where "X" indicates a letter to be assigned each assembly in alphabetical order.

DISPOSITION OF SAMPLES AFTER DISCHARGE

Special pickup will be required for both PCCF and process tube specimens. The aluminum holders will be placed in separate buckets and allowed to cool in the storage basin for up to 30 days. Following cooling, the holders will be transferred to a cask and transported to the 292T facility for the decanning operation.

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HAZARDS

No special hazards are associated with the process tube irradiations. The PCCF tube irradiations have been analyzed with respect to the hazard presented by loss of coolant (Ref. 2). It was calculated that a period of about eight (8) minutes would be available between coolant loss and burnout of the aluminum holder. The analysis was made on the basis of seven uranium samples per holder, rather than the two to three specimens in the actual holder. It was assumed that coolant loss and exposure of specimens to maximum flux are coincident. Heat input to the stagnant water from both the graphite and the uranium was considered in the computation of safe residence time. Boiling of the stagnant water was assumed to start at 250 F (30 psig), with steam ejection to the rear face piping. The calculations indicate that about eight (8) minutes would be required to reduce the stagnant water level to the point where film boiling and burnout would occur. It is believed that longer exposure of PCCF specimens prior to loss of coolant would not significantly affect the hazards analysis. Continuous Panellit monitoring of the PCCF tube and no delay Panellit coupling to the #1 safety circuit are additional factors reducing the hazard consequent from loss of water to the PCCF tube during irradiation of the uranium pellets. In the event there is doubt that the sample holder has been flushed from the PCCF tube, a solid aluminum dummy shall be flushed through the tube as a flag.

RESPONSIBILITIES

Reactor Operation will be responsible for operational safety and production continuity of the reactor. R. K. Marshall and A. E. DeMers, of Irradiation Testing Operation will be responsible for canning of the sample assemblies, scheduling sample exposure with Reactor Operations and transferring the exposed samples to R. K. Hilliard, of Chemical Effluent Technology Operation, HLO, who will perform the fission product release studies and report the results. Process and Reactor Development Operation has responsibility for overall coordination and final reporting of this production test.

REFERENCES

1. Rogers, G.J., Production Test Authorization IP-217-A, Uranium Sample Irradiation (HAPO-218), HW-5818C, November 13, 1958, SECRET.
2. Marshall, R.K., Details of Irradiation (HAPO-218) Secret Working Paper, dated October 28, 1958.

Reactor Engineering Unit
RESEARCH & ENGINEERING SECTION

GE Zima/cn

Fig: 1
Schematic of Irradiation Holders for Process Tube and PCCF

Note: Each type of holder contains not more than 25grms of natural uranium

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