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PITA-31
FRINGE-BLANKET IRRADIATION OF THORIUM OXIDE
SUPPLEMENT VI

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AS SPECIFIED IN M-3679

By:

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PITA-31
FRINGE-BLANKET IRRADIATION OF THORIUM OXIDE
SUPPLEMENT VI

I. OBJECTIVE

The objective of this supplement is to authorize recharging of the thorium in the fringe zones of the B, C, D, KE, and KW Reactors. Initial charging is described in the parent document.¹ This authorization will serve as an interim measure until Reactor Process Standards have been approved to authorize fringe blanket thorium irradiations.

II. BASIS AND JUSTIFICATION

Orders for an additional 50 kg of U-233 with less than 5 PPM of U-232 contaminant have been received from the AEC.² This commitment requires a second fringe blanket thorium cycle at each of the B, C, D, KE, and KW Reactors for about six months. The general physics and engineering behavior of the initial E-Q blanket loading was about as predicted; no insurmountable problems or large deviations from planned operation were encountered.

III. HAZARDS

Hazards associated with the recharging will remain the same as those described for the initial loading¹ with the exception that most, or all, of the enriched uranium support shall be present in the reactor during the recharging operation. This requires special procedures to assure that total control is not jeopardized during the recharging operation.

IV. PROCEDURES

All target elements authorized for this irradiation are solid cylinder, 8.865 inches, or 6.540 inches, in length. The elements will contain thorium oxide with a bulk density of 7.0 ± 0.2 g/cc. The elements will be made according to the existing fabrication specifications.

Thorium element models O11T and O12T are authorized for use in the B, C, and D Reactor fringe tubes; target element model C2T is authorized for the K Reactor fringe tubes.

Nuclear safety requirements for pre-irradiation storage of thorium elements may conservatively be assumed to be the same as for natural uranium.

¹HW-84021, PITA-31, Fringe-Blanket Irradiation of Thorium Oxide, PD Gross and KL Hladek, 9-11-64

²Letter, AT Gifford to AB Greninger, Continued Thorium Irradiation, 4-13-65

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Recharging may take place at any convenient time during the outage.

Subcritical monitoring requirements shall be as specified in the parent document¹ and its supplements (1-5).

Rods withdrawn for recharging may be as specified in Reactor Process Standards C-020.

All thorium charges are to have the standard downstream dummy length.

Solid aluminum pieces must be off of the front work platform and out of the charge makeup area during charge makeup and charging of the thorium.

Thorium elements may be used to charge-discharge other thorium elements, lithium-aluminum elements, and aluminum spacers. Thorium elements shall not be used to displace uranium elements.

Hand seating of the thorium is not necessary. Ram seating of the thorium is not permitted. Charging machine forces are to be limited to 1500 pounds during the thorium recharging operation.

Probing of thorium tubes is not required.

The charging and discharging of thorium shall be audited by a qualified representative of Research and Engineering.

The criteria for inventory control and element handling established by the parent document is still applicable.

The loading patterns described in the parent document¹ and its subsequent supplements (1-5) shall be adhered to for the recharging operation.

Provisions for flux traversing as specified in the parent document¹ need not be continued.

Up to 90 sets of front and rear caps may be removed from fringe tubes containing thorium at any one time at the smaller reactors. This number may be increased to 100 for the K reactors.

The special nozzle caps authorized in Design Change 951 shall continue to be used for all thorium charges.

To assure that total control is not jeopardized, all supporting enrichment must be compensated at all times during the recharging. In the event that certain thorium tubes are to be left empty during the recharging, the supporting enrichment must be compensated by 1) assuming the uncompensated enrichment is a part of the adjacent enrichment ring in calculating total control, 2) inserting a spline in the empty thorium channel until it is charged with thorium or an equivalent poison (e.g., Li-Al), or 3) using an adjacent uncompensated thorium column for direct compensation.

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When using methods 2 and/or 3, all supporting enriched uranium in any and every 3 by 5 fringe array must be directly compensated by equivalent strength poison material in the same 3 by 5 array.

Startup procedures as specified in Reactor Process Standards shall be followed for all startups subsequent to the recharging.

No special data is required during operation with the fresh thoria blanket. All data normally supplied to production computing operation shall continue to be supplied.

The thoria elements authorized shall be irradiated to produce U-233 with less than 5 PPM U-232 contaminant. An irradiation of approximately six months, at 80 per cent TOE, is planned. Any modifications to this goal exposure plan may be specified with the concurrence of the Manager, Production, and the individual Processing Managers concerned.

V. RESPONSIBILITIES

Responsibilities shall remain as specified in the parent document and its supplements (1-5).

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