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ATOMIC WEAPON DATA

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9. Extra File
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11. 700 File
12. Yellow File

October 3, 1952

This document consists of
10 pages, No. 12 of
12 copies. Series [redacted]

To: File

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CLASSIFICATION CANCELLED AND CHANGED TO
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NOT UCN!

PURITY DATA ON REDOX START-UP MATERIAL
THROUGH THE 231 AND 234-5 BUILDINGS

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DECLASSIFIEDINTRODUCTION

Redox effluent for production was first processed in the 231 Building on February 4, 1952. Samples of process streams were taken after each purification step to evaluate the adequacy of purification processes in the 231 and 234-5 Buildings and to provide close control of this material.

Data regarding pile residence histories, radiation surveys of "Sample Cans", reduction yields, C/Q values, and product purity after purification steps were accumulated and are presented in this report to establish preliminary data which may be used to evaluate future process changes.

SUMMARY

1. Purity of the product obtained from Redox effluent proved adequate to meet specifications (See Tables V and VI).
2. Purification factors for the major impurities are given below to indicate the magnitude of purification achieved. (Purification factors less than 2 are omitted inasmuch as the spectro-chemical analyses are considered to be accurate within $\pm 2X$)

<u>Impurity</u>	<u>Purification Factor* for</u>		
	<u>2 Peroxide Precipitations</u>	<u>1 Oxalate Precipitation</u>	<u>Reduction of PuF₄ to Metal</u>
Al	150	--	3
Ba	15	--	10
Bi	--	4	--
Ca	7	--	3
Cr	10	35	--
Fe	10	10	--
La	20	--	--
Mn	--	10	--
Na	NaOH added	45	40
Ni	5	3	--
Pb	3	5	3
Sb	--	3	--
Zn	3	--	--

*Based on Table V

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3. The C/Q value for an average of 40 buttons (calculated from B-1 analyses) produced on the RM and RG Lines are as follows:

<u>Origin</u>	<u>234-5 Process Line</u>	<u>Max.</u>	<u>Ave.</u>	<u>Min.</u>	<u>Ave. C/Q for Mg.</u>	<u>Ave. for others</u>
S-plant	RM	1.951	0.935	0.435	0.676	0.259
S-plant	RG	1.711	0.794	0.252	0.591	0.203
T-plant	RG	0.981	0.540	0.276	0.338	0.202

The average C/Q value for magnesium is included to indicate that the major portion of the C/Q value is due to Mg which is introduced during reduction of PuF_4 in an MgO crucible. Concentrations of Mg vary excessively, 20 to 500 parts per million parts plutonium. Omitting Mg, a fair comparison of light element impurities and their contribution to the C/Q value results.

4. Reduction yields in the RG Line, calculated from

$$\frac{(\text{wt. of metal} - (70 - 58 + \text{Recycle}))}{(\text{wt. of PuF}_4 \text{ charged} \times \frac{239}{315})} \times 100, \text{ averaged } 98.11\% \text{ for 120 runs}$$

reduced from processed Redox effluent as compared to 97.74% for 200 runs reduced from material from the bismuth-phosphate process during the same period.

TABLES

Spectro-chemical analyses of S-Plant material are included in Tables I to IV to indicate the purification achieved by the major purification steps. The corresponding sample codes are:

1. P-1, - analyses of Redox effluent.
2. AT, - analysis of the product after the Isolation Building treatment of 2 peroxide precipitations.
3. DC-1, - analysis of the plutonium oxalate cake.
4. B-1, - analysis of the metal button reduced from plutonium fluoride.

Table I includes 7 batches showing items 1, 2, 3, and 4 above.

Table II includes 9 batches showing items 2, 3, and 4 above.

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Table III includes 10 batches showing items 2 and 3 above.

Table IV includes 4 batches showing items 2 and 3, and 3 batches showing items 3 and 4 above.

Tables I - IV also includes pile residence in MWD, 231 Building "Sample Can" surveys in MR/hr., fluoride to metal reduction yields, and C/Q values for each batch.

Table V includes the maximum, average, and minimum impurity concentration in parts per million parts plutonium for 7 P-1, 28 AT, 48 DC-1, and 40 B-1 analyses.

Table VI includes maximum, average, and minimum impurity concentrations in parts per million parts plutonium for metal reduced from PuF_4 in the RM Line.

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REDOX BAT NUMBER	MWD	231 BATCH NUMBER	SURVEY MR/HR	X UN NUMBER	Y-RUN NUMBER
S-02-02-L-26	260	12-B-126	4	12-2-187	12-2-103
S-02-02-L-27	260	12-B-127	1	12-2-188	12-2-103
B57 S-02-02-L-28	260	12-B-128	4	12-2-189	12-2-103
617 S-02-02-L-29	260	12-B-142	1 1/2	12-2-173	12-2-96
397 S-02-02-L-28	"	12-B-143	4	12-2-200	12-2-110
377 S-02-02-L-30	567				
527 S-02-02-L-34	"	12-B-146	4	12-2-203	12-2-115
S-02-03-L-10	553	12-C-104	5	12-3-103	12-4-3

BATCH NUMBER	SURVEY MR/HR	X UN NUMBER	Y-RUN NUMBER	REDUCTION YIELD	3 VALUES		SAMPLE CODE	Ag	Al	B	Ba	Be	B
					Σ	Mg							
							P-1		1600		1600	L0.05	
B-126	4						AT	100	L20	1.1	10	L0.05	5
		12-2-187					DC-1	5	L50	20	20	L0.2	
			12-2-103	98.1%	0.47	0.31	B-1		30	0.9		L0.05	
							P-1		1600		500	L0.2	
B-127	1						AT	1	L20	L2	10	L0.03	5
		12-2-168					DC-1	2	L50	5	50	L0.2	2
			12-2-103	98.1%	0.47	0.31	B-1		30	0.8		L0.05	
							P-1		1600		500	L0.2	
B-128	4						AT	1	L13	L2	5	L0.03	5
		12-2-189					DC-1	1	L50	10	50	L0.2	5
			12-2-103	98.1%	0.47	0.31	B-1		30	0.8		L0.05	
							P-1		62000		130	L0.03	
B-142	1 1/2						AT	2	20	L2	10	L0.08	5
		12-2-173					DC-1						
			12-2-96	97.7%	0.7	0.63	B-1		L20			L0.08	
							P-1		5000		130	L0.08	
B-143	4						AT	2	30	L2	20	L0.03	2
		12-2-200					DC-1	2	L50	5	50	L0.16	2
			12-2-110	98.2%	0.25	0.16	B-1		L20	0.4		L0.03	
							P-1		63000		200	L0.05	
B-146	4						AT	20	13	L2	10	L0.05	5
		12-2-203					DC-1	1	L50	2	100	L0.16	
			12-2-115	98.4%	0.64	0.63	B-1		10	0.5		L0.02	
							P-1		25000		150	L0.05	
C-104	5						AT	1	L20	L1	L5	L0.2	
		12-3-103					DC-1	2	20	5	50	L0.1	
			12-4-3	99.9%	0.64	0.63	B-1		L20	2.0		L0.05	
							P-1						
							AT						
							DC-1						
							B-1						
							P-1						
							AT						
							DC-1						
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							AT						

SPECTRO-CHEMICAL ANALYSIS

[illegible]

Pb	Sb	Sn	Sr	V	Zn	Tl	F	REMARKS
640			L64		2*	L640		L - Less Than
100	2*	5	L1	L5	L100	L50		2* - Detection Uncertain
10	*	50	L1	L16	L100	L100		* - Interference
		5					2.0	G - Greater Than
640			L10		L1000	L640		
50	L100	L5	L1	L3	L100	L50	L200	
10	*	20	L1	L16	L100	L100	L1000	
		5					2.0	
640			L10		L1000	L64		
50	L100	L5	L1	L2	L100	L50	L230	
20	*	20	L1	L10	L100	L100	L64	
		5					2.0	
130			L2		L30	L2		
50	L100	L5	L1	L3	L100	L50	L200	
		5						DC-1 Sample not taken Mixed with T Plant material
300			L5		L50	L300		
20	L100	5	L1	L5	L100	L50	L300	
20	*	20	L1	L10	L100	L100	L640	
		5					L1.0	Mixed with T Plant material
200			L3		L30	L200		
50	L100	L5	L1	L2	L100	L50	L130	
10	*	50	L1	L10	L100	L100	L640	
		5					2.6	Mixed with T Plant material
200			L5			L200		
20	L100	5	2	L20	L100	L100	L500	
25	L100	10	L2	L25	L100	L50	L640	
		10					L1.0	

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TABLE 1

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REDOX TCH NUMBER	MWD	231 BATCH NUMBER	SURVEY MP/HR	RUN NUMBER	Y-RUN NUMBER
S-02-03-L-5	553	12-C-94	5		
				12-3-93	
					12-4-1
66% S-02-03-L-6	553	12-C-97	3		
34% S-02-03-L-7	"	"	"	12-3-96	
					12-3-54
S-02-03-L-8	553	12-C-100	2		
				12-3-99	
					12-3-54
85% S-02-03-L-7	553	12-C-101	2		
15% S-02-03-L-9	"	"	"	12-3-100	
					12-4-1
S-02-03-L-9	553	12-C-102	2		
				12-3-101	
					12-4-3
S-02-03-L-9	553	12-C-103	2		
				12-3-102	
					12-4-5
S-02-03-L-10	553	12-C-104	5		
				12-3-103	
					12-4-3
S-02-03-L-11	553	12-C-106	2		
				12-3-105	
					12-4-15
52% S-02-03-L-15	566	12-C-132	1		
48% S-02-03-L-19	"	"	"		
				12-4-19	
					12-4-15

Y-RUN NUMBER	REDUCTION YIELD	S ₂ VALUES		SAMPLE CODE	SPE "R"									
		Σ	Mg		Ag	Al	B	Ba	Be	Bi	Ca	Cd	Ce	Cr
				A.T.	L1	L20	L1	5	L0.08	L5*	20	50	L800	200
				DC-1	L2	1000	10	200	L0.05	L4	1000	L80	L500	40
12-4-1	99.2%	0.79	0.63	B-1		L20	0.5		L0.08		8			5
				A.T.	L1	L20	1	10	L0.1	L5	20	100	L500	200
				DC-1	L1	L20	5	L80	L0.05	1	L100	L50	L300	L1
12-3-54	99.0%	0.82	0.63	B-1		L20	L2		L0.03		20	2		
				A.T.	L1	L20	L1	L5	L0.2	2	20	L50	L1200	100
				DC-1	L1	L20	2	50	L0.1	*	L100	L160	L1000	2
12-3-54	99.0%	0.82	0.63	B-1		L20	L2		L0.05		20			2
				A.T.	L1	L20	L1	20	L0.1	5*	L100	50	L800	200
				DC-1	L1	L20	2	50	L0.1	*	L100	L160	L1000	2
12-4-1	99.2%	0.79	0.63	B-1		L20	0.5		L0.08		8			5
				A.T.	L1	L20	L1	L5	L0.2	5	20	L50	L1200	100
				DC-1	L1	L20	5	L50	L0.1	2*	L100	L160	L1000	2
12-4-3	99.9%	0.83	0.63	B-1		L20	2		L0.05		20			5
				A.T.	L1	L20	L1	L5	L0.2	5	20	L50	L1200	100
				DC-1	L1	L20	5	L50	L0.1	L2	L100	L160	L1000	L5
12-4-5	98.3%	0.89	0.63	B-1		L20	2.2		L0.05		30			10
				A.T.	1	L20	L1	L5	L0.2	2	20	L200	L1200	500
				DC-1	2	20	5	50	L0.1	5	L100	50	L1000	20
12-4-3	99.9%	0.84	0.63	B-1		L20	2		L0.05		20			5
				A.T.	1	L20	L1	20	L0.2	2	30	L200	L1200	500
				DC-1	L1	L20	5	L30	L0.05	L1	30	L50	L300	2
12-4-15	100.7%	1.71	1.56	B-1		L20	0.4		L0.05		50			5
				A.T.	61000	L20	L1	20	L0.08	2	50	61000	L300	200
				A.T.	L20	L20	L1	20	L0.08	2	L30	50	L300	200
				DC-1	L1	L20	10	L50	L0.05	L2	20	L50	L200	L5
12-4-15	100.7%	1.71	1.56	B-1		L20	0.4		L0.08		50			5

PE RO CHEMICAL ANALYSIS

	Cr	Cu	Fe	Hg	In	K	La	Li	Mg	Mn	Na	Ni	P	Pb	Sb	S
20	200	5	3000	2*	L10	100	L130	L1	50	50	4x10 ⁴	200	200	50	2*	11
20	40	20	220		L40	20	L50	L2	200	20	500	L40	400	10	2*	L
	5		95				L80	L1	200	20	L10	50				10
20	200	10	1600	2*	L10	50	L80	L1	50	100	2500	500	500	50	2*	5
20	L1	10	55		L10	L1	L50	L1	20	5	25	50	L100	5	L100	5
			160				L30	L1	200	20	L10	50				10
200	100	1	700	2*	L10	100	L200	L1	20	50	4x10 ⁴	50	100	L10	2*	L5
200	2	10	50		L20	5	L100	L1	10	10	250	50	L100	*	L100	10
	2		160				L30	L1	200	20	L10	50				10
200	200	5	1800	2*	L10	100	L130	L1	50	100	15000	200	200	50	2*	L5
200	2	10	50		L20	5	L100	L1	10	10	250	50	L100	*	L100	10
	5		95				L80	L1	200	20	L10	50				10
200	100	2	1000	*	L10	100	L200	L1	20	50	4x10 ⁴	50	100	20	2*	L5
200	2	10	75		L20	1	L100	L1	10	20	150	L100	L100	L640	L100	5
	5		80				L80	L1	200	20	10	200				10
200	100	2	1000	*	L10	100	L200	L1	20	50	4x10 ⁴	50	100	20	2*	L5
200	L5	10	L50		L20	L1	L100	L1	10	5	25	50	L200	L10	2*	5
	10		140				L50	L1	200	50	10	100				20
200	500	50	1400	*	L10	50	L200	L1	50	200	4x10 ⁴	200	500	20	L100	5
200	20	20	75		L20	200	L100	L1	10	5	250	50	L100	L5	L100	10
	5		60				L80	L1	200	20	10	200				10
200	500	10	1300	*	L10	100	L200	L1	50	200	4x10 ⁴	200	1000	20	L100	5
200	2	10	50		L20	1	L50	L1	10	5	250	50	L100	L5	L100	20
	5		165				L50	L1	500	50	L10	20				10
200	200	1000	1300		L10	50	L130	L1	50	100	2x10 ⁴	200	500	50	*	10
200	200	10	1300		L10	50	L130	L1	50	100	2500	200	200	50	2*	L5
200	L5	5	165		L20	2	80	L1	25	5	50	20	L200	L10	2*	5
	5		165				L50	L1	500	50	L10	20				10

REDUX BATCH NUMBER	MWD	231 BATCH NUMBER	SURVEY MR/HR	X-RUN NUMBER	Y-RUN NUMBER	RED YI
S-02-03-L-2	555	12-C-89	2			
				12-3-88		
					12-3-50	96
89% S-02-03-L-3	551	12-C-90	3			
11% S-02-03-L-4	553			12-3-89		
					12-3-49	97
85% S-02-03-L-4	553	12-C-92	2			
15% S-02-03-L-2	555			12-3-91		
					12-3-51	99
S-02-03-L-4	553	12-C-93	2			
				12-3-92		
					12-3-51	99
S-02-03-L-5	553	12-C-95	4			
				12-3-94		
					12-3-52	98
S-02-03-L-6	553	12-C-96	4			
				12-3-95		
					12-3-52	98
S-02-03-L-7	553	12-C-98	3			
				12-3-97		
					12-3-53	99
S-02-03-L-8	553	12-C-99	2			
				12-3-98		
					12-3-53	99
93% S-02-03-L-10	553	12-C-105	4			
7% S-02-03-L-11	"			12-3-104		
					12-4-2	98
S-02-03-L-12	553	12-C-125	5			
				12-3-110		
					12-4-6	99

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X-RUN NUMBER	Y-RUN NUMBER	REDUCTION YIELD	$\Sigma \frac{C}{Q}$	SAMPLE CODE	Ag	Al	B	Ba	Be	Bi	Ca	Cd
				AT	L1	L20	1	5	L0.13	1	50	L50
2-3-88				DC-1	L1	L100	2	50	L0.8	L1	100	L50
	12-3-50	98.3%	Unavailable	B-1								
				AT	L1	L20	1	2	L0.08	5	30	L50
2-3-89				DC-1	L1	L20	5	50	L0.08	10	L100	L80
	12-3-49	97.6%	"	B-1								
				AT	1	L20	1	2	L0.13	2	50	L50
2-3-91				DC-1	L1	L20	2	L50	L0.1	L1	L100	50
	12-3-51	99.9%	"	B-1								
				AT	1	L20	1	2	L0.13	2	50	L50
2-3-92				DC-1	L1	L20	5	L50	L0.05	5	L100	L50
	12-3-51	99.9%	"	B-1								
				AT	L1	L20	L1	5	L0.08	L5*	L0	50
2-3-94				DC-1	L1	L20	2	L50	L0.05	L1	L100	50
	12-3-52	98.9%	"	B-1								
				AT	L1	L20	1	10	L0.1	L5	20	100
2-3-95				DC-1	L1	L20	L2	L130	L0.08	1	L100	L50
	12-3-52	98.9%	"	B-1								
				AT	L1	L20	L1	20	L0.1	5*	L100	50
2-3-97				DC-1	L1	L20	5	L50	L0.05	L1	L100	L50
	12-3-53	99.6%	"	B-1								
				AT	L1	L20	L1	L5	L0.2	2	20	L50
2-3-98				DC-1	L1	L20	5	L50	L2	L1	L100	L50
	12-3-53	99.6%	"	B-1								
				AT	1	L20	L1	L5	L0.2	2	20	L200
2-3-104				DC-1	L1	L20	2	L50	L0.1	L1	L100	L50
	12-4-2	98.0%	"	B-1								
				AT	L2	L40	L2	40	L0.05	L2	30	L50
2-3-110				DC-1	L1	L20	5	100	L0.05	L2	30	L50
	12-4-8	99.5%	"	B-1								

ELECTRO-CHEMICAL ANALYSIS

Ca	Cd	Ce	Cr	Cu	Fe	Hg	In	K	La	Li	Mg	Mn	Na	Ni	P	Pb
50	L50	L500	200	10	1500	P*	L10	20	L5	L1	50	200	L500	500	200	50
100	L50	L500	2	50	150		L5	5	L30	L1	100	2	150	50	L100	5
30	L50	L500	200	20	1500	P*	L10	20	L50	L1	50	200	L500	500	200	50
100	L80	L500	2	20	50		L5	200	L80	5	20	5	250	50	L100	L5
50	L50	L500	200	10	1000	P*	L10	50	L50	L1	50	200	5000	200	200	50
100	50	L300	L2	200	50		L5	L1	L80	L1	20	5	50	50	L10	L5
50	L50	L500	200	10	1000	*	L10	50	L50	L1	50	200	5000	200	200	50
100	L50	L1600	2	10	50		L5	100	L250	2	20	10	250	100	L100	L5
20	50	L800	200	5	3000	P*	L10	100	L130	L1	50	50	4x10 ⁴	200	200	50
100	50	L1600	2	5	50		L5	1	L250	L1	20	10	25	100	L100	L5
20	100	L500	200	10	1800	P*	L10	50	L80	L1	50	100	2500	500	500	50
100	L50	L500	L1	10	65		L10	L1	L50	L1	L20	2	2.5	20	L100	L5
100	50	L300	200	5	1800	P*	L10	100	L130	L1	50	100	15000	200	200	50
100	L50	L300	2	10	50		L5	5	L50	L1	20	10	250	50	L100	L5
20	L50	L1200	100	1	700	*	L10	100	L200	L1	20	50	4x10 ⁴	50	100	L10
100	L50		L2	10	50		L5	2		1	50	5	150	20	L100	L5
20	L200	L1200	500	50	1400	*	L10	50	L200	L1	50	200	4x10 ⁴	200	500	20
100	L50	L1000	20	10	50		L20	5	L100	L1	10	5	250	20	L100	L5
0	L50	L200	1000	10	1000		L20	200	L800	L2	200	100	5000	L40	1000	200
0	L50	L300	130	20	61000		L20	10	L50	L1	100	200	50	80	1000*	*

P-7 HW-25834
REMARKS

6	Sb	Si	Sn	Sr	V	Zn	Ti	F
50	L100	5	L1	L8	L100	L50	L200	
5	L100	10	L1	L8	L100	L50	L200	
50	L100	5	L1	L8	L100	L50	L200	
5	L100	10	L1	L8	L100	L50	L200	
50	L100	5	L1	L8	L100	L50	L200	
5	L100	5	L1	L8	L100	L50	L200	
50	L100	5	L1	L8	L100	L50	L200	
5	L100	5	L1	L25	L100	L50	L640	
50	P*	5	L1*	L13	L100	L100	L300	
5	L100	5	L1	L25	L100	L50	L640	
50	P*	5	L1*	L8	L100	L100	L200	
5	L100	5	L1	L13	L200	L100	L300	
50	P*	5	L1*	L13	L100	L100	L300	
5	L100	5	L1	L8	L100	L50	L200	
10	P*	5	L1	L20	L100	L100	L500	
5	L100	5	L1		L100	L50		
20	L100	5	L1	L20	L100	L100	L500	
5	L100	5	L2	L25	L100	L50	L640	
20	L200	20	L2	L8	L100	L100	L200	
*	*	50	L5	L5	L100	L50		

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TABLE III

[illegible]

BATCH NUMBER	SURVEY MEASUREMENT	X-F V NUMBER	Y-RUN NUMBER	REDUCTION YIELD	C/VILL RS		SAMPLE CODE	Ag	Al	B	Ba	Be	L
					Σ	Mg							
2-C-126	2						A.T.	1	L25	L1	10	1005	L
"	"	12-3-111					DC-1	L1	L20	20	100	L0.08	
			12-4-6	99.5%	Not Available								
2-C-127	5						A.T.	1	L20	L1	20	L0.2	
"	"	12-4-1					DC-1	L1	L20	10	L80	L0.05	
			12-4-7	99.0%	Not Available								
2-C-150	3						A.T.	1	L20	L1	2	L0.05	
"	"	12-4-17					DC-1	L1	L20	5	L50	L0.05	
			12-4-22	101.9%	Not Available								
2-C-131	3						A.T.	G1000	L20	L1	20	L0.08	
		12-4-18					DC-1	L1	L20	2	L80	L0.05	
			12-4-17	98.0%	Not Available								
2-C-153	3	12-4-37					A.T.	2	L20	2	10	L0.1	
2-C-154	"	12-4-38					No DC-1						
			12-4-25	98.6%	0.78	0.68	B-1		L20	1.5		L0.05	
2-C-182	4						A.T.	10	L20	1	20	L0.1	
"	"	12-4-65					No DC-1						
2-C-183	5	12-4-66					A.T.	L1	20	L1	L5	L0.08	
			12-4-40	93.9%	0.76	0.63	B-1		L20	0.6		L0.05	
2-C-196	4						A.T.						
		12-4-78					No DC-1						
			12-4-45	99.4%	0.74	0.63	B-1		L20	0.1		L0.15	

SPECTRO CHEMICAL ANALYSIS

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REMARKS

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TABLE IV

(From Spectro-Chemical Analyses Reports)

NUMERICAL VALUES - PARTS PER MILLION PARTS PLUTONIUM

* Interference, results questionable.

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RM LINE METAL IMPURITIES
(From Spectro-Chemical Analyses Reports)

41 RMX-B-1 Analyses

<u>Impurity</u>	<u>Max.</u>	<u>Ave.</u>	<u>Min.</u>
Ag	L1	L1	L1
Al	L50	L19	L1
As	L100	L48	L1
B	1.9	0.7	L0.1
Ba	L100	39	L5
Be	L0.1	L0.06	L0.03
Bi	L5	L1.8	L1
Ca	500	51.3	8
Cd	L80	50	L30
Ce	L800	391	L200
Cr	100	15	L1
Cu	100	18	1
Fe	325	156	L50
In	L20	L14.2	L10
K	L80	10	L1
La	200	48	L8
Li	L5	L1.2	L1
Mg	500	227	100
Mn	500	97	10
Na	80	13	L5
Ni*	500	183	20
P	200	113	L100
Pb	20	10	L5
Sb	L100	L100	L100
Si	10	6	L5
Sn	20	9	L1
Sr	L13	7	L5
V	L100	L100	L100
Zn	L100	L60.4	L50
Tl	L320	L181	L130

* Does not include RMX-12-4-2 which had 2000 ppm Ni due to processing in an inconel boat.