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DOCUMENT NO.

HW-58461

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TITLE

SCOPE DESIGN FOR CONVERSION OF PUREX ANION EXCHANGE PROTOTYPE
TO A
MANUFACTURING FACILITY

AUTHOR

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SCOPE DESIGN
FOR
CONVERSION OF PUREX
ANION EXCHANGE PROTOTYPE TO A
MANUFACTURING FACILITY

[Signature]
Prepared by L. D. Gustafson

January 23, 1959

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EXTRACTION DESIGN AND DEVELOPMENT
FACILITIES ENGINEERING OPERATION
CHEMICAL PROCESSING DEPARTMENT

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I. INTRODUCTION

The plutonium tail-end anion exchange system, installed in Purex as a prototype unit, has become an integral part of the Purex two-cycle process. Although some modifications⁽¹⁾⁽²⁾, those considered most needed, were made to the unit last June, additional changes and refinements are still needed to convert the prototype to a fully acceptable manufacturing facility. This document covers the scope design of these modifications.

II. PURPOSE

The purpose of this document is to provide scope design criteria for a project to convert the plutonium tail-end Purex Anion Exchange Prototype to a manufacturing facility.

III. SUMMARY

A summary of the scope design work is shown as follows:

A. A scope drawing of an "N" Cell Operating Control Room Addition," SK-2-2956. This drawing includes:

1. A control room enclosure.
2. Relocation of stairway to mezzanine.
3. Access doorway to PR corridor.
4. A shielding wall for control room operating area.
5. Ventilation barrier between mezzanine and regulated shop.
6. Location of platform for access to east side of "N" Cell hood.
7. Installation of an instrument rack for an alpha air monitor, and relocation of an existing instrument amplifier rack.

B. Scope drawing of "Anion Exchange Miscellaneous Modifications", SK-2-2957. This drawing includes:

1. A supplemental XAF pumping system.
2. XAW sampling via the existing L-8 alpha monitor.
3. Vacuum lift resin transfer system.
4. "N" Cell solenoid valve hood.

C. Supplementary requirements of the system:

1. An improved sealing method for protection of instrument wiring and tubing within the "N" Cell hood.
2. A method for transmitting the N-1 and N-7 weight factor signals to the Central Control Room.
3. Medium pressure steam supply and PRV station for "N" Cell concentrator.

(1) Drawings E-2-57351, H-2-57353, & H-2-57354.

(2) Meeting Minutes, "Prototype Anion Exchange Conversion Meeting - April 29, 1958", by L. D. Gustafson, dated April 30, 1958.

IV. DISCUSSION

A. Drawing SK-2-2956 provides scope design for the "N" Cell Operating Control Room Addition. On this drawing is found the required criteria for:

1. An operating control room enclosure complete with lighting, ventilation, and an instrument survey station.
2. Relocation of the stairway to the mezzanine providing mezzanine access without entering "N" Cell. Stairway treads are to be enclosed to control spread of contamination.
3. A doorway through a 3-foot thick concrete wall to provide an improved access to the PR Corridor from the "N" Cell operating control room.
4. A concrete shielding wall with lead glass window between the operating control room and "N" Cell. This 4-inch thick concrete wall is required to reduce an existing control area exposure rate of approximately 3 mr/hr to less than 1 mr/hr. This is required for efficient operator utilization at the annual exposure limit of 2000 mr/year.
5. Extension of the "N" Cell wall to the ceiling providing a ventilation barrier between the mezzanine and Regulated Shop.
6. An access platform on the east side of the anion exchange hood similar to the existing platform on the west side of the hood. Platform is to be supported by two monorails with rollers allow-in traverse along length of hood.
7. A new instrument rack inside the operating control room and rearrangement and relocation of the existing instrument amplifier rack to provide improved operating access. The new instrument rack is to permit installation of an alpha air monitor. This alpha air monitor is not provided by this project.

B. Drawing SK-2-2957 provides the scope criteria for these items:

1. A supplemental XAF pumping system

The original prototype equipment for this XAF pumping service consisted of a single Lapp Pulsafeeder. Because of excessive maintenance problems associated with the Lapp Pulsafeeder installation, the pulsating action on the XA column resin, and the difficulty which is often encountered in starting flow through this pump, it is desired that an improved XAF pumping system be installed to replace the Lapp Pulsafeeder. This scope document provides the design for an improved XAF pumping system.

It is proposed that a dual pump installation be provided in order to allow continued operation of the plutonium tail-end anion exchange unit in the event of XAF pump failure. With the existing Lapp Pulsafeeder installation, a pump failure requires switching the ZBP stream to the L-Cell package or shutting down the complete Purex Plant. Frequently product from the L-Cell

Package will not meet shipping specifications or the L-Cell Package is not operable. In the proposed installation, two Wilfley pumps are installed in parallel with only one pump normally operating and the other pump immediately available as an operating spare. Scope drawing SK-2-2957 shows the proposed XAF pumping system utilizing the Wilfley centrifugal pumps.

2. A sampling installation to allow routing a portion of the XAW stream through the existing L-8 alpha monitor. The L-8 sampler discharge is to be routed to J-1 via a new L-Cell jumper.

Purex Technology is designing a modified XAW installation to permit rerouting the N-6 process condensate to the F-10 or J-1 tank. This modification to be installed by the Purex Operation is to include a sample tank which will be utilized in the XAW sampling installation as shown on drawing SK-2-2957.

3. A vacuum lift resin transfer system for moving contaminated resin from the bottom of the anion exchange hood to the resin receiver tank.
4. A new hood-type enclosure for the "N" Cell solenoid valves. Relocation of the solenoid valves to the "N" Cell mezzanine will reduce the maintenance and replacement costs now experienced with the solenoid valves located within the "N" Cell Hood. Solenoid actuated air lines within the "N" Cell hood are to be replaced with stainless steel tubing in order to eliminate the cracking problem associated with the use of plastic tubing for this service.

C. In addition to the items shown on the two scope drawings, the following items are required for converting the anion exchange system to a manufacturing facility:

1. An improved sealing method is required for protection of instrument wiring and tubing within the "N" Cell hood. These are presently covered by polyethylene tubing. The tubing itself seems a good material selection; however, the end points of the tubing runs are susceptible to penetration from vapors within the hood. A protective seal with teflon tape or equivalent is suggested for this service. Though more expensive, this material should prove a more effective sealant at these critical points.

Tubing runs are to be festooned together wherever possible to help clear congestion within the hood. Color coding will help clarify the runs as to function.

2. Transmission of the N-1 and N-7 weight factor signals to the Central Control Room will provide a valuable aid to plant operation. This may be accomplished by:
 - (a) A 2-pen recorder installed in the Central Control Room, and
 - (b) two runs, approximately 100 feet each, of copper tubing from "N" Cell to White Room where connections are made to spare instrument leads.
3. Utilizing a portion of the existing "N" Cell low-pressure steam line, medium pressure steam is to be routed from the Pipe and Operating Gallery to the Regulated Shop. A PRV is required in this line to reduce the steam pressure from 100 psi to about 50 psi. Required piping and PRV installation is to be provided by this project. This installation is required to maintain adequate steam supply to the "N" Cell plutonium concentrator.

V. APPENDIXA. Cost Estimate Summary1. Direct Costs

a. Control Room Complete	7,000
b. Stairway relocation	3,000
c. Doorway	1,600
d. Shielding wall	1,400
e. Mezzanine wall	400
f. Instrument relocation	500
g. Platform	500
h. Supplemental XAF pumping system	2,500
i. XAW Sampling Installation	700
j. Resin loading system	800
k. Solenoid hood including stainless steel "N" Cell hood tubing	3,500
l. Instrument tubing sealing	1,200
m. N-1 & N-7 Weight Factors	500
n. "N" Cell steam PRV system	500
Total Direct Costs	<u>24,100</u>

Direct Costs and Additives	30,000
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2. Design	7,000
3. Construction Engineering	6,000
4. Contingency (20%)	<u>6,000</u>
Total	49,000

B. Drawings

1. SK-2-2956, "'N' Cell Operating Control Room Addition".
2. SK-2-2957, "Anion Exchange Miscellaneous Modification".

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PROCESS PUMP SPECIFICATIONS

<u>Location</u>	Purex "N" Cell
<u>Service</u>	XAF Feed Stream
<u>Item</u>	P-N1-1 and P-N1-2
<u>Type</u>	Centrifugal
<u>Material</u>	304-L s/s
<u>Manufacturer</u>	A. R. Wilfley and Sons, Inc.*(see note).
<u>Model</u>	AF(Impeller 225-133) 1" discharge.
<u>Driver</u>	2 HP 3 Phase No/440 volt 1750 rpm.
<u>Installation</u>	Horizontal

REQUIRED PERFORMANCE

Liquid Pumped	XAF Feed Stream
Corrosive Compounds	6M Nitric Acid
Total Liquid Rate, GPM	10(9 gallons recirculated)
Pumping Temperature	150°F
Liquid Specific Gravity	1.20
Liquid Viscosity, Cp	0.7
Vapor Pressure, Psia	2.8
Suction Conditions	
Pressure, psig	0.5
Maximum pressure, psig	2.5
NPSH available, feet	25
Discharge Conditions(referred to suction elevation)	
Pressure, psig	25.5
Maximum pressure, psig	30
Hydraulic Conditions	
Differential Pressure, psi	25
Differential Pressure, ft. of pumped liquid	50
Maximum Differential Pressure at shut off, psi	27.5
Hydraulic horsepower	0.15

* Proprietary pump selection required for this service.

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GENERAL. NOTES

1. IN THE NEW OPERATING CONTROL ROOM AREA THE FOLLOWING EQUIPMENT MUST EITHER BE REMOVED ENTIRELY OR BE POSITIONED ELSEWHERE.
 - (A) WELDING OUTLET ON NORTH WALL.
 - (B) VALVE TEST BENCH ALONG SOUTH WALL.
 - (C) A PORTION OF OVERHEAD MONORAIL.
 - (D) EXISTING DRILL PRESS.
 - (E) STATIONARY GRINDER.
2. IN ADDITION TO ARCHITECTURAL CHANGES CALLED FOR ON THIS DRAWING, ADDITIONAL LIGHTING IS REQUIRED IN NEW CONTROL ROOM & AIR LOCK. FOUR DOUBLE FLUORESCENT FIXTURES 10' LONG @ 9'-0" ELEV. ARE SUGGESTED. SHORTEN EXISTING FIXTURES ABOVE THIS AREA TO ACCOMMODATE NEW MEZZANINE.
3. VENTILATION REQUIREMENTS FOR CONTROL ROOM ARE 232 CFM, BASED ON 0.8 A.C./HR. SINGLE DUCT TO CONTROL ROOM FROM EXISTING ROOM SUPPLY AND DAMPER AT ROOM DISCHARGE TO AIR LOCK THROUGH WALL FILTER. REF. DWG. H.L. 17385 FOR EXIST. VENTILATION.
4. WALLS TO BE CONCRETE OR CAST-IN-PLACE CEMENT BOARD SUPPORTED BY STEEL CONSTRUCTION.
5. WEST WALL & CEILING OF CONTROL ROOM TO BE SOUNDPROOFED.

SCOPE

APPROVED

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 100000
 N' CELL

GENERAL NOTES

1. THE REAP PUMP IS TO BE AN ARWIL PUMP PUMPING MODEL AP CENTRIFUGAL PUMP SUPPLYING 15 TO 60 P.P.O. HEAD. SEE SPEC. IN DOCUMENT HW-58461.
2. PUMP TO BE IN ACCORDANCE WITH HW-5800 UNLESS OTHERWISE INDICATED.

ANION HOOD VACUUM LIFT
 RESIN TRANSFER
 (NEW EQUIPMENT IN SOLID LINES)

SCOPE

REVISIONS		DATE	BY
NONE		7-18-59	
SK-2-2957			
SCALE NONE		RECORDING	
DO-0656		U. S. ATOMIC ENERGY COMMISSION	
		BARFORD ATOMIC PRODUCTS OPERATION	
		GENERAL ELECTRIC	
		ANION EXCHANGE	
		MISCELLANEOUS	
		MODIFICATION	
SK-2-2957			

**DATE
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