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TECHNICAL BASES - U-233 PRODUCTION STUDY

GROUP IV-A

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Research and Engineering
Irradiation Processing Department

June 24, 1964

Classification Cancelled and Changed To

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By Authority of RM Jten
CG-PR-2, 4-14-94
By DK Hanson, 4-19-94
Verified By Jessie Maley
4-19-94

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

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TECHNICAL BASES - U-233 PRODUCTION STUDY

GROUP IV-A

On June 22, 1964, W. K. Woods reviewed with Mr. W. J. Lindsey the contents of memoranda HW-82665 and HW-82765, "Technical Bases - U-233 Production Study - Group V" and "Group IV," respectively. In consequence of this review, it was suggested that a modification of Group IV be worked up for presentation to Mr. F. P. Baranowski during his visit to the Hanford plant on June 26. The following tables present the results of this recomputation.

In this calculation the premise was adopted that we would exploit fringe tube loadings in so far as possible to assist in making on the order of 200 kg of U-233 in support of the seed-and-blanket program, and that we would terminate the more expensive core loadings by July 1, 1965, in order to assist in early delivery of a substantial portion of the amount of U-233 desired. Savannah River Plant could be used to supplement Hanford production as required. We would then continue to irradiate thorium in the fringes of the reactors to produce on the order of 100 kg per year continuously.

In comparison with Group V, utilization of the fringes of the reactors without delaying the schedule (i.e., shipment by December 1, 1965) causes the following effects:

- (a) the amount of U-233 available for shipment will decrease by about 10% to 180 kg,
- (b) the amount of E-metal required per kg of U-233 will decrease about 10%, and
- (c) the amount of ThO_2 required per kg of U-233 will decrease about 4%.

W. K. Woods

Consulting Engineer
Research and Engineering

WK Woods:jm

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TABLE I

WORK SHEET FOR THORIA LOADINGS

Date	Reactor Fringes						Reactor Cores					
	B	C	D	F	KE	KW	B	C	D	F	H	KE
December 1	9	8	8		13	13				9		
December 15												
January 1												
January 15												
February 1												
February 15												
March 1												
March 15												
April 1												
April 15												
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November 1												
November 15												
December 1												

* = E-metal discharged.

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TABLE II

THORIA LOADING AND PRODUCT DISCHARGE SCHEDULES

Date	Canned ThO ₂ , Tons	ThO ₂ Charged, Tons			Mass 233 Discharged, kg		
		Reactor Fringes	Reactor Cores	Total	Reactor Fringes	Reactor Cores	Total
Dec. 1	30	17	9	26			
15	50	38	9	47			
Jan. 1	70	51	9	60			
15	90	59	27	86		8	8
Feb. 1	110	59	41	100		8	8
15	130	59	50	109		8	8
March 1	150	59	82	141		16	16
15	170	59	105	164		37	37
April 1	190	59	114	173		45	45
15	210	59	137	196		65	65
May 1	230	59	145	204		82	82
15	240	89	145	234	33	95	128
June 1	250	97	145	242	66	125	191
15	(continue at)	(continue at)	-	(continue at)	66	125	191
July 1	(8 tons/mo.)	(8 tons/mo.)		(8 tons/mo.)	66	134	200
					(continue at)	-	(continue at)
					(8 kg/mo.)		(8 kg/mo.)

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TABLE III

Batch of 200 kg (gross) of U-233

	<u>Small Reactors</u>		<u>K Reactors</u>		<u>Total</u>
	<u>Core</u>	<u>Fringe</u>	<u>Core</u>	<u>Fringe</u>	
U-233, kg	93	36	41	30	200
U-232/U-233, ppm	2.9	2.7	5.0	6.9	3.9
ThO ₂ , tons	100	33	45	26	208
E-metal, tons	550	140	240	120	1050
Natural U, tons	-935	-210	-360	-180	-1685
Pu in E, kg	320	80	165	85	650
Pu in natural, kg	-475	-105	-210	-105	- 895
Total Pu, kg	-155	-25	-45	-20	-245

Continued Production at Nominal 100 kg/year

	<u>Fringe of Three Small Reactors</u>	<u>Fringe of One K Reactor</u>	<u>Total</u>
U-233, kg/year	60	35	95
U-232/U-233, ppm	2.7	6.9	4.3
ThO ₂ , tons/year	60	30	90
E-metal, tons/year	235	135	370
Natural U, tons/year	-350	-200	-550
Pu in E, kg/year	135	90	225
Pu in natural, kg/year	-180	-120	-300
Total Pu, kg/year	-45	-30	-75

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