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ANALYSIS OF E-N TARGET CONVERSION DATA

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ANALYSIS OF E-N TARGET CONVERSION DATA

INTRODUCTION

Production efficiency studies of the E-N loading require that conversion ratio values for both plutonium and tritium be defined. Changing of the core-loading charge makeup with each core load to obtain a more efficient loading has theoretically resulted in increasing the tritium conversion ratio. Tritium recovery data from the third H Reactor E-N loading has recently become available for analysis.¹

The buildup of product is much slower in fringe blanket material than in core target pieces. The second group of fringe conversion ratio data has only recently been obtained for analysis¹; the material analyzed was from the DR Reactor, irradiated under conditions closely paralleling those in the H Reactor blanket load.

This document reports the conversion efficiencies for tritium production in Hanford E-N core and blanket loadings indicated by these most recent data.

SUMMARY

The tritium conversion ratio from the third E-N core in H Reactor is calculated to be 0.191 equivalent grams per MWD generated in the core. Analysis of fringe material from DR Reactor shows a conversion ratio of 1.435 equivalent grams per MWD generated in adjacent E columns. This can be assumed to be equivalent to the H fringe conversion ratio for the same exposure. However, the fringe lithium-aluminum material was irradiated for 2.9 years which is longer

¹DPSP-63-1901, Extraction of Tritium from Hanford Slugs, J.D. Elliot (SRO), 9-26-63

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than desirable for optimum operation.² Greater production credit can be taken for shorter irradiation times since the effective fringe conversion ratio would be increased.

DISCUSSION

The third E-N core was irradiated from January 30, 1963 to April 21, 1963 in the H Reactor. All of the 4-inch I&E lithium-aluminum irradiated in the third E-N core load has been processed at Savannah River Operation, and the data has been analyzed to determine the rate of product formation. In addition to the core material, the lithium-aluminum elements from 18 columns of the top and far side shield-protection blanket in the DR Reactor were also processed. Although DR Reactor does not have the full fringe blanket nor the E-N core, there is no reason to believe that the conversion ratio should differ significantly in the DR fringe (supported by adjacent E-metal layers) from that in the H blanket under equivalent conditions of adjacent-column accumulated exposure. Therefore, the DR Reactor fringe data is considered applicable for determining fringe blanket production in the H Reactor E-N load at equivalent exposures.

The following table summarizes the data analysis.

<u>Tritium Yield and Exposure Data</u>					
<u>Type</u>	<u>Liters^a</u>	<u>Yield^b (Grams Equiv.)</u>	<u>Corrected^c Yield</u>	<u>MWD in E</u>	<u>Conversion Ratio^d (Equiv. gms/MWD)</u>
H Core	957.42	20,415	20,415	106,799	0.191
DR Fringe	387.57	8,264	8,099	5,643 ^e	1.435

^a Based on He⁴ content

^b Liters x 0.04460 mols/liter x 2 atoms/molecule x 239.05 gram equiv./mol

^c Yields adjusted to same basis as yields reported in HW-73615, Suppl. 2; core yield is corrected by 1.02 assuming E-metal mixers, and both are reduced for two per cent decay.

^d Core conversion ratio is equivalent grams per MWD generated in core; fringe yield is equivalent grams per MWD generated in the adjacent E fuel column.

^e MWD in adjacent second lattice unit E-column

The DR fringe poison was irradiated for about 35 months. The longer the residence time in the reactor the lower the apparent conversion ratio. The reduction in conversion ratio has been estimated to be five per cent per year³. Hence the conversion ratio determined for the fringe material should be corrected by this value when calculating production for residence times different from 2.9 years. (Since the H core was irradiated to 878 MWD/T rather than the 800 MWD/T used in previous documents in comparing production, some correction for the longer irradiation time could also be made for the core. However, the irradiation time is short enough that this correction would be negligible.)

²SRD Letter, Optimum Discharge Levels for Blanket Lithium-Aluminum Targets, L. W. Lang, 9-9-63

³Private communication from L. W. Lang

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Factor (relative power generation) map data March 18 and 22, and April 10 and 15, 1963, show that the third E-N core load had a power split of 70.8 per cent power generation in the striped (E-N core) load and 29.2 per cent in the remainder (fringe) of the reactor. The charges adjacent to the fringe blanket poison were generating 14.0 per cent of the total in the fringe at this time.

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