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TRITIUM EXTRACTION FACILITY
STUDY - 1965

by

G. P. Kesel
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Process Design Engineering
Facilities Engineering
CHEMICAL PROCESSING DEPARTMENT

August 20, 1965

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TRITIUM EXTRACTION FACILITY
STUDY - 1965

I. INTRODUCTION

This study was prepared in support of AEC-requested reactor case studies. Two of the cases include local separation and purification of tritium from Hanford irradiated aluminum-lithium alloyed slugs after 1974, at which time, the Savannah River Plant would be shut down.

Consideration is given to processing N Reactor rods or "K" Reactor I&E slugs. Quantities of tritium to be produced would be five kilograms per year in one case and seven kilograms per year in the other case. The facility would process tritium only through the purification stage. At this point the material would be shipped offsite for storage, packaging and any future weapon stockpile rework.

II. SUMMARY

The new facility would be capable of producing up to 9 kg/year of 99% pure tritium based on a three shift, 5-day per week operation and a 70% operating efficiency. Since equipment components and the batch size for the two furnaces have been sized to reduce the unit extraction cost, a lesser output of 5 kg/year would not significantly reduce the facility cost. Likewise, handling K-type reactor slugs would not affect the facility cost but would require one to two additional men if dejacketing of the slugs became advantageous.

The unit cost of processing tritium (amortization of facility not included) would be

. These costs are shown in Table 1.

As conceived, the facility would be housed in a new 6,000 square foot structure located adjacent to an existing stack in an existing process area. Both the stack utilization and minimum extension of utilities contribute to reducing facility costs. In addition some savings in operating costs can be realized by "sharing" some maintenance and technical personnel. Although the plot plan, shown on attached drawing SK-2-21451, shows this location adjacent to the 234-5 Building, 200-W Area, little if any additional cost would be involved in locating the facility at other existing 200 Area process facilities or at the 100-N Area.

The technology planned for the process is essentially the same as currently used at Savannah River. Significant facility cost reductions might be realized if a development program was undertaken in the near future on alternate processes such that the results could be incorporated in the design of the new facility. Such development would have to be complete by 1970.

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III. CAPITAL COST ESTIMATE AND SCHEDULE

The proposed new facility would cost an estimated \$2,800,000 including a \$500,000 contingency. A further breakdown of this estimate is given in Table 2. Placing the facility in a new virgin area would increase the total cost to approximately \$3,300,000 due to need for stack, extended services, roads, fences, etc.

Some reduction in facility cost, in the order of \$200,000 could be realized by modifying an existing building to house the facility, and another \$200,000 could be saved by utilizing Savannah River equipment in the new facility, Table 3. Significant reasons for discouraging this action is detailed later in the report under "Discussion."

The time for design, construction and testing of the new facility is estimated to be a little over three years as shown on Table 4. This is not an expedited schedule. However, it does not reflect the lag in time required if we were to utilize Savannah River equipment which might not be available until some time in 1973.

IV. DISCUSSION

A. Bases for Study

This study provides information on the tritium extraction facility capital and operating costs as requested for AEC reactor case studies. This facility was to be ready for operation by 1974 and have a capacity of 5 or 7 kg's of tritium per year. Because many of the parameters of this facility are not defined at this time, certain assumptions were made as a basis for this study. These assumptions are:

1. The end product of the new facility will be tritium gas containing less than 1% hydrogen. This gas will be placed in a gas container and shipped offsite to a packaging plant.
2. Feed to the facility will consist of NPR rod type lithium-aluminum alloy elements or IPD type lithium-aluminum alloy elements of the solid or I&E design. The NPR elements will have the zirconium can removed.
3. The facility will not reprocess tritium-deuterium gas mixtures from the weapons stockpile.
4. Shipping containers are available within the AEC complex.

B. Process Description

The proposed process for extracting and purifying tritium is the same as that used at the Savannah River Plant and is shown on the attached

flow diagram, SK-2-21450. In brief, the process consists of drying the slugs by passing hot air over them, extracting the gaseous products from the slugs in a vacuum furnace, passing the gases over a heated uranium bed to decompose any oxides, separation of the helium isotopes from the hydrogen isotopes in a palladium diffuser, and separation of the hydrogen isotopes in a thermal diffusion column. These various process steps are discussed in more detail under the equipment description.

C. R&D Support Activity

The bulk of Savannah River's R&D activity is slanted towards packaging and rework problems. They are quite satisfied with their current extraction process and are not directing much R&D effort towards major process changes.

There are other extraction and purification processes which might show promise if developed. One of these involves chromatography which permits extraction of tritium from other gases by distinct band separation. Another involves an electrolytic process for separation of tritium from tritium water. This process would eliminate much of the need for high vacuum equipment and could well reduce the capital as well as unit cost of tritium production in a new facility.

Investigation of alternate processes would have to be carried to prototype completion by 1970 to affect the design of the new facility proposed in this study. Minimum R&D expenditures in the interim period would be in the order of the following:

<u>Man Years</u>		
1966	1	\$ 50,000
1967	2	100,000
1968	2	100,000
1969	2	100,000
1970	2	100,000
1971 & on	1	50,000

D. Proposed Facility Description

1. Building

The proposed facility will be a new building located at Z Plant in 200-W Area as shown on attached drawing, SK-2-21451. This building will be a two-story, steel frame, metal sided building with concrete floors. Each floor would have 6,000 square feet of floor space. The first floor will house the main process area, control room, storage and receiving areas, change rooms and lunch room. The second floor will accommodate the upper end of the column hood and will also house the mass spectrometers, air monitoring chambers, and ventilation fans and duct work. A small basement will be required for the lower end of the column hood.

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Ventilation control will be similar to that used in the 234-5 Building with the building divided into three pressure control zones. The process hoods will be maintained at a negative pressure of about 0.8 inches water, the potentially contaminated process area will be at about 0.02 inches water negative, and the clean office and storage area will be slightly positive in pressure. Air locks will separate the clean area from the process area.

Air will be supplied to the building through a standard system consisting of dust filter, pre-heat coil, air washer reheat coil and fan. Exhaust air from the Zone I or clean area will be exhausted through gravity type dampers in the roof. The process hoods will be supplied with room air via filters in the hood walls. The hood exhaust system will be sized to provide 150-200 feet per minute air velocity through any portion of the hood which may be opened for maintenance. The hood exhaust air and the process room exhaust air will be discharged to the atmosphere through the 234-5 Building stack.

Equipment will also be provided in the new facility for fire protection, breathing air, instrument air, etc.

2. Process Equipment

a. Shielded Cell

The shielded cell facility provides equipment for receiving, storing, handling and melting the product slugs. Because of the gamma radiation associated with the impurities in the lithium-aluminum alloy and the aluminum cans, this cell has two feet thick concrete walls and lead glass viewing windows. Equipment within the cell is operated remotely.

Material handling and storage within the shielded cell is based on handling 40,000 NPR slugs annually for the 5 kg case and 56,000 annually for the 7 kg case. The slugs will be received from NPR in casks which contain about 200 slugs in a basket. Each slug is expected to contain approximately 0.125 grams of tritium. If the slugs are from the K reactors, then about twice as many slugs will be handled per batch as they are smaller in size and contain only 0.067 grams of tritium each.

The slug cask will be shipped from the reactor to the extraction facility by truck. This cask is then removed from the truck via a monorail and moved into the shielded cell. The slug basket is removed from the cask and stored in one of the nine storage positions. The storage positions are receptacles in the cell floor which reduces the radiation level within the cell. Each slug storage position is equipped with an air duct so that 95°C air can be passed over the slugs for drying. Six additional storage positions are provided in the cell for loaded and spent furnace crucibles.

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The slug baskets are removed from storage with a miniature jib crane and moved to the furnace crucible loading area with the cell monorail. It is planned to load the slugs directly into the furnace without decanning, but space will be provided for decanning equipment in the event that it becomes necessary. A manual manipulator will be used to load the slugs into the crucible. The crucible will then be moved to one of the two extraction furnaces by the monorail.

An extraction furnace is a vacuum chamber with resistance heaters and mechanical handling equipment for loading the furnace crucible and closing the furnace lid. The furnace crucible is a stainless steel container which will hold 100 NPR type slugs or 200 K-type slugs constituting a batch.

Upon completion of the extraction of gas from the slugs, the spent crucible containing the melted slugs is removed from the furnace, cooled and then stored. The crucible is disposed of by loading it into a cask which is hauled to a burial vault. The crucible is then dumped out of the cask into the vault for burial. A new crucible is required for each batch.

b. Element Separation Hood

The element separation hood is equipped with vacuum pumps, a uranium bed, palladium diffuser, and hold tanks. The hood has a stainless steel floor and frame and is enclosed with plastic door panels. The doors can be opened for equipment adjustment or maintenance. Tritium emits only beta radiation which does not constitute a shielding problem.

The product vacuum pumping system which pumps the gas from the furnace is located in this hood.

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c. Thermal Column Hood

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d. Product Load-Out Hood

e. Raffinate Hood

The raffinate hood contains pumps and tanks for pumping the hydrogen gas from the column and then disposing of it to the stack. The raffinate coming from the column is collected in two 25-liter hold tanks. This gas is then analyzed for composition and if the tritium content is less than 0.5% it is pumped to the exhaust stack with a standard mechanical roughing pump. If the tritium content is too high, the gas is recycled through the thermal diffusion column.

f. Vacuum System Hood

The vacuum system hood contains the general vacuum system used for outgassing the furnaces and to pump down any other part of the system as may be required for maintenance or startup. This vacuum equipment consists of a liquid nitrogen cold trap, a mercury diffusion pump, and a mechanical fore pump. Gas pumped through this system is discharged to the stack. Also in this hood are the by-product hold tanks and the stack gas recovery system. The by-product hold tanks are each of 135 liter capacity and receive the helium gas from the palladium diffuser. This gas is analyzed for composition and measured. The gas is then pumped through the stack gas recovery system to the by-product trailer tanks for shipment offsite. The stack gas recovery system is used to remove small quantities of tritium from the by-product or waste gases. This is done by passing the gas through a heated hopcolite bed (80% MnO₂ and 20% CuO₂) which oxidizes any of the hydrogen isotopes to form water, and then through a zeolite bed which removes these waters.

g. Zeolite Recovery System

A zeolite recovery system is provided to extract the tritium from the zeolite bed used in the stack gas recovery system. The zeolite bed is placed in a resistance heated furnace which drives off the tritium and hydrogen waters as a vapor. This water vapor is passed over a magnesium bed which decomposes the oxides and releases the tritium and hydrogen as gases. The gases are then recycled through the process equipment.

h. Mass Spectrometer Hood

Two mass spectrometers will be provided for analysis of gas composition. These spectrometers will be the primary control instruments and will receive samples from various points in the process via capillary tubes.

i. Air Monitoring Equipment

All exhaust air streams from the process hoods and the various process rooms will be continuously monitored for tritium gas. This is done by passing a gas sample from each stream through a Kanne chamber (ion chamber). The signal output of the chamber is recorded on a strip chart equipped with audible high level alarms.

E. Alternate Facilities

Previous Hanford studies included providing complete new facilities as well as utilizing existing facilities. This study proposes providing a new facility adjacent to an existing process facility to realize savings in extending utilities, sharing maintenance personnel as well as obtaining security guard service at no additional cost. Cost of providing a new

facility at a virgin Hanford site would increase the total cost by at least \$500,000 and would increase operating costs.

Certain economies could be effected, however, by installing the facility in one of the existing plants not in operation. To this end, 108-B Building, 2101-E Building, 271-U Building and the old Recuplex area within the 234-5 Building were considered as outlined below.

1. Buildings

- 108-B - This was the site of the first production extraction facilities at Hanford. Since operations have ceased, the basic loading, decanning, furnaces and "metal" extraction line remain. However, instrumentation and electrical controls have for the most part been removed. The basic problem with this building is its physical layout. It is not suited for a manufacturing plant with its multiple floors, corridors, etc. A major rework of the building's interior would have to be made to promote reduced operating costs and personnel safety as well as to include provision for column purification facilities. Even so, optimum building layout could not be accomplished. In addition, future expansion of the facilities would be a major and costly undertaking.
- 2101-E- This facility is primarily a warehouse. Construction is light weight framing covered with insulated metal panels. There is ready access to a railroad siding and the other utilities required. Extensive rework to the structure would be required to support duct and air monitoring equipment. A "pent house" would also have to be constructed for housing the upper end of the purification column, if any space other than the graphite mock-up room was to be utilized. Even here, the primary gain would be shelter thereby eliminating the cost of a new building, but with considerable counter-acting modification cost. One point in this building's favor would be that expansion of the proposed facility would not be limited.
- 271-U - A study in 1958 considered use of the similar 271-B Building, now utilized for waste management. While the building would be suitable for renovation and modification to a tritium production facility, the cost of such changes would be high and future expansion of the facilities for greater output would be a problem. In addition, conversion would utilize only a small part of the 221-271-U facility but would virtually eliminate this area's use for future extraction processes.

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234-5 - The space which contained the old Reclamation Facility within the 234-5 Building, would be utilized to house the proposed facility. There is adequate supply ventilation and utilities available. Change rooms and lunchroom are close by. The main drawback to utilization of this space is limited room for facility expansion since the area is surrounded by other activity. In addition, numerous other proposals have been made for utilization of this space. Availability by 1970 is questionable. As with other existing buildings, considerable modification effort would also be required to modify the space to the needs of the proposed facility.

In the above cases, the cost of a new structure including extension of utilities and providing office and other supporting space would be eliminated or reduced. However, a stack would have to be provided at 2101-E and 271-U as well as extensive modifications made to all of the structures as noted on Table 3. In total, only about \$200,000 in savings could be initially realized at considerable expense in loss of operating efficiency as well as potential for future expansion. Further definition of savings which could be realized with utilization of any particular existing building could only be accomplished by a detailed engineering study.

Another problem in basing 1970 performance on today's availability of buildings is that these structures might be utilized for other activity in the interim period and therefore would not be available.

2. Equipment

Consideration was also given to utilization of existing tritium separation equipment at Hanford as well as equipment from Savannah River which would be available when that facility was shut down in 1974, as outlined below.

- a. 108-B Process Equipment - Previous studies considered utilizing mainly the metal extraction line and in some cases the furnaces. By 1974, this equipment will be nearly 20 years old and if serviceable at all, would require complete overhaul. This study did not consider this equipment for the above reason and because of sizing of same is not compatible with requirements of the proposed facility to make the cost of processing tritium competitive with Savannah River. In addition such items as the palladium bed is not now used in the form present in the existing metal line.
- b. Savannah River Equipment - There is no real reason, other than cost of handling, why equipment as currently used or that which will be in use at Savannah River at time of shutdown could not be moved to the new facility. Some equipment would not be

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compatible in size for our process. However, such items as columns, pumps, control valves, palladium diffuser, Kanne detection chambers, mass spectrometers and instrumentation in part could be utilized in the new facility.

Table 3 indicates that approximately \$200,000 could be saved by utilizing Savannah River equipment in the proposed facility. The validity of this saving is anybody's guess. To utilize the equipment it would have to be dismantled, decontaminated, and crated for shipment in such a manner as to eliminate escape of tritium. The latter is not easy since tritium contaminated material can be decontaminated to a non-smearable condition one day and in a few days it will again be contaminated because the tritium diffuses out of material to the surface.

Timing of a Savannah River Plant shutdown would affect the availability of the equipment as well as affect the start-up date of the new facility at Hanford. It is estimated that these two points in time would have to be at least one year apart.

Finally the use of contaminated equipment would adversely affect the facility cost. Installation of equipment and what would normally have been "cold testing" would have to be carried out under SWP conditions involving fresh air masks and utilizing the CPFF contractor.

F. Operating Costs

Previous studies on tritium extraction plants in 1954 and 1958 estimated the unit cost for extracting tritium as _____ per gram dependent on the quantity produced. These previous studies were based on using the old metal line type equipment (108-B) which limited furnace batch sizes

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The proposed facility will be a sub-section processing organization with maintenance, laboratory, and engineering personnel utilized in this facility provided by other organizations within the department. It is planned to operate the plant on a 3-shift, 5-day week. The manpower required for this facility totals 11 exempt and 35 non-exempt. The manpower requirements will be the same for both the 5 and 7 kg cases. One additional operator will be required if MRD fuel decanning is required, and two additional operators will be required for decanning if the slugs are from the IPD reactors. A breakdown of the manpower estimate is shown in Table 5.

G. Hazards

The tritium extraction facility will not significantly increase the hazards of operating the existing plutonium processing plant. In general, tritium is less hazardous than plutonium.

1. Radiation

Radiation in tritium processing comes from two sources - hard gamma radiation from the irradiated impurities in the aluminum-lithium metal, and soft beta radiation emitted by the tritium gas. Adequate shielding of the hard gamma radiation will be provided by lead casks and the shielded cell which will be constructed of thick concrete walls and lead glass shielding windows.

The soft beta radiation of the tritium does not present an external radiation problem as it is shielded by a thin sheet of material such as the plastic hood panels. However, it can enter the body through inhalation, ingestion, or absorption through the skin and cause internal damage. In the body tritium exchanges with ordinary hydrogen in the body fluids and damage occurs through radioactive decay. Tritium is discharged from the body through biological means and has a biological half life of about ten days.

Personnel exposure is determined by routine urinalysis. Personnel protection is provided by controlled ventilation, continuous air monitoring, protective clothing, fresh air masks, and contamination surveys.

Escape of tritium to the atmosphere is controlled by operating the process system at less than atmospheric pressure, continuous air sampling of exhaust air, analyses of all product waste gases in hold tanks prior to release, and supervisory controlled key lock valves on all process exhaust lines. All ventilation air from the process area and hoods is exhausted through a 200-foot stack.

2. Explosion

The tritium and hydrogen gases in the process can form explosive mixtures with oxygen. However, the equipment and controls required

for processing tritium are such that the hazard of explosion from this source is negligible.

The heated uranium bed which contains uranium turnings may react violently with air at high temperatures. Precautions taken to avoid this hazard are to use heavy uranium chips and to install the uranium bed within a secondary vessel which is designed to contain any reaction that may occur.

3. Other Hazards

Other hazards are those commonly found in industry such as movement of heavy casks, high temperature equipment and electrical power supplies.

G. P. Kesel

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GPK:DDW/ash

V. REFERENCE DOCUMENTS

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- D. TID-5583, "Conceptual Design For A Commercial Tritium Recovery Plant," dated August, 1959, by M. E. Calkins and G. C. Mitchell, Savannah River Operations Office. (Secret.)
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TABLE 1

ESTIMATED ANNUAL OPERATING COSTS

	<u>Annual Cost</u>	<u>Unit Cost \$/Gram</u>	<u>Annual Cost</u>	<u>Unit Cost \$/Gram</u>
1. Furnace Crucibles @ \$250 Each				
2. Labor (All)				
3. Essential Materials:				
Argon				
Helium				
Liquid Nitrogen				
Miscellaneous Supplies				
Total				
4. Power:				
Electricity				
Steam				
Total				
5. Miscellaneous Equipment & Supplies				
6. Miscellaneous - Contingency				
TOTAL				

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TABLE 2

COST SUMMARY - NEW FACILITY

A. Building	\$ 420,000
B. Equipment	1,000,000*
C. Burial Pit & Jib Crane	15,000
D. Instrumentation	140,000
E. Ventilation	65,000
F. Piping	90,000
G. Electrical	<u>70,000</u>
Sub-Total	1,800,000
Contingency (28%)	500,000
Engineering	<u>500,000</u>
TOTAL	<u>\$2,800,000</u>

*Electrical & Piping Requirements Within
Hoods Are Included In This Equipment Cost

(A Breakdown of these costs is shown on the
following pages.)

TABLE 2
COST SUMMARY - NEW FACILITY
BREAKDOWN

A. Building

1. Temporary Construction - Site Preparation	\$ 10,000
2. Building and General Services: 60' x 100' 2-Story with partial basement for column. Steel frame construction, concrete second floor, 10' x 20' concrete storage vault. Building general services including lights, heating and cooling, fire protection, sewer, etc. @ \$60/Ft ²	360,000
3. Outside Services - Hookup to steam, electricity, water. Fences, roads, etc.	35,000
4. Stack Tie-in	<u>15,000</u>
TOTAL	<u>\$ 420,000</u>

B. Equipment

1. Shielded Cell, including storage, material handling equipment and two furnaces	\$ 280,000
2. Element Separation Hood	270,000
3. Column Hood	100,000
4. Product Load-out Hood	50,000
5. Raffinate Hood	30,000
6. Vacuum System Hood	65,000
7. Mass Spectrometers (2)	90,000
8. Zeolite Recovery Hood	30,000
9. Hot Maintenance Hood	<u>20,000</u>
Sub-Total Forwarded	<u>\$ 935,000</u>

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TABLE 2

COST SUMMARY - NEW FACILITY
BREAKDOWN (Continued)

B. Equipment (Continued)

Sub-Total Brought Forward	<u>\$ 935,000</u>
10. Container Outgassing Station	10,000
11. Portable Leak Detectors (2)	12,000
12. Transfer Cask and Truck	20,000
13. Furnace Crucible Cask	5,000
14. Basket for Slugs (12)	<u>3,000</u>
TOTAL	<u>\$ 985,000</u>
ROUNDED TOTAL	<u>\$1,000,000</u>

C. Burial Pit & Jib Crane

1. Burial Pit for One Year's Operation	\$ 10,000
2. Jib Crane	<u>5,000</u>
TOTAL	<u>\$ 15,000</u>

D. Instrumentation

1. Graphic Panel	\$ 100,000
2. Kanne Detection Chambers (15)	18,000
3. Personnel Monitors	7,000
4. Miscellaneous	<u>15,000</u>
TOTAL	<u>\$ 140,000</u>

TABLE 2

COST SUMMARY - NEW FACILITY
BREAKDOWN (Continued)

E. Ventilation

1. Hood Ductwork	\$ 15,000
2. Exhaust Fan System	<u>50,000</u>
TOTAL	<u>\$ 65,000</u>

F. Piping

1. Breathing Air	\$ 10,000
2. Instrument Air	10,000
3. Process Piping	50,000
4. Air Monitoring	5,000
5. Column Water Chiller	5,000
6. Mass Spectrometer Capillary System	<u>10,000</u>
TOTAL	<u>\$ 90,000</u>

G. Electrical

1. Electrical, including power to equipment, motor control center, electricity to air monitors, emergency power tie-in, etc.	<u>\$ 70,000</u>
TOTAL	<u>\$ 70,000</u>

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TABLE 3

ALTERNATE FACILITY COSTS

A. House Facility in Existing Building

1. Reduction in Cost

Building	<u>\$420,000</u>
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2. Added Costs

Stack	75,000
Building Modifications	<u>125,000</u>

\$200,000

3. Net Savings

\$220,000

B. Utilizing Savannah River Equipment Where Practical

1. Deductions

Kanne Chambers	\$ 12,000
Mass Specs	70,000
Sprengel Pumps	100,000
Instrumentation	50,000
Column	50,000
Control Valves	20,000
Palladium Diffuser	40,000
Uranium Bed	8,000
Miscellaneous	<u>50,000</u>

400,000

2. Added Costs

Dismantlment, Packaging & Shipping	50,000
Modification & Repair	20,000
Installation Under Controlled	
Conditions	100,000
Facility Testing	<u>30,000</u>

\$200,000

3. Net Saving

\$200,000

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TABLE 4
SCHEDULE - NEW FACILITY

	1970	1971	1972	1973
A. <u>Design</u>				
B. <u>Procure - Engineering Materials</u>				
Pumps				
Hoods				
Instruments				
Instrument Panel				
Mass Spec.				
Cave Equipment				
Furnaces				
Column				
C. <u>Fixed-Price Contract</u>				
Award				
Building				
Hoods				
Piping				
Vent				
Instruments				
Equipment				
D. <u>Testing & Cold Start-Up</u>				

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TABLE 5
ESTIMATED MANPOWER REQUIREMENTS

	<u>Number of People</u>	
	<u>Exempt</u>	<u>Non-Exempt</u>
<u>1. Processing</u>		
Level 4 Manager	1	
Shift Supervisors	3	
Relief Supervisor	1	
Engineer-Analyst	1	
Clerk-Accountability		1
Stenographer		1
**Operators		
Receiving & Slug Handling		3
Furnace and Outgassing		3
Extraction and Panel Operation		3
Utility		3
Relief		3
Day		1
*Janitor		1/2
Truck Driver		1
*Power (Ventilation)		1/2
<u>2. RMU</u>		
Supervisor	1	
Radiation Monitors		3
<u>3. Maintenance</u>		
Foreman	1	
Instrument		3
*Electrician		1-1/2
*Pipefitter		1-1/2
*Millwright		1
*Miscellaneous		1
<u>4. Engineering</u>		
R&E - Process Control-Mass Spec Lab	2	3
FEO - Design	<u>1</u>	<u>1</u>
TOTAL	<u>11</u>	<u>35</u>

*Shared with other area work.

**Crew sizes are minimum to operate equipment and as such, an increase in output from 5 to 7 kg will not increase manpower. If decanning is required, one additional operator will be required for NPR slugs and two additional operators if slugs are IPD type.

U. S. ATOMIC ENERGY COMMISSION
HANFORD ATOMIC PRODUCTS OPERATION
GENERAL RELEASE
TRITIUM EXTRACTION
& PURIFICATION
FLOW DIAGRAM
200-644 7000
=SK-2-21450

APPROVED FOR CONSTRUCTION	DATE	BY
APPROVED FOR PURCHASE	DATE	BY
APPROVED FOR DESIGN	DATE	BY
APPROVED FOR FABRICATION	DATE	BY
APPROVED FOR ASSEMBLY	DATE	BY
APPROVED FOR TESTING	DATE	BY
APPROVED FOR DELIVERY	DATE	BY

NO. USED ON	DATE	BY
REFERENCE DRAWING	DATE	BY
DRAWING TITLE	DATE	BY

REVISION	DATE	BY
REVISION	DATE	BY
REVISION	DATE	BY

STUDY

THIS DOCUMENT CONTAINS DATA
AS OBTAINED IN THE ATOMIC ENERGY ACT OF
1946, AND IS TRANSMITTED TO THE PUBLIC
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ADVISED PERSON IS PROHIBITED.

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LEGEND
PRODUCT
BY-PRODUCT
RECYCLE
WASTE
LITERS
FLOW CONTROL VALVE
MASS SPEC. SAMPLE POINT

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SECOND FLOOR PLAN

FIRST FLOOR PLAN

SK-2-21451

STUDY

APPROVED FOR CONST. BY: [Signature] DATE: [Blank]		U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL PLANT	
APPROVED FOR PURCHASE BY: [Signature] DATE: [Blank]		EXTRACTION FACILITY BUILDING LAYOUT	
SCALE: 1/4" = 1'-0" DESIGNED BY: H. LAYFIELD CHECKED BY: [Signature]		200-GEN, 0110 SK-2-21451	
APPROVED FOR DESIGN BY: [Signature] DATE: [Blank]		NONE	

NO.	DESCRIPTION	REV. DATE	APP. BY	FOR DATE	NEXT USED ON
1	H2-23872 PLOT PLAN 234-5Z				

SECRET

VII.

NOTES ON TRIP TO SAVANNAH RIVER OPERATIONS
232-H BUILDING

By

J. R. LaRiviere
D. D. Wodrich

July 26-27, 1965

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Our visit to the Savannah River Operation was arranged through the Atomic Energy Commission. The purpose of the trip was to gather information necessary to estimate the cost of a tritium extraction facility at Hanford. Clearance was requested for weapons (O3) information but was not granted. The discussion therefore did not include the tritium packaging facility or weapons stockpile rework. Our AEC hosts were C. B. Bastin and R. A. Caldwell of the Chemical Processes Branch, Technical & Production Division. R. A. Caldwell made arrangements for us to meet the various DuPont people and accompanied us throughout our tritium discussions and plant tour.

DuPont personnel with whom we discussed the tritium extraction facility were as follows:

R. P. Fenninger, Manager of H Area
J. A. Conaway, Manager of the Tritium Plant
A. S. Messick, 232-H Building Superintendent
N. A. Johnson, Shift Supervisor
Bill Mottel, Manager of the Technical Group

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