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LA - 406

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## (SUMMARY OF RESULTS)

## BUILDING D PLUTONIUM PURIFICATION

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By REPORT LIBRARY S. M. Martin, 2/6/75**PUBLICLY RELEASABLE**Per B. Pollock, FSS-16 Date: 3-22-96By M. Bellinger, CIC-14 Date: 5-2-96**VERIFIED UNCLASSIFIED**Per ZMP 6-11-79By M. Bellinger 5-2-96

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ABSTRACT

LA - 406 can be separated into two independent sections; 1) the data from and results of all experimental purification runs on scales ranging from 5 milligrams to 8 grams; 2) the data from and results of all experimental and production purification runs on the 160-gram scale. In each of these sections, an attempt has been made to present data which provide a complete picture of the purity of a sample of plutonium from the time of its receipt at this site, through its purification and finally its reduction to the metal.

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(SUMMARY OF RESULTS)BUILDING D PLUTONIUM PURIFICATIONTABLE I

Summary of all Experimental and Production  
Purification Runs, up to and including  
Those on the 8-gram Scale.

## Notes

## on the Headings

1. All purification runs up to, but not including 200-P were performed by the Recovery phase. From 200-P, all purification runs were performed by the Purification phase.

2. Lot numbers were assigned at this site. (Run numbers and lot numbers were assigned consecutively, to indicate the order in which material was received; i.e., the combination of run numbers and lot numbers forms a series of consecutive numbers).

The numbers and letters in parenthesis are designations assigned at Clinton; the number denotes the Clinton batch, and the letter denotes the lot which was taken from the batch indicated.

3. The notations have the following meanings:

O Oxalate precipitation; Reduction to Pu<sup>III</sup> with KI, followed by precipitation of  $\text{Pu}_2(\text{C}_2\text{O}_4)_3$  using  $\text{H}_2\text{C}_2\text{O}_4$  (in solution or as a solid), followed by two  $\text{H}_2\text{O}$  washes of the precipitate.

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O<sub>2</sub> Oxalate precipitation: Reduction to Pu<sup>III</sup> with 5.5M HI, followed by precipitation of Pu<sub>2</sub>(C<sub>2</sub>O<sub>4</sub>)<sub>3</sub> using H<sub>2</sub>C<sub>2</sub>O<sub>4</sub> (in solution or as a solid), followed by two washes of the precipitate with a 0.1M HNO<sub>3</sub> -- 0.1M HCl solution, and one H<sub>2</sub>O wash.

A Acetate precipitation: Oxidation to Pu<sup>VI</sup> with NaBrO<sub>3</sub> and HNO<sub>3</sub>, followed by precipitation of NaPuO<sub>2</sub>Ac<sub>3</sub> using a NaAc -- NaNO<sub>3</sub> solution, followed by two washes of the precipitate with a buffered (pH ≈ 5) NaNO<sub>3</sub> -- NaAc -- HAc solution.

E Ether extraction: "A" (above), or just oxidation to Pu<sup>VI</sup> with NaBrO<sub>3</sub> and HNO<sub>3</sub>, followed by an extraction into ethyl ether using NH<sub>4</sub>NO<sub>3</sub> as a salting out agent in a 0.5 -- 1.5M HNO<sub>3</sub> solution.

C Ether extraction: Oxidation to Pu<sup>VI</sup> with NaBrO<sub>3</sub> and HNO<sub>3</sub>, followed by an extraction into ethyl ether using Ca(NO<sub>3</sub>)<sub>2</sub> as a salting out agent in dilute HNO<sub>3</sub> solution.

H Hydroxide precipitation: Reduction to Pu<sup>III</sup> with SO<sub>2</sub>, followed by precipitation of Pu(OH)<sub>3</sub>, followed by three or four H<sub>2</sub>O washes of the precipitate.

Extraction curves referred to in many of the runs will be found in report LA 404. The method used and the results obtained from all research runs are described in detail in LA 404.

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Run Number	Date Started	Source	Method	Remarks - Purpose Other Than Production
5	2-19-44	Lot 400 (4A)	AEE	Purified material was used for assay, purification, and dry conversion research. Analyses made after AEE. Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> oxidation.
7	3-6-44	Lot 6 (7-A) Lot 2 (4-A)	AAEE	Purified material was used for research. Analyses before and after purification. Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> oxidation.
9	3-20-44	Lot 1 Lot 3 (5-A) Lot 4 (5-A.5.C) Lot 7 (Recovery. R-3, and Metal)	AAEE	Research run. Analyses made after AAEE. Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> oxidation.
12	4-6-44	Lot 10 (10) Lot 11 (11)	AAEEH	Production and research run. Analyses made after AAEE.
14	4-11-44	Lot 13 (12-A.B)	AAEEH	Production and research run. Analyses made after AAEE.
16	4-28-44	Lot 15 (13-A.B)	AAEE	Production and research run. Analyses made after AAEE.
18	4-30-44	Lot 17 (Recovery)	AAEE	Production and research run. Analyses made after AAEE.
20	4-30-44	Lot 19 (Recovery)	AAEEH	Production and research run. Analyses made after AAEE.
22	5-6-44	Lot 21 (15-A)	AAEE	Production and research run. Analyses made after AAEE.
24	5-15-44	Lot 23 (Recovery)	AAEE	Production and research run. Analyses made after AAEE.
26	5-16-44	Lot 25 (16-B)	AAEE	Production and research run. Analyses made after AAEE.
28	5-18-44	Lot 27 (Recovery)	AAEE	Production and research run. Analyses made after AAEE.
30	5-19-44	Lot 29 (Recovery)	AAEE	Production and research run. Analyses made after AAEE.
32	5-20-44	Lot 31 (Recovery)	AAEE	Production and research run. Analyses made after AAEE.
34	5-20-44	Lot 33 (17-D) (16-A)	AAEE	Production and research run. Analyses made after AAEE.
39	5-31-44	Lot 5 "6 and 77. Purified plus lots 36 and 38	AAEE	Production and research run. Analyses made after AAEE.
41	6-3-44	Lot 40 (16-A)	AAEE	Production and research run. Analyses made after AAEE.
43	6-6-44	Lot 42 (Recovery)	AAEE	Production and research run. Analyses made after AAEE.
45	6-8-44	Lot 44 (Recovery)	AAEE	Production and research run. Analyses made after AAEE.
49-P <sup>4</sup>	6-10-44	46-R5	AAEE	Production and research run. Analyses made after AAEE.
52-P	6-14-44	50-R. 51-R	AAEE	Production and research run. Analyses made after AAEE.
54-P	6-15-44	57-R	AAEE	Production and research run. Analyses made after AAEE.

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Run Number Started	Date	Source		Remarks - Purpose Other Than Production
56-P	6-16-44	55-R (53-P Returned)	AAER	Production and research run. Analyses made after AAEE.
58-P	6-17-44	57-R	AAER	Production and research run. Analyses made after AAEE.
60-P	6-19-44	59-X <sup>6</sup> (19-B, 20-A)	AAEE	Production and research run. Analyses made after AAEE.
62-P	6-20-44	61-R	AAEE	Production and research run. Analyses made after AAEE.
64-P	6-21-44	63-R	AAEE	Production and research run. Analyses made after AAEE.
66-P	6-27-44	65-R	AAEE	Production and research run. Analyses made after AAEE.
68-P	7-2-44	67-R (66-P with im- purities)	O <sub>2</sub> AAEO <sub>a</sub>	Research run-in micro-apparatus Impurities added: Li, Be, B, Na, Mg, Al, K, Ca, Fe-2000 ppm; La, Th, U-10,000 ppm.
70-P	6-29-44	69-R	AAER	Production and research run. Analyses made after AAEE.
72-P	7-7-44	71-R	O <sub>2</sub> AAEE	Production and research run. Analyses made after AAEE. O <sub>2</sub> done by Recovery, to remove U.
74-P	7-4-44	73-R	AAEE	Production and research run. Analyses made after AAEE.
76-P	7-4-44	75-X (21-A, 22-A)	AAEE	Production and research run. Analyses made after AAEE.
78-P	7-5-44	77-O (70-P, 72-P, 74-P, 76-P)	O <sub>a</sub>	Production and research run. Analyses made after AAEE.
80-P	7-5-44	79-R	AAEEO <sub>a</sub>	Production and research run. Analyses made after AAEE.
82-P	7-6-44	81-R	AAEEO <sub>a</sub>	Production and research run. Analyses made after AAEE.
84-P	7-6-44	83-R (78-P, 80-P, 82-P)	-----	This run was made to prepare 15.538 gm. of Pu as Pu <sub>2</sub> (O <sub>2</sub> D <sub>4</sub> ) <sub>3</sub> .
86-P	7-11-44	85-R	AAEEO <sub>a</sub>	Production and research run. Analyses made after AAEE.
88-P	7-13-44	87-X (17-A)	AAEEO <sub>a</sub>	Production and research run. Analyses made after AAEE.
90-P	7-15-44	89-R	AAEEO <sub>a</sub>	Production and research run. Analyses made after AAEE.
92-P	7-17-44	91-R	AAEEO <sub>a</sub>	Production and research run. Analyses made after AAEE.
94-P	7-27-44	93-X (26-B)	AEO <sub>a</sub>	Production and research run. Analyses made after AAEE.
96-P	7-29-44	95-X	AEO <sub>a</sub>	Production and research run. Analyses made after AAEE.
98-P	7-29-44	97-R	AEO <sub>a</sub>	Production and research run. Analyses made after AAEE.
100-P	8-1-44	99-R	AEO <sub>a</sub>	Production and research run.
102-P	8-3-44	101-R	AEO <sub>a</sub>	Production and research run.
104-P	8-9-44	103-X (27)	AEO <sub>a</sub>	Production and research run. Analyses made after AAEE.
106-P	8-9-44	105-R	AEO <sub>a</sub>	Production and research run. Analyses made after AAEE.
108-P	8-6-44	107-X (27)	O <sub>2</sub> AEO <sub>a</sub>	This run was made in an enclosed apparatus, on a 1-gram. scale.
110-P	8-9-44	109-R	AEO <sub>a</sub>	Production and research run.
112-P	8-9-44	111-R	AEO <sub>a</sub>	Production and research run.
115-P	8-23-44	114-X (26-C)	AEO <sub>a</sub>	Production and research run.

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TABLE I (Cont.)

Run Number <sup>1</sup>	Date Started	Source <sup>2</sup>	Method	Remarks-Purpose Other Than Production
116-P	8-24-44	117-X	O <sub>2</sub> EO <sub>2</sub>	Production and research run.
120-P	8-26-44	119-R	O <sub>2</sub> EO <sub>2</sub>	Production and research run.
200-P	9-12-44	200-X (29-A) 200-R	O <sub>2</sub> AE <sub>2</sub> O <sub>2</sub>	Starting with 200-P, all runs were standardized to the 6-gram scale, until shipments of Hanford material began to arrive.
201-P	9-22-44	201-R	O <sub>2</sub> AE <sub>2</sub> O <sub>2</sub>	-----
202-P	9-26-44	201-X (29-B) 202-X (5-3A)	O <sub>2</sub> AE <sub>2</sub> O <sub>2</sub>	-----
203-P	10-8-44	203-R 204-R	O <sub>2</sub> AE <sub>2</sub> O <sub>2</sub>	Oxalate wash was added to the NaPuO <sub>2</sub> Ac <sub>2</sub> precipitate by mistake. Mixture was re-oxidized, and the acetate precipitation repeated.
204-P	10-6-44	203-R	O <sub>2</sub> AE <sub>2</sub> O <sub>2</sub>	-----
205-P	10-10-44	207-X (31-A, 32-A, 37-A, 5-7A)	O <sub>2</sub> AE <sub>2</sub> O <sub>2</sub>	Ra-La was added at the beginning of the run, and the stepwise removal of La determined by means of its $\gamma$ -activity. Acetate precipitation effected the most satisfactory separation in this test.
206-P	10-15-44	205-R 203-X (31-A, 32-A, 33-A, 5-7A, 3-8A)	O <sub>2</sub> AE <sub>2</sub> O <sub>2</sub>	The starting material was analyzed, then the following impurities were added: Ba, Hg-80 ppm.; Mg, Ca-1000 ppm.; Al, Cr, Mn, Tl-2000 ppm. each; Co, Ni, Cd, Zr, Th-6000 ppm. each; Fe, Zn, Cs, Pb-10,000 ppm. each; La-65,000 ppm., 500 ppm. of which was Ra-La. Satisfactory purification was achieved as indicated by analyses after O <sub>2</sub> , O <sub>2</sub> A, and O <sub>2</sub> AE.
207-P	10-17-44	205-R 206-R	EO <sub>2</sub>	Impurities as for 206-P except Ra-La. (See above) Analyses made after E. Satisfactory purification was achieved.
208-P	10-18-44	206-R 207-R	O <sub>2</sub> AE <sub>2</sub> O <sub>2</sub>	Analyses made after O <sub>2</sub> AE.
209-P	10-27-44	204-X (34-C) 205-X (34-D) 206-X (26-A) 207-B	O <sub>2</sub> AE <sub>2</sub> O <sub>2</sub>	Analyses made after O <sub>2</sub> AE.
210-P	10-25-44	207-R 208-R	-----	Returned to Recovery--insufficient H <sup>+</sup> for initial reduction.
211-P	10-26-44	209-R	O <sub>2</sub> AE <sub>2</sub> O <sub>2</sub>	Analysis made after O <sub>2</sub> AE.
212-P	11-1-44	207-X (36-A)-H <sup>+</sup>	O <sub>2</sub> AE <sub>2</sub> O <sub>2</sub>	-----
213-P	11-4-44	209-R 210-R	O <sub>2</sub> AE <sub>2</sub> O <sub>2</sub>	-----
214-P	11-7-44	206-X (35-A, 35-B)	O <sub>2</sub> AE <sub>2</sub> O <sub>2</sub>	Source material was exposed to stainless steel for 6 days. Analysis made before O <sub>2</sub> . Zr-Ob( $\gamma$ -active) was added, and $\gamma$ -activity measured after each step. Acetate precipitation effected best separation of Zr-Ob if present in tracer quantities. Over-all satisfactory purification was achieved.
215-P	11-14-44	208-X 210-R 211-R 211-X (40-B)	O <sub>2</sub> AE <sub>2</sub> O <sub>2</sub>	$\gamma$ -active Zr-Ob added plus Zr-Ob carrier. $\gamma$ -activity measured after each step. Oxalate effected best separation of Zr-Ob if present in carrier quantities. Over-all satisfactory purification was achieved.
216-P	11-16-44	211-X 212-X (41-B)	O <sub>2</sub> AE <sub>2</sub> O <sub>2</sub>	-----

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TABLE I (Cont.)

Run Number <sup>1</sup>	Date Started	Source <sup>a</sup>	Method <sup>b</sup>	Remarks-Purpose Other Than Production
217-P	11-17-44	212-R	$\text{EO}_1\text{EO}_2$	First $\text{E}$ was unsatisfactory in removal of $\text{Zr-Ob}$ , present as $\gamma$ -active tracer.
218-P	11-21-44	212-X (41-A) 212-R	$\text{U}_1\text{AO}_2$	-----
219-P	11-24-44	212-R 213-X (42-A)	-----	Returned to Recovery--insufficient $\text{E}^+$ for initial reduction.
220-P	11-25-44	209-X 210-X (49-A. 40-A)	$\text{U}_1\text{AO}_2$	$\gamma$ -activity of source material was followed through the process. Negligible $\gamma$ -activity left after purification.
221-P	11-24-44	209-X 210-X 213-X (42-A)	$\text{O}_1\text{AO}_2$	$\gamma$ -activity of source material was followed through the process. Negligible $\gamma$ -activity left after purification.
222-P	11-27-44	214-R	$\text{EO}_1\text{AO}_2$	Zr, Ob added initially. Analyses made after $\text{E}$ and $\text{EO}_1\text{AE}$ . Satisfactory purification was achieved.
223-P	12-1-44	213-R 214-R 215-R	$\text{O}_1\text{AO}_2$	Analysis made after $\text{O}_1\text{AE}$ . $\text{PuO}_2^{++}$ solution was accurately titrated with $\text{NaO-NaNO}_3$ to the precipitation of $\text{NaPuO}_2\text{AO}_2$ .
224-P	12-5-44	215-R	$\text{O}_1\text{AO}_2$	-----
225-P	12-6-44	215-R 214-X (47)	$\text{O}_1\text{AO}_2$	-----
226-P	12-7-44	214-X (47)	$\text{O}_1\text{AO}_2$	$\text{PuO}_2^{++}$ solution was accurately titrated with $\text{NaO-NaNO}_3$ to the precipitation of $\text{NaPuO}_2\text{AO}_2$ . Ether "splashed".
227-P	12-11-44	216-R	$\text{O}_1\text{AO}_2$	$\text{PuO}_2^{++}$ solution accurately titrated with $\text{NaO-NaNO}_3$ to the precipitation of $\text{NaPuO}_2\text{AO}_2$ . Impurities added before purification: 1000 ppm. $\text{Fe}$ , 10,000 ppm. $\text{Mg}$ , $\text{Ca}$ , $\text{Sr}$ , $\text{Ba}$ , $\text{Al}$ . Analysis made after $\text{O}_1\text{AE}$ . Purification was satisfactory.
228-P	12-13-44	217-R	$\text{EO}_2$	Impurities added as in 227-P. Analysis made after $\text{E}$ . Purification was satisfactory.
229-P	12-16-44	216-R 217-R	$\text{O}_1\text{AO}_2$	Impurities added before purification: 1000 ppm. of $\text{Cd}$ , $\text{Mg}$ , $\text{Rh}$ , $\text{U}$ , $\text{Be}$ ; 5000 ppm. of $\text{Zn}$ . Analysis made after $\text{O}_1\text{AE}$ . Purification was satisfactory.
230-P	12-18-44	216-R 217-R	$\text{EO}_2$	Impurities added as in 229-P. Analysis after $\text{E}$ . Purification was satisfactory.
231-P	1-2-45	219-R	$\text{O}_1\text{AO}_2$	$\text{PuO}_2^{++}$ solution accurately titrated with $\text{NaO-NaNO}_3$ to the precipitation of $\text{NaPuO}_2\text{AO}_2$ . Impurities added before purification: 2000 ppm. of $\text{Mn}$ , $\text{Cat}$ ; 5000 ppm. of $\text{Cr}$ , $\text{Ni}$ ; 20,000 ppm. of $\text{U}$ . Analysis made after $\text{O}_1\text{AE}$ . Purification was satisfactory.
232-P	1-6-45	231-P	$\text{EO}_2$	Added impurities as in 231-P. Analysis made after $\text{E}$ and after $\text{EO}_2$ . Satisfactory purification.
233-P	1-19-45	214-X (47-X) 220-R	$\text{O}_1\text{AO}_2$	-----
234-P	1-20-45	220-R 221-R	$\text{O}_1\text{AO}_2$	$\text{NaPuO}_2\text{AO}_2$ precipitate was not washed. Satisfactory purification.
235-P	1-22-45	220-R 221-X (48-A) 222-X (48-A)	$\text{O}_1\text{AO}_2$	-----
236-P	1-26-45	222-R	$\text{O}_1$	Used $\text{Na}_2\text{CaO}_4$ for $\text{O}_1$ . $\text{rpt}$ . obtained was very poor, would not oxidize. Returned to recovery.

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TABLE I (cont.)

Run Number <sup>1</sup>	Date Started	Source <sup>2</sup>	Method <sup>3</sup>	Remarks-Purpose Other Than Production
237-P	2-2-45	223-R	O <sub>1</sub> AEO <sub>3</sub>	Used K <sub>2</sub> C <sub>2</sub> O <sub>4</sub> for satisfactory O <sub>1</sub> .
238-P	2-6-45	224-R	O <sub>1</sub> AEO <sub>3</sub>	Used K <sub>2</sub> C <sub>2</sub> O <sub>4</sub> for satisfactory O <sub>1</sub> .
239-P	2-12-45	1-W	O <sub>1</sub> AEO <sub>3</sub>	Analysis made after O <sub>1</sub> AE.
240-P	2-13-45	1-W	O <sub>1</sub> AEO <sub>3</sub>	-----
241-P	2-14-45	1-W	O <sub>1</sub> AEO <sub>3</sub>	-----
242-P	2-15-45	1-W	O <sub>1</sub> EO <sub>3</sub> AEO <sub>3</sub>	Impurities added before purification: 1000 ppm. of Cd, Cr, P <sub>b</sub> ; 40,000 ppm. of U. Analysis for U made after O <sub>1</sub> E; analysis for other impurities after E. This procedure was repeated, adding above impurities again after O <sub>1</sub> E. Satisfactory purification.
243-P	2-18-45	1-W	O <sub>1</sub> AEO <sub>3</sub>	Impurities added before purification: 10,000 ppm of Li; 50,000 ppm. of Na and K. Analysis made after O <sub>1</sub> AE. Extraction curve data was obtained. Satisfactory Purification.
244-P	2-20-45	1-W	O <sub>1</sub> AEO <sub>3</sub>	Extraction curve made.
245-P	2-21-45	1-W	O <sub>1</sub> EO <sub>3</sub>	Extraction curve made. Analysis after O <sub>1</sub> E.
246-P	2-22-45	1-W	O <sub>1</sub> EO <sub>3</sub>	Extraction curve made. Plutonium stock solution exposed to sun before purification (See LA - 408 for corrosion data). Analysis after O <sub>1</sub> E. Satisfactory purification.
247-P	2-24-45	225-R	O <sub>1</sub> AEO <sub>3</sub>	Used K <sub>2</sub> C <sub>2</sub> O <sub>4</sub> for satisfactory O <sub>1</sub> .
248-P	2-26-45	224-7-X (49-A,50-A, 51-A, 52-A)	O <sub>1</sub> AEO <sub>3</sub>	All supernatants and washes kept separate for assay of Pu loss.
249-P	2-27-45	224-7-X (49-A,50-A, 51-A, 52-A)	O <sub>1</sub> AEO <sub>3</sub>	Extraction curve made. All supernatants and washes kept separate for assay of Pu loss.
250-P	2-28-45	227-R	O <sub>1</sub> AEO <sub>3</sub>	Extraction curve made. All supernatants and washes kept separate for assay of Pu loss.
251-P	3-1-45	227-R	O <sub>1</sub> AEO <sub>3</sub>	Extraction curve made. All supernatants and washes kept separate for assay of Pu loss.
252-P	3-2-45	226-R 227-R	O <sub>1</sub> AEO <sub>3</sub>	-----
253-P	3-4-45	224-4-7X (49-A,50-A, 51-A, 52-A) 226-R	O <sub>1</sub> AEO <sub>3</sub>	-----
254-P	3-5-45	226-R	O <sub>1</sub> AEO <sub>3</sub>	-----
255-P	3-6-45	228-R	O <sub>1</sub> CO <sub>3</sub>	Extraction curve made. Analysis for Ca after O <sub>1</sub> C.
256-P	3-7-45	228-R	O <sub>1</sub> CO <sub>3</sub>	Extraction curve made. Analysis for Ca after O <sub>1</sub> C.
257-P	3-9-45	224-7-X (49-A,50-A, 51-A, 52-A)	O <sub>1</sub> AEO <sub>3</sub> E	Run made to prepare stock solution of super-pure Clinton plutonium as a Pu (IV)-Pu (VI) mixture in dilute (~1 M.) HNO <sub>3</sub> .
258-P	3-13-45	1-W	O <sub>1</sub> CO <sub>3</sub>	6 mg. Ca <sup>++</sup> added just before O <sub>1</sub> to determine effect on dry conversion and reduction. No apparent effect on dry conversion. Apparently lowered reduction yield at least 2% from average and gave a "messy" reduction.
259-P	3-13-45	229-R	CO <sub>2</sub>	Extraction curve made. NE <sub>4</sub> I used satisfactorily for last reduction.
260-P	3-12-45	229-R	O <sub>1</sub>	Unsatisfactory oxidation. Ret. to recovery.

REF ID: A6500

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TABLE I (Cont.)

Run Number <sup>1</sup>	Date Started	Source <sup>2</sup>	Method <sup>3</sup>	Remarks-Purpose Other Than Production
261-P	3-13-45	229-R	-----	Could not obtain satisfactory O <sub>2</sub> due to presence of peroxide in 229-R. Return to recovery.
262-P	3-25-45	229-R	-----	Could not obtain satisfactory O <sub>2</sub> due to presence of peroxide in 229-R. Return to recovery.
263-P	3-27-45	231-R	CO <sub>2</sub>	Extraction curve made. Extra wash on O <sub>2</sub> still didn't remove I <sub>3</sub> <sup>-</sup> color in ppt. Dry conversion and reduction was satisfactory.
264-P	3-28-45	231-R	CO <sub>2</sub>	Extraction curve made.
265-P	3-29-45	231-R	CO <sub>2</sub>	Extraction curve made. Five H <sub>2</sub> O washes used on O <sub>2</sub> - no peptization occurred.
266-P	3-30-45	4-W	O <sub>2</sub> , AEO <sub>4</sub> A CO <sub>2</sub> , AB <sub>3</sub> O <sub>6</sub>	Preparation of super-pure Hanford Pu (IV)-Pu(VI) mixture in 1M HNO <sub>3</sub> . Analysis before last O <sub>2</sub> .
267-P	4-5-45	4-W	CO <sub>2</sub>	-----
268-P	4-6-45	233-R	CO <sub>2</sub>	Added Na <sub>2</sub> SO <sub>4</sub> instead of Ca(NO <sub>3</sub> ) <sub>2</sub> for extraction. Returned to recovery.
269-P	5-8-45	10-W	O <sub>2</sub>	Test effect of SiO <sub>2</sub> on single oxalate pptn. Determine if O <sub>2</sub> constitutes satisfactory purification if used on production basis. Results indicated necessity for more purification than O <sub>2</sub> .
270-P	5-8-45	10-W	O <sub>2</sub>	Test effect of SiO <sub>2</sub> on single oxalate pptn. purification if used on production basis. Results indicated necessity for more purification than O <sub>2</sub> .
271-P	5-8-45	10-W	O <sub>2</sub>	SiO <sub>2</sub> removed before O <sub>2</sub> . Used as control against 269-P and 270-P.
272-P	5-8-45	10-W	O <sub>2</sub>	SiO <sub>2</sub> removed before O <sub>2</sub> . Used as control against 269-P and 270-P.
273-P <sup>c</sup>	7-1-45	21-W	C	Test purification efficiency of Ca(NO <sub>3</sub> ) <sub>2</sub> extraction. Impurities added before C: Fe, La: 20,000 ppm; Cr, Ni, Sm=5000 ppm; SO <sub>4</sub> <sup>-2</sup> =182,000 ppm; PO <sub>4</sub> <sup>-3</sup> =900 ppm. Analysis after C.
274-P <sup>c</sup>	7-5-45	21-W	C	Same as 273-P (control run).
275-P <sup>c</sup>	7-5-45	21-W	C	Same as 273-P except that SO <sub>4</sub> <sup>-2</sup> =500,000 ppm. and PO <sub>4</sub> <sup>-3</sup> =5000 ppm. before C.
276-P <sup>c</sup>	7-6-45	21-W	O	Same as 275-P (control run)
277-P <sup>c</sup>	7-6-45	21-W	C	Same as 277-P except that SO <sub>4</sub> <sup>-2</sup> =500,000 ppm. and PO <sub>4</sub> <sup>-3</sup> =20,000 ppm. before C.
278-P <sup>c</sup>	7-9-45	21-W	C	Same as 277-P (control run)
279-P <sup>c</sup>	7-9-45	21-W	S	Same as 273-P except that PO <sub>4</sub> <sup>-3</sup> =20,000 ppm. before C.

\* These last seven runs were made, specifically, as a check on the "B" Process for complete purification of Pu. Extraction alone removed all elements present below the amount which the subsequent oxalate pptn. could handle (even though some impurities were far in excess of the amount expected from Hanford). Excess SO<sub>4</sub><sup>-2</sup> had no bad complexing effects on the extraction in addition to being removed nearly completely by the single extraction. The "B" Process (steps "CO<sub>2</sub>") was adopted for use on the 160 g. scale shortly afterwards.

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TABLE I-A

Summary of Purification Runs on the 160-gram Scale

Notes on the Headings

1. Each batch of material which entered the purification process was assigned a number, followed by the letter "P." Lot numbers 500-P to 705-P inclusive were all of the order of 160 grams.
2. Each batch of material received from Recovery (at this site). Clinton, and Hanford was assigned a number, followed by a letter indicating the source: "X" denotes Clinton material; "W" denotes Hanford material, when the batch was of the order of 80 grams; "H" denotes Hanford material, when the batch was of the order of 160 grams; "R" denotes recovered material.

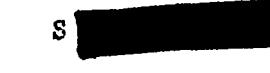
Clinton lots were assigned numbers starting with 200-X, and recovered lots were assigned numbers beginning with 200-R. Hanford lots through the twenty-sixth lot were assigned numbers, consecutively, from 1-W to 26-W. Starting with the twenty-seventh, Hanford lots were of the order of 160 grams and were consequently known as "H" lots.

- 3 For a complete explanation of the processes, see report LA 405.
- 4 The amount purified is the weight of metallic Pu in the  $\text{PuO}_2$  obtained from each "P" lot.

- 5 A loss  $\frac{P}{O + \sum P} \times 100$ , where  $P$  = the weight, in grams, in a given residue,  
 $O$  = the weight, in grams, of the amount purified for the "P" lot involved,  
 $\sum P$  = the sum of all the residue weights, in grams, for that particular "P" lot.

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For the "A" procedures;

P-1 denotes the supernatant and washes from the first  $\text{Pu}_2(\text{C}_2\text{O}_4)_3$  precipitation.

P-2 denotes the supernatant and washes from the  $\text{NaPuO}_2\text{Ac}_3$  precipitation.

P-3 denotes the residue from the ethyl ether extraction.

P-4 denotes the supernatant and washes from the second  $\text{Pu}_2(\text{C}_2\text{O}_4)_3$  precipitation.

P-4-A denotes the supernatant and first wash from the second  $\text{Pu}_2(\text{C}_2\text{O}_4)_3$  precipitation.

P-4-B denotes the second and third washes from the second  $\text{Pu}_2(\text{C}_2\text{O}_4)_3$  precipitation.

P-6 denotes the residue obtained from washing the boiler after the transfer of the second  $\text{Pu}_2(\text{C}_2\text{O}_4)_3$  precipitate.

P-146 denotes the combined residues of P-1, P-4, and P-6.

For the "B" procedures;

P-1 denotes the residue from the ethyl ether extraction.

P-2 denotes the residue obtained from washing the reagent reservoir and extractor after the extraction.

P-3 denotes the supernatant and washes from the  $\text{Pu}_2(\text{C}_2\text{O}_4)_3$  precipitation.

For the "C" procedures;

P-4 denotes the residue and washes from the  $\text{Pu}_2(\text{C}_2\text{O}_4)_3$  precipitation.

P-6 denotes the residue obtained from washing the boiler after the transfer of the  $\text{Pu}_2(\text{C}_2\text{O}_4)_3$  precipitate.

P-146 denotes the combined residues of P-4 and P-6.

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For all procedures;

P-8 denotes the material left in the transfer bottle by "Dry Conversion," and as such, is not a true Purification loss.

P-10 denotes residues obtained through errors and accidents.

6 A =  $\frac{O}{Or EP} \times 100$ , where O = the weight in grams of the amount purified.  
 EP = the sum of all the residue weights, in  
 grams, for the particular "P" lot.

$B = \frac{O}{C.T.} \times 100$ , where O = the weight in grams of the amount purified,  
 C.T. = the weight in grams of the material initially introduced, for the particular "P" lot,  
 as determined by chemical titration assay.

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Lot Number	Date Started	Source <sup>a</sup>	Method <sup>b</sup>	Process Time (Hours)	Apparatus Number	Amount Purified (Grams)	Losses (%) <sup>c</sup>										Yield (%) <sup>d</sup>	
							1	146	2	3	4	4-A	4-B	5	6	10	A	B
500-P	1-2-45	215-X <sup>e</sup> 216-X 217-X 218-X 219-X 220-X 218-R 219-R	A-1	26	3	152.414	.71		1.27	.96		.92	.06	.72			95.4	
501-P	3-13-45	2-W 3-W	A-1	20.5	3	140.655	.40		1.15	2.94		.36	.06			1.12	94.0	
502-P	3-23-45	230-R	A-1	17	5	146.656	.30		1.47	.35		.55	.52				96.6	
503-P	4-3-45	6-W 5-W 232-R	A-1	16	5	146.543	.37		2.62	2.95		.51	.27	.10	.16		96.6	
504-P	4-8-45	6-W 6-W	A-1	16	5	128.420	.49		13.84	1.83		.80	.07	.14			84.0	84.2
505-P	4-11-45	234-R	A-1	16	5	157.513	.18		1.41	.16		1.12	.02	.14			96.9	95.0
506-P	4-16-45	9-W 235-R	A-1	18.5	5	162.646	.44		1.16	2.02							---	---
507-P	4-25-45	236-R 237-R	A-1	18	5	148.148	.71		1.36	.76		1.22	.03	.10	4.16	4.66	87.6	89.1
508-P	4-26-45	239-R 241-R	A-1	17	5	161.149	.24		1.28	.76		.41	.03	.13			97.2	105.3
509-P	4-27-45	236-R 240-R	A-1	14	5	161.207	.28		1.62	.67		.41	.03	.06	.27		96.9	97.6
510-P	4-30-45	11-W 12-W	A-2	15	5	128.282		6.67	2.00	.74							88.4	87.9
511-P	5-6-45	13-W 14-W	A-2	16	5	141.438		.93	1.40	.57							97.7	97.1
512-P	5-7-45	15-W 16-W	A-2	17	5	0.0 <sup>e</sup>		4.49	1.66	1.46							---	---
513-P	5-8-45	17-W 18-W	A-2	18	5	134.617		1.06	10.61	1.21							88.8	88.8 <sup>d</sup>
514-P	5-9-45	19-W 20-W	A-2	16	5	146.523		.89	1.28	.61							96.2	95.4
515-P	5-10-45	22-W 23-W	A-2	16	5	146.247		1.23	2.84	.49							95.3	95.4
516-P	5-11-45	24-W 25-W	A-2	14.25	5	135.360		7.85	1.97	.44							95.1	86.0
517-P	5-13-45	26-W 242-R	A-2	16	5	166.842		.97	1.44	.62							96.3	99.2
518-P	5-14-45	245-R 244-R	A-2	17	5	142.226		.88	2.24	.08							91.6	94.1
519-P	5-15-45	27-W	A-3	30.75	5	156.720		1.37	1.01	.34							97.0	96.5
520-P	5-17-45	28-W	A-4	18.5	5	59.392 <sup>e</sup>		90.35	1.04	.39							37.4	37.1
521-P	5-17-45	29-W	A-4	15	6	143.839		1.43	1.62	1.56							94.5	---
522-P	5-17-45	30-W	A-4	16.5	5	149.735		.92	1.58	.20							96.2	---
523-P	5-18-45	31-W	A-4	15.25	6	134.136		.59	11.45	7.27							82.0	85.6
524-P	5-18-45	32-W	A-4	16.5	5	149.557		.87	1.40	7.65							90.7	95.3
525-P	5-21-45	33-W	A-4	15.75	5	145.236		2.11	1.45	.18							94.3	95.3
526-P	5-21-45	34-W	A-4	16	6	150.690		1.27	1.29	.59							96.2	96.2
527-P	5-22-45	35-W	A-4	16	5	154.406		.89	1.34	.45							96.9	96.0
528-P	5-22-45	36-W	A-4	15 <sup>f</sup>	5	149.990 <sup>f</sup>		1.27	1.40	1.02							94.0	94.6

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REF ID: A6572 PAGE 24 (CONT'D) • • •

Lot Number	Date Started	Source	Method	Process Time (Hours)	Apparatus Number	Amount Purified (Grams)	Losses (%)										Yield (%)	
							1	145	2	3	4	4-A	4-B	5	8	10	A	B
529-P	5-23-45	37-H	A-4	19.3	5	150.095	1.07	1.44	6.74						.60		91.4	97.7
530-P	5-23-45	38-H	A-4	15.75	6	131.809	2.08	1.31	.39						.50		95.8	85.7
531-P	5-23-45	39-H	A-4	17.25	5	150.183	1.81	.97	.47						.32		97.2	96.5
532-P	5-23-45	41-H	A-4	17	6	150.024	1.88	1.11	.68						.23		96.2	97.7
533-P	5-24-45	40-H	A-4	17	5	146.186	.92	1.80	.81						.31		96.9	---f
534-P	5-24-45	246-R	A-4	17	6	106.312	2.17	.99	.30						.55		96.0	---f
535-P	5-27-45	42-H	A-4	21 <sup>6</sup>	6	136.184	3.19	3.26	1.87						.20		91.8	92.8
536-P	5-27-45	43-H	A-4	21.5 <sup>h</sup>	7	136.284	4.48	2.45	2.87						.24	.05	91.3	91.9
537-P	5-28-45	44-H	A-4	16.75	6	111.949	7.02	.21	3.02						1.14		86.8	73.4
538-P	5-28-45	45-H	A-4	18.5	7	97.090	7.00	1.20	.98						.22	1.15	85.6	82.6
539-P	5-29-45	46-H	A-4	17.5	6	145.405	1.03	1.41	.17						.28		97.0	94.2
540-P	5-29-45	47-H	A-4	18.5	7	123.706	2.22	1.58	1.82						.57		93.5	81.7
541-P	5-30-45	48-H	A-4	17.5	6	119.457 <sup>i</sup>	1.98	2.48	.17						3.22		91.0	77.2
542-P	5-30-45	49-H	A-4	17.5 <sup>j</sup>	7	124.973	3.37	1.37	.58						.22		93.5	81.3
543-P	5-30-45	50-H	A-4	16.7	6	143.308	2.02	1.90	.28						.11		95.7	96.1
544-P	5-31-45	51-H	A-4	17	7	146.407	1.18	1.29	.31						.32		96.6	96.6
545-P	5-31-45	52-H	A-4	18.5	7	136.983	2.11	1.48	.42						.96		94.4	92.4
546-P	5-31-45	247-R	A-4	18	5	135.789	1.81	1.31	.28						2.92		93.6	92.2
547-P	6-1-45	53-H	A-4	15.75	5	139.077	1.84	1.14	.53						1.59		94.9	94.6
548-P	6-1-45	248-R	A-4	18.25	7	128.203	17.88	1.61	.28						.63		81.4	90.2
549-P	6-3-45	54-H	A-4	16.5	5	146.285	.92	1.05	.42						1.84		96.0	96.7
550-P	6-5-45	55-H	A-4	18	7	129.024	5.40	1.23	.58						1.09		91.0	83.5
551-P	6-5-45	56-H	A-4	15.5	5	145.878	.17	1.32	.33	2.88					1.16	.27	93.4	95.7
552-P	6-5-45	57-H	A-4	17	7	114.155	.17	2.31	.48	7.07					14.29	.82	74.9	74.6
553-P	6-6-45	58-H	A-4	15.5	5	137.271	.72 <sup>k</sup>	1.25	4.71						.03	.12	93.0	91.4
554-P	6-6-45	59-H	A-4	15.75	7	150.911	1.24 <sup>k</sup>	1.82	.24						3.64	.34	93.3	96.9
555-P	6-6-45	248-R	A-4	19	5	142.880	.99	1.45	1.21						.60		95.7	94.7
556-P	6-7-45	60-H	A-4	20	5	144.270	.94	.83	1.80						.88		95.5	94.8
557-P	6-7-45	61-H	A-4	17	6	136.876	1.71	2.14	.16						.47		95.2	86.9
558-P	6-8-45	62-H	A-4	16.25	5	136.182	2.08	1.43	1.87						2.16		93.3	91.7
559-P	6-8-45	63-H	A-4	16.5	6	153.256	1.89	1.51	.14						.12		96.7	97.2
560-P	6-11-45	64-H	A-4	17.5	5	144.890	1.13	1.85	2.40						.99		93.7	95.1
561-P	6-11-45	65-H	A-4	15.25	6	146.916	.88	1.17	.76						.30		96.9	96.1
562-P	6-12-45	66-H	A-4	14.75	6	137.611	5.04	1.63	.75						1.32		91.2	89.8
563-P	6-12-45	66-H	A-4	17.75	5	142.766	1.42	1.41	2.18						2.42		92.6	92.7
564-P	6-13-45	67-H	A-5	17.5	5	131.899	5.72	1.00	2.50						.62		91.8	88.4
565-P	6-13-45	249-R	A-5	15.5	6	141.950	1.37	1.56	1.55						1.18		94.4	92.4
566-P	6-13-45	250-R	A-7	24.75	5	113.817	8.28	1.17	.77						3.01	1.21	85.2	71.4
567-P	6-13-45	251-R	A-7	19.75	6	156.731	1.40	.86	.82						.15		97.7	94.0
568-P	6-14-45	252-R	A-7	18.25	6	152.174	4.25	1.09	.82						.99		93.2	91.4
569-P	6-14-45	253-R	A-7	17.75	7	126.131	2.56	7.86	.28						1.29		87.4	83.1

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Lot Number	Date Started	Source	Method	Process Time (Hours)	Appears-tus Number	Amount Purified (Grams)	Losses (%)								Yield (%)					
							1	146	2	3	4	4-A	4-B	6	8	10	A	B		
570-P	6-15-45	73-H	C-1	4	5	144.802	.208									1.13	96.9	96.8		
571-P	6-16-45	74-H	C-1	3.75	7	69.596	.2792									1.72	66.7	66.6		
572-P	6-18-45	69-H	A-6	16.25	7	130.171	.540	1.60	.32							6.41	66.0	65.8		
573-P	6-18-45	70-H	A-7	22.75	6	130.579	.536	2.27	1.45							.53	.02	91.9	86.6	
574-P	6-19-45	71-H	A-7	22.5	7	140.092	.13	1.70	.22	.45						.17	3.18	94.1	93.6	
575-P	6-19-45	72-H	A-7	---	5	0.0 <sup>n</sup>												0.0		
576-P	6-19-45	75-H	B-1	10	6	150.647	? <sup>o</sup>												96.9	
577-P	6-21-45	76-H	B-1	11.5	5	146.199	? <sup>o</sup>												96.9	
578-P	6-20-45	254-R	A-7	16	6	63.919	.661	1.39	1.04									63.8	57.2 <sup>P</sup>	
579-P	6-21-45	255-R	A-7	21	7	130.167	.543	1.67	.49							.28	94.4	94.6		
580-P	6-21-45	266-R	A-7	17.25	6	104.851	.440	1.36	5.01							6.16	62.6	71.9		
581-P	6-22-45	77-H	A-6	18.7	7	147.621	1.57	1.51	.24								96.7	98.0		
582-P	6-22-45	78-H	A-6	16	6	145.059	.270	2.05	.97							.50	92.9	95.7		
583-P	6-24-45	79-H	A-6	19	7	145.060	2.03	1.54	.29									96.2	96.6	
584-P	6-24-45	62-H	A-6	22	8	134.072	2.99	1.45	4.45									90.9	66.6 <sup>q</sup>	
585-P	6-25-45	61-H	A-6	19.5	7	134.705	3.29	1.03	.20									95.7	91.4	
586-P	6-25-45	63-H	A-6	25.5	8	139.978	4.47	1.35	2.65									91.6	92.6	
587-P	6-26-45	66-H	A-6	16.25	7	144.851	2.46	.27	.94									95.4	96.7	
588-P	6-26-45	65-H	A-6	20.7	6	91.061	32.71	1.40	.75									64.3	62.6 <sup>r</sup>	
589-P	6-27-45	64-H	A-6	22	6	146.724	.43	1.23	.11							.29	.03	.11	97.6	98.3
590-P	6-27-45	87-H	A-6	18	7	139.516	4.19	1.55	.16									94.1	93.6	
591-P	6-27-45	66-H	A-6	19.75	6	129.483	4.28	1.02	1.04									93.2	66.2	
592-P	6-28-45	69-H	A-6	17.75	7	126.097	2.43	1.29	.33									14.12	62.2	84.0
593-P	6-28-45	90-H	A-6	19	6	142.740	.77	1.24	1.14									96.6	96.2	
594-P	6-29-45	91-H	A-6	25.5	6	142.096	? <sup>o</sup>												94.9	
595-P	6-29-45	60-H	A-6	22.5	7	145.860	.59	1.36	.16	.34						.78		96.6	97.4	
596-P	6-29-45	257-R	A-6	---	6 & 6	0.0												0.0 <sup>t</sup>		
597-P	7-1-45	258-R	A-6	21.75	6	150.680	.24	1.80	2.68	.57						6.12	.01	69.1	86.9	
598-P	7-1-45	92-H	A-6	23.5	7	145.665	.37	1.24	.20	.50						.49		97.2	96.2	
599-P	7-2-45	93-H	A-6	21.25	5	143.052	1.26	1.65	.59							.32		96.5	97.5	
600-P	7-2-45	94-H	A-6	17	6	142.626	.65	2.11	2.32									95.9	96.7	
601-P	7-2-45	95-H	A-6	19	7	145.684	1.73	1.16	.13									97.1	99.4	
602-P	7-3-45	96-H	A-6	16.75	6	142.050	.96	1.23	1.11									96.7	97.4	
603-P	7-3-45	97-H	A-6	19.5	7	139.527	2.71	1.52	.62									95.1	94.6	
604-P	7-4-45	98-H	A-6	17.75	7	143.194	2.16	1.02	.11								.26	96.5	96.3	
605-P	7-4-45	259-R	A-6	17.75	6	149.094	1.00	1.27	1.47								.69	95.6	95.4	
606-P	7-5-45	260-R	A-6	17.75	7	149.792	1.66	1.96	1.35									96.1	96.8	
607-P	7-5-45	262-R	A-6	20	6	139.493	1.25	1.25	1.62									95.7	92.6	
608-P	7-6-45	261-R	A-6	17	7	161.702	.99	1.29	.16									97.6	96.1	
609-P	7-6-45	99-H	A-6	17	6	150.489	1.00	1.57	.52									97.3	109.5 <sup>u</sup>	
606-1-P	7-6-45	257-R-45	A-6	17.25	6	144.320	2.50	1.40	1.17									94.8	91.7	

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TABLE P-A (Cont.)

Lot Number	Date Started	Source	Method	Process Time (Hours)	Apparatus Number	Amount Purified (Grams)	Losses (%)									Yield (%)			
							1	146	2	3	4	4-A	4-B	6	8	10	A	B	
610-P	7-10-45	100-H	A-8	17.5	6	146.057		1.25	1.31	.19						.79	96.8	99.2	
611-P	7-10-45	102-H	A-8	17	7	155.562		.89	1.42	.34							97.4	98.6	
612-P	7-10-45	103-H	A-8	16.5	8	145.115		.89	5.58	.29						.21	95.1	96.8	
613-P	7-11-45	101-H	A-8	17	6	146.222		.87	.96	.20						.26	97.7	97.8	
614-P	7-11-45	104-H	A-8	17	7	147.692		1.09	1.23	.16							97.6	99.3	
615-P	7-11-45	105-H	A-8	17	6	147.077		.95	2.38	.22							96.4	98.3	
616-P	7-12-45	264-R	A-8	16	6	151.413		1.62	1.21	.18							96.6	97.4	
617-P	7-12-45	106-H	A-8	16.5	7	149.615		1.03	.89	.06							96.0	97.9	
618-P	7-12-45	107-H	A-8	16	6	146.563		.92	1.36	.49							97.2	97.8	
619-P	7-13-45	108-H	A-8	16.5	6	153.023		1.35	1.46	.19							97.0	96.4	
620-P	7-13-45	110-H	A-8	15	7	146.590		1.69	1.28	.16							96.2	96.6	
621-P	7-13-45	111-H	A-8	16.5	6	146.657		.87	1.36	.27							97.6	100.4	
622-P	7-16-45	268-R	A-8	16.25	6	155.251		.94	1.35	.10						.07	97.5	97.7	
623-P	7-16-45	109-H	A-8	19.25	7	146.140		3.02	1.22	.10							95.6	96.1	
624-P	7-15-45	112-H	A-8	17	6	142.370		1.57	1.20	.51							96.7	94.8	
625-P	7-16-45	113-H	A-8	17.7	7	145.145		1.60	1.03	.17							96.9	96.1	
626-P	7-16-45	114-H	A-8	15	6	146.370		.72	1.15	1.05							97.1	99.1	
627-P	7-22-45	266-R	A-8	18.75	6	155.271		1.09	1.56	.32							97.1	96.1	
628-P	7-22-45	117-H	A-8	16.5	7	145.615		1.13	1.77	.13							97.0	96.2	
629-P	7-22-45	120-H	A-8	17	6	136.036		1.17	1.26	.25						2.84	93.3	91.4	
630-P	7-23-45	115-H	A-8	23	9	154.629		1.07	1.92	1.65						4.54		91.0	92.9
631-P	7-23-45	116-H	A-8	15	6	147.722		1.35	1.11	.38							97.2	96.2	
632-P	7-23-45	118-H	A-8	15.5	7	136.025		1.19	1.34	.47							96.9	92.6	
633-P	7-30-45	266-R	B-1	22.5	6	162.580	1.07		.02	1.17							97.6	97.9	
634-P	7-30-45	119-H	B-1	11.5	7	151.191	.03		.05	.55							99.4	107.2	
635-P	7-30-45	121-H	B-1	12	6	152.024	.02		.01	2.11							97.6	100.7	
636-P	7-31-45	122-H	B-1	16.5	9	155.114	.16		.02	1.06							98.8	99.9	
637-P	7-31-45	268-H	B-1	10	7	151.644	.02		.02	.50							99.5	100.7	
638-P	7-31-45	124-H	B-1	15.25	6	147.648	.05		.01	.56							99.4	97.0	
639-P	7-31-45	125-H	B-2	14	6	152.094	1.07		.05	.60							98.8	100.0	
640-P	7-31-45	126-H	B-2	11	6	154.702	.04		0 <sup>w</sup>	.46							99.5	102.5	
641-P	7-31-45	129-H	B-2	12	6	147.048	.39		0	1.09							98.4	99.6	
642-P	8-1-45	130-H	B-2	9	7	148.947	.03		.01	.31							99.7	101.5	
643-P	8-1-45	267-R	B-2	10.75	6	138.095	.07		.01	.50							99.4	88.6	
644-P	8-1-45	128-H	B-2	11.5	7	145.986	.02		.04	.51							99.4	100.1	
645-P	8-1-45	127-H	B-2	9.25	6	166.374	.05		0	.49							99.5	111.6	
646-P	8-1-45	268-R	B-2	14.7	6	149.058	.21		0	.59						.24	99.0	98.9	
647-P	8-2-45	131-H	B-2	9	7	146.865	.07		0	.67							99.3	99.5	
648-P	8-2-45	269-R	B-2	14.5	6	148.365	.04		0	.55						.19	99.2	101.2	
649-P	8-2-45	132-H	B-2	11.75	7	149.261	.05		0	.48							99.5	100.0	
650-P	8-2-45	133-H	B-2	15	9	143.041	1.54		.05	.51							97.6	94.3	

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Lot Number	Date Started	Source	Method	Process Time (Hours)	Apparatus Number	Amount Purified (Grams)	Loans (%)										Yield (%)	
							1	148	2	3	4	4-A	4-B	6	8	10	A	B
661-P	6-3-45	134-II	B-2	10.25	6	146.860	.02	0	.57								99.4	100.6
662-P	6-3-45	135-II	B-2	10.75	7	144.505	.02	0	3.20								98.8	98.6
663-P	6-3-45	137-II	B-2	---x	3	0.0											0.0	0.0
664-P	6-3-45	136-II	B-2	10	6	146.705	.03	.08	.62								99.5	100.8
665-P	6-3-45	138-II	B-2	11.75	6	146.823	.00	.01	.78								99.1	99.9
666-P	6-3-45	139-II	B-2	10	7	151.480	.02	0	.48								99.5	100.6
667-P	6-6-45	140-II	B-2	11	6	146.600	2.67		.01	.68							98.5	98.5
668-P	6-6-45	141-II	B-2	11.25	7	147.914	.04	0	1.28								98.7	100.5
669-P	6-6-45	142-II	B-2	14.75	6	121.582	.05		.01	.42							99.4	81.4
670-P	6-6-45	143-II	B-2	11	6	149.307	.05		.01	1.74							98.2	99.4
671-P	6-6-45	144-II	B-2	13.5	7	146.975	.12		.02	1.06							98.6	98.1
672-P	6-6-45	145-II	B-2	10	6	145.962	.05		.01	.62							99.4	99.6
673-P	6-7-45	270-R	B-2	12.25	6	146.536	.10	0	.68								99.2	100.3
674-P	6-7-45	271-R	B-2	15.3	7	154.973	.22	0	.48								99.3	100.0
675-P	6-7-45	146-II	B-2	10.25	6	151.106	.10		.01	.28							99.7	101.2
676-P	6-8-45	146-II	B-2	11	6	149.498	.05	0	.06								99.9	100.2
677-P	6-8-45	147-II	B-2	10.5	6	148.242	.15	0	.94								99.0	100.3
678-P	6-8-45	149-II	B-2	11	7	149.330	.01		.06	.68							98.3	99.1
679-P	6-8-45	150-II	B-2	10.75	6	141.595	.09		.01	.57							99.3	100.5
680-P	6-8-45	151-II	B-2	11.75	6	150.349	.10	0	.44								99.5	100.8
671-P	8-10-45	152-II	B-2	10.75	6	149.986	.04	0	2.09								98.0	102.6
672-P	8-10-45	153-II	B-2	12	7	150.874	.03	0	.53								99.4	100.2
673-P	8-10-45	154-II	B-2	9	6	146.602	.10		.01	.89							99.0	100.1
674-P	8-10-45	155-II	B-2	10	6	149.045	.02	0	1.65								98.4	100.9
675-P	8-10-45	156-II	B-2	9.5	6	145.587	.10		.01	2.28							97.7	102.0
676-P	8-17-45	157-II	B-2	11.25	7	146.770	.02		.02	.63							99.3	99.6
677-P	8-17-45	158-II	B-2	10.25	7	146.042	.04	0	.49								99.5	99.4
678-P	8-17-45	159-II	B-2	9.5	6	133.054	.35	0	.63								99.0	90.7
679-P	8-20-45	160-II	B-2	9.75	6	146.809	.02	0	.56								99.4	102.3
680-P	8-20-45	161-II	B-2	9.75	7	149.246	.05	0	.53								99.4	104.2
681-P	8-20-45	162-II	B-2	10	6	155.306	.45	0	.65								99.0	106.2
682-P	8-20-45	163-II	B-2	10	7	147.713	.02	0	.43								99.6	99.8
683-P	8-20-45	164-II	B-2	10.5	6	150.621	.02	0	.20								99.6	101.9
684-P	8-20-45	165-II	B-2	17.75	6	148.437	.02	0	.66								99.3	97.2
685-P	8-23-45	166-II	B-2	9.5	7	140.649	.02	0	.29								99.7	99.4
686-P	8-23-45	167-II	B-2	9.5	7	147.358	.02	0	.42								99.6	99.6
687-P	8-23-45	168-II	B-2	10.25	6	155.340	.02	0	.30								99.7	92.5
688-P	8-24-45	169-II	B-2	25.5	6	150.537	.04	0	.32								99.7	102.7
689-P	8-24-45	168-II	B-2	9.5	7	150.967	.05	.09	.59								99.3	101.2
690-P	8-24-45	170-II	B-2	6.75	6	147.390	.59	.01	.67								98.5	100.6

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TABLE I-A (Cont.)

Lot Number	Date Started	Source	Method	Process Time (Hours)	Apparatus Number	Amount Purified (Orams)	Losses (%)										Yield (%)	
							1	146	2	3	4	4-A	4-B	6	8	10	A	B
691-P	6-24-45	273-R	B-2	26.5	6	147.530	.40		.06	1.88							6.08	92.4 102.4
692-P	6-24-45	171-H	B-2	6.5	7	152.421	.03		0	.86								99.5 100.3
693-P	6-24-45	172-H	B-2	9.5	6	150.537	.18		0	.31								99.5 100.4
694-P	6-27-45	173-H	B-2	10.25	6	146.506	.03		0	.43								99.5 99.1
695-P	6-27-45	174-H	B-2	9	7	146.732	.01		.01	.74								99.2 97.6
696-P	6-27-45	175-H	B-2	11	6	143.549	.02		0	.56								99.4 98.6
697-P	6-27-45	176-H	B-2	8.5	7	153.182	.01		0	.32								99.7 101.9
698-P	6-27-45	177-H	B-2	6	6	150.456	.15		0	.41								99.5 102.4
699-P	6-27-45	179-H	B-2	8	8	145.440	1.96		.04	.48								97.8 101.9
700-P	6-28-45	178-H	B-2	11.25	7	140.915	5.18		.03	.71								93.6 98.5
701-P	6-28-45	180-H	B-2	20.75	6	146.753	.03		0	.47								99.5 101.0
702-P	6-26-45	181-H	B-2	9.5	6	149.199	.03		.01	.55								99.4 101.4
703-P	6-28-45	272-R	B-2	12.75	7	115.794	.12		.13	.76								99.0 100.2
704-P	6-28-45	162-H	B-2	11	6	145.008	.03		.06	1.33								98.6 98.0
705-P	6-29-45	184-H	B-2	11.25	6	150.211	.02		.01	.35								99.9 100.5

## SUMMARY

Total Amount of Plutonium Purified	29.16 kg.
Total Number of Purification Runs	207
Total Number of "A" Process Purification Runs	150
Total Number of "B" Process Purification Runs (2 Runs Experimental)	75
Total Number of "C" Process Purification Runs (Experimental)	2
Average Process Time for 125 "A" Process Runs	17.6 hrs.
Average Process Time for 72 "B" Process Runs	11.8 hrs.
Average Process Time for "C" Process Runs	3.9 hrs.
Average A Yield for 125 "A" Process Runs	91.1 %
Average A Yield for 73 "B" Process Runs	97.6 %
Average A Yield for Both "A" and "B" Processes	93.4 %
Average B Yield for 121 "A" Process Runs	89.7 %
Average B Yield for 73 "B" Process Runs	98.4 %
Average B Yield for Both "A" and "B" Processes	93.0 %

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TABLE I-A

Notes

on the Data

- a The Clinton material used in 500-P had the following composition:

<u>"Y" Lot No.</u>	<u>"X" Batch No.</u>	<u>"X" Lot No.</u>
215-X	44	44-A
216-X	44	44-B
217-X	45	45-A
218-X	45	45-B
219-X	46	46-A
220-X	47	47-A

No chemical titration assays were performed on any of the preceding batches.

b This lot was given to Recovery as the "6 NO<sub>3</sub>" for experimental use.

c When this lot was delivered to Dry Conversion, it was discovered that the transfer bottle had broken in transit, and the lot was given to Recovery.

d The oxidation was incomplete after three hours.

e Some difficulty was encountered during the oxidation. However, when the last exalate was being precipitated, apparently the mixture was insufficiently stirred, and the H<sub>2</sub>C<sub>2</sub>O<sub>4</sub> solution not thoroughly mixed with the Pu<sup>++</sup> solution; hence the high loss in P-146.

f The chemical titration assay of the material initially introduced into the apparatus was in error, and the value obtained was discarded.

g During a cooling cycle, the coolant accidentally escaped from the system, causing a five hour delay.

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h The ethyl ether extraction was run for four hours, and the last oxalate settled to 630 ml., an abnormally high volume.

During the transfer, the stirrer broke, resulting in an inefficient transfer, and a high loss in P-146.

i During the conversion from  $Pu_2(C_2O_4)_3$  to  $PuO_2$ , the product obtained from 541-P and all succeeding runs was heated to  $600^{\circ}C.$ , instead of  $900^{\circ}C.$ , as heretofore.

j A two-hour delay was incurred for mechanical repairs.

k This residue should be labelled "P-14," a combination of P-1 and P-4.

m This residue should be labelled "P-46."

n A wrong reagent was mistakenly added in place of the acetate precipitating reagent. The run was sent to Recovery.

o No data are available for the residue losses.

p The discrepancy between the two yields can undoubtedly be accounted for by the fact that the residue in P-146 is predominantly the highly insoluble  $Pu_2(C_2O_4)_3$ . As a result, not all of it can be dissolved and the aliquot which is removed for radio-assay is not truly representative. This would tend to make the "A" yield higher than the "B" yield.

q The  $NaPuO_2^{AC}$  precipitate settled to an abnormally high volume of 1000 ml., and the second  $Pu_2(C_2O_4)_3$  precipitate settled to an abnormally high volume of 600 ml.

r Apparently, quite a bit of the first  $Pu_2(C_2O_4)_3$  precipitate was removed along with the supernatant.

s No data are available for the residue losses.

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t This run was started in Apparatus Number 8, but because of the addition of a wrong reagent in one of the steps, it was given to Recovery. On its return from Recovery, the material was put into Apparatus Number 6. However, a wrong reagent was again added and the material once again was sent to Recovery. On its return from Recovery the second time, the material was run as 596-1-P.

u Although the chemical titration value of starting material indicates a yield greater than 100%, it cannot be discarded. With the system in use after 583-P, the slurry which Dry Conversion failed to transfer was left in the transfer bottle, and the bottle was then used for another run. It is probable, therefore, that an appreciable amount of slurry had been left in the transfer bottle used for 609-P--enough so that when it was finally transferred by Dry Conversion, as 609-P, it raised the apparent yield to 109.5%. This explanation may be applied to any succeeding runs which have "B" yields of more than 100%.

v This residue should be labelled "P-14," a combination of P-1 and P-4.

w For all runs which used the B procedures, a P-2 loss of 0% indicates that the loss was less than .005%.

x During the oxidation, the extractor pot cracked and allowed about half of the product to escape into the circulation system. The entire lot was sent to Recovery.

y The Apparatus Number was not recorded.

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~~REF ID: A6512~~  
~~SERIALIZED~~

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TABLE II

## Purity Record of Incoming Clinton Material

Table II is a summary of all impurities, for which we have known analyses, present in Clinton plutonium as received by the purification phase of CM-5. All results are given in parts by weight of the impurity per million parts of plutonium (ppm). All lots omitted from this table have not had any analysis record made on them.

Under the heading "Site Y Lot No" is given the lot number assigned at Los Alamos when the plutonium was received. Under the heading "Site X Lot No." is given the shipment designation made at Clinton. Here the first number indicates the Clinton batch number and the capital letter refers to the Clinton lot number.

~~REF ID: A6512~~  
~~SERIALIZED~~  
~~RECORDED~~

REF ID: A6573  
S1F1E0

## TABLE II. PURITY RECORD OF CLINTON PLUTONIUM

REF ID: A6573  
SECRET

Site Y Lot No.	2	3	4	5	6	10	11	33	40
Site X Lot No.	4-A	5-A	6-A, 6-B 6-C, 6-D and 6-E	7-A	6-A and 6-B	10	11	17-D and 18-A	18-A
Li	-	-	-	-	-	-	-	-	-
Be	-	-	<10	<21	<20	<20	<20	<20	<20
B	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-
Mg	5340	-	<140	+208	<200	100	100	<20	<20
Al	<5340	5710	<140	<2080	<2000	<200	<200	<200	<200
Ca	<5340	-	<1400	4160	1000	200	600	<100	80
V	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	200	200	<400	<200
Mn	-	-	-	-	-	-	-	-	-
Fe	-	-	-	<2080	<2000	<2000	<200	<200	<400
Co	-	-	-	-	-	-	-	-	-
Ni	-	-	-	-	-	-	-	-	-
Cu	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-
As	-	-	-	-	-	-	-	-	-
Sr	-	-	-	-	-	-	-	-	-
Zr	<6680	3880	<1400	4160	250,000	2000	$2 \times 10^5$	<400	$>2 \times 10^5$
Cd	-	-	-	-	-	-	-	-	-
Sn	-	-	-	-	-	-	-	-	-
Sb	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
La	33,400	14,300	28,000	$2 \times 10^5$	15,000	30,000	60,000	2000	60,000
Ce	-	-	<7000	<10,400	<10,000	<10,000	10,000	<2000	<2000
Hg	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Bi	<1670	2860	<1400	31,200	20,000	2000	4000	<200	2000
Th	167,000	5710	<7000	20,600	30,000	<2000	20,000	<1000	-
U	-	-	-	-	-	-	-	-	-

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TABLE II (cont.)

Site Y Lot No.	59-X	75-X	67-X	103-X	200-X	201-X 202-X	203-X	204-X
Site X Lot No.	19-B and 20-B	21-A and 21-B	17-A and 74-A	27-A	29-A	29-B and 3-6A	32A,33A 37a, and 86a	34-0
Li	-	*	-	-	-	-	-	-
Be	<20	<20	<10	<2	<10	<10	<10	<0.4
B	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-
Mg	<20	<20	<20	<20	<20	<20	400	100
Al	<400	<200	<200	<400	<1000	<400	<200	10
Ca	<20	<20	200	40	-	-	-	1000
V	-	-	-	-	-	<1000	<1000	-
Cr	<200	<400	<200	<400	<2000	<400	<200	1800
Mn	-	-	-	-	-	<400	<400	4
Fe	<400	<400	<800	<1000	-	-	-	16,200
Co	-	-	-	-	-	-	-	<5
Ni	-	-	-	-	-	<1000	<1000	<5
Cu	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	<2000	<2000	<5
Aa	-	-	-	-	-	-	-	700
Sr	-	-	-	-	-	-	-	20
Zr	<200	5000	1000	10,000	4000	<1000	1000	-
Cd	-	-	-	-	-	<1000	<400	350
Sn	-	-	-	-	-	<1000	-	100
Sb	-	-	-	-	-	-	-	<5
Ba	-	-	-	-	-	-	-	<5
La	<400	<200	<400	<1000	<2000	<1000	2000	26,000
Ce	<1000	<1000	<400	<2000	<2000	<1000	2000	<5
Hg	-	-	-	-	-	-	-	350
Pb	-	-	-	-	-	-	-	250
Bi	<200	<1000	<400	<400	<4000	<400	<1000	-
Th	<2000	<2000	-	<2000	-	<1000	<2000	-
U	500	500	-	-	-	-	-	<50

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TABLE IX (Cont.)

Site Y Lot No.	205-X	206-X	207-X	208-X	209-X 210-X	211-X	212-X	213-X	214-X
Site X Lot No.	34-D	26-A	36-A	35-A and 35-B	39-A and 40-A	40-B	41-A	42-A	43X, 43B and 43A
Li	-	-	-	-	-	-	-	-	<4
Be	<0.4	<0.4	<0.3	<0.4	<0.4	<0.5	<0.3	-	<0.4
Na	-	-	-	-	-	-	-	-	170
Mg	<4	7	20	13	29	19	16	800	300
Al	4	4	20	30	54	48	65	100	130
Ca	6	40	180	170	290	48	320	-	2200
V	-	-	<1000	<1000	-	<1000	<1000	-	-
Cr	6	<4	30	23	54	48	65	<200	390
Mn	<4	<4	11	10	29	5	130	-	260
Fe	1925	190	470	1050	840	350	28000	-	3644
Co	<40	<20	<20	<17	<18	<24	<16	-	<22
Ni	<40	<20	<20	<17	54	24	32	-	220
Zn	<40	<40	<40	30	<18	24	<18	-	<44
As	<40	<400	<2000	<300	<300	<2000	<2000	-	-
Sr	<4	<4	0.6	0.6	<4	<5	<3	-	<4
Zr	-	-	2000	2000	1000	<1000	<1000	<200	-
Cd	60	<20	<20	<17	<18	<24	<16	-	<9
Sn	16	<20	130	80	90	140	100	-	130
Sb	<40	<400	<1000	<1000	-	-	<1000	-	-
Ba	<40	<4	6	10	7	4	2	-	130
La	800	4	10000	10000	2000	380	2000	8000	1100
Ce	<40	<40	<40	<30	<36	<24	<16	-	<22
Hg	<400	<400	<400	<300	290	<48	<32	-	<44
Pb	<40	<40	30	80	32	<6	260	<200	130
Bi	-	-	<1000	<1000	-	<2000	<2000	-	-
Th	-	-	<2000	<2000	<2000	6000	6000	<2000	-
U	<400	<400	<2000	<2000	<60	<480	<20	-	<440

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[REDACTED] TABLE II (Cont.)

Site Y Lot No.	215-8-X	217-X	219-X	220-X	223-X	224-7-X
Site X Lot No.	44-A,44B and 45-B	45A	46A	42A	P-32	49A,50A 51A,52A
Li	-	-	-	-	-	-
Be	<10	<10	<10	<10	<20	<10
B	-	-	-	-	-	-
Na	-	-	-	-	-	-
Mg	20	60	20	40	<20	<100
Al	<200	<200	<200	<200	<200	<400
Ca	-	-	-	-	20	-
V	<1000	<1000	<1000	<1000	<1000	<1000
Cr	200	<200	<200	<200	<200	<1000
Mn	<20	<20	<20	<20	<100	<200
Fe	-	-	-	-	-	-
Co	<2000	<2000	<2000	<2000	<2000	<1000
Ni	<200	<200	<200	<200	<1000	<1000
Cu	-	-	-	-	-	-
Zn	<2000	<2000	<2000	<2000	<1000	<2000
As	-	<2000	<2000	<2000	-	-
Sr	<200	<200	<200	<200	<1000	-
Zr	<1000	<1000	<1000	<1000	<1000	<1000
Cd	<200	<200	<200	<200	<200	<1000
Sn	<1000	15,000	<1000	<1000	<1000	<1000
Sb	<2000	<2000	<2000	<2000	-	-
Ba	400	1000	400	400	<100	-
La	<1000	<1000	<1000	<1000	<200	10,000
Ce	<2000	<2000	<2000	<2000	<2000	<2000
Hg	<2000	<2000	<2000	<2000	<2000	<2000
Pb	1000	20,000	<200	1000	<1000	<1000
Bi	<1000	<1000	<1000	<1000	<1000	<1000
Th	<2000	<2000	<2000	<2000	<2000	<2000
U	<2000	<2000	<2000	<2000	20,000	<2000

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TABLE III-A

Purity of Incoming Material

All elements except S as  $\text{SO}_4^{2-}$ ,  $\text{Pu}^{\text{VI}}$ , and those listed under "Solids" have been reported as parts per million parts of plutonium. S has been reported as weight per cent of  $\text{SO}_4^{2-}$  to Pu. (For example, 16 grams of  $\text{SO}_4^{2-}$ , as determined volumetrically, in an "H" lot of 160 grams of Pu would be reported as 10%  $\text{SO}_4^{2-}$ .) The amount of  $\text{Pu}^{\text{VI}}$ , determined spectrophotometrically, has been reported as a per cent of the total amount of Pu present in the lot.

Solids have been reported as the total weight, in milligrams, of centrifugable solid matter, dried to constant weight at  $110^{\circ}\text{-}120^{\circ}\text{C}$ . The constituents under solids were determined spectrochemically and have been reported as per cent of the total solids, of the following compounds.

<u>Element</u>	<u>Compound</u>
Si	$\text{SiO}_2 \cdot \frac{1}{2} \text{H}_2\text{O}$
P	$\text{H}_3\text{PO}_4$
Cr	$\text{CrO}_3$
Fe	$\text{Fe(OH)}_3$
Zn	$\text{ZnO}$
Sn	$\text{H}_2\text{Sn}_5\text{O}_{11} \cdot 2\text{H}_2\text{O}$

The marked differences in sensitivities in the reports of an element, as evidenced generally by a comparison of every tenth lot with its neighbors, is caused by different methods of analysis. All elements listed have been

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detected by one or more of the following methods: direct copper spark, cupferren spectrochemical procedure, pyro-electric analysis, colorimetric analysis, and fluorimetric analysis.

For the direct copper spark results, an HCl solution containing 50% of Pu is evaporated on copper electrodes and the spark spectrum is then photographed. The quantity of impurities present in the sample is estimated by a comparison of the intensity and width of the impurity lines with corresponding lines of standard spectra, photographed on the same plate. This method reveals the presence of the following elements, with the limits of sensitivity as indicated.

<u>Element</u>	<u>Limit of Sensitivity (ppm)</u>
Li	200
Be	10
Na	200
Mg	20
Al	200
K	2000
Ca	20
V	1000
Cr	400
Mn	400
Ce	1000
Ni	1000
Zn	2000
Sr	20
Zr	1000
Cd	1000
Sn	1000
Ba	20
La	1000
Ce	2000
Au	200
Hg	2000
Pb	2000
Bi	1000
Th	2000
U	2000

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(In Table II-A, Li, Na, K, and Au, as determined by direct copper spark, have not been reported.)

The cupferron spectrochemical procedure generally yields higher sensitivities for much the same list of elements, because the interfering plutonium is first removed from the sample by extraction of plutonium cupferride with chloroform. The aqueous phase is then evaporated on copper electrodes and a photograph of the spark spectrum is made. The quantitative determination of the impurities is done as in the direct spark analysis, with the following sensitivities.

<u>Element</u>	<u>Limit of Sensitivity (ppm)</u>
Li	2
Be	0.2
Na	2
Mg	2
Al	2
K	20
Ca	10
Cr	2
Mn	2
Co	10
Ni	10
Sr	2
Cd	5
Ba	2
La	2
Ge	20
Pb	10

If any lot had both direct copper spark and cupferron analyses performed on it, the cupferron values have always been reported, except in the case of La, when the direct copper spark value has been used. (This was done because the amount of La present generally was of the order of magnitude of the direct copper spark sensitivity.)

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The third method of analysis, which, with the direct copper spark and cupferren analyses, accounts for about 90% of the elements reported, is the pyro-electric analysis. In this method, the sample is mixed with  $U_3O_8$  and  $GaCl_3$ , placed in a hollow carbon electrode, and an arc is struck. The resulting spectrum is photographed and a quantitative determination of impurities made by a comparison of the impurity lines with corresponding lines of standards, which have been photographed on the same plate. This method yields the following results.

<u>Element</u>	<u>Limit of Sensitivity (ppm)</u>
Si	6
V	300
Cu	30
Ge	6
Ag	<6
In	15
Sa	15
Sb	150
Tl	30

P, Fe, and B are determined by colorimetric analyses. For the P determination, after removal of  $HNO_3$ , the P is complexed with  $(NH_4)_2MoO_4$ , the Pu extracted with n-butyl alcohol, and  $SnCl_2$  added to form "molybdate blue," the intensity of which is compared to those of a set of standards, for a quantitative determination of P. In the Fe analysis, the Fe is reduced with hydroxylamine, the resulting solution buffered, o-phenanthroline added, and the intensity of the resulting color measured with a Beckman spectrophotometer. Any B present in the "H" lot sample is distilled out with  $CH_3OH$  as  $B(OCH_3)_3$  into  $Ca(OH)_2$ , which is then acidified and mixed with curcumin, after which a

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color comparison is carried out. These analyses result in the following sensitivities.

<u>Element</u>	<u>Limit of Sensitivity (ppm)</u>
B	0.5
Fe	20
P	20

The fluorimetric U analysis is performed by dissolving the sample in  $H_3PO_4$ , freezing the solution, and exposing the glass to ultra-violet light, with the resulting fluorescence compared to those of a set of standards. The limit of sensitivity of this analysis is 100 ppm. If any lot had both a direct copper spark and a fluorimetric U analysis performed on it, the result from the latter method has always been reported.

Any S present is reduced to  $S^{2-}$ , acidified, and distilled into  $Cd(NO_3)_2$  as  $H_2S$ . A measured excess of  $I_2$  is added and the solution is then back titrated with standard  $S_2O_3^{2-}$ . This volumetric analysis has a limit of sensitivity of ~1.5 mg.  $SO_4^{2-}$ .

In any lot which had a "solids" analysis performed on it, the centrifuged solids and the supernatant from the sample were analyzed separately. Should a report on any element have appeared in both analyses, the two results have been added together, and the sum has been reported above "Solids" in Table II-A.

An attempt has been made to include with the impurity data some indication of the irradiation received by the pile material from which each "W" or "H" lot was derived. This has been done in the "Irradiation" column, the

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units used being grams of plutonium per metric ton of uranium, as determined by radio-assay. (This is equivalent to parts per million.)

Note" -- For an explanation of lot numbers, see Table I-A, "Notes on the Headings," footnote 2.

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	1-W	2-W	3-W	4-W	5-W	6-W	7-W	8-W	9-W	10-W
Irradiation	26.6	37.6	36.6	44.0	35.0	59.5	62.5	64.5	57.0	-b
Li	<4	<3	<6	<1.5	<1.6	-	-	-	-	<1
Be	50.4	<0.2	<0.2	<0.7	<0.6	<10	<10	<10	<10	<0.1
B	-	-	-	-	-	-	-	-	-	-
Na	100	670	34	230	230	-	-	-	-	28
Mg	100	100	50	120	80	<200	60	<200	<200	12
Al	21	17	10	15	15	<200	<20	<200	<200	18
Si	~1200	35	-	-	-	*	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-
80 <sub>4</sub> <sup>a</sup>	-	-	22.6	21.7	22.8	-	-	-	-	16.6
X	-	3000	<34	750	960	-	-	-	-	~31
Ca	60	670	340	750	157	300	100	300	<200	470
V	<1000	<1000	<1000	<1000	-	<1000	<1000	<1000	<1000	-
Cr	2100	1000	1700	1500	800	3000	2000	3000	1000	600
Mn	210	380	170	150	125	<400	<200	<400	<400	47
Fe	8250	4250	4600	6000	4650	-	-	5500	5000	10330
Co	<21	<17	<17	<8	<8	<1000	<1000	<1000	<1000	<8
Ni	1250	1000	1400	750	600	<200	1000	<200	4000	470
Cu	-	-	-	-	-	-	-	-	-	-
Zn	83	-	<34	<15	<15	-	-	-	-	<31
As	*	-	-	-	-	<2000	<4000	<2000	<2000	-
Br	<4	<3	<4	≤2	<1.5	<200	<20	<200	<200	<2
Zr	<2000	1000	<1000	<1000	-	<1000	<1000	<1000	<1000	-
Ag	-	-	-	-	-	-	-	-	-	-
Cd	86	<17	<17	<8	<8	<1000	<1000	<1000	<1000	<8
In	-	-	-	-	-	-	*	-	-	-
Sn	42	<170	-	75	31	<2000	<1000	<2000	<2000	125
Sb	-	-	-	-	-	-	<200	-	-	-
Bi	<4	<3	<4	<0.2	<0.2	<200	<200	<200	<200	<2
La	125	67	70	6	8	<2000	<1000	<2000	<2000	14
Ge	<42	≤38	≤34	<15	<15	<10000	<4000	<10000	<10000	<18
Hg	-	-	<34	-	<15	<4000	<4000	<4000	<4000	<18
Tl	-	-	-	-	-	-	-	-	-	-
Pb	125	350	65	75	65	<1000	<1000	<1000	<1000	110
Bi	<2000	<2000	<2000	<2000	-	<1000	<1000	<1000	<1000	-
Th	~300	-	-	-	-	<4000	<4000	<4000	<4000	-
U	-	<30	<100	<75	<75	<10000	<4000	<10000	<10000	-
Pu <sup>VI</sup>	-	-	-	-	-	-	-	-	-	-
60 <sub>6</sub> <sup>a</sup>	-	-	-	-	-	-	-	-	-	~600
a. Si	-	-	-	-	-	-	-	-	-	-
b. Sn	-	-	-	-	-	-	-	-	-	-

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	11-W	12-W	13-W	14-W	15-W	16-W	17-W	18-W	19-W	20-W
Irradiation	-	-	-	-	-	-	-	-	-	-
Li	-	-	-	-	-	-	-	-	-	-
Be	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
B	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-
Mg	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
Al	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
Si	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-
SO <sub>4</sub> <sup>2-</sup>	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-
Ca	<200	400	200	300	<200	300	300	400	<200	<200
V	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Cr	4000	4000	3000	4000	3000	1500	4000	3000	4000	4000
Mn	<400	<400	<400	<400	<400	<400	<400	<400	<1000	<1000
Fe	12277	10084	12046	11786	11928	6609	11109	10900	18600	10540
Co	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<2000	<2000
Ni	2000	2000	2000	3000	1000	2000	2000	2000	1000	1500
Cu	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-	-
As	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000
Se	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
Zr	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Ag	-	-	-	-	-	-	-	-	-	-
Cd	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
In	-	-	-	-	-	-	-	-	-	-
Sn	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	2000	2000
Sb	-	-	-	-	-	-	-	-	<1000	<1000
Br	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
La	10000	<2000	6000	6000	<2000	<2000	6000	6000	6000	4000
Ce	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	-	-
Hg	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<10000	<10000
Tl	-	-	-	-	-	-	-	-	-	-
Pb	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<2000	<2000
Bi	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Th	<6000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<10000	<10000
U	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000
Pu <sup>VI</sup>	-	-	-	-	-	-	-	-	-	-
Solids	~210	-	-	-	-	-	-	-	-	-
a. Si	-	-	-	-	-	-	-	-	-	-
b. Sn	-	-	-	-	-	-	-	-	-	-

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[REDACTED] TABLE II-A (Cont.)

	21-W <sup>a</sup>	22-W	23-W	24-W	25-W	26-W	27-H	28-H	29-H	30-H <sup>a</sup>
Irradiation	-	-	-	-	-	-	-	-	-	-
Li	<1	-	-	-	-	-	-	-	-	<1.5
Be	<0.1	≤10	<10	<10	<10	<10	<10	<10	<12	<0.2
B	-	-	-	-	-	-	-	-	-	-
Na	150	-	-	-	-	-	-	-	-	160
Mg	9	600	<200	<200	<200	<200	<200	150	<25	12
Al	15	200	<200	<200	<200	<200	<200	<20	<250	9
Si	-	-	-	-	-	-	-	-	-	300
P	930	-	-	-	1460	1220	930	830	1130	1690
60 <sub>4</sub> <sup>m</sup>	16.2	-	-	-	-	-	-	14	-	26.2
K	190	-	-	-	-	-	-	-	-	800
Ca	56	<200	<200	<200	<200	<200	<200	100	<120	47
V	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1200	<300
Cr	4000	3000	4000	3000	2000	3000	1600	2000	2300	3000
Mn	75	<1000	<1000	<1000	<1000	<1000	<1000	<200	<1200	95
Fe	8060	10185	9830	6985	7260	7700	8815	9500	9450	6950
Co	<9	<2000	<2000	<2000	<2000	<2000	<2000	<1000	<1200	<12
Ni	280	1000	1500	1000	1000	1500	800	2000	<1200	230
Cu	-	-	-	-	-	-	-	-	-	50
Zn	<7	-	-	-	-	-	-	-	-	<47
As	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<4000	<4800	-
Sr	<2	<200	<200	<200	<200	<200	<200	<20	<120	<2
Zr	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1200	-
Ag	-	-	-	-	-	-	-	-	-	-
Cd	<19	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1200	<23
In	-	-	-	-	-	-	-	-	-	<6
Sn	110	2000	2000	1000	1000	2000	1000	<1000	<1200	120
6b	≤1000	<1000	<1000	<1000	≤1000	<1000	<11100	2000	-	<25
Be	<2	<200	<200	<200	<200	<200	<200	<200	<120	<2
La	2000	3000	10000	20000	10000	4000	1000	2000	1800	6000
Ce	<19	-	-	-	-	-	-	<4000	<4800	<23
Hg	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<4000	-	-
Tl	-	-	-	-	-	-	-	-	-	<6
Pb	9	<2000	<2000	<2000	<2000	<2000	<2000	<4000	<1200	12
Bi	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<2400	250
Th	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<4000	<4800	-
U	140	<10000	<10000	<10000	<10000	<10000	<10000	<4000	-	100
Pu <sup>VI</sup>	51.5	-	-	-	-	-	-	-	-	67
60 <sub>4</sub> <sup>m</sup>	213	-	-	-	-	-	-	-	-	1120
a. Si	-	-	-	-	-	-	-	-	-	-
b. Sn	-	-	-	-	-	-	-	-	-	-

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TABLE II-A (Cont.)

	31-H	32-H	33-H	34-H	35-H	36-H	37-H	38-H	39-H	40-H
Irradia-tion	-	-	-	-	-	-	-	148	168	157
Li	-	-	-	-	-	-	-	-	-	-
Be	<13	<10	<10	<12	<12	<13	<14	<10	<10	<10
B	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-
Mg	<25	<20	<20	<25	<25	<25	<30	\$20	<20	\$20
Al	<250	<200	<200	<250	<250	<250	<300	\$200	<200	\$200
Si	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-
SO <sub>4</sub> <sup>2-</sup>	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-
Ca	<130	<100	<100	<125	<125	<130	<150	<100	<100	<100
V	<1300	<1000	<1000	<1250	<1200	<1250	<1500	<1000	<1000	<1000
Cr	2000	1600	2000	1850	1500	1500	1800	4000	4000	2000
Mn	<1300	<1000	<1000	<1250	<1200	<1250	<1500	<1000	<1000	<1000
Fe	6220	6350	15300	5850	13300	4310	6400	10800	4720	12400
Co	<1300	<1000	<1000	<1250	<1200	<1250	<1500	<1000	<1000	<1000
Ni	<1300	<1000	<1000	<1250	<1200	<1250	<1500	<1000	<1000	<1000
Cu	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-	-
As	<5000	<4000	<4000	<5000	<5000	<5000	<6000	<10000	<10000	<10000
Br	<130	<100	<100	<125	<125	<130	<150	<200	<200	<200
Zr	<1300	<1000	<1000	<1250	<1250	<1250	<1500	<1000	<1000	<1000
Ag	-	-	-	-	-	-	-	-	-	-
Cd	<1300	<1000	<1000	<1250	<1250	<1250	<1500	<1000	<1000	<1000
In	-	-	-	-	-	-	-	-	-	-
Sn	<1300	<1000	<1000	<1250	<1250	<1250	<1500	<2000	<2000	<2000
Sb	-	-	-	-	-	-	-	-	-	-
Ba	<130	<100	<100	<125	<125	<130	<1500	<1000	<1000	<1000
La	3700	3000	6000	5000	3800	3800	9000	40000	16000	<2000
Ce	<2500	<2000	<2000	<2500	<2500	<2500	<3000	<4000	<4000	<4000
Hg	-	-	-	-	-	-	-	-	-	-
Tl	-	-	-	-	-	-	-	-	-	-
Pb	<1300	<1000	<1000	<1250	<1250	<1250	<1500	<1000	<1000	<1000
Bi	<2500	<2000	<2000	<2500	<2500	<2500	<3000	<1000	<1000	<1000
Th	<5000	<2000	<4000	<5000	<5000	<5000	<6000	-	<4000	<4000
U	-	-	-	-	-	-	-	-	-	-
Pu <sup>VI</sup>	-	-	48.7	-	-	-	-	-	-	-
Solids	-	-	-	-	-	-	-	-	-	-
a. Si	-	-	-	-	-	-	-	-	-	-
b. Sn	-	-	-	-	-	-	-	-	-	-

## APPROVED FOR PUBLIC RELEASE

	41-H	42-H	43-H	44-H	45-H	46-H	47-H	48-H	49-H	50-H
Irradia-tion	158	154	149	161	149	148	139	138	140	130
Li	<2	-	-	-	-	-	-	-	-	<2
Be	<0.2	<10	<10	<10	<10	<10	<10	<10	<10	<0.2
B	-	-	-	-	-	-	-	-	-	-
Na	200	-	-	-	-	-	-	-	-	380
Mg	13	<20	<20	<20	<20	<20	80	<20	<20	13
Al	16	200	<200	<200	<200	<200	<20	<100	<100	20
Si	250	-	-	-	-	-	-	-	-	200
P	1250	-	-	-	-	-	-	-	-	152
80 <sub>e</sub>	-	-	-	-	-	-	-	-	-	-
K	650	-	-	-	-	-	-	-	-	800
Ca	100	<20	<20	<100	<20	<20	1000	<20	<20	64
V	<300	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<300
Cr	2500	4000	4000	<2000	4000	2000	1800	>2000	<1000	2500
Mn	100	<1000	<1000	<1000	<1000	<1000	-	<1000	<1000	100
Fe	6400	6800	7520	6850	5120	5140	5875	8900	5000	7900
Co	<13	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<13
Ni	500	<1000	<1000	<1000	<1000	1000	2000	<200	<200	500
Cu	125	-	-	-	-	-	-	-	-	80
Zn	<50	-	-	-	-	-	-	-	-	<50
As	-	<4000	<4000	<10000	<4000	<4000	<4000	<4000	<4000	<4000
Sr	<2.5	<100	<100	<200	<100	<100	<20	<100	<100	<2.5
Zr	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	-
Ag	-	-	-	-	-	-	-	-	-	-
Cd	<25	<1000	1600	<1000	1600	1600	<1000	<1000	<1000	<25
In	<8	-	-	-	-	-	-	-	-	<8
Gn	150	<2000	<2000	<2000	<2000	<2000	<1000	<2000	<2000	125
8b	<25	-	-	-	-	-	-	-	-	<25
Ba	<2.5	<200	<200	<1000	<200	<200	<200	<200	<200	<2.5
La	>10000	20000	2000	14000	4000	2000	10000	60000	>10000	>10000
Ce	<25	<4000	<4000	<4000	<4000	<4000	<4000	<2000	<2000	<25
Hg	-	-	-	-	-	-	-	-	-	-
Tl	<8	-	-	-	-	-	-	-	-	<8
Pb	36	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	38
Bi	250	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	500
Th	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000
U	100	-	-	-	-	-	<4000	-	-	100
Pu <sup>VI</sup>	-	-	-	-	-	-	-	-	-	-
solid	-°	-	-	-	-	-	-	-	-	-°
a. Si	-°	-	-	-	-	-	-	-	-	-°
b. Sn	-°	-	-	-	-	-	-	-	-	-°

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	51-H	52-H	53-H	54-H	55-H	56-H	57-H	58-H	59-H	60-H
Irradiation	108	140	180	180	186	184	177	186	183	186
Li	-	-	-	-	-	-	-	-	-	<1.3
Be	<10	<10	<10	<10	<10	<10	<10	<15	<10	<0.1
B	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	150
Mg	<20	<20	<20	<20	<20	<20	<20	<30	<20	6
Al	<100	<100	<100	<100	<100	<100	<100	<300	<200	15
Si	-	-	-	-	-	-	-	-	-	3100
P	-	-	-	-	-	-	-	-	-	1020
$\text{SO}_4^{=}$	-	-	-	-	-	-	-	-	-	21.1
K	-	-	-	-	-	-	-	-	-	500
Ca	20	40	40	40	80	140	200	<30	<20	75
V	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1500	<1000	<300
Cr	2000	2000	2000	2000	2000	4000	2000	3000	<1800	2000
Mn	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1500	<1000	23
Fe	6820	13000	5000	8500	5360	6820	5540	4800	3240	3770
Co	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1500	<1000	<13
Ni	<200	<200	<200	<200	<1000	<200	<200	1500	<1000	<1000
Cu	-	-	-	-	-	-	-	-	-	80
Zn	-	-	-	-	-	-	-	-	-	<50
As	<4000	<4000	<4000	<4000	<4000	<4000	<4000	-	<4000	<4000
Sr	<100	<100	<100	<100	<100	<100	<100	<150	<100	<1.3
Zr	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1500	<1000	-
Ag	-	-	-	-	-	-	-	-	-	-
Cd	<1000	<100	<1000	<1000	<1000	<1000	<1000	<1500	1600	<13
In	-	-	-	-	-	-	-	-	-	<6
Sn	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<3000	<2000	800
Sb	-	-	-	-	-	-	-	-	-	<25
Ba	<200	<200	<200	<200	<200	<200	<200	<300	<200	<13
La	>10000	40000	8000	>10000	>10000	40000	40000	3000	<2000	6000
Ce	<2000	<2000	<2000	<2000	<2000	<2000	<200	<6000	<4000	<25
Hg	-	-	-	-	-	-	-	-	-	<50
Tl	-	-	-	-	-	-	-	-	-	<6
Pb	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1500	<1000	25
Bi	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	250
Th	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<6000	<4000	-
U	-	-	-	-	-	-	-	-	-	100
PuVI	-	-	-	-	-	-	-	-	-	-
801ida	-	-	-	-	-	-	-	-	-	221
a. Si	-	-	-	-	-	-	-	-	-	17
b. Sn	-	-	-	-	-	-	-	-	-	46
c. P	-	-	-	-	-	-	-	-	-	27
d. Fe	-	-	-	-	-	-	-	-	-	10

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TABLE II-A (Cont.)

	61-II	62-II	63-II	64-II	65-II	66-II	67-II	68-II	69-II	70-II
Irradia-tion	195	179	184	179	164	156	184	156	186	187
Li	-	-	-	-	-	-	-	-	-	-
Be	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
B	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-
Mg	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Al	<200	<200	200	<200	<200	<200	<200	<200	<100	<200
Si	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-
SO <sub>4</sub> <sup>=</sup>	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-
Ca	<20	<20	<20	<20	<20	-	-	-	80	-
V	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Cr	2000	1000	4000	2000	2000	4000	2000	1600	8000	4000
Mn	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Fe	4720	6130	9170	5350	5130	4900	5100	4530	7480	5980
Co	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Ni	<1000	2000	<1000	-	3000	8000	2000	2000	<200	<1000
Cu	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-	-
As	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000
Sr	<100	<100	<100	<100	<100	<100	400	∼100	<1000	<100
Zr	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Ag	-	-	-	-	-	-	-	-	-	-
Cd	1000	1000	1000	1000	2100	<200	<2000	<2000	<1000	<2000
In	-	-	-	-	-	-	-	-	-	-
Sn	<2000	<2000	<2000	<2000	<2000	<1000	<1000	<1000	<2000	<1000
sb	-	-	-	-	-	-	-	-	-	-
Da	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
La	60000	20000	<1000	2000	2000	<2000	<2000	<2000	32000	40000
Ce	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<2000	<4000
Hg	-	-	-	-	-	-	-	-	-	-
Tl	-	-	-	-	-	-	-	-	-	-
Pb	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<4000
Bi	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Th	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000
Pu VI	-	-	-	-	-	-	-	-	-	-
Solid	-	-	-	-	-	-	-	-	-	-
a. Si	-	-	-	-	-	-	-	-	-	-
b. Sn	-	-	-	-	-	-	-	-	-	-

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TABLE II-A (Cont.)

	71-H	72-H	73-H	74-H	75-H	76-H	77-H	78-H	79-H	80-H
Irradiation	160	173	172	196	166	177	167	196	203	206
Li	<1	-	<1	<1	<1.2	<1.2	-	-	-	-
Be	<0.1	-	<0.1	<0.1	<0.1	<0.1	<10	<10	<10	<10
B	<1	-	1.4	2.7	1.2	2	-	-	-	-
Na	200	-	170	140	180	140	-	-	-	-
Mg	2.5	-	2	2.5	2.5	2.4	≤20	≤20	≤20	≤20
Al	7	-	11	10	13	12	<20	<20	<20	<200
Si	340	-	-	<250	790	<120	-	-	-	-
P	980	-	1165	1280	1100	1320	1215	1175	1175	940
Se	21.9	-	20.9	17.4	19.6	21.4	-	-	-	-
X	~600	-	~450	190	300	240	-	-	-	-
Ca	28	-	220	50	25	24	≤20	≤20	≤20	-
V	150	-	-	<150	<50	<50	<1000	<1000	<1000	<1000
Cr	2110	-	~1100	~700	~750	~600	1600	1600	1200	1400
Mn	50	-	65	35	38	36	<200	<200	<200	<200
Fe	6190	6240	4980	3810	2720	2380	4330	3350	3150	3100
Co	<12	-	<11	<12	<13	<12	<1000	<1000	<1000	<1000
Ni	~960	-	~1100	~700	360	240	≤200	≤200	≤200	2000
Cu	75	-	-	<50	-	-	-	-	-	-
Zn	25	-	45	47	<25	<24	-	-	-	-
As	-	-	<4000	-	<4000	-	-	<2000	<2000	<2000
Br	<1	-	<1	<1	<1.2	<1.2	<20	~200	<200	≤20
Zr	-	-	-	-	-	-	<1000	<1000	<1000	<200
Ag	-	-	-	-	-	-	-	-	-	-
Cd	<25	-	<22	<24	<25	<24	<1000	<1000	<1000	<1000
In	<16	-	-	<15	<10	<10	-	-	-	-
Sn	1120	-	110	395	2015	95	≤1000	≤1000	≤1000	≤400
Sb	<100	-	-	<100	<60	<60	<2000	<2000	<2000	-
Ba	<1	-	<1	<1	<1.2	<1.2	<20	<20	<100	<1000
La	~12000	-	14000	~4200	4000	3000	8000	10000	8200	6000
Ce	<25	-	<22	<24	<25	<24	<2000	<1950	<2000	<2000
Hg	<50	-	<45	<50	<50	<48	<4000	<4000	<4000	<4000
Tl	<150	-	-	100	<100	<100	-	-	-	-
Pb	60	-	65	35	75	60	<200	<200	<200	<200
Bi	-	-	<1000	-	<1000	<1000	<1000	<1000	<1000	<1000
Th	-	-	-	-	-	-	<2000	-	<4000	<4000
U	~100	-	~100	~100	~100	~100	<2000	-	<4000	<4000
Pu <sup>VI</sup>	34	-	-	-	-	45	-	-	-	-
solida	333	78	181	123	600	374	-	-	-	-
a. Si	10	-	-	20	12	-	-	-	-	-
b. Sn	60	-	-	66	66	66	-	-	-	-
c. Cr	10	-	-	-	-	-	-	-	-	-
d. Fe	20	-	-	22	28	28	-	-	-	-

## APPROVED FOR PUBLIC RELEASE

	61-H	62-H	63-H	64-H	65-H	66-H	67-H	68-H	69-H	70-H
Irradiation	210	213	204	203	200	193	194	191	198	206
Li	-	-	-	-	-	-	-	-	-	<1.8
Be	<10	<10	<10	<10	<10	<10	<10	<10	<10	<0.1
B	-	-	-	-	-	-	-	-	-	<1
Mg	-	-	-	-	-	-	-	-	-	10
Al	<20	<20	<20	<20	<20	<20	<20	<20	<20	5
Si	-	-	-	-	-	-	-	-	-	400
P	1275	1285	1147	1402	1464	1500	1228	1305	1150	1237
60 <sub>Si</sub>	-	-	-	-	-	-	-	-	-	25
K	-	-	-	-	-	-	-	-	-	250
Ca	<20	<20	<20	<20	<20	<20	<20	<20	<20	25
V	<1000	<900	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<100
Cr	1200	1200	1200	1200	1600	1600	1200	1400	1400	1200
Mn	<200	<200	<200	<200	<200	<200	<200	<200	<200	18
Fe	2710	3160	2560	3160	2870	3240	2910	4160	4320	3820
Co	<1000	<900	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<15
Ni	<200	<200	<200	2000	<200	<200	-	3000	3000	2000
Cu	-	-	-	-	-	-	-	-	-	30
Zn	-	-	-	-	-	-	-	-	-	50
As	<2000	<1900	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000
Br	<200	<200	<200	<20	<200	<200	<20	<20	<20	<1
Zr	<1000	<900	<1000	<200	<1000	<1000	<200	<200	<200	<200
Ag	-	-	-	-	-	-	-	-	-	-
Ca	<1000	<900	<1000	<1000	<1000	1000	<1000	<1000	<1000	<13
In	-	-	-	-	-	-	-	-	-	<6
S <sub>2</sub>	<1000	<960	<1000	<400	<1000	<1000	<400	<400	<400	810
S <sub>b</sub>	<2000	<2000	<2000	-	<2000	<2000	-	-	-	<25
Be	<20	<20	<20	<1000	<20	<20	<1000	<1000	<1000	<13
La	5000	5000	6000	10000	10000	10000	4000	4000	2000	2000
Ge	<2000	<1900	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<25
Hg	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<50
Tl	-	-	-	-	-	-	-	-	-	<6
Pb	<200	<200	<200	<200	<200	<200	<200	<200	<200	13
Bi	<1000	<900	<1000	<1000	<1000	<1000	<1000	<1000	<1000	250
Th	-	<3600	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000
U	-	<3600	<4000	<4000	<4000	<4000	<4000	<4000	<4000	100
Pa <sub>VI</sub>	-	-	-	-	-	-	-	-	-	-
solid	-	-	-	-	-	-	-	-	-	242
a. Si	-	-	-	-	-	-	-	-	-	28
b. Sn	-	-	-	-	-	-	-	-	-	48
c. Fe	-	-	-	-	-	-	-	-	-	24

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[REDACTED]

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	91-H	92-H	93-H	94-H	95-H	96-H	97-H	98-H	99-H	100-H
Irradiation	169	204	485	82	168	185	181	181	- <sup>d</sup>	196
Li	-	-	<1.8	-	-	-	1.3	<1.8	-	<1.8
Be	<10	<10	<0.1	<10	<10	<10	<0.1	<0.1	<10	<0.1
B	-	-	<1	-	-	-	<1	<1	-	1.5
Na	-	-	125	-	-	-	175	380	-	210
Mg	20	<20	2.6	<20	<20	<20	5	8	<20	26
Al	<200	<100	5	<200	<200	<200	5	5	<200	<1
Si	-	<100	490	-	-	-	230	450	-	980
P	1091	1345	1422	1094	1225	1295	1054	1133	-	1042
60 <sub>Si</sub>	-	-	16.8	-	-	-	18.2	22.5	-	14.3
K	-	-	200	-	-	-	200	200	-	50
Ca	<20	-	13	<100	<100	<100	13	50	<100	130
V	<1000	<1000	<300	<1000	<1000	<1000	<300	<300	<1000	<300
Cr	600	2000	1500	1200	1200	1200	700	2000	<2000	770
Mn	<200	<1000	15	<1000	<1000	<1000	25	25	<1000	77
Fe	3500	3370	3420	2890	3780	4040	4955	6160	5050	3495
Co	<1000	<1000	<13	<1000	<1000	<1000	<13	<13	<1000	<13
Ni	800	<200	~1000	<1000	<1000	<1000	~1000	~1000	<1000	~650
Cu	-	-	20	-	-	-	80	50	-	40
Zn	-	-	<50	-	-	-	<50	<50	-	260
As	<2000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<10000	<10000
Sr	<20	<100	<1	<100	<100	<100	<1	<1	<200	<1.3
Zr	<200	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Ag	-	-	-	-	-	-	-	-	-	-
Cd	<1000	<1000	<13	<1000	<1000	<1000	<13	<13	<1000	77
In	-	-	<6	-	-	-	<6	<6	-	<6
Sn	<400	<2000	1000	<1000	<1000	<1000	180	185	<2000	940
St	-	-	<25	-	-	-	<25	<25	-	<25
Ba	<1000	<200	<13	<100	<100	<100	<13	<13	<1000	<3
La	1000	3000	~2500	1400	<3000	4000	2000	~2500	<2000	~770
Ce	<2000	<2000	<25	<2000	<200	<2000	<25	<25	<4000	<50
Hg	<4000	-	<50	-	-	-	<50	<50	-	<50
Tl	-	-	<6	-	-	-	<6	<6	-	<6
Pb	<200	<1000	18	<1000	<1000	<1000	25	25	<1000	<28
Bi	<1000	<1000	250	<2000	<2000	<2000	500	500	<1000	250
Th	<4000	<4000	-	<4000	<4000	<4000	<4000	<4000	<4000	-
U	<4000	-	100	-	-	-	100	100	-	100
PuVI	-	-	-	-	-	-	-	-	-	-
solid	-	-	500	-	-	-	51.3	137	-	542
a. Si	-	-	25	-	-	-	56	81	-	62
b. Sn	-	-	36	-	-	-	30	9	-	26
c. P	-	-	26	-	-	-	-	7	-	9
d. Fe	-	-	9	-	-	-	14	3	-	3

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TABLE II-A (Cont.)

	101-H	102-H	103-H	104-H	105-H	106-H	107-H	108-H	109-H	110-H
Irradiation	212	186	213	219	196	201	215	176	209	193
Li	-	-	-	-	-	-	-	-	-	<1.3
Be	<10	<10	<10	<10	<10	<10	<10	<10	<10	<0.1
B	-	-	-	-	-	-	-	-	-	<1
Na	-	*	-	-	-	-	-	-	-	150
Mg	≤20	≤20	≤20	≤20	≤20	≤20	≤20	<20	<20	15
Al	≤200	≤200	≤200	<200	≤200	≤200	≤200	<100	<100	<5
Si	-	-	-	-	-	-	-	-	-	1650
P	-	-	-	-	-	-	-	-	-	1345
SO <sub>4</sub> <sup>2-</sup>	-	-	-	-	-	-	-	-	-	21.4
K	-	-	-	-	-	-	-	-	-	370
Ca	<100	<100	<100	<100	<100	<100	<100	<20	<20	100
V	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<100
Cr	≤2000	≤2000	<1000	1000	<1000	1000	1000	2000	2000	700
Mn	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	60
Fe	2650	2870	2580	3170	2970	3020	3480	3200	2630	3715
Co	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<12
Ni	<1000	<1000	<1000	<1000	<1000	<1000	<1000	≤1000	≤1000	500
Cu	-	-	-	-	-	-	-	-	-	30
Zn	-	-	-	-	-	-	-	-	-	2600
As	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<4000	<4000	<4000
Br	<200	<200	<200	<200	<200	<200	<200	<100	<100	<1.2
Zr	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	-
Ag	-	-	-	-	-	-	-	-	-	-
Cd	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<25
In	-	-	-	-	-	-	-	-	-	<8
Sn	<2000	<2000	<2000	<2000	<2000	<2000	6000	<1000	<1000	850
Sb	-	-	-	-	-	-	-	-	-	<25
Ba	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<200	<200	<3
La	<2000	<2000	<2000	<2000	<2000	<2000	<2000	≤2000	≤2000	6000
Ce	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<60
Hg	-	-	-	-	-	-	-	-	-	<50
Tl	-	-	-	-	-	-	-	-	-	<8
Pb	<1000	<1000	<1000	<1000	<1800	<1000	<1000	<1000	<1000	<25
Bi	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	250
Th	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	-
U	-	-	-	-	-	-	-	-	-	<50
PuVI	-	-	-	-	-	-	-	-	-	-
solida	-	-	-	-	-	-	-	-	-	741
a. Si	-	-	•	•	•	•	•	-	-	77
b. Sn	-	-	•	•	•	•	•	-	-	17
c. Fe	-	-	-	-	-	-	-	-	-	6

TABLE II-A (Cont.)

	111-H	112-H	113-H	114-H	115-H	116-H	117-H	118-H	119-H	120-H
Irradia-tion	203	191	200	204	208	191	210	210	210	210
Li	-	-	-	-	-	-	-	-	-	<1.3
Be	<10	<10	<10	<10	<10	<10	<10	<10	<10	<0.1
B	-	-	-	-	-	-	-	-	-	0.5
Na	-	-	-	-	-	-	-	-	-	260
Mg	<20	<20	<20	<20	<20	<20	<20	<20	<20	28
Al	<100	<100	<100	<100	<100	<100	<100	<100	<100	5
Si	-	-	-	-	-	-	-	-	-	490
P	-	-	-	-	-	-	-	-	-	1870
SO <sub>4</sub> <sup>2-</sup>	-	-	-	-	-	-	-	-	-	23.2
K	-	-	-	-	-	-	-	-	-	53
Ca	200	200	200	100	180	≤20	≤20	20	20	60
V	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<300
Cr	1000	1000	2000	1000	1600	1600	1000	1600	1600	400
Mn	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	80
Fe	2800	2750	3800	4030	3700	3290	3090	5520	3640	2569
Co	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<13
Ni	≤1000	≤1000	4000	2000	≤1000	≤1000	≤1000	1600	≤1000	320
Cu	-	-	-	-	-	-	-	-	-	30
Zn	-	-	-	-	-	-	-	-	-	553
Ag	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	-
Br	<100	<100	<100	<100	<100	<100	<100	<100	<100	<1.3
Zr	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	-
As	-	-	-	-	-	-	-	-	-	-
Cd	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	28
In	-	-	-	-	-	-	-	-	-	<8
Sn	~1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	174
Sb	-	-	-	-	-	-	-	-	-	<28
Ba	<200	<200	<200	<200	<200	<200	<200	<200	<200	<3
La	<2000	<2000	4000	2000	4000	<2000	1000	<2000	<2000	~2100
Ce	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<28
Hg	-	-	-	-	-	-	-	-	-	130
Tl	-	-	-	-	-	-	-	-	-	<6
Pb	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<28
Rb	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	250
Th	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	-
U	-	-	-	-	-	-	-	-	-	≤50
solid	-	-	-	-	-	-	-	-	-	137
a. Si	-	-	-	-	-	-	-	-	-	94
b. Sn	-	-	-	-	-	-	-	-	-	2
c. Fe	-	-	-	-	-	-	-	-	-	2

## APPROVED FOR PUBLIC RELEASE

	121-H	122-H	123-H	124-H	125-H	126-H	127-H	128-H	129-H	130-H
Irradiation	212	207	212	210	207	211	213	214	220	217
Li	-	-	-	-	-	-	-	-	-	<2.5
Be	<10	<10	<10	<10	<10	<10	<10	<10	<10	<0.1
B	-	-	-	-	-	-	-	-	-	<0.5
Na	-	-	-	-	-	-	-	-	-	160
Mg	40000	<20	<20	<20	<20	<20	<20	<20	<20	60
Al	<200	<200	<200	<200	<200	<200	<200	<200	<200	16
Si	-	-	-	-	-	-	-	-	-	760
P	-	-	-	-	-	-	-	-	-	1274
SO <sub>4</sub> <sup>2-</sup>	-	-	-	-	-	-	-	-	-	17.6
K	-	-	-	-	-	-	-	-	-	260
Ca	-	-	-	-	-	-	-	-	-	130
V	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<800
Cr	2000	1800	2000	2000	2000	2000	2000	2000	2000	~650
Mn	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	130
Fe	4200	2910	4060	3450	5530	4860	3890	4840	4600	3890
Co	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<13
Ni	20000	<1000	<1000	<1000	<1000	<1000	-	<1000	<1000	~760
Cu	-	-	-	-	-	-	-	-	-	30
Zn	-	-	-	-	-	-	-	-	-	<70
As	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	-
Sr	<100	<100	<100	<100	<100	<100	<100	<200	<200	<3
Zr	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	-
Ag	-	-	-	-	-	-	-	-	-	<8
Cd	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<1000	<1000	<25
In	-	-	-	-	-	-	-	-	-	-
Sn	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	330
Se	-	-	-	-	-	-	-	-	-	<30
Ba	<200	<200	<200	<200	<200	<200	<200	<200	<200	<3
La	2000	2000	<2000	<2000	<2000	≤2000	<2000	10000	10000	2600
Cs	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<25
Hg	-	-	-	-	-	-	-	-	-	-
Tl	-	-	-	-	-	-	-	-	-	-
Pb	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	130
Bi	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	~150
Th	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	-
U	-	-	-	-	-	-	-	-	-	50
Pu <sup>VI</sup>	-	-	-	-	-	-	-	-	-	-
solida	-	-	-	-	-	-	-	-	-	89
a. Si	-	-	-	-	-	-	-	-	-	61
b. Sn	-	-	-	-	-	-	-	-	-	9
c. Fe	-	-	-	-	-	-	-	-	-	4
d. Zn	-	-	-	-	-	-	-	-	-	6

APPROVED FOR PUBLIC RELEASE

## APPROVED FOR PUBLIC RELEASE

	131-H	132-H	133-H	134-H	135-H	136-H	137-H	138-H	139-H	140-H
Irradiation	218	208	289	200	205	206	210	210	208	218
Li	-	-	-	-	-	-	-	-	-	<2.5
Be	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.8
B	-	-	-	-	-	-	-	-	-	2
Na	-	-	-	-	-	-	-	-	-	52
Mg	<20	<20	<20	<20	<20	<22	<20	<20	<20	28
Al	<200	<200	<200	<200	<200	<220	<200	<200	<200	18
Si	-	-	-	-	-	-	-	-	-	630
P	-	-	-	-	-	-	-	-	-	1350
S <sub>60</sub> <sup>+</sup>	-	-	-	-	-	-	-	-	-	20.7
X	-	-	-	-	-	-	-	-	-	~780
Ca	<20	<20	<20	<20	<20	<22	<20	<20	<20	52
V	<1000	<1000	<1000	<1000	<1000	<1100	<1000	<1000	<1000	<800
Cr	2000	4000	1000	1000	<1000	1100	1000	1000	1000	~650
Mn	<1000	<1000	<1000	<1000	<1000	-	<1000	<1000	<1000	106
Fe	4850	8860	5170	4350	5810	3210	4360	4710	4460	4965
Co	<1000	<1000	<1000	<1000	<1000	<1100	<1000	<1000	<1000	<13
Ni	1000	1000	<1000	<1000	<1000	1100	1000	1000	<1000	~800
Cu	-	-	-	-	-	-	-	-	-	25
Zn	-	-	-	-	-	-	-	-	-	<75
As	<4000	<4000	<4000	<4200	<4000	<4400	<4000	<4000	<4000	-
Sr	<100	<100	<100	<100	<100	<100	<100	<100	<100	<3
Zr	<1000	<1000	<1000	<1000	<1000	<1100	<1000	<1000	<1000	-
Ag	-	-	-	-	-	-	-	-	-	<6
Cd	<1000	<1000	<1000	<1000	<1000	<1100	<1000	<1000	<1000	<26
In	-	-	-	-	-	-	-	-	-	-
Sn	<1000	<1000	<1000	<1000	<1000	<1100	<1000	<1000	<1000	310
Se	-	-	-	-	-	-	-	-	-	<30
Br	<1000	<1000	<1000	<1000	<1000	<1100	<1000	<1000	<1000	<3
La	40000	40000	40000	20000	<2000	22000	40000	40000	20000	~2800
Ce	<4000	<4000	<4000	<4200	<4000	<4400	<4000	<4000	<4000	<28
Hg	-	-	-	-	-	-	-	-	-	-
Tl	-	-	-	-	-	-	-	-	-	-
Pb	<1000	<1000	<1000	<1000	<1000	<1100	<1000	<1000	<1000	130
Bi	<1000	<1000	<1000	<1000	<1000	<1100	<1000	<1000	<1000	~350
Th	<4000	<4000	<4000	<4000	<4000	<4400	<4000	<4000	<4000	-
U	-	-	-	-	-	-	-	-	-	~80
PuVI	-	-	-	-	-	-	-	-	-	-
a. Si	-	-	-	-	-	-	-	-	-	92
b. Fe	-	-	-	-	-	-	-	-	-	5
c. Zn	-	-	-	-	-	-	-	-	-	3

THE  
REPRODUCTION  
OR  
TRANSMISSION  
OF  
THIS  
DOCUMENT  
IN WHOLE  
OR IN PART  
IS PROHIBITED BY LAW.

SOLID

TABLE II-A (Cont.)

	141-N	142-N	143-N	144-N	145-N	146-N	147-N	148-N	149-N	150-N
Irradiation	220	216	221	222	222	217	217	216	218	216
Li	-	-	-	-	-	-	-	-	-	<0.2
Be	<10	<10	<10	<10	<10	<10	<10	<10	<10	<0.1
B	-	-	-	-	-	-	-	-	-	1.3
Na	-	-	-	-	-	-	-	-	-	60
Mg	<20	<20	<20	<20	<20	<20	<100	<100	<100	10
Al	<200	<200	<200	<200	<200	<200	<200	<200	<200	20
Si	-	-	-	-	-	-	-	-	-	470
P	-	-	-	-	-	-	-	-	-	1365
SO <sub>4</sub> <sup>=</sup>	-	-	-	-	-	-	-	-	-	18.9
K	-	-	-	-	-	-	-	-	-	400
Ca	<20	<20	<20	<20	<20	<20	<100	<100	<100	~800
V	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	600
Cr	<1000	1000	1000	1000	1000	<1000	4000	4000	4000	~1200
Mn	<1000	<1000	<1000	<1000	<1000	<1000	≤1000	≤1000	≤1000	60
Fe	4550	3880	3090	3550	6440	3910	3980	3810	2800	3015
Co	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<10
Ni	<1000	<1000	<1000	<1000	<1000	<1000	≤1000	≤1000	≤1000	~800
Cu	-	-	-	-	-	-	-	-	-	20
Zn	-	-	-	-	-	-	-	-	-	-
As	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	-
Br	<100	<100	<100	<100	<100	<100	<100	<100	<100	<1
Zr	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	-
Ag	-	-	-	-	-	-	-	-	-	<8
Cd	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<20
In	-	-	-	-	-	-	-	-	-	-
Sn	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	~420
Sb	-	-	-	-	-	-	-	-	-	<30
Ba	<1000	<1000	<1000	<1000	<1000	<1000	<100	<100	<100	~2
La	40000	40000	40000	40000	20000	40000	<10000	<10000	<10000	~4000
Ce	<4000	<4000	<4000	<4000	<4000	<4000	-	-	-	<40
Mg	-	-	-	-	-	-	-	-	-	<20
Tl	-	-	-	-	-	-	-	-	-	-
Pb	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	80
Bi	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	~360
Ta	<4000	<4000	<4000	<4000	<4000	<4000	<1000	<4000	<4000	-
U	-	-	-	-	-	-	-	-	-	75
Pu <sup>VI</sup>	-	-	-	-	-	-	-	-	-	-
Solids	-	-	-	-	-	-	-	-	-	122
a. Si	-	-	-	-	-	-	-	-	-	50
b. Sn	-	-	-	-	-	-	-	-	-	19
c. Fe	-	-	-	-	-	-	-	-	-	6
d. Zn	-	-	-	-	-	-	-	-	-	25

SIFTED

TABLE II-A (Cont.)

	151-H	152-H	153-H	154-H	155-H	156-H	157-H	158-H	159-H	160-H
Irradia-tion	216	219	219	217	222	222	216	222	233	241
Li	-	-	-	-	-	-	-	-	-	<0.2
Be	<10	<10	<10	<10	<10	<10	<10	<10	<10	<0.1
B	-	-	-	-	-	-	-	-	-	1
Na	-	-	-	-	-	-	-	-	-	60
Mg	1000	<100	<100	<100	<100	<100	<100	<100	<100	6
Al	1000	<200	<200	<200	<200	<200	<200	<200	<200	2
Si	-	-	-	-	-	-	-	-	-	760
P	-	-	-	-	-	-	-	-	-	1412
SO <sub>4</sub> <sup>2-</sup>	-	-	-	-	-	-	-	-	-	15.6
K	-	-	-	-	-	-	-	-	-	60
Ca	1000	<100	<100	<100	<100	<100	<100	<100	<100	60
V	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<600
Cr	2000	4000	2000	4000	4000	4000	4000	4000	4000	~1000
Mn	≤1000	≤1000	≤1000	≤1000	≤1000	≤1000	≤1000	≤1000	≤1000	42
Fe	8870	2880	2910	3950	8290	8400	8270	2880	3500	3295
Co	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<10
Ni	4000	2000	≤1000	≤1000	2000	≤1000	≤1000	≤1000	4000	~600
Cu	-	-	-	-	-	-	-	-	-	40
Zn	-	-	-	-	-	-	-	-	-	20
As	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	-
Br	<100	<100	<100	<100	<100	<100	<100	<100	<100	<1
Zr	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	-
Ag	-	-	-	-	-	-	-	-	-	10
Cd	<1000	<100	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<21
In	-	-	-	-	-	-	-	-	-	-
Sn	<1000	2000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	185
Sb	-	-	-	-	-	-	-	-	-	<30
Ba	<100	<100	<100	<100	<100	<100	<100	<100	<100	<2
La	<10000	10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	~1000
Ce	-	-	-	-	-	-	-	-	-	~42
Hg	-	-	-	-	-	-	-	-	-	~21
Tl	-	-	-	-	-	-	-	-	-	-
Pb	20000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	21
Si	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	~550
Th	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	<4000	-
U	-	-	-	-	-	-	-	-	-	~0
PuVI	-	-	-	-	-	-	-	-	-	-
Golda	-	-	-	-	-	-	-	-	-	70
a. Si	-	-	•	•	•	•	•	-	-	67
b. Sn	-	-	•	•	•	•	•	-	-	5
c. Fe	-	-	•	•	-	-	-	-	-	2
d. Zn	-	-	•	•	•	•	•	-	-	6

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ADMB-12-A<sup>b</sup> (Cont.)

	161-H	162-H	163-H	164-H	165-H	166-H	167-H	168-H	169-H	170-H <sup>a</sup>
Irradiation	244	224	244	231	223	220	236	223	231	233
Li	-	-	-	-	-	-	-	-	-	<0.2
Be	<10	<10	<10	<10	<10	<10	<10	<10	<10	<0.1
B	-	-	-	-	-	-	-	-	-	11
Na	-	-	-	-	-	-	-	-	-	~300
Mg	<100	<100	<100	<100	<100	<100	<100	<100	<100	20
Al	<200	<200	<200	<210	<210	<210	<210	<200	<200	30
Si	-	-	-	-	-	-	-	-	-	200
P	-	-	-	-	-	-	-	-	-	1476
SO <sub>4</sub> <sup>m</sup>	-	-	-	-	-	-	-	-	-	18.5
K	-	-	-	-	-	-	-	-	-	500
Ca	<100	<100	<100	<100	<100	<100	<100	<100	<100	50
V	<1000	<1000	<1000	<1050	<1050	<1050	<1070	<1000	<1000	<600
Cr	4000	2000	2000	1050	1050	1050	≤1070	≤1000	≤1000	~1000
Mn	≤1000	≤1000	≤1000	<1050	<1050	<1050	-	<1000	<1000	180
Fe	2920	3060	2770	3180	3590	4200	3050	3990	5480	6590
Co	<1000	<1000	<1000	<1050	<1050	<1050	<1070	<1000	<1000	<10
Ni	20000	≤1000	≤1000	<1050	<1050	<1050	<1070	<1000	<1000	~1000
Cu	-	-	-	-	-	-	-	-	-	40
Zn	-	-	-	-	-	-	-	-	-	40
As	<4000	<4000	<4000	<4000	<4200	<4200	<4300	<4000	<4000	-
Sr	<100	<100	<100	<100	<100	<100	<100	<100	<100	<1
Zr	<1000	<1000	<1000	<1050	<1050	<1050	<1070	<1000	<1000	-
Ag	-	-	-	-	-	-	-	-	-	<6
Cd	<1000	<1000	<1000	<1050	<1050	<1050	<1070	<1000	<1000	<20
In	-	-	-	-	-	-	-	-	-	-
Sn	<1000	<1000	<1000	<1050	<1050	<1050	<1070	-	<1000	~300
Sb	-	-	-	-	-	-	-	-	-	<30
Bi	<100	<100	<100	<100	<100	<100	<100	<100	<100	3
La	<10000	<10000	<10000	<10500	<10500	<10500	<10700	<10000	<10000	~4000
Ce	-	-	-	<8400	<8400	<8400	<8600	<8000	<8000	60
Hg	-	-	-	-	-	-	-	-	-	≤20
Tl	-	-	-	-	-	-	-	-	-	-
Pb	<1000	<1000	<1000	<1050	<1050	<1050	<1070	<1000	<1000	100
Bi	<1000	<1000	<1000	<1050	<1050	<1050	<1070	<1000	<1000	~700
Th	<4000	<4000	<4000	<4200	<4200	<4200	<4300	<4000	<4000	-
U	-	-	-	-	-	-	-	-	-	<0
PuVI	-	-	-	-	-	-	-	-	-	-
Solids	-	-	-	-	-	-	-	-	-	25.6
As Si	-	-	-	-	-	-	-	-	-	<0
As Sn	-	-	-	-	-	-	-	-	-	<0

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	171-H	172-H	173-H	174-H	175-H	176-H	177-H	178-H	179-H	180-H
Irradiation	242	231	228	224	228	234	240	251	251	d
Li	-	-	-	-	-	-	-	-	-	0.4
Be	<10	<10	<10	<10	<10	<10	<10	<10	<10	<0.1
B	-	-	/	-	-	-	-	-	-	3
Na	-	-	-	-	-	-	-	-	-	145
Mg	<100	<100	<100	<100	<100	<100	<100	<100	<100	13
Al	<200	<210	<200	<200	<200	<200	<210	<200	<210	6
Si	-	-	-	-	-	-	-	-	-	250
P	-	-	-	-	-	-	-	-	-	1935
$\text{SO}_4^{2-}$	-	-	-	-	-	-	-	-	-	87
K	-	-	-	-	-	-	-	-	-	~530
Ca	<100	<100	<100	<100	<100	<100	<100	<100	<100	84
V	<1000	<1070	<1000	<1000	<1000	<1000	<1070	<1000	<1070	<800
Cr	≤1000	≤1070	≤1000	-	≤1000	≤1000	≤1070	≤1000	≤1070	~1050
Mn	<1000	<1070	<1000	<1000	<1000	<1000	<1070	<1000	<1070	106
Fe	4250	3850	3820	3440	6270	5990	4280	3160	3700	7920
Co	<1000	<1070	<1000	<1000	<1000	<1000	<1070	<1000	<1070	<11
Ni	<1000	<1070	<1000	<1000	<1000	<1000	<1070	<1000	<1070	~2100
Cu	-	-	-	-	-	-	-	-	-	60
Zn	-	-	-	-	-	-	-	-	-	<42
Ae	<4000	<4500	<4000	<4000	<4000	<4000	<4500	<4000	<4500	-
Er	<100	<100	<100	<100	<100	<100	<100	<100	<100	<1
Zr	<1000	<1070	<1000	<1000	<1000	<1000	<1070	<1000	<1070	-
Ag	-	-	-	-	-	-	-	-	-	10
Cd	<1000	<1070	<1000	<1000	<1000	<1000	<1070	<1000	<1070	11
Sn	<1000	<1070	<1000	<1000	<1000	<1000	<1070	<1000	<1070	650
Sb	-	-	-	-	-	-	-	-	-	<30
Bi	<100	≤100	<100	<100	<100	<100	<100	<100	<100	4
La	<10000	<10700	<10000	10000	<10000	<10000	<10700	<10000	<10700	~4200
Ge	<8000	<8600	<8000	<8000	<8000	<8000	<8600	<8000	<8600	42
Hg	-	-	-	-	-	-	-	-	-	-
Tl	-	-	-	-	-	-	-	-	-	-
Pb	<1000	<1070	<1000	<1000	<1000	<1000	<1070	<1000	<1070	210
Rh	<1000	<1070	<1000	<1000	<1000	<1000	<1070	<1000	<1070	~350
Th	<4000	<4500	<4000	<4000	<4000	<4000	<4500	<4000	<4500	-
U	-	-	-	-	-	-	-	-	-	0
$\text{Pu}^{VI}$	-	-	-	-	-	-	-	-	-	-
solida	-	-	-	-	-	-	-	-	-	107.5
a. Si	-	-	-	-	-	-	-	-	-	0
b. Sn	-	-	-	-	-	-	-	-	-	0

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# SUPERIOR

TABLE II-A (Cont.)

	181-H	182-II	183-H	184-H	185-H
Irradiation	236	238	260	262	269
Li	-	-	-	-	-
Be	<10	<10	<10	<10	<10
B	-	-	-	-	-
Na	-	-	-	-	-
Mg	<100	<100	<100	<100	<100
Al	<200	<200	<200	<200	<210
Si	-	-	-	-	-
P	-	-	-	-	-
SO <sub>4</sub> <sup>2-</sup>	-	-	-	-	-
K	-	-	-	-	-
Ca	<100	<100	<100	<100	<100
V	<1000	<1000	<1000	<1000	<1070
Cr	≤1000	≤1000	≤1000	≤1000	≤1070
Mn	<1000	<1000	<1000	<1000	<1070
Fe	3190	3250	4160	3880	3430
Co	<1000	<1000	<1000	<1000	<1070
Ni	<1000	<1000	<1000	<1000	<1070
Cu	-	-	-	-	-
Zn	-	-	-	-	-
As	<4000	<4000	<4000	<4000	<4300
Br	<100	100	<100	<100	<100
Zr	<1000	<1000	<1000	<1000	<1070
Ag	-	-	-	-	-
Cd	<1000	<1000	<1000	<1000	<1070
In	-	-	-	-	-
Sn	<1000	<1000	<1000	<1000	<1070
Sb	-	-	-	-	-
Ba	<100	<100	<100	<100	<100
La	<10000	<10000	<10000	<10000	<10700
Ce	<8000	<8000	<8000	<8000	<8600
Hg	-	-	-	-	-
Tl	-	-	-	-	-
Pb	<1000	<1000	<1000	<1000	<1070
Bi	<1000	<1000	<1000	<1000	<1070
Th	<4000	<4000	<4000	<4000	<4300
U	-	-	-	-	-
Pu <sup>VI</sup>	-	-	-	-	-
solidia	-	-	-	-	-
a. Si	-	-	-	-	-
b. Sn	-	-	-	-	-
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TABLE II-A

## Notes

## on the Data

- a        Although the total weight of the solids in this lot was determined, the residue was not analyzed. Since the sample for the cupferron or direct spark analysis which was performed on this lot was taken from the supernatant above the centrifuged solids, the values reported for some elements, especially Si, Fe, and Sn, are probably low.
- b        Unless otherwise indicated, a dash indicates that the datum was not requested.
- c        Analysis was requested, but not reported.
- d        This lot was a composite of recycles; hence no irradiation data are available.

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TABLE II-B

## Summary of Purity of Incoming Material

## Notes

## on the Headings

All elements except S as  $\text{SO}_4^{=2}$  have been reported as parts per million parts of plutonium. S has been reported as weight per cent of  $\text{SO}_4^{=2}$  to Pu. (For example, 16 grams of  $\text{SO}_4^{=2}$ , as determined volumetrically, in an "H" lot of 160 grams of Pu, would be reported as 10%  $\text{SO}_4^{=2}$ .

Solids have been reported as the total weight, in milligrams of centrifugable solid matter, dried to constant weight at  $110^{\circ}\text{-}120^{\circ}\text{C}$ .

a The "average" figure which is reported is that value below which 90% or more of the determinations fell.

b The number is the total number of determinations used to compute the "average" value.

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TABLE III

## Purity Record of Purified Plutonium

Table III is a summary of the impurities present after purification. By comparison with Tables I and II of this report, the following information can be found for many purification lots.

- (1) Principal impurities present in the incoming plutonium (Table II)
- (2) Purification methods used to obtain pure Pu (Table I)
- (3) Actual purity of the final product (Table III).

Impurities are listed as parts by weight per million parts by weight of plutonium (ppm)

Notations used in Table III as superscripts.

- No working by the ppm. of any impurity indicates analysis was made after a diethyl ether extraction of Pu (VI) nitrate.
- a- Indicates analysis made after a Pu (III) oxalate precipitation.
- b- Indicates analysis made after a Pu (VI) acetate precipitation.
- c- Indicates analysis made after the purified plutonium has been reduced to the metal by Baker's group.
- d- Indicates analysis made after dry conversion of the purified plutonium to the tetrafluoride by Garner's group.
- e- Indicates analysis made after the reduced metal has been remelted by Hammel's group.

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	1-W to 118-H		118-H to 184-H		1-W to 184-H	
	Average <sup>a</sup>	Number <sup>b</sup>	Average <sup>a</sup>	Number <sup>b</sup>	Average <sup>a</sup>	Number <sup>b</sup>
L1	<6	22	<0.4	7	<5	29
B9	<0.7	22	<1.5	7	<0.4	29
B	1.5	11	11	7	2	18
W5	380	22	300	7	320	29
W6	800	118	100	65	200	183
A1	81	22	1000	7	100	22
W1	2700	17	760	5	1600	22
P	1464	39	1570	7	1470	46
SO <sub>4</sub>	25	19	37	7	24	26
H	950	21	780	7	900	28
SiO <sub>2</sub>	540	118	160	65	200	183
V	<500	24	<600	7	<600	21
Cr <sup>6+</sup>	8000	118	4500	66	5000	182
Si	310	22	160	7	200	29
Fe	10300	117	4900	66	9400	182
Ca	<17	22	<18	7	<15	29
Ti	360	116	2100	66	3000	180
Co	128	18	60	7	60	19
Zn	260	21	<75	5	200	26
As	<10000	106	<4300	66	<4000	163
Br	<3	22	<3	7	4	29
Er	<1000	106	<1070	66	<1000	164
Ag	-	0	11	6	10	6
Cd	3000	22	26	7	1600	29
Sn	<30	14	<6	1	<30	15
Bi	2100	50	630	6	2000	36
Br	<100	34	<30	7	<100	21
Se	<18	22	4	7	<15	29
Ia	18000	118	41000	65	32000	183
Co	<60	22	60	7	<50	29
Eq	<60	18	130	4	<60	19
Tl	<150	14	<6	1	<150	15
Fe	500	22	210	7	150	29
Si	950	10	700	7	600	17
Ta	<10000	100	<4300	58	<4000	166
U	140	30	80	4	100	34
Solids	740	17	184	6	740	25

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TABLE III. PURITY RECORD OF PURIFIED PRODUCT

Site Y Lot No.	7	9	12	14	16	18	20	22	24	26
Li	-	-	-	<0.4	<0.4	<0.5	<0.5	<1	-	<1
Be	-	<20	<40	0.5	<0.4	<0.5	<0.5	<1	<20	<1
Na	-	-	-	20	100	90	120	40	-	50
Mg	20	<200	<2000	100	10	<1	20	1	<200	<5
Al	<2000	<2000	<400	<5	<4	<2	<4	<6	<200	<5
K	-	-	-	-	-	-	-	-	-	20
Ca	<200	<200	<400	200	80	1	200	5	<200	<10
Cr	-	-	<2000	<200	<400	<200	-	-	<200	<200
Mn	-	-	-	-	-	-	-	-	-	-
Fe	<200	<200	<200	<200	<200	<200	-	-	<200	<200
Co	-	-	-	-	-	-	-	-	-	-
Ni	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-	-
Sr	-	-	-	-	-	-	-	-	-	-
Zr	<2000	<2000	<400	<1000	<2000	<2000	-	-	200	<1000
Cd	-	-	-	-	-	-	-	-	-	-
Sn	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-
La	<2000	<2000	<2000	<1000	1400	<100	-	-	400	<200
Ce	<10000	<10000	<4000	<4000	<2000	<4000	-	-	<1000	<4000
Hg	-	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-	-
Th	2000	<10000	<4000	-	<1000	<400	-	-	<4000	<2000
U	-	-	-	-	-	-	-	-	-	-

REF ID: A6570  
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TABLE II (Cont.)

Site Y Lot No.	28	30	32	74	73	41	47	45	49-P	51-F
Li	<1	<1	<1	<1 <10	<1	<1	<1	<1	<1	<1
Be	<1	<1	<1	<1 <10	<1	<1	<1	<1	<0.5	<0.5
Na	22	30	65	15 <5	15	45	20	35	-	80
Mg	45	45	5	5 <5	<1	<5	3	<2	10	5
Al	3	3	2	2 15 <sup>o</sup>	10	<5	2	<1	<1	8
K	<15	6	<10	<10 <20	<10	<20	<10	<20	35	10
Ca	25	55	16	<5 15 <sup>o</sup>	25	5	5	<5	10	20
Cr	<200	<400	<200	<200	<200	<200	<200	<200	<200	<200
Fe	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
Co	-	-	-	-	-	-	-	-	-	-
Ni	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-	-
Sr	-	-	-	-	-	-	-	-	-	-
Zr	<1000	<400	<1000	<1000	<1000	-	-	<2000	-	<200
Cd	-	-	-	-	-	-	-	-	-	-
Sn	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-
In	<1000	<3000	<1000	<1000	<400	<400	<400	<200	<400	<400
Cs	<1000	<2000	<2000	<2000	<1000	<200	<2000	<2000	<2000	<2000
Hg	-	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-	-
Bi	<400	<200	<200	<200	<1000	<200	<200	<1000	<400	<200
Th	<2000	<1000	<1000	<1000	<1000	-	-	<2.00	-	<2.00
U	800	410	>12000	130	150	500	>13000	200	200	200

TABLE III (cont.)

Site Y Lot No.	52-F	54-P	56-P	58-P	60-P	62-P	64-P	66-I	68-P	70-P
Li	<1 <sup>a</sup>	<1 ND <sup>b</sup>	<1 <1 <sup>a</sup>	<1 <10 <10	<1 <1 <sup>a</sup> <10	<1	<1	<1	<1	<1
Be	<0.5 <sup>a</sup>	<0.5 ND <sup>b</sup>	<0.5 <0.5 <sup>a</sup>	<5	<0.5 <0.5 <sup>a</sup>	<0.5	<0.5	<0.5	<0.5	<0.5
Na	3C <sup>a</sup>	550 ND <sup>b</sup>	12C 20 <sup>a</sup>	5	<5 <5 <sup>a</sup> .c	50	50	<5	>1000	70
Mg	5 <sup>a</sup>	10 20 <sup>a</sup>	3 100 <sup>a</sup>	<1	<5 <800 <5 <sup>a</sup>	<5	<5	<5	<5	<5
Al	50 <sup>a</sup>	<1 ND <sup>b</sup>	<5 <5 <sup>a</sup>	<5	<5 <5 <sup>a</sup> .c	5	<5	5	<20	3
K	<20 <sup>a</sup>	20 ND <sup>b</sup>	60 <20 <sup>a</sup>	<30	<30 <20 <sup>a</sup> .c	<30	<20	<40	<40	<40
Ca	3C <sup>a</sup>	15 30 <sup>a</sup>	30 8C <sup>a</sup>	5	<5 70-6000 <sup>a</sup> <10 <sup>a</sup>	5	<5	70	40	30
Cr	-	<200	-	<200	<200	<200	-	-	-	<100
Mn	-	-	-	-	-	-	-	-	-	-
Fe	-	<400	<400	<400	<400	<400	-	-	-	<400
Co	-	-	-	-	-	-	-	-	-	-
Ni	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-	-
Sr	-	-	-	-	-	-	-	-	-	-
Zr	-	<400	<200	-	<1000	<1000	-	-	-	<200
Cd	-	-	-	-	-	-	-	-	-	-
Sn	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-
La	-	<400	<400	<400	<400	<400	-	-	-	<200
Ce	-	<2000	<1000	<1000	<2000	<2000	-	-	-	<1000
Hg	-	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-	-
Bi	-	<200	<400	<400	<1000	<1000	<1000	-	-	<1000
Th	-	<2000	<2000	<2000	-	<4000	-	-	-	<2000
U	-	200	400	1000	67C	840	1040	-	810	640

REF ID: A6520

TABLE III (Cont.)

Site Y Lot No.	72-F	74-F	76-F	80-F	82-F	86-F 90-F	88 thru 92-F	104-F 106-F	9.1-F	11.7-F
Li	<1	<1	<1	<1	<1	-	-	-	-	-
Be	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<40°	<20°c	0.5°	<10° <5° <4
Ba	-	-	-	-	-	-	-	-	-	-
Mg	<3	20	<3	<3	<2	20	<400°	<200°c	4-45°	<10° <10° <5
Al	<3	<3	<3	15	15	<400	<400°	<100°c	40- 1200°	<100° <100° <20
K	-	-	-	-	-	-	-	-	<400°	-
Ca	5	70	<10	15	100	20	-	40° 100°	<4-9°	1000° 100° <20
Cr	<400	<400	<400	<200	<200	<200	<200°	<200° <400°	<6-8°	<1000° <600° <40
In	-	-	-	-	-	-	-	400° 250°	<6°	<100° <200° <40
Fe	<400	<400	<400	<400	<400	<400	150°	-	175°	30° 250° 145
Co	-	-	-	-	-	-	-	-	-	<200° <40
Ni	-	-	-	-	-	-	<400°	-	-	<200° <40
Zn	-	-	-	-	-	-	-	-	<20°	<200° <40
Sr	-	-	-	-	-	-	-	-	-	<200° <20° <4
Zr	<200	<200	<200	<400	<400	<400	<400°	<400°c	-	-
Cd	-	-	-	-	-	-	-	-	<10°	<2000° <2000° <40
Sn	-	-	-	-	-	-	-	-	-	<200° <40
Ba	-	-	-	-	-	-	-	-	-	<2000° <2000° <40
La	<200	<200	<200	<400	<400	<400	<1000°	<1000°c	<60°	20,000° 100° <40
Ce	<1000	<1000	<1000	<1000	<1000	<1000	<1000°	<1000°c	<10°	20,000° <5000° <100
U	-	10	164	<118	<700	-	-	-	-	-

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TABLE III (cont'd)

Site Y Lot No.	207-P	208-P	209-P	210 thru 216-P	220-P	222-P	223-P	227-P	228-P	229-P
Li	-	-	-	<400*	-	<400*	<400*	<4	<4	-
Be	<0.4 <0.4*	<0.4	<0.3 <0.3d	<0.3° <0.3d	<0.4	<0.3	<0.3	<0.4	1.7	<0.3
Na	-	-	-	20° 7-13°	-	38	94	<4	85	-
Mg	40 70°	<4	10 3d	17-80°	<4	6	3	4	4	26
O	-	-	-	<100°	-	-	-	-	-	-
Al	40 70°	<4	7	50° 4-87°	15	10 3	6	13	13	16
K	-	-	-	<4000°	-	<310	<310	-	-	-
Ca	<20 35°	<4	30 3d	<7° <4-50°	36	31 6	13	42	33	16
Cr	100 <4°	<4	3 3d	<4° <4°	<4	<3	<15	<4	<4	3
Mn	<40 7°	<4	<3 3d	2-10° 2°	<4	1.5	<3	<4	<4	<4
Fe	42 15°	138	60 216d	80-200°	45	81 22	23	143	68	56
Co	48 15°	<40	<15 <15d	<17° <22°	<19	<16 <16	<16	<21	<21	<16
Ni	<40 <5°	<40	<15 <15d	<17° 17-50°	<19	<3 <3	<3	<8	<8	<16
Zn	<400 <5°	<40	<10 <10d	<17° <22°	<19	<31	63	<42	<42	9
Sr	<400	<4	<3	<30°	<<4	<<3	<3	<4	<4	<4
Zr	-	-	-	-	-	<1000	<1000	<1000	<1000	-
Cd	<40 <20°	80	<15 <10d	<40 <30°	<19	<16	<16	<8	<8	9
Sn	<400 4°	<4	<15 <15d	<10 <9°	<4	<3	<3	<21	83	<3
Ba	<40 <5°	<40	<3 3d	<3° <5°	<4	3	10	<4	6	5
La	<40 <4°	<4	<3 <15d	<17° <17°	<19	<16	<16	<4	<4	5
Cr	<400 <45°	<40	<10 <10d	<30° <25°	<38	<31	<31	<21	<21	<31
As	-	<40	<15d	-	-	<10	<10	-	-	-
Hg	-	120	<30d <100	<30° <220°	<8	<31	<31	<42	<42	<31
Pb	<40 100°	<40	30 3d	<10° <17°	<4	<3	<3	8	210	47
Th	-	-	<30d	-	-	<2000	<2000	<2000	<2000	<2000
U	>>4000° <50°	<400	<100	-	<380	260	160	630	1600	-

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TABLE III (Cont.)

Site Y Lot No.	C27 thru C29-P	230-P	231-P	232-P	233-P	242-P	243-P	244-P	245-P	246-P
Li	<1°	-	<5°	<6° <4° <0.8°	<6	-	<5° <4°	-	<4	<5
Be	<1.5°	<0.3	<0.4	<0.4°	<0.5	-	<0.4°	-	<0.4	<0.25
C	<100°	-	-	<200°	-	-	675°	<100°	-	-
Na	<96°	-	-	90° 8°	110	-	35° <10°	-	32	50
Mg	5°	7	28	<4°	5	-	10°	4-740°	4	<5
O	<100°	-	-	<100°	-	-	<100°	<120°	-	-
Al	4-32°	17	7 5°	9 4° 19°	9	-	<1°	30°	1°	<5
K	-	-	-	-	<440	-	<6°	8-31°	<400	1500
Ca	<5-30°	20	70 75°	33 10° 4°	20	-	11 320°	-	40	10
Cr	<6°	3	<4 5°	<4° 11°	<5	125 <5	<4°	-	<4	5
Mn	<36°	<7	<4 5°	<6 <4°	<6	-	36°	100°	<4	<5
Fe	7-300°	-	-	50 115°	-	-	-	-	40	22
Co	<33°	<17	<38 <25°	<27 <20°	<22	-	<18°	-	<20	<25
Ni	<72°	<17	<7 -10°	<3 -5°	<22	-	<18	-	<20	<25
Zn	<18°	10	-	<13	<15	-	>3000°	-	<10	-
Sr	<36°	<7	<7	<10°	<5	-	<4°	-	<4	<6
Zr	-	-	-	<200°	-	-	-	-	-	-
Cd	<27°	10	<18	45 20° <13°	<13	<27	-	-	<20	<25
Sn	<27°	<3	<18 5°	<19°	<22	-	<15°	-	<20	<25
Ba	<6°	-	11	5 <4°	<6	-	<4°	-	4	<5
La	<5°	?	<4	<4°	<5	-	<4°	-	<4	<0.05
Ce	-	<13	<5	<130°	<45	-	<6°	-	<40	<50
Hg	-	170	-	-	-	<46	-	<8°	<40	-
Pb	<5°	50	<4	46	<60	<100	<100°	<51°	<100	50
Bi	<1000°	-	-	<10°	-	-	-	-	-	-
Tl	-	3-30	-	10,000 150°	-	<460	-	-	-	-
U	-	-	-	10,000 150°	-	<460	-	-	<400	-

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TABLE III (Cont.)

Site Y Lot No.	255-P	256-F	257-P	268-P	269-P	270-P	270-r	270-t	271-P	272-t
Li	-	-	-	<2°	<2°	<2	<1°	<1°	<1°	<1°
Be	-	-	<10	<0.1°	<0.1°	<0.1	<0.1°	<0.1°	<0.1°	<0.1°
C	-	-	-	-	-	-	145°	335°	205°	105°
O	-	-	-	-	<100°	-	<100°	<100°	<100°	<10°
Na	-	-	-	16°	60°	100	2°	10°	8°	12°
Mg	-	-	<200°	2°	2°	<0.2	2°	2°	2°	2°
Al	-	-	<200°	50°	29°	2°	41°	49°	76°	45°
K	-	-	-	<100°	<100°	<20°	<1°	<2°	<38°	<2°
Ca	100	1250	<200	18°	8°	16	<2°	8°	6°	8°
Cr	-	-	<200	-	-	<2	-	-	-	-
Mn	-	-	<100	-	-	<2	-	-	-	-
Fe	-	-	70	160°	240°	60	-	-	-	-
Co	-	-	<100	-	-	<10	-	-	-	-
Ni	-	-	<200	-	-	<10	-	-	-	-
Zn	-	-	-	<20°	<20°	<20	-	-	-	-
As	-	-	<200	-	-	-	-	-	-	-
Sr	-	-	<200	-	-	<20	-	-	-	-
Cd	-	-	<1000	-	-	<10	-	-	-	-
Sn	-	-	<2000	-	-	<40	-	-	-	-
Ba	-	-	<200	-	-	<0.2	-	-	-	-
La	-	-	<2000	-	-	<10	-	-	-	-
Ce	-	-	<10000	300°	300°	<20	-	-	-	-
Hg	-	-	<4000	<20°	<20°	<20	-	-	-	-
Pb	-	-	<100	39°	60°	<10	-	-	-	-
Bi	-	-	<1000	-	-	-	-	-	-	-
Th	-	-	<1000	-	-	-	-	-	-	-
U	-	-	<10000	-	-	<10	-	-	-	-
B	-	-	-	-	-	-	7.4°	6.1°	2.9°	5.2°
αt-n/mo., per gram	-	-	-	-	-	-	2.06	2.77	2.44	2.49

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TABLE III (Contd)

Site Y Lot No.	273-P	271-Y	275-P	276-P	277-P	278-P	279-Y
Li	-	-	-	-	-	<18	<2
Be	-	-	-	-	-	<0.25	<0.25
P	<25	<25	<50	<50	<50	<50	<50
S as SO <sub>4</sub> <sup>2-</sup>	<18,000	<18,000	<18,000	<15,000	<15,000	<14,000	<15,000
Na	-	-	-	-	-	<45	<60
Mg	-	-	-	-	-	<5	<5
Al	-	-	-	-	-	0	60
K	-	-	-	-	-	<18	<30
Ca	170	70	60	60	150	270	220
Cr	220	220	240	210	300	450	400
Mn	-	-	-	-	-	<5	<5
Fe	170	210	157	88	140	274	100
Co	-	-	-	-	-	<23	<25
Ni	7	10	10	8	20	<23	<25
Zn	-	-	-	-	-	<30	<100
Br	-	-	-	-	-	<0.5	<0.5
Cd	-	-	-	-	-	<45	<60
Sn	120	70	100	100	200	160	150
Ba	-	-	-	-	-	11	10
Ta	<2	<3	<2	<2	<2	<5	<5
Ge	-	-	-	-	-	<45	<60
Pb	-	-	-	-	-	<45	<60

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TABLE III-A

## Purity of Metal

## Notes on the Headings

All elements have been reported as parts per million parts of plutonium.

- a See Table V.
- b For a complete explanation of method, see report La 405.
- c The "average" figure which is reported is that value below which 90% or more of the determinations fell.
- d The number is the total number of determinations used to compute the "average" value.
- e A dash indicates that the datum was not requested or not reported.
- f The sample was a combination of A and B process lots.

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	5965-B	7057-B	7063-B	7064-C	7062-A	7065-A	7099-A	7105-A	7115-A	7130-A
Method	A	A	A	A	A	A	A	A	A	A
Li	<0.6	<1	<1	<0.6	<1.1	<0.9	<0.9	<1	<1.1	<1
Be	<0.08	<0.1	<0.1	<0.08	<0.11	<0.08	<0.08	<0.1	<0.11	<0.1
B	1.2	5	0.7	-	1	<0.5	<0.5	<0.5	<0.5	0.5
C	150	250	226	-	-	-	-	-	-	-
O	-	-	-	-	-	395	-	-	<100	-
F	<8	-	-	-	-	-	-	-	<9	-
Ne	5	<8	<8	<8	<11	9	14	8	11	<8
N	5	5	4	<2	<2	4	17	8	5	4
Al	24	19	18	5	5	180	9	29	9	17
Si	-	-	200	-	-	-	-	-	-	-
K	<32	<42	<41	<31	<45	<36	<35	<38	<45	<34
Ca	4	17	41	8	11	6	170	11	18	~350
V	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-
Mn	-	-	-	-	-	-	-	-	-	-
Fe	-	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-	-
Ni	-	-	-	-	-	-	-	-	-	-
Cu	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-	-
Sr	-	-	-	-	-	-	-	-	-	-
Ca	-	-	-	-	-	-	-	-	-	-
In	-	-	-	-	-	-	-	-	-	-
Sb	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-
La	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-
Rg	-	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-	-
Bi	-	-	-	-	-	-	-	-	-	-
U	-	-	-	-	-	-	-	-	-	-

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	7176-A	7177-A	7193-A	7201-A	7203-A	7205-A	7244-A	7185-A	7181-A
	A	A	A	A	A	A	A	B	B
	<1.2	<1.2	<0.8	<1.2	<0.8	<1.2	<1.0	<1	<1.2
	<0.11	<0.08	<0.12	<0.08	<0.12	<0.08	<0.10	<0.1	<0.11
	0.4	0.4	0.7	<0.5	<0.5	<0.5	0.9	0.3	0.4
	-	-	-	-	-	-	-	-	-
	-	-	100	-	-	-	-	-	-
	-	-	<4	-	-	-	-	-	-
	<0.2	<0.2	<0.2	<0.2	9	7	<8	20	14
	<10	<10	46	2500	98	75	98	4	35
A	V	V	V	3	8	19	5	37	9
	-	-	-	-	-	-	-	~300	~200
	<11	<11	<11	<11	<19	<24	<15	<40	<46
	70	47	180	180	95	148	63	48	<7
	-	-	-	-	-	-	-	<30	<60
	-	-	-	-	-	-	-	<2	<2
	-	-	-	-	-	-	-	226	186
	-	-	-	-	-	-	-	<10	<12
	-	-	-	-	-	-	-	<4	12
	-	-	-	-	-	-	-	<60	<60
	<10	-	-	-	-	-	-	<40	<46
	<11	-	-	-	-	-	-	15	15
	<11	-	-	-	-	-	-	<10	<12
	-	-	-	-	-	-	-	15	15
	-	-	-	-	-	-	-	<60	<60
	-	-	-	-	-	-	-	<2	<2
	-	-	-	-	-	-	-	6	9
	<21	-	-	-	-	-	-	<20	<23
	<21	-	-	-	-	-	-	<150	<23
	<21	-	-	-	-	-	-	<15	<16
	-	-	-	-	-	-	-	<100	<12
	80	-	-	-	-	-	-	40	20

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TABLE VIII-4 (Cont.)

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Summary						
	A <sup>b</sup>	B <sup>b</sup>	C <sup>b</sup>			
	Average <sup>c</sup>	Number <sup>d</sup>	Average <sup>c</sup>	Number <sup>d</sup>	Average <sup>c</sup>	Number <sup>d</sup>
Li	<1.7	17	<1.2	10	<0.9	2
Be	<1.2	16	<0.16	10	<0.09	2
B	1	16	0.7	10	0.5	2
C	250	5	-	-	-	-
O	395	2	-	-	-	-
F	<2	3	-	-	-	-
Na	12	16	21	10	20	2
Mg	60	17	60	9	3	2
Al	30	18	26	10	8	2
Si	200	2	300	3	300	2
X	<46	18	165	10	<38	2
Ca	160	16	125	10	17	2
V	<300	1	<60	2	<30	2
Cr	<2	1	<2	2	<2	2
Mn	<2	1	<2	2	<2	2
Fe	22*	2	227	2	160	2
Co	<11	1	<12	2	<9	2
Ni	<6	1	13	2	11	2
Cu	<6	1	<60	2	<50	2
Zn	<46	1	<46	2	165	2
Sr	<1.1	1	<1.2	2	3	2
Cd	<11	1	<12	2	<9	2
Sn	26	1	16	2	65	2
Sb	<25	1	<60	2	<60	2
Da	<2	1	<2	2	<2	2
La	6	1	10	2	1360	2
Ce	<23	1	<23	2	165	2
Rg	<23	1	<150	2	<18	2
Pb	<11	1	<15	2	<9	2
Bi	-	-	<100	2	<100	2
U	60	1	41	2	25	2

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TABLE IV

## Comparison of A, B, and C Processes

## Notes on the Headings

All elements have been reported as parts per million parts of plutonium.

The product from five experimental purification runs was analyzed thoroughly at certain stops in its processing, and the results tabulated in Table IV. The first value reported is the amount of impurity present in the last oxalate; the second, the amount present in the product after hydroflourination; the third, the amount present in the metal after reduction and remelt.

a For a complete explanation of processes, see report LA 405.

b A dash indicated that the datum was not requested or not reported.

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A <sup>a</sup>			574-P			576-P			574-E		
Oxalate	Flouride	Metal	Oxalate	Flouride	Metal	Oxalate	Flouride	Metal	Oxalate	Flouride	Metal
Li	<0.31	- <sup>b</sup>	<1.1	-	-	<1	<0.8	-	<1.2	-	
Be	<0.4	<0.14	<0.11	<0.6	<0.2	<0.1	<0.08	<0.2	<0.12		
B	0.2	-	0.4	<0.3	-	0.3	<0.3	-	0.4		
Na	12.5	-	<11	-	-	20	3	-	14		
Mg	≤0.4	3	7	≤6	<4	4	<2	≤4	35		
Al	18	~7000	7	-	~2000	8	<2	~2200	9		
Si	<100	-	100	≤120	-	~300	<120	-	~200		
P	<31	-	-	<43	-	<600	<65	-	-		
K	<31	-	<45	-	-	<40	<35	-	<46		
Ca	40	56	<7	220	600	<6	<2	88	<7		
V	<150	-	<300	<40	-	<10	<60	-	<60		
Cr	<16	11	<2	<22	<4	<2	<2	<4	<2		
Mn	<4	0.3	<2	<6	4	<2	<2	≤4	<2		
Fe	15.3	-	183	16.3	-	228	-	-	186		
Co	<20	<14	<11	<22	<20	<10	<8	-	<12		
Ni	<16	14	<6	<22	20	<4	8	22	12		
Cu	<50	-	<6	-	-	<40	-	-	<60		
Zn	-	<6	<6	-	-	<40	<33	-	<16		
Sr	-	3	<1.1	-	4	<1	-	2	<1.2		
Cd	-	<14	<11	-	<40	<10	<8	44	<12		
In	-	-	-	<30	-	<30	<30	-	-		
Sn	-	<14	26	-	40	15	<8	68	16		
Sb	<100	-	<25	<60	-	<60	<60	-	<60		
Ba	18	28	<2	43	120	<2	<2	88	<2		
La	9	23	5	<6	4	8	<2	<4	9		
Ce	-	<28	<23	-	<80	<20	<17	<88	<23		
Hg	<150	-	<23	-	<40	<160	<17	<44	<23		
Tl	-	-	-	<100	-	-	<100	-	-		
Pb	<24	28	<11	38	40	<15	<8	≤44	<15		
Bi	-	-	-	-	-	<100	-	-	<12		
U	-	-	60				40	-	-	20	

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C <sup>a</sup>					
570-P			571-P		
Oxalate	Flouride	Metal	Oxalate	Flouride	Metal
Li	<0.44	-	<0.6	<0.48	-
Be	<0.44	<0.14	<0.08	<0.48	<0.2
B	<0.3	-	0.4	<0.3	-
Na	180	-	19	160	-
Mg	90	6	2	38	<4
Al	22	~7000	<2	24	~800
Si	~250	-	~300	~400	-
P	<40	-	-	<48	-
K	<44	-	<31	40	-
Ca	440	110	18	240	<12
V	<150	-	<30	<150	-
Cr	<4.4	<14	<2	<4.8	<4
Mn	<4.4	6	<2	<4.8	<4
Fe	300	-	98	125	-
Co	4.4	<14	<8	<4.8	<20
Ni	<44	110	<5	<48	20
Cu	<<30	-	<60	<<30	-
Zn	-	<58	160	-	-
As	44	3	-	-	-
Sr	-	-	2	24	<2
Cd	<44	<14	<8	<48	<40
In	<30	-	-	<30	-
Sn	200	14	~80	160	<40
Se	<150	-	<60	<150	-
Ba	44	42	<2	38	12
La	2200	~6600	1300	1420	830
Ce	<44	<28	180	46	<80
Hg	44	-	<18	48	<130
Pb	<30	28	<8	<30	<41
Bi	<100	-	<100	<100	-
Th	<150	-	-	-	-
U	<130	-	20	~180	-

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Sample	Method <sup>a</sup>	Composition - Purification Lots
5965-E	A	?
7057-B	A	?
7083-B	A	67% 513-P, 67% 514-P, 67% 515-P, 67% 516-P, 67% 517-P, 33% 518-P, 33% 519-P 525-P.
7084-C	A	?
7082-A	A	531-P, 536-P, 538-P, 541-P, 542-P.
7085-A	A	533-P, 537-P, 543-P, 544-P.
7099-A	A	551-P, 552-P, 553-P, 554-P, 555-P.
7105-A	A	558-P, 557-P, 558-P, 559-P.
7115-A	A	560-P, 561-P, 562-P, 563-P.
7130-A	A	564-P, 565-P, 566-P, 567-P.
7159-A	A	574-P.
7170-A	A	581-P, 582-P, 583-P.
7177-A	A	584-P, 585-P, 586-P, 587-P.
7193-A	A	592-P, 593-P, 594-P, 595-P, 596-P, 598-P.
7201-A	A	598-P, 599-P, 590-P, 591-P, 599-P.
7203-A	A	600-P, 601-P, 602-P, 603-P.
7205-A	A	604-P, 605-P, 606-P, 607-P.
7244-A	A	622-P, 623-P, 624-P, 625-P.
7158-A	B	576-P.
7161-A	B	577-P.
7267-A	B	633-P, 634-P, 635-P, 636-P, 637-P, 638-P, 33% 639-P, 33% 640-P, 67% 641-P, 33% 642-P, 67% 643-P, 67% 644-P.
7276-A	90% B 10% A	33% 641-P, 33% 642-P, 33% 644-P, 645-P, 646-P, 647-P, 648-P, 649-P, 650-P, 654-P, 655-P, 656-P, plus 10% from an unknown A lot.
7289-A	B	651-P, 652-P, 657-P, 658-P, 659-P, 660-P, 661-P, 662-P, 663-P, 664-P, 665-P, 666-P.
7302-A	B	667-P, plus 10% from an unknown B lot.
7326-A	B	50% 671-P, 50% 672-P, 50% 673-P.
7360-A	B	668-P, 669-P, 670-P, 50% 671-P, 50% 672-P, 50% 673-P, 676-P, 677-P, 678-P, 680-P, 681-P, 682-P.
7374-A	B	679-P, 683-P, 684-P, 685-P, 686-P, 687-P, 688-P, 689-P, 690-P, 67% 691-P, 67% 692-P, 67% 693-P.
7381-A	B	694-P, 695-P, 696-P, 50% 697-P, 50% 698-P, 50% 699-P.
7140-A	C	670-P.
7144-A	C	671-P.

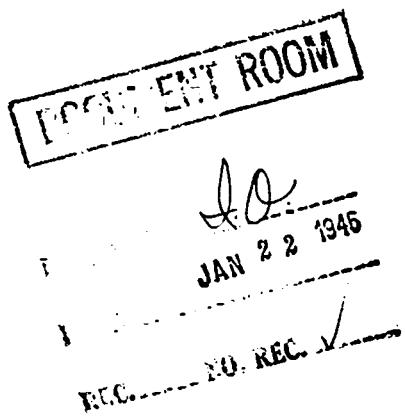
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