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HW-32875

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Richland, Washington
August 19, 1954

ESSENTIAL MATERIAL

FLOW SHEET

of

PRECIPITATION SEPARATIONS PROCESS

300 AREA
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August 19, 1954

To: C. T. Groswith
Superintendent, T Plant Sub-Section
Separations Section

From: W. G. Browne,
Superintendent, Process and Plant Services
T Plant Sub-Section

INTRODUCTION

This report describes the direct essential material requirements for processing a standard run through the precipitation separations process in effect on August 1, 1954. Flow sheet conditions are based on a starting maximum batch size of 300 grams of product at a uranium irradiation level of 215 MWD/ton.

The essential material requirements are those used to process with 2.5 grams of Bismuth per liter in Extraction, First Decontamination Cycle volumes at 56% of the September 1, 1946 standard, and Second Decontamination Cycle through the Lanthanum Fluoride Product Precipitation volumes at 49% of this standard.

Basis

A. Dissolving Basis

215 MWD/T Material
1.072 Runs/cut balanced metal solution in the 4-B tank or
1.5571 short tons uranium/run (1)

B. Extraction Basis

18,593 to 18,704 pounds metal solution per run (2)

C. Volume Basis

Standard Runs: 56% volume through First Decontamination Cycle,
49% volume through Second Decontamination Cycle and 724-7
Concentration Building.

(1) Based on runs produced from 315.159 tons of uranium processed during April, May, June, July and a portion of August 1954.

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221 BUILDING ESSENTIAL MATERIAL FLOW SHEET

I. PREPARATION OF METAL SOLUTION

A. Coating Removal (3-5L, 3-5R & 4-5L)

26% Sodium Nitrate - 1788# (Per Run)
50% Sodium Hydroxide - 497# (Per Run)

B. Metal Dissolution (3-5L, 3-5R & 4-5L)

60% Nitric Acid - 7187# (Per Run)
Mercuric Nitrate Salt - 1.32# (Per Run)

C. Metal Solution Storage (4-8 & 4-7)

93% Sulfuric Acid - 1319# (Per Run)

D. Batch Size Make-up and Pretreatment (6-1 & 6-3)

25% Sodium Nitrite - 591# (Per Run)

II. PRODUCT EXTRACTION (7 & 8)

A. Precipitation

24% Bismuth Subnitrate - 337# (17.5% Bi & 30% HNO_3)
75% Phosphoric Acid - 1606#
25% Sodium Nitrite - 317#
60% Nitric Acid - 169# (For Bi Dissolving)

B. Centrifugation

None

C. Cake Dissolution

60% Nitric Acid - 1760#

III. FIRST DECONTAMINATION - BY-PRODUCT (12-7 & 12-8 13 & 16)

A. Oxidation (12-7 & 12-8)

10% Sodium Bismuthate - 105#
10% Sodium Dichromate - 32#

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B. Precipitation (13-1 & 16-1)

10% Sodium Bismuthate	-	92#
24% Bismuth Subnitrate	-	48#
60% Nitric Acid	-	24# (For Bi Dissolving)
60% Nitric Acid	-	10#
75% Phosphoric Acid	-	149#
10% Sodium Dichromate	-	28#
5% Zirconium Nitrate	-	83#
20% Ceria Ammonium Nitrate	-	2.75#
60% Nitric Acid	-	20# (For Zirconium Dissolving)

C. Centrifugation

None

D. Cake Removal

60% Nitric Acid	-	2150#
50% Hydrogen Peroxide	-	23#

IV. FIRST DECONTAMINATION - PRODUCT (14 & 17)

A. Reduction and Precipitation

14% Ammonium Silico Fluoride	-	880#
20% Ferrous Ammonium Sulfate	-	1090#
24% Bismuth Subnitrate	-	120#
75% Phosphoric Acid	-	680#
60% Nitric Acid	-	60# (For Bi Dissolving)

B. Centrifugation

None

C. Cake Dissolution

60% Nitric Acid	-	1200#
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V. SECOND DECONTAMINATION - BY-PRODUCT (18)

A. Oxidation

10% Sodium Bismuthate	-	90#
10% Sodium Dichromate	-	28#

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B. Precipitation

75% Phosphoric Acid - 100#
10% Sodium Dichromate - 13#

C. Centrifugation

None

D. Cake Removal

60% Nitric Acid - 770#

VI. SECOND DECONTAMINATION - PRODUCT (19 & 20)

A. Reduction and Precipitation

14% Ammonium Silico
Fluoride - 570#
20% Ferrous Ammonium
Sulfate - 745#
24% Bismuth Subnitrate - 82#
75% Phosphoric Acid - 460#
60% Nitric Acid - 41# (For Bi Dissolving)

B. Centrifugation

None

C. Cake Dissolution

60% Nitric Acid - 920#

VII. WASTE DISPOSITION

A. Coating Removal Waste

None

B. Extraction (Metal) Waste (7-3, 8-3)

50% Sodium Hydroxide - 4678#
30% Sodium Carbonate - 20,296#

C. First Decontamination Waste (13-4 & 16-4 14-3 & 17-3)

50% Sodium Hydroxide - 4220#

D. Second Decontamination Waste (18-4 & 19-3)

50% Sodium Hydroxide - 2385#

E. Cell Drainage Waste (5-6)

50% Sodium Hydroxide - 4575#/Month
(Historical Average)

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224 BUILDING ESSENTIAL MATERIAL FLOW SHEET

I. BISMUTH PHOSPHATE - BY-PRODUCT (A CELL)

A. Oxidation (C-4)

3.9% Sodium Bismuthate - 11# Salt
1.4% Sodium Dichromate - 4# Salt

B. Precipitation (A-1)

2.25% Sodium Dichromate - 4.5# Salt
75% Phosphoric Acid - 69#
99% Potassium Permanganate - 0.1# Salt

C. Centrifugation

None

D. Cake Removal

60% Nitric Acid - 1000#

II. LANTHANUM FLUORIDE - BY-PRODUCT (D CELL)

A. Oxidation and Precipitation

5% Potassium Permanganate - 170#
Lanthanum Ammonium Nitrate - 12# Salt
(24# - 12# historical ave. for recycle additions)
60% Nitric Acid - 19# (37 minus 18# ave. for recycle)
100% Hydrofluoric Acid - 23#
5% Potassium Permanganate - 50#
(average recycle additions)

B. Reduction (D-3)

Cxalic Acid - 75# Salt

C. Centrifugation

60% Nitric Acid - 50#

D. Cake Removal

None

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E. Rework Oxidation

Sodium Dichromate	-	0.75# Salt
60% Nitric Acid	-	215#
5% Potassium Permanganate	-	125#
100% Hydrofluoric Acid	-	10#

F. Rework Centrifugation

60% Nitric Acid	..	25#
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G. Rework Cake Removal

None

III. LANTHANUM FLUORIDE PRODUCT (E & B CELLS)

A. Precipitation

100% Hydrofluoric Acid	-	66#
Lanthanum Ammonium Nitrate	-	6.6# Salt
60% Nitric Acid	-	6.8#

B. First Centrifugation

None

C. Second Precipitation

Lanthanum Ammonium Nitrate	-	6.6# Salt
60% Nitric Acid	-	6.8#

D. Second Centrifugation

None

E. Third Precipitation

Lanthanum Ammonium Nitrate	-	3.3# Salt
60% Nitric Acid	-	3.4#

F. Third Centrifugation

60% Nitric Acid	-	50#
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G. Cake Removal

Potassium Hydroxide	-	234# Salt
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IV. METATHESIS (F CELL)

A. Metathesis (B-4)

None

B. Metathesis Centrifugation

None

C. First Cake Removal

Potassium Hydroxide - 28# Salt

D. Metathesis Wash Centrifugation

None

E. Final Cake Dissolution

60% Nitric Acid - 27#

F. Rework Precipitation

Lanthanum Ammonium

Nitrate

60 % Nitric

- 1# Salt

- 1#

G. Centrifugation

None

H. Rework Cake Washback

None

V. WASTE DISPOSITION

A. Bismuth Phosphate Cross-Over (A-4BP)

50% Sodium Hydroxide - 870#

B. Lanthanum Fluoride - By-Product (D-4-BP)

None

C. Lanthanum Fluoride - Product (B-3, E-3W3)

50% Sodium Hydroxide - 1670#

D. Metathesis Waste (F-8)

None

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MASTER RECYCLE RUNS, 224 BUILDING
ESSENTIAL MATERIAL FLOW SHEET
AT 10% VOLUME

I. LANTHANUM FLUORIDE - BY PRODUCT (D CELL)

A. Oxidation and Precipitation

5% Potassium Permanganate - 210#
Lanthanum Ammonium Nitrate - None (Historical average)
60% Nitric Acid - 360#
(Historical average for additions to recycle)
5% Potassium Permanganate - 100#
(Historical average for additions to recycle)
100% Hydrofluoric Acid - 23#

B Reduction (D-3)

Oxalic Acid - 75# Salt

C. Centrifugation

60% HNO₃ - 50#

D. Cake Removal

None

E. Rework Oxidation

Sodium Dichromate - 0.75# Salt
10% Nitric Acid - 215#
5% Potassium Permanganate - 150#
100% Hydrofluoric Acid - 10#

F. Rework Centrifugation

60% Nitric Acid - 25#

G. Rework Cake Removal

None

III. LANTHANUM FLUORIDE PRODUCT (E & B CELLS)

A. Precipitation

100% Hydrofluoric Acid - 66#
Lanthanum Ammonium Nitrate - 6.6# Salt
60% Nitric Acid - 6.8#

B. First Centrifugation

None

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C. Second Precipitation

Lanthanum Ammonium Nitrate - 6.6# Salt
60% Nitric Acid - 6.8#

D. Second Centrifugation

None

E. Third Precipitation

Lanthanum Ammonium Nitrate - 3.3# Salt
60% Nitric Acid - 3.4#

F. Third Centrifugation

60% Nitric Acid - 50#

G. Cake Removal

Potassium Hydroxide - 23.4# Salt

IV. METHATHESIS (F CELL)

A. Methathesis (B-4)

None

B. Methathesis Centrifugation

None

C. First Cake Removal

Potassium Hydroxide - 28# Salt

D. Methathesis Wash Centrifugation

None

E. Final Cake Dissolution

60% Nitric Acid - 27#

F. Rework Precipitation

Lanthanum Ammonium Nitrate - 1# Salt
60% Nitric Acid - 1#

G. Rework Centrifugation

None

H. Rework Cake Washback

None

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V. WASTE DISPOSITION

A. Lanthanum Fluoride - By-Product (D-4-BP)

None

B. Lanthanum Fluoride - Product (B-3, E-JWS)

50% Sodium Hydroxide - 1670#

C. Methathesis Waste (F-3)

None

BY:

H. W. Murray
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WG Browne:HWM:rc

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