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GENERAL ELECTRIC

HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

DOCUMENT NO.

HW-66346. SUP 1

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TITLE

REDOX BIRCH RECOVERY
SCOPE DESIGN
REVISION NO. 1

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SCOPE DESIGN
REVISION NO. 1

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Per DOC May 1973
By B. Roberts 2/6/74

By

H. E. Hanthorn
Process Design and Development
Facilities Engineering
CHEMICAL PROCESSING DEPARTMENT

October 24, 1960

This document has been reviewed and
approved as a basis for project action.

SPECIAL RE-REVIEW
FINAL DETERMINATION
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BY JW Jordan 8-25-81
BY 9-14-81

Submitted by:

Manager
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10/25/60
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REDOX BIRCH RECOVERY
SCOPE DESIGN
REVISION NO. 1

I. INTRODUCTION

The scope design for Birch recovery at Redox was presented in document HW-66346, dated September 12, 1960. Final plutonium purification and decontamination by anion exchange in a pulsed-bed contactor under development by Hanford Laboratories was proposed. Potential advantages of low cost and improved operability were anticipated from the new contactor; when these were not demonstrated in the development work in time to meet project schedules, it was decided to revert to the Higgins-type contactor (Reference 7), for which considerable Purex operating experience can be drawn upon for design bases. This scope revision presents the necessary changes to cover the change of contactors.

No process or equipment changes for the Birch accumulation, decontamination, concentration and load-out processes are proposed herein. The section numbering of the original document is retained in this revision for the convenience of the reader.

II. SUMMARY

A revised process flow diagram and engineering flow diagram and a scope design of the proposed Higgins-type contactor are presented. Each item of work required for the project is listed in detail, and the listing is correlated with the engineering flow diagram by symbol.

III. DESIGN BASES

This section of the original document stands without change.

IV. DESCRIPTION OF THE PROCESS

A. Birch Accumulation (SK-2-18438)

B. Birch Decontamination (SK-2-18438)

No change in these processes is proposed in this revision.

C. Plutonium Decontamination (SK-2-18439 Rev. 1)

The proposed Birch decontamination process withdraws the 3A-3B plutonium solvent extraction cycle from its normal function. The decontamination factor of about 10 currently obtained in this cycle must, therefore, be provided in some other manner.

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A continuous pushed-bed anion exchange process, to be located in 233-S Building, is proposed. This process will give the necessary decontamination from Ru-Rh and Zr-Nb, and will at the same time remove the metal ions introduced as reagents in the preceding solvent extraction cycles, such as Fe(III), BiO(I), Al(III), Na(I). Such a reagent-free plutonium solution will be readily adaptable to reduced cost 234-5 Building processes.

For this process, the plutonium (2BP) will be treated by ozone sparge for ruthenium removal in E-2 as at present. The solution will then be pumped by air displacement pump to E-3, where the plutonium valence will be stabilized at Pu(IV) by the addition of a small amount of nitrite ion. The solution will then be pumped at constant rate to the L-12 condensate evaporator in 233-S Building. Here the plutonium solution will be concentrated to 10 gm/l and 7 molar nitric acid concentration. At this concentration, Pu(IV) exists largely in the form of the hexanitrate divalent complex anion, $\text{Pu}(\text{NO}_3)_6^{--}$. This anion is strongly absorbed by strong base type anion exchange resins, among which Permutit SK has been shown by Ryan and Wheelwright (Reference 5) to be satisfactory for use with plutonium.

The concentration step will also serve to destroy the remaining nitrite ion, so that recycle to 202-S Building will not contain nitrite, with the hazard of catalyzing hexone-nitric acid reactions.

The concentrated plutonium solution will be air-lifted from the concentrator to a feed tank, a portion of the existing critically-safe L-10 tank. From the feed tank, a controlled pumped feed will be sent, via a preheater-filter, to the feed point on the continuous ion-exchange column (SK-2-18449). At this point, the feed stream, passing clockwise around the loop (as shown in the engineering flow diagram, SK-2-18446 Sheet 2, Rev. 1) of the Higgins-type contactor, will meet a packed bed of ion exchange resin, intermittently being pushed counterclockwise around the loop. In counter-current contact, the feed solution will be fairly completely stripped of its plutonium by the resin. The mass-transfer rate depends upon the plutonium concentration difference between the resin phase and the solution phase, and upon the diffusion rate of the plutonium anion in the resin. The over-all equilibrium depends upon the partition coefficient between the resin phase and the solution phase, and the ionic equilibrium between Pu(IV) and its various nitrato complexes. Ryan and Wheelwright (Reference 5), determined that both rates and equilibrium depend upon temperature, and that 60 C was the optimum, giving high rates with satisfactory equilibrium values. The extraction section of the column will be operated, therefore, at 60 C.

The partition coefficient for $\text{Pu}(\text{NO}_3)_6^{--}$ is so large that about 3 equilibrium contacts with resin phase will be sufficient to strip the solution to less than 1% of its original Pu content. The resin phase may readily be loaded to 40 gm Pu per liter of wet packed resin from the 10 gm/l feed solution.

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The loaded resin will be scrubbed with 7 molar nitric acid solution as it passes below the feed point. Elution of the fission products and metal impurity ions may depend, in part at least, on time for breakdown of complex ions as well as on the partition coefficients of the various ions; therefore, the scrub section of the column is to be made as long as possible. A low scrub flow rate is postulated in the process flow diagram; this rate may be increased by a factor of 2 without difficulty, but at a greater rate disposition of the extraction waste acid would be troublesome. The scrub stream will be preheated to 60 C and fed to the indicated scrub point on the column. Auxiliary heat will be applied to the column as necessary.

The loaded, scrubbed resin will be intermittently forced, by the hydraulic push system described below, past the valve C (normally closed, but open during the push cycle) into the elution section of the loop. The preheated eluant, 0.75 M nitric acid, will be introduced at the indicated point on the loop, and will pass counter-current to the loaded resin, leaving the loop at the indicated product take-off point. At an acid concentration of 0.75 M and temperature of 60 C, the hexanitrate complex is quickly broken down, and the uncharged or cationic complexes formed quickly diffuse out of the resin beads. The product solution, containing plutonium at 30 to 40 gm/l and 3 to 4 molar nitric acid, with all metallic impurities in the parts per million parts plutonium range and an over all log dF of about 7, will pass to the L-3 concentrator. With the proposed replacement of the Y vapor line connection to the de-entrainment columns with a titanium connection, all parts of the concentrator normally contacted by solution will be titanium or tantalum. This will avoid recontaminating the Pu solution with Fe(III), Ni(III), and Cr(III) from corrosion of stainless steel.

The L-3 concentrator product will flow to the L-4 product receiver, L-6 product sampler, and loadout as at present.

It should be noted that plutonium solutions are no longer routed to critically-unsafe vessels in 233-S Building. The L-1 feed tank, which will have been bypassed, will be used as a supply tank for the ion-exchanger scrub solution.

At flowsheet rate, resin movement in the column will take place on a timed cycle of approximately ten minutes. A cycle timer will automatically position the ball valves at the column entry and exit ports by electric motor drives. The position of the valves will be indicated by pilot lamps on a graphic panel. In the extraction portion of the cycle, extraction and scrubbing will take place concurrently in these sections of the loop, as described above. Backwashing of the resin in the reservoir section of the loop and the resin receiver above the three-way valve A, for removal of fines resulting from resin attrition or particles introduced in the feed, can also take place during the extraction portion of the cycle. At the end of the extraction period, the timer will close all of the feed and exit valves, open the resin push valve, and open valves B and C. It will position the three-way valve A to allow eluted resin next to the eluant entry point to be forced up into the resin receiver section,

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but closing the passage between that section and the resin reservoir. A snap-action valve controlled by a short-time relay will then open in the resin push line, and push acid (0.75 M) will be admitted to the column at 35 psig for a period of about 5 seconds. The cycle timer will then return all valves to their normal positions for the extraction cycle. The resin pushed into the resin receiver will drop into the resin reservoir, to be transferred into the extraction section on the next push. About 2.5 l of wet resin and approximately an equal quantity of push acid will be transferred on each push. In the proposed 4" schedule 10 column, 4.26" inside diameter, this quantity of resin will occupy a length of about 10-3/4 inches. Sight glasses will be provided on the resin reservoir to check the resin movement.

Operation of the Higgins unit in the extraction portion of the cycle will be simple, since the extraction and elution sections of the column are physically separated, equivalent to two separate batch resin columns. The feed, scrub, and eluant streams will be metered by flow control systems, and the product and waste streams will be piped directly to their destinations via the required instruments for supervision of column performance. The eluant flow rate will be increased for about two minutes at the beginning of the extraction cycle to displace the approximately 3.5 liters of scrub acid from the elution section. This acid will be evaporated in the product evaporator and returned to D-14.

The performance of the column will be measured by two instruments: a gamma absorptometer placed just below the feed point to determine the resin loading, and a continuous alpha monitor on the waste stream to determine that the plutonium content of this stream remains within limits.

The normal plutonium loading of the resin below the feed point will be 40 gm/l, and the normal solution concentration will be 10 gm/l. The normal absorptometer reading will therefore correspond to a plutonium concentration of 20 to 30 gm/l. If this reading should drop below the normal level, one or more of the following conditions would be indicated, in the order of probability:

1. Insufficient nitric acid in the scrub stream, permitting escape of Pu to the waste stream.
2. Loss of ion exchange capacity by the resin due to radiation damage after long use.
3. Loss of feed.
4. Low plutonium in the feed.

If the absorptometer reading should rise above the normal level, one or both of the following conditions would be indicated:

1. Movement of resin column slowed or stopped.
2. Higher than normal Pu feed rate.

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The normal plutonium concentration in the ion-exchange waste stream will correspond to a recycle of less than 1% of the entering plutonium. Observation of the absorptometer reading and the continuous alpha monitor on the waste stream will give the operator ample time to avoid accumulation of hazardous quantities of plutonium in the 2DW vessels.

The plutonium product from the anion exchange column will normally have a concentration of about 30 gm/l of plutonium, be about 3 M in nitric acid, and be almost entirely free from other components. The product stream will be continuously checked for plutonium concentration with the existing L-16 neutron monitor. Concentrations can be measured to $\pm 0.2\%$ Pu in the normal product concentration range. The product will be concentrated in the existing L-3 evaporator to about 200 gm/l Pu and loaded out into PR cans in the existing equipment.

The existing L-10 condensate receiver will be withdrawn from its normal service and converted into two critically safe tanks, one for anion exchange feed and one for waste. Condensate can be safely routed directly to the backcycle concentrator, D-14, since it is always low in plutonium content.

Means will be required for occasional removal and replacement of spent resin. Though the resin is fairly resistant to radiation damage, the incorporation of plutonium, an energetic alpha emitter, into the substance of the beads during loading affords the maximum opportunity for damage to occur. Damage results either in increased cross-linking, hardening and embrittling the resin and reducing its exchange capacity, or in bond breakage, with formation of sticky or gummy materials.

Spent resin will be removed from the column as follows: The feed will be shut off, by overriding the appropriate cam on the cycle timer. The column will then be operated for about 7 hours, a sufficient time for all of the contained resin to be exhaustively leached. At the end of that time, a resin sample will be withdrawn and checked for plutonium content. Plutonium concentrations of 0.02 gm/l or less have been regularly achieved at Purex, giving a total plutonium loss of no more than 1/2 gm for a complete resin change. When the resin is completely eluted, the cycle timer will be stopped in the resin push position, closing all entrance and exit valves (except the push valve) and positioning the column valves to allow ejection of the resin from the top of the column. The overflow and vent valves of the column will be manually closed, and the resin discharge valve manually opened. The scrub admission valve will then be opened, by overriding the appropriate cam on the cycle timer, and scrub introduced at the maximum rate, to fluidize the portion of the resin bed above the scrub. At the same time, the resin push valve will be tripped, with the timer overridden. In less than five minutes, all resin will be swept from the column and to the waste neutralizer (D-8) in 202-S Building. Some resin may be trapped in valve A; a brief return to the extraction position, followed by a second push of a half-minute duration, will suffice to clear this resin, if deemed necessary. This procedure will require careful administrative control to ensure that the resin is thoroughly eluted before discharging it and that the plutonium feed is off during the entire resin discharge procedure.

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The resin slurry addition to D-8 will not interfere with transfer of wastes to storage.

The column will be prepared for the addition of fresh resin by displacement of a portion of the liquid contents (0.75 M push acid) with air. With the cycle timer in push position and with the push acid manually valved off in the operating gallery, air will be turned into the push line from the operating gallery. A portion of the liquid will be displaced out of the resin discharge line to D-8.

The resin discharge valve will then be manually closed, the vent and overflow valves manually opened, and the fresh resin supply dolly connected to the resin inlet line. The hose connection will be bagged into the enclosure through a bag port and the connection made through glove ports. The fresh resin slurry pump will then be started and resin will be pumped into the column. This operation will be carefully watched; and when the liquid level rises into the resin receiver section, the rate of resin addition will be controlled as required to allow it to settle into a compact bed in the loop. When the column appears to be filled, it will be operated for several cycles of about three minutes each, with the feed valve closed (by overriding the cycle timer). This will serve to pack the resin in the column to normal operating density. Resin addition will then be continued until the full operating complement has been replaced. The resin supply dolly will be left in place until the column has been operated with normal feed for two shifts, since it may be necessary to add a little more resin to compensate for shrinkage during loading. This may be done during normal operation by shutting off the backwash stream and adding resin slurry at a controlled rate.

V. ALTERNATES CONSIDERED

This section of the original document remains essentially unchanged, except that the final choice of contactor, for the reasons stated above, was a Higgins unit. Since the Higgins column resin bed is fully packed (not at incipient fluidization as in the pulsed-bed contactor), flow velocities appropriate to batch units may be used in the extraction and elution sections. The resulting column diameter is 4.26 inches; a loop of pipe of this diameter constructed on two foot centers is critically safe and can readily be designed for installation in the available space in 233-S Building.

The valving of the Higgins unit, in the four inch size, can be handled reasonably economically. It is proposed to use the Continental gear-motor valve operator. This unit is compact, well-enclosed, high in torque output, readily adapted to in-hood location, and designed to be attached directly to the valve or pipe line. Ball valves will be used throughout, except for valve A, which must be a three-way plug cock.

Mechanical attrition of the resin has not been a noticeable problem in Purex experience. Provision of the backwash inlet will allow continuous removal of fines from the bed, if this is found to improve over-all performance. Replacement

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of the resin every 60 to 90 days, as indicated by an increasing duration of push time required for a given resin movement, has avoided resin sticking problems at Purex.

VI. PROCESS EQUIPMENT AND PIPING

This section of the original report remains unchanged down to item T6. The remaining items are changed to read as follows:

T. Routing Plutonium Product Solution to Ion Exchange Evaporator L-12 and Ion Exchange Column L-18

- T7. Connect the controlled feed stream to L-19 inlet nozzle. Connect the preheated and filtered feed stream to the feed point of the ion exchange column L-18. Connect the backwash inlet nozzle of L-19 to a branch from the scrub line (L-1 pump line) mentioned in V3 below, using a manually-operated ball valve. Connect the flush nozzle to the recycle header with a line using two manually-operated ball valves in series.
- T8. Provide a temperature-sensing element in the designated nozzle of the filter-preheater. Connect to a temperature recorder-controller at the panel. Connect the controlled electric current to the heating element of L-19. The recorder-controller shall be capable of on-off control of the feed stream to ± 2 C in the range 40 to 80 C.

V. Scrub and Eluant Connections to Ion Exchange Column L-18

V1, V2. Unchanged

- V3. Provide a new L-1 pump capable of delivering one gallon per minute at a discharge pressure of 50 psig. The new pump may be a few inches shorter than standard L-1 pump length since it will no longer have to empty the tank. A pump to E-5 specification will serve. Connect the pump discharge, via a new flow control system, to the scrub preheater. The flow control system will consist of a flow element, connections to a controller at the panel, and connections from the controller to a diaphragm-operated valve in the scrub line.
- V4. Provide a temperature-sensing element in the designated nozzle of the scrub preheater. Connect to a two-point latching type temperature recorder-controller at the panel. Connect the controlled electric current to the heating element of the scrub preheater. The recorder-controller shall be capable of on-off latching type control of two separate streams to 60 C ± 2 C.
- V5. Delete
- V6. Connect the preheated scrub to the scrub inlet of the ion exchange column.
- V7. Delete
- V8. Delete

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- V9. Connect a valved branch line to the wash header (L-1-A header). Provide a flow control system capable of metering the eluant flow with a precision of $\pm 2\%$ of the nominal flow rate. Provide a motor-operated ball valve at the shield wall, actuated by a low-pressure signal from the pipe line. Provide a bypass around the flow control system, containing a solenoid valve operated by the cycle timer, and an orifice for flow restriction.
- V10. Provide an eluant preheater identical to the scrub preheater V2. Fit with a temperature-sensing element and connect the element and the heater to the remaining point of the two-point recorder-controller V4. Connect the eluant line V9 to the preheater and connect the preheated eluant to the designated point on L-18.
- W. Characteristics of L-18; Resin Movement; Resin Removal and Replacement
- W1. Provide a compound Higgins-type (Reference 7) pushed-bed anion exchange column (SK-2-18449). Column to be 4 inch sch. 10 stainless steel pipe (4.26 inch ID); over-all height approximately 24 feet. Column to be a simple loop with extraction and elution sections separated by valves. Loading and elution sections to be at least 6 feet long each, and scrub section to be about 17 feet long. Resin reservoir to be 4 feet long and resin relief chamber and backwash to be about 6 feet long. Column to have screened entrance fittings for feed, scrub, eluant, resin push, and screened exit fittings for product, overflow, vent and waste streams. Unscreened outlets are also to be provided for resin removal and resin sampling, and an unscreened inlet for fresh resin slurry. All screens are to be approximately 200 mesh, 3.5% open area, except the screen at the backwash and push slipwater outlet, which is to be about 80 mesh, 3.5% open area, to permit removal of fines from the system. All entry and exit points are to be provided with ball valves. Ball valves are to be operated by Continental electric motor operators located inside the enclosure, with dry air purge supply to the motor case through the electrical conduit. The following ball valves will have manual operators only, to be operated using a hood glove: vent, overflow, resin removal, resin addition, and resin sampling. Main column valves will include two 4-inch ball valves (3-1/2 inch diameter round opening minimum) and one 4-inch Teflon-lined three way plug valve with maximum obtainable opening. Provide means of warming the column; either warm the entire enclosure to $50^{\circ} - 60^{\circ} \text{C}$ with low temperature heaters and on-off thermostat, or apply Glas-Col or equal heating tapes to the column, with contact thermostats for on-off control.
- W2. Provide and install a 9 inch impeller in the L-1-A pump. The present motor will drive the new impeller without overload.
- W3. Connect a 1 inch valved branch line to the wash header (L-1-A header). Provide a globe valve for flow rate control and a Fisher and Porter Rotasight flow indicator (or equal). Provide a solenoid-operated

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snap-action on-off valve, with a timer relay adjustable between 2 and 30 seconds. Connect the output of this valve system to the resin push inlet of the ion exchange column L-18, using a motor-operated ball valve at the shield wall, actuated by a low-pressure signal from the pipe line.

- W4. Connect a valved branch from the 100 psig inert gas header into the hydraulic push line W3.
- W5. Provide a cycle timer with at least 16 cams and an adjustable total sequence time from 5 to 20 minutes. Connect the electric motor operators of the following valves to the cycle timer:

<u>Service</u>	<u>Valve No.</u>
Main column three-way valve	A
Main column valve, waste to backwash	B
Main column valve, product to scrub	C
Resin push in	1
Backwash in	2
Extraction waste out	3
Feed in	4
Scrub in	5
Product out	6
Eluant in	7

Arrange the cycle timer for the following valve position schedule:

Valve No.	A	B	C	1	2	3	4	5	6	7
OPERATION:										
Extraction &										
Backwash (E)	2	C	C	C	0	0	0	0	0	0
Resin Push (P)	1	0	0	0	C	C	C	C	C	C

Provide an override for valve 5 so that with the cycle timer stopped in the resin push position, valve 5 may be opened, using a switch, as a part of the resin removal sequence. Provide an override of the timer relay mentioned in W3 for the same purpose. Provide an override for valve 4 to permit it to remain closed through the entire cycle, to allow exhaustive elution of the resin before discharge. Provide override for all flow and temperature controls to maintain them in a fixed position during the push cycle.

The valve position schedule for the manual valves is as follows:

<u>Service</u>	<u>Valve No.</u>
Overflow	8
Resin Removal	9
Vent	10
Resin Addition	11
Resin Sampling	12

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Valve No.	8	9	10	11	12	Motorized Valves	Notes
OPERATION:							
Resin Sampling	O	C	O	C	O	E	(1)
Resin Removal	C	O	C	C	C	P	(2)
Blow Column	C	O	C	C	C	P	(3)
Resin Addition	O	C	O	O	C	P	(4)

- (1) Valve 4 is closed by override to permit exhaustive elution out of the resin before sampling and discharge.
- (2) Valve 5 is opened by override to fluidize a portion of the resin bed.
- (3) Resin push acid is shut off and compressed gas is turned in from the branch mentioned in W3. Valve 5 is closed.
- (4) Resin push acid and compressed gas are turned off.

- W6. Provide a sub-branch from the wash header via a rotameter and globe valve to the backwash entry point on the column, using a motor-operated ball valve at the shield wall, actuated by a low-pressure signal from the pipe line.
- W7. Connect the resin removal point on the column to the fourth of the 5 new pipe trench lines mentioned in L4. Connect the 202-S Building termination of this trench line to the unused sampler return line at the D-8 waste neutralizer.
- W8. Connect the resin addition point on the column to a blanked flange near the enclosure face. Provide a bagport for a fresh resin slurry hose connection and two gloveports for manipulation of the flange bolts, hose, and valve.
- W9. Provide a stainless steel resin slurry tank, capacity approximately 50 gal., and a small centrifugal pump, Eastern Industries or equal, to develop about 35 ft. head at 1 gal/min. Connect to 35 ft. of hose with a flange matching the flange mentioned in W8. Mount tank and pump on a dolly. (Not shown on SK-2-18446).
- W10. Connect the column vent to the vessel vent header.

X. Product and Waste Connections to L-18; Instrumentation; Enclosure

- X1. Connect the product connection of L-18 to the feed connection of L-3 via a chamber containing a neutron monitor head. Relocate the L-16 neutron monitor-lead to the new head. Disconnect the existing routing from L 2 to the feedpoint of L-3.
- X2. Relocate the F-1 gamma absorptometer from 202-S Building. Provide a new source as recommended by Instrument Development Operation, Hanford Laboratories. Determine whether a new ion chamber is needed; provide

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one if required. Mount the source and ion chamber 12 to 18 inches beyond the feed point on the column. Connect the ion chamber to the amplifier rack in the can storage room, and the amplifier output to the instrument on the panel.

- X3. Connect the waste outlet point of L-18 to L-10W via the measuring chamber of the alpha monitor.
- X4. Unchanged.
- X5. Unchanged.
- X6. Unchanged.
- X7. Connect the overflow outlet of L-18 to the recycle header if it is determined that the Redox process can tolerate small amounts of ion exchange resin in the recycle. Connect it to the resin removal line W7 if it is determined that small amounts of ion exchange resin upset the process.
- X8. Provide two gloveports and a bagport in the enclosure near the resin sample valve to permit introduction and removal of a resin sample bottle and operation of the valve.

Y. Miscellaneous Changes to 233-S Building Piping; Birch Loadout

This section remains unchanged.

VII. SAFETY

The sections on nuclear safety remain unchanged.

C. Radiation Safety

The alterations in routing and equipment for Redox Birch recovery do not alter the safety conditions of the plant. Installation of the Higgins ion exchange contactor in 233-S Building requires a change in design philosophy, however, since it is a relatively high pressure vessel and so is not adapted to the seal pot system now used for lines through the concrete shield wall between the operating area and the process area. Three lines are required to serve the Higgins unit: the hydraulic push line, 1 inch, and the backwash line and the elution line, each 1/2 inch. At all times that the unit is in operation, the pressure in the lines will be greater, by the amount of pressure drop in the pipe lines and entry fittings at least, than that in the vessel, since the L-1-A pump will maintain a header pressure of 35 psig. However, it is possible to turn off the L-1-A pump and continue operation of the scrub and feed pumps in the enclosure. This would give a pressure differential of some 15 psig into the operating area. Even if appropriate administrative controls are set up to assure that the pumps inside the enclosure are turned off whenever the L-1-A header or any of the three lines mentioned is depressurized, there would remain a head of several feet of liquid against the entry point through the shield wall, because of the height of the column. It is proposed to install

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a motor-operated ball valve actuated by a low-pressure signal from the pipe line immediately adjacent to the shield wall on the operating area side for each pipe line, and to establish administrative controls requiring that the feed and scrub pumps be turned off whenever the unit is shut down. This proposal provides double valving of the three lines entering the operating area, so that even if the operator fails to shut down the feed and scrub pumps, the operating area will be protected against backflow except in case of failure of two highly reliable valves to hold. This arrangement, while not giving as complete protection against backflow as the seal pots used on low-pressure lines, is expected to be adequate. Maintenance of the automatic block valves will be done in the isolated zone behind the operating panelboard in 233-S Building, and the plastic sleeve technique may be used as further assurance against backflow of contaminated air while this work is being done.

The alternatives explored to give complete protection are most unattractive from the standpoint of maintenance. One possibility is the installation in the process enclosure of double motor-operated valves, with a motor-operated drain valve draining the space between the two main valves when they are closed. These valves and their operators, for complete protection of the process area, would be located adjacent to the shield wall, at the most inaccessible part of the 233-S Building enclosure. Maintenance work at this location would be hazardous and expensive. Further, reliance would be placed on the dependable operation of five separate pieces of equipment per pipeline -- three valves and two motor operators. A second possibility, even less attractive, would be to move the L-1-A pump into the process area, provide a seal pot pump feed tank, and install the three flow control systems in the enclosure. This alternative raises maintenance problems, makes operation much less convenient, and requires physical crowding of components.

Prevailing design details will be used on all other entries into process areas so that no increase in over-all radiation hazard is expected.

D. Chemical Safety

This section is unchanged from the original document.

VIII. REFERENCES

1. Letter, WK MacCready to JE Travis, "Palm Production - Hanford," dated 4/15/60.
2. Letter, WK MacCready to JE Travis, "Project CGC-821, Title I Design, Purex Palm Recovery and Purification," dated 6/6/60.
3. Letter, WK MacCready to JE Travis, "Redox Birch Recovery," dated 6/27/60. (HW-65841)
4. "Requirements for Continuous Palm Recovery at Redox," by RG Barnes, dated 6/7/60. (HW-65562)
5. "The Recovery, Purification and Concentration of Plutonium by Anion Exchange in Nitric Acid," JL Ryan and EJ Wheelwright, dated 1/2/59. (HW-55893)
6. "Recovery of Neptunium from Purex Waste by an Agitated Bed of Anion Exchange Resin," Prout and Fernandez, dated 2/60. (DP-453)
7. Description of loop-type Higgins contactor; I. R. Higgins, private communication, July 1960.

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-SCCPE-

~NOTES~

APPROVED

[illegible]

(1) PLUTONIUM RECYCLE SHOULD NOT EXCEED 0.5% OF AN ENTERING IN REAR (RE)-THE GOAL FOR TOTAL METAL IMPURITIES IN THE FINAL PRODUCT IS

[illegible]

with 100

PROCESS FLOW DIAGRAM -
PLUTONIUM ANION

AMERICAN TRADING COMPANY
EXCHANGE

44-38861-7000
-SK-2-18439

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THE ASSOCIATION

LEFEND

OR DISCONNECTED

NOTE
ALL LINES IN PROCESS ARE
ARE 4-108, EXCEPT NEWBORN
AND WERE OTHERWISE NOTED

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GENERAL NOTES

1. ALL PIPE, FITTINGS AND PLATE TO BE TYPE 304-L STAINLESS STEEL.
2. ALL LAP JOINT BACKUP PLANGERS TO BE ANY 300 SERIES STAINLESS STEEL.
3. ELECTRICAL CABLE TO BE SEALED THROUGH SHEATH USING SILICONE RUBBER. GIN-SETTING PASTES MAY BE USED. NEOPRENE SHEATHED CABLE TO BE USED, NOT CONDUIT.
4. SHEATH MATERIAL 304-L OR 307 S.S.T.
5. SERVICE CONDITIONS:
OPERATING PRESSURE - 30 PSIG MAX.
DESIGN PRESSURE - VACUUM TO 100 PSIG
SOLUTION - HANDLED - 30% HNO₃
OPERATING TEMPERATURE 125°C

SCRUB PREHEATER
ELUANT PREHEATER

FEED PREHEATER FILTER

LEGEND

- (A) FEED SOLUTION IN
- (B) FILTERED SOLUTION OUT
- (C) WASH IN
- (D) WASH OUT
- (E) TEMPERATURE ELEMENT

-SCOPE-

1/2" PSIG (301102) 1/2"	
NOTE: 1/2" PSIG 1/2" PSIG	
10RE	
SK-2-18447	
U. S. ATOMIC ENERGY COMMISSION HARTFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC	
ANION EXCHANGE STREAM PREHEATERS	
REDON BIRCH RECOVERY	
SK-2-18447	1000-1

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DATE

FILMED

6/24/94

END