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November 14, 1958

SUPPLEMENT C, PT-IP-132-AC, PRODUCTION OF HIGH Pu-240 PLUTONIUM AT C REACTOR

PURPOSE

The purpose of the original production test was to irradiate a sufficient number of depleted uranium columns to produce 11 kilograms of plutonium at a concentration of 20 per cent Pu-240. Because of a high rupture frequency in depleted columns

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PURPOSE (Continued)

which were charged on March 17, 1958, it was decided on November 10 to discharge the remainder of the columns charged on March 17 (13 columns) immediately, although they had reached only about 50 per cent of their goal exposure. This supplement authorizes the recharging of 15 fresh depleted columns to replace those described above and some of those discharged because of rupture. Additional recharging is authorized should the discharge below goal exposure of other depleted columns become necessary. Two of the recharged depleted columns will not contain natural uranium centering segments; temperature rise data from these charges will aid considerably in correlating yield and quality predictions with existing tube temperature data.

Supplement A of this production test permitted the upstream displacement of compensating E columns in order to optimize longitudinal flux distribution. Also authorized by the current supplement is the displacement of D columns by 24 inches or less as a means of optimizing front-to-rear distribution should it appear desirable.

BASIS AND JUSTIFICATION

In order to meet the original commitment to the Commission to produce 11 kilograms of plutonium containing 20 per cent Pu-240, it will be necessary to reach goal exposures on between 65 and 70 depleted columns or to exceed goal exposures on a smaller number of columns while supplementing them with depleted material discharged at a lower goal exposure. Should the latter procedure be adopted, a total of between 70 and 80 columns would be required. Since the number of original depleted columns discharged because of rupture and high rupture potential has exceeded 14 columns, fresh replacement columns must be charged in order to calculate that the commitment will be met.

The relative distributions of heat generation and exposure between natural uranium and depleted pieces in the present "D" columns have been developed theoretically. Analytical work is in progress to determine the rate of plutonium and Pu-240 build-up vs. exposure in depleted uranium. Unfortunately the exposure of the analyzed samples must be determined to a large extent from a theoretical standpoint, introducing uncertainties in the results. In order to more accurately determine the rate of change of heat generation vs. exposure in the depleted material, it is necessary that data be obtained from D columns which are not complicated with natural uranium end segments.

An attempt has previously been made (Supplement A, PT-IP-132-AC) to adjust the front-to-rear flux distribution by displacement of E columns in the region of the Pu-240 irradiation. This attempt was, in the main, successful; however, some downstream peaking still exists in the center far side of the pile. Displacement of the depleted columns should provide approximately the same effect as displacement of the enriched columns in the opposite direction, while involving less than half as many columns and saving outage time. Since D columns are somewhat isolated from each other, no shield damage problem would be expected as a result of their displacement up to 24 inches. This procedure would be implemented if further flux depeaking or "rooftopping" toward the front is deemed desirable to control corrosion rates and reduce the rupture potential of the depleted columns. Any attempts in this direction would also tend to have a beneficial effect on natural uranium and E-metal columns in the region.

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een depleted columns were discharged during the outage of November 11 because of apparent high rupture rate in the group. The 15 tubes are now charged with solid pieces to preserve the locations and supporting enrichment pattern while replacement pieces are prepared. Approximately 500 D slugs, enough for 15 to 18 charges, are presently being re-canned in the 300 Area for this purpose. The discharged depleted columns will be replaced with fresh depleted uranium; one of the charges is to consist of a full length column of 38 numbered depleted uranium pieces and another of 26 numbered depleted pieces centered with dummies. The rest of the columns are to be charged with the original charge pattern.

brated venturis will be installed on the two depleted-only tubes and on one central tube containing natural uranium.

al charge makeups, rear-to-front, are:

1. One column: Standard downstream dummy pattern. 38 numbered depleted pieces, No. 1 downstream.
2. One column: Standard downstream dummy pattern
5 - 8" expendable perfs.
1 - 5" expendable perf.
26 numbered depleted pieces, No. 1 downstream.
3. All other columns: Standard downstream dummy pattern.
5 - 8" I & E natural uranium.
26 - Depleted Uranium,
5 - 8" I & E natural uranium.

placement of depleted columns will be accomplished by the addition to or removal from the downstream dummy charge of up to 3-8" perforated or tubular dummies.

displacements need not be accomplished during a single outage, nor does the displacement of a particular column imply that it cannot be redisplaced if necessary.

TS

Outage Time

Ten minutes per column of outage time is authorized for recharging depleted columns.

One hour of outage time is authorized for installation of three calibrated venturis.

Eight hours outage time are authorized for potential displacement of depleted columns.

Production Losses

About 50 MWD of production will be lost during approximately 12 months irradiation because of the absence of natural uranium in one depleted

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Production Losses (Continued)

column. No production loss will be incurred in the full length depleted column since the end pieces may be blended with the normal uranium stream.

Goal Exposures

The goal exposures of these columns will be adjusted to coincide with other depleted charges through the use of data obtained during the irradiation.

Limits

Normal TAI and annulus boiling limits will apply to these columns; the depleted columns will be less restrictive than standard natural uranium or E-metal columns.

RESPONSIBILITIES

C Reactor Processing Operation will be responsible for charging and discharging of this material and for the continuity and safety of reactor production.

Operational Physics Operation (W. S. Nechodom) will be responsible for choosing the location of the tubes to be used for assuring supply of the numbered pieces, for recommendations on D column displacement, and for evaluating the results of this test.

Process Technology Operation (E. E. Leitz) will furnish three calibrated venturis.

The numbered columns will be shipped to the C reactor with the remainder of the depleted replacement loading.

W S Nechodom

Operational Physics Operation
Research and Engineering
IRRADIATION PROCESSING DEPARTMENT

WS Nechodom:mwe

Reference: HW-54250, "PT-IP-132-AC, Production of High Pu-240 Plutonium at C Reactor;
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