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REVISED REQUIREMENTS FOR
CONTINUOUS BIRCH RECOVERY AT REDOX

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REVISED REQUIREMENTS FOR
CONTINUOUS BIRCH RECOVERY AT REDOX

By

R. G. Barnes

Redox Technology Operation
Research and Engineering
CHEMICAL PROCESSING DEPARTMENT

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REVISED REQUIREMENTS FOR
CONTINUOUS BIRCH RECOVERY AT REDOX

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I. INTRODUCTION AND SUMMARY

The process criteria set forth in reference (1) proposed use of the existing organic wash column, 10, as a stripping column for the neptunium accumulation and isolation cycles. It is now proposed to employ a new processing concept which will permit the use of the scrub section of the neptunium extraction column, 1S, for neptunium stripping thereby obviating the use of the 10 Column. This proposed new scheme will provide increased neptunium stripping efficiency and greater processing flexibility for the 1S Column. The revision will require four new jumpers, but will permit the deletion of eight jumpers required for the original proposal.

This document discusses the technical bases and incentives for the proposed change and presents revised flow diagrams and jumper routings.

III. DISCUSSION

A. Technology

1. Revised Processing Scheme (Figure 1)

The proposed revision affects only the equipment employed for neptunium stripping in the accumulation and isolation portions of the neptunium recovery and decontamination process. From a functional standpoint the revised processing scheme is essentially identical to that originally proposed.

During the accumulation portion of the process cycle, the neptunium extracted in the 1S Column will be permitted to pass, via the existing LSP routing, to the 2E Column where it will be stripped and drained into the F-2 evaporator. Thus, existing routings are employed to permit the 2E Column to fulfill the function originally proposed for the 10 Column.

During the isolation portion of the process cycle, the neptunium extracted in the 1S Column will be stripped into an unsalted aqueous phase passing through the scrub section of the column. This product stream will then leave the 1S Column through the unused back-cycle nozzle, thence, via a rotameter and control valve to the 3AF tank (E-1). A jack-leg will be included in the new line to prevent the withdrawal of an organic phase from the 1S Column. Thus, the scrub section of the 1S Column will supplant the 10 Column for the isolation process.

The stripping portion of the 1S Column will be controlled in such a manner that a small portion of the salted aqueous phase from the extraction section leaves the column at the outlet from the stripping section. This technique will prevent the refluxing of neptunium,

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uranium, plutonium or nitric acid in that portion of the column between the stripping and extraction sections. The control will be exercised, primarily, by maintaining the effluent flow from the stripping section at a slightly higher rate than the influent flow. A secondary check on the flow balance will be provided by a specific gravity measurement made in the effluent line to E-1. Similar measurements in the LAW and LSW streams have indicated that specific gravity can be controlled to within approximately ± 0.005 unit of the desired value. A third check on the control of the stripping section will be provided by the 1S Column pressure recorder which should indicate relatively constant pressure during normal control, but would show a decreasing pressure if the unsalted aqueous phase passed below the stripping section outlet.

2. Incentives for Revision

The proposed revision offers the following process and economic incentives:

- a. Improved neptunium stripping efficiency.
Since relatively low organic flows will be required for neptunium extraction in the 1S Column, the use of the 11-inch-diameter 1S scrub section will be considerably more favorable than the 16-inch-diameter 10 Column. The effective packed heights are approximately equal.
- b. Greater processing flexibility for the 1S Column.
Retention of the existing LSP routing to the 2E Column will permit emergency use of the 1S Column in parallel with or in place of the 1A Column.
- c. Retention of the 10 Column in organic service.
Continuing the use of the 10 Column in organic service minimizes the potential for losses due to maloperation of any of the stripping columns, by assuring that any product values will be returned via the 10W to the back-cycle concentrator (D-14) rather than going via the organic still (G-3) to the waste system.
- d. Fewer jumpers required.
The proposal requires only four new jumpers in place of the eight required to place the 10 Column in neptunium stripping service.

3. Process Safety

Maloperation of the 1S Column during one of the brief neptunium isolation periods could, through extended failure of all of the control measures previously discussed, result in loss of salt in the section of column between the stripping and extraction sections. Such a condition would be undesirable since it would result in partial reflux of plutonium and nitric acid. Plutonium reflux, to be hazardous, would have to reach a concentration of approximately 90 grams per gallon. Such a concentration could

not be attained, under conditions that would prevail in the column, despite the maximum credible loss of plutonium from either the 2D Column or the anion exchange system. A reflux of nitric acid in the column would have to exceed a concentration of 1 molar to present a hazard from reaction with hexone. It is extremely unlikely that this concentration could be achieved within the range of acid concentrations and flows projected for the isolation cycle. Thus it appears that the proposed process change involves no serious hazards.

B. Equipment

1. Additional Equipment Required

The additional equipment requirements for the proposed revision consist of the jumpers required to permit a controlled flow of stripping solution from the 1S Column to the E-1 tank. The necessary jumpers and associated cold-side facilities include:

- a. A jumper from nozzle 11 on the 1S Column to a male nozzle, on 1.b. below, near the top of the 1C Column. This jumper should include a jack-leg at the 1S end to prevent withdrawal of an organic phase from the 1S Column.
- b. A jumper providing a male nozzle for 1.a. above, and connecting to nozzle 1C-U4 (the spare 10F header). This jumper should contain a control valve, with integral air line to nozzle 1C-U10, and a rotameter.
- c. An electrical jumper from the rotameter of jumper 1.b. to connector 1C-U8.
- d. A jumper from nozzle 10-U12, the spare 10F header outlet, to nozzle 2B-11 on the 2B Column lower U-frame.
- e. A flow recorder-controller at K-Panel with electrical signal from 1C-U8 and air signal to 1C-U10.

2. Jumper Revision

The proposed change in routing will permit deletion of the control valve in E-Cell in the line from E-T1 to E-1 tank. The sample pot in this jumper should be designed to permit specific gravity measurement using the unused air lines from E-G1 and E-G2. The dip tube spacing should be 20 inches to permit accurate measurement of specific gravity between 1.0 and 1.1. The specific gravity recorder should be located at K-Panel.

3. Jumper Deletions

The revised routing will permit deletion of the following jumpers:

- a. 10W -- 2AW-3AW-3DW H-2-30870
- b. 1S-9 -- 1S-U-15 H-2-30874

c.	1S-12 -- 1S-U14	H-2-30875
d.	1C-U13 -- 1C-U4	H-2-30876
e.	10-U12 -- 10-6	H-2-30877
f.	10-U3 & U13 -- 10-8	H-2-30878
g.	10-L1 -- 10-7	H-2-30879
h.	2B-L1 -- 10-L1	H-2-30880

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TO H-4

F-7

11A

D-14

2 E

F-2

F-1

20

HNO₃ FROM

XAW

G-3-B-

pH MONITOR

702-D -

15

REWORK

D-7

E-7

F-8

BIRCH
DECONTAMINATION
SYSTEM

FIG. 1
REDOX BIRCH RECOVERY
PROCESS FLOW ARRANGEMENT

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FIG. 2
REDOX BIRCH ACCUMULATION
FLOW DIAGRAM

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FIG. 3
REDOX BIRCH DECONTAMINATION
SYSTEM

VIA F-1.34
(SEE FIG 2)

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U7 DIFF. PRESS. RECORDER
DPR
PRESS. RECORDER
PR

U.S. 1951

**US ATTORNEY
FED. CONTROLLER
IRC**

U10 FINE DETECTOR

U1 N₂ VENT TO J-8
J-T24 @ 28

**U12 LAS TO IS
FROM 801AS**

US 1A TO 1-8
TK-001 SA

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SILO ARRANGEMENT TOWER SHAFT

FIG. 10

10

1. ● DENOTES DOWEL PIN.
2. CONNECTOR NUTS PAINTED RED SHALL BE DISASSEMBLED FIRST.

**SILO ARRANGEMENT
TOWER SHAFT
FIG. 11**

E-1

AIR TO VALVES & SRGR.

- 1- AIR TO VALVES & SRGR.
- 2- SAMPLER
- 3- LUBE E-1 AGIT.
- 4- POWER E-1 AGIT. 1HP AND FINE DETECTOR JACKET INLET
- 5-
- 6-
- 7- E-1 WT. FTR. (N2 BLEED)
- 8- ELECT. SPARE
- 9- CHEM ADDN FROM E-12-3A
- 10- E-1 TEMP & NINE
- 11- STEAM JET E-1 TO E-4, 10 GPM
- 12- E-1 SAMPLER
- 13- LUBE E-1 PUMP
- 14- POWER E-1 PUMP 0.75 GPM
- 15- INST SPARE
- 16- FRC E-1 TO 3A

FROM IOW
2B-L1

FROM 3AW
2B-L2

N₂ VENT TO J-5
J-724825

TO E-4, 10GPM
E-TIS

JACKET OUTLET
207-S

TM 2-15

- 1- TO 3AF 3A-L18
- 2- TO 3AF 3A-L14 SPARE
- 3- JACKET OUTLET 207-S
- 4- N₂ VENT TO J-5 J-T24825
- 5- FROM 2BP 38-L1
- 6- FROM 3BP 38-L2
- 7- JACKET OUTLET 207-S
- 8- N₂ VENT TO J-5 J-T24825
- 9- TO E-7 106PM E-139
- 10- TO AIR TUNNEL J-T24825 SPARE
- 11- TO E-10 6PM-19 E-T8
- 12- FROM E-6 SPARE E-T31
- 13- TO 8-1, 250PM
- 14- TO D-1 SPARE
- 15- AIR TO CV E-1 TO 3-A UTIL. SPARE
- 16- E-2 WT. FTR.
- 17- CHEM ADDN FROM E-182A
- 18- AIR TO CV 3BP - E-2
- 19- E-2 TEMP & MIKE
- 20- INST SPARE
- 21- E-2 SPRAY, 30PM
- 22- JACKET INLET
- 23- E-2 ELECT. SPARE
- 24- STEAM JET (NITROGEN BLEED) E-2 TO E-3, 106PM
- 25- E-2 ELECT. SPARE
- 26- E-3 WT. FTR. & SPG.
- 27- E-2 TO E-3 JET INLET
- 28- LUBE E-3 ABT.
- 29- E-3 TEMP & MIKE
- 30- AIR TO PUMP & CHEM ADD. (2)
- 31- POWER E-3ABT. 0.33 HP AND FINE DETECTOR
- 32- INST. SPARE
- 33- E-3 SAMPLER
- 34- JACKET INLET
- 35- SAMPLER SPARE
- 36- STEAM JET E-4 TO L-1, 0.2 GPM
- 37- E-3 TO L-1
- 38- STEAM JET E-3 TO E-4, 10 GPM
- 39- TO E-16 JET DISCHARGE
- 40- E-4 WT. FTR. & SPG. (NITROGEN BLEED)
- 41- 3PAR Q, 8 Q, 9
- 42- STEAM JET E-4 TO E-7, 10 GPM
- 43- E-4 TEMP & MIKE
- 44- AIR TO VENT JET
- 45- E-2 ELECT. SPARE
- 46- STEAM TO JET E-4 TO E-1
- 47- E-1 SAMPLER
- 48- JACKET INLET
- 49- INST. SPARE
- 50- E-3 TO E-4, 250PM
- 51- UTIL. SPARE
- 52- STEAM JET E-3 TO E-4, 106PM
- 53- INST. SPARE
- 54- E-3 WT. FTR.
- 55- E-4 WT. FTR.

ES

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NOTE

1. DENOTES COVER BLOCK OPENING.

2. * DENOTES KEY BLOCKS.

NOTE

1. ● DENOTES DOWEL PIN.
2. CONNECTOR NUTS PAINTED RED SHALL BE DISASSEMBLED FIRST

CELL ARRANGEMENT
E-CELL
FIG. 12

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UTILITY SPARE - 38
 UTILITY SPARE - 39
 INST. SPARE - 40
 AIR TO CONTROL VALVE
 F-1 TO 2 DF - 41
 FLOW RECORDER CONTROLLER
 F-1 TO 2 DF - 42
 POWER TO F-1 PUMP
 (5 H.P., 1.8 GPM) - 43
 LUBE TO F-1 PMUP - 44
 F-1 COIL INLET - 45
 F-1 SAMPLER - 46
 POWER TO F-1 AGITATOR (1 H.P.) - 47
 SAMPLER 2 EP - 48
 F-1 TEMP & MIKE - 49
 ELECT. SPARE - 50
 LUBE TO F-1 AGITATOR - 51
 INST. SPARE - 52
 F-1 WEIGHT FACTOR
 (NITROGEN BLEED) - 53
 F-1 CHEM ADD - 54
 F-1 TO E-12 SPARE - 55

CELL ARRANGEMENT

F-CELL

FIG. 15

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