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HW-67207- SUP. B

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SUPPLEMENT B TO PRODUCTION TEST IP-372-K,
URANIUM DISCHARGING DURING OPERATION KE REACTOR

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RESEARCH AND ENGINEERING

May 22, 1961

MASTER

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SUPPLEMENT B TO PRODUCTION TEST IP-372-K, URANIUM DISCHARGING DURING OPERATION KE REACTOR

INTRODUCTION

The original test authorized the discharge of three columns of irradiated fuel elements from KE Reactor as a first step in an Operational Recharging program for this reactor. Supplement A of the test authorized the operational discharge of an additional three columns of fuel elements under the provisions of the original test.

The purpose of this Supplement is twofold: 1) to authorize the discharge of any number of columns of irradiated fuel elements after shutdown, using the installed actuator and remotely operated outlet tube closures; 2) to continue in force Supplement A of this test, with a changed timing of operational discharge (initially eight hours before shutdown) to a less restrictive statement which would permit discharge as early as a week or two before a scheduled outage.

OBJECTIVES

Refer to the objective as stated in the original Production Test.

BASIS AND JUSTIFICATION

- a) As stated in original Production Test.
- b) Experience with installed equipment will be gained at an earlier date by increased opportunities to use the equipment.
- c) KE Processing personnel will have added opportunity to become acquainted with the procedure of discharging irradiated fuel through the remotely operated tube closures.

TEST DETAILS

The provisions of the basic test remain in effect, except that tubes may be discharged up to two weeks prior to an outage. The following additions apply:

- 1) The tubes to be discharged following shutdown are those which would normally be discharged as a result of goal considerations, and not for any abnormal reason such as a ruptured slug. Tubes included in this test are only those equipped with ball or flapper caps at the time of test performance.
- 2) The flexible front connectors of those tubes discharged after shutdown will be subjected to cavitating flow for a period of not to exceed four (4) hours for each discharge made from a tube-connector assembly. Should any connector be subjected to this treatment six times (even though its accumulated exposure to cavitating flow might be less than twenty four hours), the connector will be replaced prior to the following reactor startup, and will not be re-used on the reactor. Records on those connectors subjected to such flow conditions as a result of this test, will be kept by KE Processing Operation.

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TEST DETAILS (Cont'd)

- 3) For the first affected outage of KE Reactor, the method of assuring that all slugs have been discharged from affected tubes will be the use of a push-pole or stiff cable, threaded through the front to rear. For those tubes scheduled for discharge during future outages, fittings for a pressure gauge will be attached to the front nozzle pressure tap. The fittings will consist of an elbow, block-valve (or equivalent), and a shut-off quick-disconnect. An equivalent to a block-valve is a mating quick-disconnect, with plug. On tubes to be discharged in future outages, a pressure gauge attached to the quick-disconnect will read less than 30 psi at full flow⁽¹⁾, to indicate an empty tube with an opened rear cap.

HAZARDS

The potential for uranium fires is increased by some small increment by performing the discharge operation with less than the normally required two hours decay time. Since the ratio of heat generation due to fission product decay decreases exponentially as a function of time after "shutdown" of the fission reaction, the heat generation ratio at the time of discharge of fuel elements in this test may be higher than for normal discharge operations. The higher heat generation is of no significance if the fuel element remains adequately cooled. The most probable source of an uncooled element is associated with a damaged discharge guide which might permit a fuel element to become caught in the rear face piping. Studies by Zaloudek⁽²⁾ and Zima⁽³⁾ have been made to predict the time-temperature behavior of fuel elements following discharge from an operating reactor, and the hazards associated with abnormal residence of slugs in the discharge area. Zaloudek's study concluded that in tube powers of the order of K-Reactor's current levels (1600 kw), the time required after an equilibrium discharge for aluminum jacket melting temperature to be reached is 280 seconds in still air. A one hour delay before discharge, extends this time to fourteen minutes. Both studies show that use of the installed fog spray system produces a high likelihood of avoiding a) slug fires, and b) radiological contamination spread. Radioactivity levels will be watched closely following discharge, for the possible need for the coolant effect of the fog spray.

TERMINATION

Performance of this test for an indefinite period may be desirable. However, since a review of objectives, justification, and even test details is believed to be needed as a consequence of elapsed time, the test shall expire on June 1, 1962.

PROCEDURE

Only certain of the procedural steps for discharge during operation are applicable to discharge after shutdown, as: check operation of fog spray, assure that suitable radioactivity monitors are in operation at various points in the building, open rear cap and flush, monitor rear-face Beckman and stack air activity before and after, assure that tube is empty, close rear cap, record actual time of flush and time that each pigtail is exposed to cavitation.

For the discharge of later tubes that may be fitted with front nozzle quick-disconnects, the assurance that a tube is empty can be done by a check that front nozzle pressure is less than 30 psi with rear cap opened.

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RESPONSIBILITIES

The responsibilities outlined in the original Test remain in effect; also KE Processing will maintain records of connectors subjected to cavitating flow as described in Test Details (2).

- (1) Letter, P. B. McCarthy to R. S. Hammond, "Pressure Drop Detection of Empty Tube", dated May 18, 1961.
- (2) HW-67747 REV 1, "Time-Temperature Behavior of Irradiated Fuel Elements Discharged to Air", April 4, 1961, by F. R. Zaloudck.
- (3) HW-6809, "Some Fire and Fission Product Release Possibilities for Discharged Fuel Slugs", February 7, 1961, by G. E. Zima.

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