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EVALUATION OF THORIUM OXIDE AS A FRINGE
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SUPPLEMENT B TO PRODUCTION TEST IP-648-AC
EVALUATION OF THORIUM OXIDE AS A FRINGE LOADING

By

K. L. Hladek

April 21, 1964

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SUPPLEMENT B TO PRODUCTION TEST IP-648-AC
EVALUATION OF THORIUM OXIDE AS A FRINGE LOADING

INTRODUCTION

Irradiation of thorium oxide elements of the original test^[1] began in January 1964. Twenty columns of thorium oxide elements located in the outermost processing channels of F Reactor, accompanied by 40 columns of enriched, 0.947 w/o U-235, uranium elements in two adjacent lattice unit channels, were charged to permit evaluation of the reactivity effects of the loading and to obtain data on product and contamination build-up rates. Of the two loadings of thorium elements authorized by the initial test, the first has been discharged. Supplement A to Production Test IP-648-AC^[2] authorized two of the columns of thorium oxide elements to be irradiated through both cycles of the fringe loading. This supplement, Supplement B, to the test involves modification of the discharge schedule of the second loading of thorium elements and the two columns of elements authorized by Supplement A to permit discharge of the thorium columns at goal exposure of the supporting enriched uranium fuel columns.

OBJECTIVE

The objective of this supplemental test is to extend the irradiation time for the second fringe loading of thorium oxide elements authorized by Production Test IP-648-AC.

BASIS AND JUSTIFICATION

Originally, the objectives of thorium irradiations at Hanford were slanted toward production of U-233 with very low concentrations of contaminant U-232, in the order of 1 ppm. Capability of production of this "clean" U-233 has been demonstrated with the several small-scale tests which have been conducted. Emphasis in the irradiation programs has now shifted to two areas: 1) obtaining numerous data to give added confidence in calculations, and 2) investigation of U-233 production with slightly higher concentrations of U-232 contaminant, up to 5 ppm. With these new objectives, it is desirable to modify existing irradiation plans to obtain the desired information, as the prospects of obtaining additional test material within a relatively short period of time are not too optimistic.

Extending the irradiation time for the 20 columns of thorium oxide elements, including the two columns already authorized for longer irradiation, now in F Reactor will permit sampling of elements from the demonstration test which have calculated contaminant levels of about 0.8, 1.2, 2 and 4 ppm. Chemical processing of these elements will provide the necessary data for evaluation of the validity of the theoretical calculations.

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[1] Carter, R. D., and K. L. Hladek. Production Test IP-648-AC, Evaluation of Thorium Oxide as a Fringe Loading, HW-80205. January 13, 1964. ( )

[2] Carter, R. D., and K. L. Hladek. Supp. A to Production Test IP-648-AC, Evaluation of Thorium Oxide as a Fringe Loading, HW-80205 B. February 17, 1964. ( )

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In future thorium irradiations, this information will undoubtedly prove valuable, as the required contaminant level for the finished product is still unknown. The data obtained from this test could then be used to establish guidelines for the irradiation variables, depending on the requirements, for future U-233 production.

TEST DETAILS

The test details established in the original test are applicable for this supplement, except as noted below:

6. Irradiation

D. Goal Exposure

The goal exposure for the thorium oxide charges of this test is established at 1000 Mwd/t in the adjacent second lattice unit enriched uranium fuel columns. This exposure is the total exposure accumulated by the enriched uranium fuel columns during their irradiation. At the time of discharge, the maximum irradiation time for thorium elements of this supplement test will be about 180 full-reactor-power operating days.

E. Operating Conditions and Limits

At the end of the extended irradiation period, the columns of this test will have a maximum heat generation estimated to be about 30 kw per column.

RESPONSIBILITIES

The responsibilities outlined in the original test document are unchanged for this supplement.

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