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234-5 BUILDING

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234-5 BUILDING

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July 9, 1956

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Process Engineering Sub-Section
Design Section
Engineering Department
General Electric Company
Hanford Atomic Products Operation

This document has been reviewed and approved by
the appropriate members of the Process Engineering
Sub-Section as a basis for the detailed design of
continuous Task I and Task II process equipment
for the RMA Line in the 234-5 Building.

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IMPROVEMENTS TO TASK I AND TASK II
234-5 BUILDING

I. INTRODUCTION

In the 234-5 Building operation, Task I consists of converting plutonium nitrate solution received from the primary separations plants to a plutonium oxalate slurry. The slurry is filtered and the filter cake is transferred to Task II while the filtrate is treated and returned for further processing in either Recuplex, Redox, or Purex. The basic Task II process consists of calcining the plutonium oxalate cake to form plutonium dioxide. The plutonium dioxide is then fluorinated to form plutonium tetrafluoride which is transferred to Task III for further processing.

The existing Task II equipment was installed as part of the original RMA line and placed in operation in 1952. Production increases have been made incrementally since that time, however contemplated production goals for FY 1958 can be achieved only by complete modification of the system. The budget for fiscal year 1956 contained \$500,000 for these potential modifications.

The existing Task I equipment was installed under Project CG-549 and placed in operation in 1955. Completion of the 1952 Hanford Expansion Program and achievement of capacity increases in reactor and in separations fields have made it desirable to increase the capacity of the RMA Task I.

Various alternate schemes for increasing production have been studied by the Technical and Design Sections during the past several months. The results of these studies are available in references (10) and (11).

II. PURPOSE

It is the purpose of this document to describe in detail the new equipment required for replacing Task I and II and to serve as a basis for detailed design of the proposed project.

III. SUMMARY AND CONCLUSIONS

The proposed installation will consist of installing continuous Task I and Task II process equipment in the area presently occupied by the existing Task II equipment. The existing Task II equipment, shown on attached drawing SK-2-6448, will be removed, and disposed of prior to installation of new equipment shown on the attached arrangement drawing SK-2-6407. The process equipment will be located in Zone III behind the operating barrier, while the remotely operated controls for each piece of equipment will be located in Zone I. The new installation will consist primarily of one pre-reduction and filtrate treatment hood (H-7), two identical hoods for performing the continuous precipitation, filtration, calcination, and fluorination processes (H-9A and H-9B), a balance hood (H-9C) for weighing the product, a storage hood, and conveyor hood (H-8) for transfer of material between hoods.

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The proposed equipment is designed to process plutonium solutions at the rate of one kilogram of plutonium per hour. The preliminary estimate of the project cost is \$700,000; this estimate was made on the basis of partially completed scope and should be considered to be only approximate.

IV. RECOMMENDATION

It is recommended that the data contained in this document constitute the scope of the project and be used as the basis for detailed design.

V. DISCUSSION

A. Process Description

The proposed process is defined in references (13), (14), (15) and the attached engineering flow diagrams SK-2-6422 and SK-2-6423.

In brief, the continuous Task I and II process consists first of batch reduction of plutonium nitrate solution reducing the plutonium (VI) to plutonium (IV) valence state by use of hydrogen peroxide. The reduced solution is batch transferred from the pre-reduction tank (PRT) to the transfer head tank (THT) where it is fed continuously to the reactor (RCTR). In the reactor, oxalic acid is added continuously forming a plutonium oxalate slurry. The resultant slurry overflows to the vacuum drum filter pan (VDF) where the oxalate precipitate is continuously filtered. The filtered precipitate is fed to the continuous calciner (CLNR) while the filtrate solution is transferred to the vacuum receiver tank (VR).

The plutonium oxalate precipitate in passing through the continuous calciner (CLNR), maintained at a temperature of 350°C - 400°C , is converted to plutonium dioxide. The plutonium dioxide is transferred to a continuous fluorinator (FLUR) which is maintained at a temperature of 450°C - 500°C . The plutonium dioxide under the action of a gaseous hydrogen fluoride and oxygen mixture is converted to plutonium tetrafluoride. The plutonium tetrafluoride powder is batch transferred to Task III.

The filtrate and wash solution from the vacuum drum filter contains approximately one per cent of the plutonium introduced to the system. The solution is transferred from the vacuum receiver tank (VR) to a continuous kill tank (FKT) where potassium permanganate is introduced to dissolve any oxalate solids. The killed filtrate is continuously treated in a filtrate catch tank (FCT) with hydrogen peroxide to dissolve the resulting manganese dioxide. The treated filtrate is continuously transferred to the Recuplex filtrate evaporator for volume reduction and further treatment.

The proposed equipment will be designed to process plutonium at the rate of one kilogram per hour. When operating at 80% efficiency and 30 days per month, the capacity of the system will be 576 kilograms of plutonium per month.

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B. Equipment Description

1. Hood Construction

Hoods will be fabricated of 304L stainless steel and will be of welded construction with angle iron frame-work, solid plate floor, and tops and walls constructed of plate wherever equipment is mounted or hung. Lucite panels will be used wherever possible to furnish maximum visibility within the hoods. Panels will be clamped to the hood by means of Nelson weld studs and retaining strips. Molded neoprene channel gaskets will be used as air-tight seals. Plastic bag access ports will be located at strategic points on the hoods to facilitate maintenance of equipment. Ports installed on Lucite panels will be fabricated of Lucite and cemented to the panel. Ports installed on stainless steel panels will be fabricated from stainless steel and bolted to the panels.

2. Pre-Reduction and Filtrate Treatment Hood H-7 - Drawing SK-2-6418

The basic operations which will be performed in this hood consist of reducing the plutonium nitrate feed solution, killing the oxalate and manganous ions in the filtrate solutions, and transferring solutions to the Recuplex concentrator and hoods H-9A or H-9B.

Equipment installed in this hood consists of a pre-reduction tank (PRT), a transfer head tank (THT), a filtrate kill tank (FKT), a filtrate catch tank (FCT), metering pumps, agitators, valves, and associated piping. Vessels will be fabricated from double-strength glass pipe with the exception of the transfer head tank (THT), which will be fabricated of 6-inch sch. 80 stainless steel pipe. The remainder of the equipment will be fabricated from either type 304 or 304L stainless steel, teflon, or glass. The proposed arrangement is shown on SK-2-6418, attached.

3. Task I and II Hoods H-9A and H-9B - Drawing SK-2-6417

The basic operation performed in this hood will consist of oxalate formation and filtration, calcination, and fluorination. Facilities for product storage and handling will be provided. The pieces of equipment to be installed are described below:

- (a) The reactor vessel (RCTR) will be fabricated from 6-inch diameter double-strength glass pipe; a mechanical agitator will be installed with the drive located outside of the hood.
- (b) A vacuum drum filter fabricated from either type 304 or 304L stainless steel will be installed. A device for agitation of the slurry in the filter pan will be required. The vacuum drum filter will be turned by a variable-speed drive which will be located outside the hood.

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- (c) The continuous calciner will consist of a horizontal trough, a screw conveyor, a conveyor drive (located outside the hood), heaters, insulation jacket, exhaust collector, Kel-F or teflon filters, and air supply. All equipment, with the exception of the filters, will be made from 304 or 304L stainless steel.
- (d) The continuous fluorinator will consist of an oval-shaped fluorinator tube, a vibrator, heaters, piping, and valves. The fluorinator tube will be fabricated from either Inconel or Hastelloy "C" and will be lined with either platinum or Baker 413 alloy. Sight glasses will be installed at both ends of the fluorination tube; it is believed that calcium fluoride crystals will be satisfactory for this service. The vibrator used in this service will be adequately housed within a corrosion-resistant envelope such as teflon to minimize corrosion. Piping used for HF service will be either Monel or Inconel; all metallic bellows will be made from Inconel. Gasketing materials used in the fluorinator will be either platinum or annealed nickel.
- (e) Oxide and fluoride powder hoppers will be fabricated from 304L stainless steel with calcium fluoride sight glasses installed for determining the powder levels in each hopper.
- (f) The rotary feed valves will be fabricated either from Hastelloy "C", teflon, fluorethene, or a combination of these materials.
- (g) A vacuum receiver and overflow vessel will be made from 6-inch diameter glass pipe with stainless steel flanges.
- (h) A dumb-waiter provided for recycle of powder to the calciner and for transferring materials inside the hood will be fabricated from 304 or 304L stainless steel.

4. Storage Hood - Drawing SK-2-6409

At the present time, one of the two Task III storage hoods is used for storage of Task IV castings and briquettes. It is planned to utilize one of the Task III storage hoods for storage of Task II powder and to build a storage hood for handling of castings and briquettes. The new storage hood will be similar to the existing Task III storage hoods and will be installed in the vicinity of hood 19 (see SK-2-6448, attached).

5. Balance Hood H-9C - Drawing SK-2-6410

The basic operation performed in this hood consists of weighing the fluoride powder and transferring this material to Task III powder pans. The equipment installed in this hood will consist of a remote balance, transfer equipment for handling material between Task II and III, and the head-end slat conveyor. The existing Task II remote balance will be utilized and a new weigh pan installation will be fabricated.

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6. Ventilation

All hoods will be maintained under negative pressure (0.8" H₂O) with respect to Zone III area. Hoods H-8, H-9C, and the Task II portion of H-9A and H-9B will be ventilated with dry air supplied from the RMA line ventilation system. The dry air will flow from the Task III area along the slat conveyor and will be exhausted from the line through the hoods. Hood H-7 and the upper and lower portions of hoods H-9A and H-9B will be ventilated with Zone III air. Exhaust air from Task I will be drawn through hood H-7. The upper and lower sections of hood 9A and 9B will be maintained at a pressure slightly positive with respect to the center section of the hood. The flow of air through the system will be controlled by manually-operated dampers. Supply and exhaust ducts will be made of stainless steel. All air will be filtered before entering the main exhaust headers. Each hood exhaust line will be equipped with a sampling port, an air velocity probe, and a manually-operated damper valve.

7. Conveyor System

A slat conveyor system will be used to service the Task II hoods and will be connected to the existing Task III conveyor. The conveyor will be fabricated from stainless steel slats fastened to a guided roller-chain and will be driven by the motor presently used to drive the existing H-10 conveyor system. The head-end of the slat conveyor will be located in hood H-9C; the take-up assembly will be located in H-8. The general arrangement is shown on SK-2-6407, attached. The existing Task I conveyor will be removed from service when hood H-7 is attached to hood H-6, section 4. When removed from service, the slats will be fastened to the angle track in hood 7, sections 1-4 to form a continuous platform along the Task I conveyor hood.

8. Electrical Considerations

Electrical engineering flow diagrams are shown on SK-2-6440, sheets 1 and 2, attached.

a. Wiring Methods

Wiring will originate at control cubicles located in the duct and main floor levels and will be distributed through wiring ducts and conduits to instrument panels, control desks, process hoods, valve cabinets, and remote mechanical equipment. The voltages available for use will be: 120 volts, 3 phase; 240 volts, 3 phase; 480 volts, 3 phase; and 125 volts DC. Circuit protection will be provided by circuit breakers and fuses located in the control cubicles and instrument panels. Wiring through the barrier to the process hoods and equipment will be enclosed in conduit.

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b. Circuit Philosophy

Tasks I and II circuits shall be kept as simple as possible consistent with good design practice. Interlocking will be provided to protect against injury to personnel, damage to equipment or disruption of the process. Electrical interlocks used will be of the permissive or lock-out type and mechanical interlocks will be of the linkage type. Combinations of these will also be used.

9. Process Instrumentation

The method of control for the batch and continuous portions of the Task I and II replacement facilities is to be provided as shown functionally on drawings SK-2-6442 and SK-2-6443, attached.

The batch portion of the process, vessels PRT and THT (Drawing SK-2-6442) shall be controlled such that vacuum transfers may be made with maximum efficiency, maximum reliability and the minimum possibility of operational error. The chemical addition to the PRT vessel shall be made by a manually-adjustable, time-varied, batch-rate meter system.

A heat balance shall be maintained on the calciner, fluorinator and FKT reaction vessels. The heat input to the calciner and fluorinator shall be controlled to maintain a powder temperature within twenty-five degrees centigrade of the operating temperature. The furnace elements shall be divided into three sections with individual manual input adjustments to each section to help balance the heat distribution throughout the furnace. The heat input to the reaction vessel FKT shall be controlled within plus or minus five degrees centigrade to obtain best production rates.

In addition to the control functions outlined above and shown on drawings SK-2-6442 and SK-2-6443, an automatic shut-down system will be provided as follows:

- (a) Automatic shut down of the entire process shall occur and none of the equipment may be started up again until the fault is corrected if:
 - 1. Malfunction is experienced of any component which would cause immediate loss of product. (Example: Loss of agitator on RCTR).
 - 2. A safety or health hazard develops due to failure of equipment (Example: Failure of fluorinator aspirator system).
- (b) Automatic shut down of individual equipment shall occur when a component failure may cause serious equipment damage. (Example: High temperature of the calciner trough will shut off the power supply to the furnace).

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All other equipment shall have manual shut down control. Additional instrumentation shall be provided as necessary to obtain measurements needed to aid start-up, operational data, safety, etc. All instruments shall be installed to conform with the best practices of radiation and contamination control.

C. Method of Installation

In order that continuity of operation be maintained through the RM line, the installation of the continuous Task I and Task II equipment will be performed in three phases as follows:

1. Phase I

Phase I will consist of removal and disposal of hoods H-9 to and including H-16 in the RG area (see drawing SK-2-6448) and temporary installation of hood H-9A and temporary transfer hood in the RG area as shown on drawings SK-2-6407 and SK-2-6403. After satisfactory start-up of the equipment, the RM production through Task I and II will be diverted to hood H-9A. Any modifications in design found necessary during the start-up of H-9A will be incorporated in the installation of hood H-9B.

2. Phase II

Phase II will consist of removing hoods H-9, H-9WD, H-10D, the balance hood H-6, sections 5 and 7, desks D-7 to D-9 (SK-2-6448) in the RM line and installing hood H-9B as shown on SK-2-6407. After this equipment has been installed it will be operated in parallel with H-9A until any deficiencies have been corrected. At that time full production will be routed through hood H-9B in the RMA line. The new storage hood will also be installed at this time.

3. Phase III

Phase III will consist of moving hood H-9A from the RG area and installing in position in the RMA line as shown on SK-2-6407. The temporary transfer hood (SK-2-6403) will be removed and buried. The entire area will be cleaned and normal operation resumed. The present Task I system will be placed on a stand-by basis after installation has been completed.

D. Safety and Operability Considerations

1. Accessibility of Equipment

Wherever practicable, operating mechanisms will be located outside the hood; air-tight seals will be maintained at all points where the hood wall is penetrated. Ready access to equipment inside the hood will be achieved by strategic location of equipment. Glove and access ports will be installed in sufficient number for easy access to equipment. Equipment will be designed so that various parts or entire assemblies may be readily removed for repair or replacement. Sumps will be provided in the floors of the hoods to allow for hood drainage.

2. Criticality Considerations

It is difficult to be explicit with respect to criticality at this time since details of the equipment design are as yet undetermined. The following data, obtained from references (17) and (19) however, can be applied in detailing the design. Final, dimensionally correct arrangement drawings must be reviewed carefully for nuclear safety considerations.

Nuclear safety of the vacuum drum filter will be based on a safe volume of oxalate slurry. A minimum volume of 5.3 liters for precipitated plutonium slurries is adequate for densities less than 0.5 grams Pu/cc of slurry; however, for higher concentrations in the range of 0.5 gm/cc to 3.5 gm/cc, the minimum critical volume may be as low as 4.4 liters for isolated vessels. Because of interaction, the minimum critical volume may be reduced from 5.3 liters to 4.2 liters for concentrations of 0.5 gm/cc or less.

To increase the minimum critical volume of the filter, several methods are available, the most practical, however, is designing a vessel of such a particular geometry that larger volumes are safe. By judicious choice of dimensions, it is felt that a volume of 5 liters will be safe despite interaction and use of concentrations as high as 3.5 gm/cc.

Variables to consider include dimensions of drum, filter pan, and annulus, relative positions of the components, and the possibility of plutonium solutions entering the drum.

Nuclear safety of the calciner and fluorinator will be based on the cross-sectional area and relative position of each unit. If the volume occupied by the plutonium compound does not exceed 16 cubic inches for any one-inch length of column, the column is considered safe. Two columns satisfying the above condition are always safe if the edge-to-edge separation is not less than:

$$\frac{1.5 (ah)^{1/2}}{(1 + \frac{h}{4a})^{1/2}}$$

Where a = maximum outer diameter

h = height of Pu bearing
part of each column

It is desirable that all other vessels be critically safe when filled with solutions up to 0.5 gm/cc since slurry concentrations may approach this value. When this is impossible, suitable provisions must be made to either limit the batch size or the maximum allowable concentration.

The powder pan should be designed to hold a maximum of 2.0 kg of plutonium as this powder will be stored in Task III storage facilities.

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In the design of the storage hood, the average density of plutonium shall not exceed 1.5 kg per cubic foot for any possible three-dimensional array. For two-dimensional arrays, the average density shall not exceed 2.0 kg per square foot.

Further details may be found in references (17) and (19).

3. Shielding Requirements

Shielding requirements for the proposed installation are covered in Appendix I.

4. Hydrogen Peroxide Hazards

The particular hazardous nature of hydrogen peroxide requires that every precaution be used in the design of the equipment for its handling; the following recommendations are contained in reference (18).

1. Hydrogen peroxide feed systems should be isolated from other vessels and streams except at the particular point of application.
2. Hydrogen peroxide vent systems should be isolated, as far as practicable, from other vents. Especially, such vents should be isolated to the extent that splashes or overflow from any vessel cannot cause mixing of peroxide with other material.
3. Vessels containing hydrogen peroxide should have sufficient vent capacity to handle the escape of gases at the maximum decomposition rate.
4. Wherever possible, hydrogen peroxide systems should be designed to preclude or minimize the entry of dirt or other foreign material into the system.
5. All piping should be designed so that hydrogen peroxide cannot be closed or trapped within a section without adequate venting of decomposition gases.
6. All vessels containing hydrogen peroxide in concentrations greater than 12 per cent should have a temperature alarm set for 15°C over ambient, with facilities for immediate dilution to less than 12 per cent if such a temperature is reached.
7. All long piping runs, or runs to a metering device, should be self-venting to allow escape of decomposition gases and insure accuracy of flow and metering.
8. For extended storage of hydrogen peroxide, 99.6 per cent pure aluminum or the 2-S alloy, is recommended.

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9. For piping and intermittent storage, aluminum, 300 series stainless steels, or glass may be used. Gasketing should be of Teflon, fluorothene, or polythene.

5. Contamination Control

The following contamination control items will be incorporated in the design of the Task I and II system:

- (a) Only electrical lines will penetrate the Zone I - Zone III barrier and will be sealed in conduit.
- (b) All cold chemical addition lines to the hood will be designed to prevent back-up of contamination.
- (c) All process lines between hoods will be enclosed so that leakage will not contaminate the Zone III area.
- (d) Process hoods will be designed to be air-tight throughout.
- (e) All piping which enters the Zone IV area will be carefully reviewed to eliminate the hazard of contamination back-up.

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VI. APPENDIX I: SHIELDING CONTINUOUS TASK I AND TASK II

INTRODUCTION

The existing Task II of the RMA Line in the 234-5 Building will be replaced with continuous Task I and II. The Task I process solutions will present potential radiation hazards to operating personnel because of residual fission products from the upstream processing plants and Task II process material, in addition to gamma radiation, will also present radiation hazards due to neutrons from the α -n reaction of PuF_4 . The objective of this report was to investigate the magnitude of the potential hazards involved and recommend shielding where required in order to comply with the HAPD Radiation Protection Standards (see section 3.1 of reference 5). However, protection against radiation exposure during equipment maintenance was specifically excluded from consideration because the equipment is to be designed for contact maintenance.

PURPOSE

The purpose of this report is to present recommendations for shielding of the continuous Task I and II of the RMA Line in the 234-5 Building.

RECOMMENDATIONS

It is recommended that shielding be provided as follows:

I. Hood 7:

1. One-half inch thickness of steel (or lead glass of sp. gr. 6.2) should be provided at the Zone I - Zone III barrier directly opposite Hood 7. This shield should extend horizontally from the new barrier in Zone III to the point at which the existing barrier extends further into Zone I and should extend vertically from the floor up to the six-and-one-half foot level.
2. The new barrier in Zone III between Task I and Task II should be made of three-eighths inch thick steel. This thickness of steel should extend horizontally from the existing Zone I - Zone III barrier back to Hood 7, and should extend vertically from the floor to the 6-1/2 foot level.
3. Shielding should be provided between Hood 7 and the platform in Zone III. The shielding should be made of 3/4" thick steel (or lead glass of sp. gr. 6.2) or 3/8" of lead. The shield should extend horizontally over as much of the hood as practicable (this depends on the type of shield support dictated by the need for maintenance access to Hood 7). The shield should extend vertically from the platform to the top of the hood.
4. The floor of the platform back of Hood 7 in Zone III should be made of 3/8" steel.

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5. The transfer head tank in Hood 7 should be made of six inch schedule 80 pipe.

II. Hoods 9A and 9B:

1. Fluorinator: One-half inch thick steel shielding should be provided on the front and back of the insulation casing. This should extend upward from the hinge high enough to provide protection at the 6-1/2 foot levels in Zone I and Zone III.

Additional shielding of plexiglas should be provided on the front sides of Hoods 9A and 9B. This shielding should be a slab of plexiglas 2-1/2 inches thick by 1-1/2 feet high by 5 feet - 8 inches long. The slab should be centered longitudinally on the front face of the hood and the lower edge of the slab should be placed at the elevation of the maintenance platform.

2. Powder Storage Hopper: The plexiglas shield (Item 24 on reference 5) for the powder storage hopper should be 4-1/2" thick.
3. Task III Powder Pan Loading Station: A slab of 2-1/2" thick plexiglas should be provided on the front face of the conveyor hood. This slab should be 1 foot-4 inches high by 2 feet long. The slab should be centered longitudinally on the centerline of the loading station and the top edge of the slab should be placed at the elevation of the top of conveyor hood.

III. Hood 9C:

1. Weighing station: A plexiglas slab of the same dimensions as the slab recommended above for the powder pan loading station should also be provided at the weighing station. The slab should be centered longitudinally on the centerline of the weighing station.

DISCUSSION

I. Bases and Assumptions

The shielding recommendations and dose rate estimates were based on the following considerations:

1. Activity concentration in the feed material is 15.5 uc/gm Pu. This represents a safety factor of two applied to the bases used in reference (3).
2. Gamma energy is 0.75 Mev (100% Zr⁹⁵ -Nb⁹⁵).
3. Vessel dimensions and arrangements as shown on SK-2-6407, SK-2-6417, and SK-2-6418, (references 4, 5, & 9).
4. Activity concentrations in Task I were based on the volumes shown on the engineering flow diagrams (references 7 & 8).
5. It was assumed that the powder in the fluorinator would contain 2kg. of plutonium and that the powder in the storage hopper would contain 4kg. of plutonium.

6. For Task II the neutron dose rate was based on the measurements presented in reference 1. The neutron dose rate curve on page 15 of reference (1) was multiplied by the appropriate weight ratio and by a factor of 0.3 to correct for the new neutron counting rate conversion factor now being used (see reference 2).
7. The gamma dose rates used for Task II were based on the measurements presented on page 26 of reference (1) multiplied by the appropriate weight ratios.
8. The effect of plexiglas shielding on the gamma dose rate from powder was based on Study No. 3 on page 24 of reference (1), and the effect of plexiglas on the neutron dose rate was based on curves shown on page 13 of reference (1).
9. No credit was taken for the partial shielding of the reactor provided by the fluorinator in Hoods 9A and 9B.
10. Hood 9A and 9B will not be routinely operated simultaneously.

In reference (3) an activity concentration corresponding to a gamma/AT ratio of 10×10^{-10} was presented as the basis to be used for shielding calculations. This basis included a safety factor of ten applied to some of the "hotter" batches initially produced by Purex. It was further pointed out in reference (3) that the safety factor could be relaxed if economic factors warranted it. The preliminary shielding calculations, based on the above concentration, indicated that the amount of shielding required would have been considerable.

The cost of the shielding was roughly estimated to be in excess of \$8000. The exact cost depends on the shielding material used and its distribution in space. Both of these factors are restricted by the requirements of visibility and maintenance access. All of the factors involved were discussed with the contact engineer and a review of the safety factor used in selecting the basis in reference (3) was requested.

On the basis of this review the safety factor was subsequently reduced from 10 to 2. This corresponds to a gamma/AT of 2×10^{-10} . This safety factor still seems to be reasonably conservative because in 36 consecutive Purex batches (batch numbers 16-5-24 through 16-6-25) produced after replacement of the Purex 1A column, the gamma/AT ratio never exceeded 2×10^{-10} in only 3 batches.

II. Dose Rate Estimates

With the shielding recommended above, the following dose rate estimates were obtained:

A. Hood 7:

Zone I Side:

- a. At the point of closest approach to Hood 7 in Zone I, the dose rate will be 0.8 mr/hr or less for Hood 7 solutions with a gamma/AT ratio of 2×10^{-10} or less.

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- b. At the Hood 7 operating desk (D-7 on reference 4) the dose rate estimates are as follows:

<u>Gamma/AT</u>	<u>Dose Rate</u>	<u>Frequency</u>
2×10^{-10}	1.5 mr/hr	0
1.4×10^{-10}	1.0 mr/hr	97%

Frequency is based on the first 36 Purex batches processed after replacement of the Purex 1A column and is the percentage of those batches for which the gamma/AT is less than that shown in the first column above.

Zone III Side:

On the platform behind Hood 7 and midway between the vessels the dose rate was estimated to be 13.0 mr/hr for Hood 7 solutions with a gamma/AT ratio of 2×10^{-10} .

B. Hood 9A (or 9B)

Zone I Side:

At the operating desk, directly in front of the powder storage hopper of Hood 9A (or 9B) the dose rate estimates are as follows:

<u>Source</u>	<u>Shield</u>	<u>Neutrons mrem/hr.</u>	<u>Gammas, mr/hr.</u>	<u>Total N + mrem/hr.</u>
1. Fluorinator	1/2" Steel + 2-1/2" Plexiglas	0.28	0.09	0.37
2. Powder Storage Hopper	4-1/2" Plexiglas + 2-1/2" Plexiglas	0.14	0.13	0.27
3. Reactor	None	—	0.24	0.24
4. Vacuum Receiver	None	—	0.24	0.24
Total				1.1

When 2 kg. of powder have been transferred from the storage hopper to the powder can and the can is at the powder pan loading station, the total dose rate at the barrier in front of Hood 9A (or 9B) will be 1.5 mrem/hr of which 0.5 mrem/hr will be due to the material in the powder can. When the powder can has been moved out to the centerline of the conveyor, the total dose rate will be about 2.0 mrem/hr of which 1.0 mrem/hr will be due to the material in the powder can.

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Zone III Side:

Three feet behind Hood 9A (or 9B) and directly opposite the powder storage hopper the dose rate estimates are as follows:

<u>Source</u>	<u>Shield</u>	<u>Neutrons mrem/Hr.</u>	<u>Gammas mr/Hr.</u>	<u>Total N + γ mrem/Hr.</u>
1. Fluorinator	1/2" steel	2.2	0.9	3.1
2. Powder Storage Hopper	4-1/2" Plexiglas	1.1	1.3	2.4
3. Reactor	None	—	1.5	1.5
4. Vacuum Receiver	None	—	1.5	<u>1.5</u>
			Total	8.5

2. Hood 9C

Zone I Side:

The dose rate directly in front of the weighing station during weighing operations will be about 1.0 mrem/hr.

III. Zone I Dose Rates

The design objective for the Zone I shielding was that the accumulated dose per week would be 60 mrem or less. To attain this, shielding was calculated to give a dose rate of 1 mrem/hr, or less, 90-95% of the time at the points of closest approach to the Zone I - Zone II barrier.

Since the first of the year, the "hottest" PR solutions have been produced by Purex. However, since start-up of Purex, there has been a general downward trend in the activity concentration of the Purex PR solutions. As pointed out above, in 33 batches out of 36 (about 91% of the time) the gamma/AT of the Purex PR solutions was less than 1×10^{-10} . It seems probable, that as more processing experience is accumulated with the Purex plant, that the PR solution activity concentration would be lower. In addition, the Redox plant will continue to supply a significant portion of Z plant feed material, and the activity concentration of Redox material has been relatively lower than Purex material.

IV. Zone III Dose Rates

Zone III is a controlled access area, consequently no attempt was made to achieve dose rates of 1.0 mrem/hr. However, partial protection was provided for persons passing through Zone III.

The continuous Task I and II is to be designed for contact maintenance, therefore no protection was provided for personnel during maintenance.

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SCOPE

7/6.27.56

APPROVED

DESCRIPTION						REV. BY DATE		APP'D BY		FOR		DATE	
REVISIONS													
DWG. NO.						SHEET NO.		TOTAL SHEETS		REV. NO.			
SK-2-6403						—		—		—			
CLASSIFICATION						CLASSIFIED BY							
NONE						J.R. Kelly							
						DATE 1-26-56							
SCALE NONE						APPROVALS							
DRAWING PREPARED BY DATE 7-16-56						CY		FOR		DATE			
CHECKED BY DATE						J.R. Kelly		Kelly		7-16-56			
INVESTIGATED BY DATE 7-15-56													
DESIGNER J.R. Kelly UNIT Eng Div E & H													
DIST. NO.													
8396													
PRIOR PROJECT NO.													
A-00027													
U. S. ATOMIC ENERGY COMMISSION													
HANFORD ATOMIC PRODUCTS OPERATION													
GENERAL ELECTRIC													
TASK II REPLACEMENT													
TEMPORARY CONVEYOR													
ARRANGEMENT													
234-S						DWG. NO.		SK-2-6403		SHEET NO.		TOTAL SHEETS	
ENCLOSURE

PLAN

ELEVATION

QTY.	NO.	DESCRIPTION	DATE
X 1	1	ASSEMBLY	
2	2	CONTINUOUS BELT LIFT HOOD ASSEMBLY	SK-2-6417
1	4	BALANCE HOOD	SK-2-6418
1	5	PRE-REDUCTION (FILTRATE TREATMENT) HOOD	SK-2-6418
1	6	TEMPORARY CONVEYOR HOOD	SK-2-6483
1	7	CONVEYOR ASSEMBLY	

NOTES

1. INSTALL PLEXIGLAS PANEL AFTER H-10 HAS BEEN REMOVED. SEE H-2-16892 FOR TYPICAL INSTALLATION.
2. REMOVE SLAT CONVEYOR IN HOOD-10 AFTER H-9A HAS BEEN INSTALLED ON TASK II LINE.

DECLASSIFIED

SCOPE

APPROVED

DESCRIPTION		REV. BY	DATE	APP'D BY	DATE
SK-2-6407					
CLASSIFICATION		CLASSIFIED BY			
NONE		J. L. Smith			
SCALE: NONE		DATE: 2-2-55			
DRAWN: J. L. Smith		DATE: 2-2-55			
CHECKED: J. L. Smith		DATE: 2-2-55			
REV. NO. 8396		REV. DATE 7-18-55			
PROJECT NO. A-00027		PROJECT NAME			
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC					
TASK II REPLACEMENT EQUIPMENT ARRANGEMENT					
234-5		SK-2-6407		REV. NO. 8396	

2	SK-2-6483	E.F.D. SHY 3
1	SK-2-6482	E.F.D. SHY 1
REV.	DATE	BY
REFERENCE DRAWINGS		
MATERIAL USED ON

① ARRANGEMENT

NO.	NAME	QTY	UNIT
1	AKRAT.		
2	BALANCE SA		
3	WEIGH PAN ASM		
4	ADAPTER		
5	HYD. CYL.		
6	PLATFORM		
7	COLUMN	20185 ± 5/16" EA.	STL
8	PANEL	1" HX 1" FIELD TO FIT	LIGHTS
9	PANEL		
10	PANEL		
11	GASKET MOUNTED		
12	CLAMPING STRIP		
13	ACORN NUT	1/2" X 1/2" X 1/2"	STL
14	BOLT	1/2" X 1/2" X 1/2"	STL
15	GASKET	1/2" X 1/2" X 1/2"	STL
16	GASKET, CORNER	1/2" X 1/2" X 1/2"	STL
17	HEX. HD. BOLT	1/2" X 1/2" X 1/2"	STL
18	HEX. NUT	1/2" X 1/2" X 1/2"	STL
19	HEX. NUT	1/2" X 1/2" X 1/2"	STL
20	HEX. TAM NUT	1/2" X 1/2" X 1/2"	STL
21	BASE PLATE		
22	LIMIT SWITCH	MICRO SWITCH-SEN-22P 22P	
23	SUPPORT		
24	ACTUATOR		
25	PAN STOP		
26	CAP SCREW	1/2" X 1/2" X 1/2"	STL
27	WELDING STUD	1/2" X 1/2" X 1/2"	STL
28	MACH. SCREW	1/2" X 1/2" X 1/2"	STL
29	NUT	1/2" X 1/2" X 1/2"	STL
30	LOCKWASHER	1/2" X 1/2" X 1/2"	STL
31	PLATE	1/2" X 1/2" X 1/2"	STL
32	ANCHOR	1/2" X 1/2" X 1/2"	STL
33	WASHER	1/2" X 1/2" X 1/2"	STL
34	CYLINDER MTQ

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SCOPE

APPROVED

SK-2-6410

REVISIONS		DATE	BY	CHKD	DATE
SCALED	NONE	DATE	1-18-54		
DESIGNED	DATE	1-18-54			
ENGINEER	DATE	7-12-54			
CHKD	DATE	7-12-54			
APPV	DATE				
NO.	8396				
PROJECT	A00027				
U. S. ATOMIC ENERGY COMMISSION SANDHURST ATOMIC PROJECTS OPERATION GENERAL ELECTRIC					
TASK II REPLACEMENT BALANCE HOOD					
CLASS.	2-15-54				
CLASSIFIED BY	W. J. Sullivan				
UNCLASSIFIED	NONE				
NO.	234-5				
NO.	SK-2-6410

1 ARRANGEMENT H-9 A
HOOD 9-B TO OPPOSITE HAND

SECTION "A-A"

DECLASSIFIED

SCOPE

APPROVED

REVISIONS		REV. BY	DATE	APPROVED BY	DATE
1. SK-2-6417					
CLASSIFICATION		CLASSIFIED BY			
NONE		DATE 3/13/72			
SCALE:		APPROVALS			
DRAWN BY: J. F. L. DATE 3-14-72		BY: J. F. L. DATE 3-14-72			
CHECKED BY: J. F. L. DATE 4-18-72		BY: J. F. L. DATE 4-18-72			
REWORK BY: J. F. L. DATE 7-11-72		BY: J. F. L. DATE 7-11-72			
DIN. ENG. J. F. L. UNIT: HANFORD		BY: J. F. L. DATE 11-4-71			
PROJECT NO. A-00027		U. S. ATOMIC ENERGY COMMISSION			
HAFNORD ATOMIC PRODUCTS OPERATION		GENERAL ELECTRIC			
TASK II REPLACEMENT		CONTINUOUS TASK I & II			
HOOD H-9A & H-9B ARR'G'T		234-5			
SK-2-6417		234-5			

2 SK-2-6423 EFD SAY 2	
1 SK-2-6407 TASK II REPLACEMENT EQUIP ARR'G'T	
DWG. NO.	DRAWING TITLE
11471	REFERENCE DRAWINGS
NEXT USED ON SK-2-6407

PLAN

FRONT ELEVATION

HOOD ARRANGEMENT

QTY.	PT. NO.	DESCRIPTION
1	1	HOOD ARRANGEMENT
1	2	FILTRATE CATCH TANK ASSEMBLY
1	3	PRE-REDUCTION TANK ASSEMBLY
1	4	TRANSFER HEAD TANK ASSEMBLY
1	5	PROPORTIONING PUMP
1	6	AGITATOR DRIVE ASSEMBLY
1	7	FILTRATE WCL TANK ASSEMBLY

NOTES:
1. FOR PIPING IN HOODS, SEE DWG. SK-2-6422

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SCOPE

DESCRIPTION		REV. BY	DATE	APP'D BY	FOR	DATE
REVISIONS						
DWG. NO. SK-2-6418		ISSUED FOR		REV. NO.		
CLASSIFICATION		CLASSIFIED BY		DATE		
NONE		J. R. [Signature]		DATE 6-15-56		
SCALE: NONE		BY		FOR	DATE	
DRAWN IN SECTION		DATE		DATE		
CHECKED BY		DATE		DATE		
REV. NO. 11588		DATE		DATE		
PROJECT A-00418						
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC						
PRE-REDUCTION & FILTRATE TREATMENT-HOOD ARRANGEMENT						
TASK II REPLACEMENT						
DWG. NO. SK-2-6418		ISSUED FOR		REV. NO.		

SK-2-6422	ENGINEERING FLOW DIAGRAM
SK-2-6407	EQUIPMENT ARRANGEMENT
DWG. NO.	DRAWING TITLE
REV. NO.	REFERENCE DRAWINGS
NOT USED ON

NOTES:

1. FOR ADDITIONAL GENERAL NOTES, LEGEND & NOMENCLATURE, SEE DRAWING JM-E-6422.
2. STAND-IN MATERIALS WILL BE PROCESSED THROUGH EQUIPMENT PRIOR TO THE INTRODUCTION OF PR SOLUTIONS.
3. THESE LINES SHALL NOT BE CONNECTED UNTIL ALL PRELIMINARY TESTS HAVE BEEN COMPLETED WITH A SATISFACTORY STAND-IN MATERIAL.
4. THESE TRUNK & ASSOCIATED PIPING WILL BE DISCARDED AFTER STAND-IN MATERIAL TESTS HAVE BEEN COMPLETED.
5. AFTER STAND-IN MATERIAL TESTS HAVE BEEN COMPLETED, THESE LINES SHALL BE CONNECTED TO D-G DRAIN.
6. METERING PUMPS FROM ADDITION SYSTEM FOR THE "FRT" & "FCTS" MAY TEMPORARILY BE USED HERE.
7. METERING PUMP FROM H-3 MAY BE LOCATED IN THIS HOOD.
8. DRAINAGE CONDUCTIONS FROM THESE LINES TO MOUNTAIN 1 & 2 SHOULD TRANSFER THROUGH MANIFOLD TO SUMP TANKS.

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NOL	DESCRIPTION	REV. BY DATE	APPR'D BY	FOR	DATE		
	REVISIONS						
DWG. NOL	SK-2-6420	SHEET NO.	-	SHEETS	-	REV. NOL	-
	CLASSIFICATION						
	NONE						
		DATE	6/24/58				
		APPROVALS					
		BY		FOR		DATE	
		J.R. Ritz		Wm. J. ...		7-11-58	
	SCALE: NONE						
	DRAWING DATE 3/18/56						
	CHECKED 1/1/58 DATE 6/26/58						
	ISSUED 1/22/58 DATE 6-26-58						
	DRG. ENCL. NOTE UNIT PREFIX DOZ.						
DWT. NOL	14 471						
PROJECT NOL	A-00067						
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC							
ENGINEERING FLOW SKETCH FOR

MATERIAL BALANCE FOR CONTINUOUS TASK I & II SYSTEM

STREAM	PR CAN	RINSE TANK	H ₂ O MAKE-UP TANK	PRT	PRT	THT	KMnO ₄ MAKE-UP TX	FRT	FRT	H ₂ O MAKE-UP TX	FRT	FCT		
PHASE	LIQ.	LIQ.	LIQ.	GAS	LIQ.	LIQ.	LIQ.	LIQ.	GAS	LIQ.	LIQ.	GAS		
SP Q	1.35	1.00	1.20		1.26	1.26	1.025	1.09		1.2	1.001			
COMPONENTS	Q/BATCH	WT %	Q/BATCH	WT %	Q/BATCH	WT %	Q/HR	WT %	Q/HR	WT %	Q/HR	WT %	Q/HR	WT %
P ₂ O ₅ (HOS) ₂	1572	12.2							15	-		15		
P ₂ (HOS) ₄					1630	12.0	2036	12.0						
P ₂ (HOS) ₂ 6H ₂ O	753	7.0			753	5.7	441	5.7	504	5.0		504	4.8	
Al (HOS) ₃ 5H ₂ O	1111	10.3			1111	8.5	1385	8.5	1535	4.2		1330	4.2	
HNO ₃	2910	23.3			2026	16.0	2622	16.0	3416	11.0		3193	10.1	
H ₂ O	5070	47.2	2000	100.0	240	50.0	7521	57.4	7401	57.3	6701	56.0	25,344	80.9
H ₂ (HOS) ₂ 6H ₂ O											60	300	200	1.0
H ₂ O ₂									154	6.5				
KNO ₃									179	6.5		179	6.5	
O ₂					167	100.0							57	0.2
CO ₂									225	6.8	225	100.0		
H ₂ O ₂			240	50.0							60	30.0		
KMnO ₄							279	4.0						
							</							

SECRET

LEGEND

- (EF) ----- ELECTRICAL FAILURE
 (MC) ----- MAIN CUT-OUT
 (H) ----- HEATER
 (SC) ----- SELF SEALING COUPLING
 (HT) ----- HIGH TEMPERATURE
 (S) ----- STREAM NUMBER

FOR SYMBOLS NOT LISTED REFER TO
NAPO INSTRUMENT STANDARDS

HOOD No. 7

TIMING SPECIFICATIONS

CODE

- A-1 TUBING, STN. STL. TYPE 304, .049" WALL, KONCENTRIK FITTINGS, TEFLON GASKETS, SCREWED VALVES.
 A-2 TUBING, STN. STL. TYPE 304, .049" WALL, KONCENTRIK FITTINGS, TEFLON GASKETS, SCREWED VALVES, TUBING TO BE ENCASED IN PRESSURE TIGHT DUCTS WHEN RUNNING BETWEEN HOODS. TWO SPARE LINES/PROCESS LINE TO BE INCLUDED IN DUCT.
 A-3 TUBING, SARAN, SARAN FITTINGS, SCREWED VALVES.
 A-4 TUBING, STN. STL. TYPE 304, .049" WALL, FLANGED FITTINGS FOR ATTACHMENT TO GLASS PIPE.
 A-5 TUBING, MONEL, .109" WALL, KONCENTRIK FITTINGS, TEFLON GASKETS, SCREWED VALVES.
 A-6 TUBING, INCONEL, .049" WALL, KONCENTRIK FITTINGS, FLANGED WHEN ATTACHED TO FLUORINATOR, INCONEL BELLOWS, TEFLON & NICKEL GASKETS.
 A-7 TUBING, CARBON STEEL, .049" WALL, KONCENTRIK FITTINGS, TEFLON GASKETS, SCREWED VALVES.
 A-8 PIPE, STN. STL. TYPE 304, SCH. 40, WELDED WITH FLANGED JOINTS AT THE HOOD WALL.
 A-9 FLEXIBLE HOSE, TEFLON, SCREWED FITTINGS.
 A-10
 A-11

FCT	(S)
LIG	
1.089	
4/H.S. TWT	
15	
804	1.8
1833	4.2
8193	0.8
28,844	80.8
308	1.6
173	0.6
31,476	100.6
28.3	
CAB	
20	

SCOPE

RESTRICTED DATA

THIS DOCUMENT CONTAINS RESTRICTED DATA AS DEFINED IN THE ATOMIC ENERGY ACT OF 1954. ITS TRANSMISSION OR THE DISCLOSURE OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED.

3rd revision
6-25-56

HW-44105

PAGE 26

TASK I & II NOMENCLATURE	WORKING VOLUME IN LITERS	RESIDENCE IN MINUTES
ITEM	ABBREVIATION	
FILTRATE HEAD TANK	HT	40
RINSE TANK PR STATION	RT	
REACTOR	RCTR	12.25
FILTRATE CATCH TANK	CT	3.5
FILTRATE FILTER	F	
FILTER E-4 VENT	F-E-4	
FILTER 26" VACUUM	FV	
TRAP E-4 VENT	TP-E-4	
TRAP 26" VACUUM	TPV	
VACUUM DRUM FILTER	VD-F	PAN 24
CALCINER	CLNR	60
FLUORINATOR	FLUR	60
ROTARY "FEED" VALVE	RV	
TASK III POWDER PAN	PP	
VACUUM RECEIVER	VR	3-7
OVERFLOW TANK	OT	5
OXIDE HOPPER	OH	1
FLUORIDE HOPPER	FH	2
PRE-REDUCTION TANK	PRT	10
TRANSFER HEAD TANK	THT	15
RECYCLE CAN	RC	40
PRODUCT RECEIVER CAN	PR	8
FILTRATE KILL TANK	FKT	30

GENERAL NOTES

- MATERIAL BALANCE BASED ON PROCESSING 1 KG PLUTONIUM/HR WITH 1% WASTE LOSSES IN TASK I. STREAMS 1 - 5 ARE BASED ON A PR CAN BATCH OF 8 LITERS OF SOLUTION CONTAINING 100 G. PU/L. STREAMS 19 - 26 ARE BASED ON 40 L BATCHES IN THE FHTS. INFORMATION FOR M.B. OBTAINED FROM DOCUMENTS HW-39328 & HW-39581.
- ALL VESSELS TO BE FABRICATED FROM 6" DIA GLASS PIPE, UNLESS OTHERWISE NOTED.
- THE MAIN CUTOUT SWITCH IS AUTOMATICALLY OPERATED BY THE FOLLOWING PIECES OF EQUIPMENT:
 - HF SUPPLY SYSTEM
 - O₂ SUPPLY SYSTEM
 - HF EXHAUST SYSTEM
 - VACUUM DRUM FILTER
 - FEED SOLUTION (STREAM 6) & H₂C₂O₄ ADDITION SYSTEMS
 - CONTINUOUS SAMPLER

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SCOPE

NO.	DESCRIPTION	REV.	DATE	APPROVED BY	FOR	DATE
REVISIONS						
SK-2-6422						
CLASSIFICATION						
9.05						
DATE 4/1/56						
APPROVALS						
SCALE: NONE						
DRAWN: J.E.J. DATE 3-26-54						
CHECKED: [Signature] DATE 4-27-54						
REVISED: [Signature] DATE 6-2-56						
NO. 11.471						
PROJECT NO. A-00027						
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC						
ENGINEERING FLOW DIAGRAM FOR CONTINUOUS TASK I & II SHEET-I						
TASK II REPLACEMENT						
254-5						
SK-2-6422						

LEGEND

- ⊗ MOTOR CONTROLLER OR CONTACTOR
 - ⊞ PUSH BUTTON STARTING DEVICE
 - ③ PROCESS STREAM - SEE REF 1 & 2
 - Ⓜ MOTOR
 - ⊙ ANNUNCIATOR ALARM LIGHT
- FOR ADDITIONAL SYMBOLS SEE REF DWG5

QTY.	NO.	DESCRIPTION
------	-----	-------------

180V.18	1	180V.18
240V.58	1	240V.58
480V.58	1	480V.58

APPROVED

3rd Rev
7-8-56

NO. 1		NO. 2	
CLASSIFICATION		CLASSIFICATION	
REVISIONS		REVISIONS	
DESCRIPTION		DESCRIPTION	
DATE		DATE	
BY		BY	
APPROVALS		APPROVALS	
DATE		DATE	
SCALE: NONE		SCALE: NONE	
CLASSIFIED BY		CLASSIFIED BY	
DATE		DATE	
PROJECT NO. 1-00498		PROJECT NO. 1-00498	
NO. 7555		NO. 7555	
DES. ENG. H.S. MATHIAS		DES. ENG. H.S. MATHIAS	
CHECKED BY		CHECKED BY	
DATE		DATE	
DRAWING NO. 1-00498		DRAWING NO. 1-00498	
SHEET NO. 1		SHEET NO. 1	
NO. 1		NO. 1	
NO. 2		NO. 2	
NO. 3		NO. 3	
NO. 4		NO. 4	
NO. 5		NO. 5	
NO. 6		NO. 6	
NO. 7		NO. 7	
NO. 8		NO. 8	
NO. 9		NO. 9	
NO. 10		NO. 10	
NO. 11		NO. 11	
NO. 12		NO. 12	

DECLASSIFIED
SCOPE

NOTES
1. MAIN CUT-OUT & MAIN CUT-OUT CONTROL BUS SHALL BE CONNECTED TO COMPONENTS OF THE RECORDS SO THAT FAILURE OF EQUIPMENT WILL AUTOMATICALLY SHUT DOWN ASSOCIATED EQUIPMENT TO PREVENT EQUIPMENT DAMAGE OR LOSS OF PRODUCT

DECLASSIFIED

SCOPE

APPROVED

NO.	DATE	REVISIONS	DATE	BY	APPROV.	DATE	BY	NO.
1		1						1
2		2						2
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25.6.2

SEE SK-2-4443
FOR CONTINUATION

- LEGEND**
- C - COMMON PORT
 - E-4 - EXHAUST SYSTEM
 - EPC - ELECTRIC-PNEUMATIC CONVERTER
 - HLN - HIGH LEVEL ALARM LIGHT
 - LLN - LOW LEVEL ALARM LIGHT
 - MP - METERING PUMP
 - NC - NORMALLY CLOSED
 - NO - NORMALLY OPEN
 - LA - LIMITING ORIFICE
 - DP - DIFF. PRESS. RELAY
 - SI - STREAM IDENTIFICATION

SCOPE

DECLASSIFIED

APPROVED

NOTE
1. FOR ADDITIONAL LETTER & SYMBOL IDENTIFICATION NOT SHOWN IN LEGEND, REFER TO H.A.R.D. DRAFTING PRACTICE MANUAL FIG. 11.3, 2A THRU FIG. 11.3 EF
2. FOR STREAM IDENTIFICATION SEE DWG. SK-2-6442

SK-2-6442	INSTRUMENTATION - ENGINE FLOW SCHEMATIC
SK-2-6442	DIAG. FOR CONTINUOUS TASK I & II SHEET 2
SK-2-6442	E.F.D. FOR CONTINUOUS TASK I & II SHEET 2
SK-2-6442	E.F.D. FOR CONTINUOUS TASK I & II SHEET 1
DWG. NO.	DRAWING TITLE
REF. NO.	REFERENCE DRAWINGS
NEXT USED ON	

NO.	DESCRIPTION	REV. BY	DATE	APP'D BY	FOR	DATE
REVISIONS						
DWG. NO.	SK-2-6442		SHEET NO. 2		REV. NO.	
CLASSIFICATION	NONE		CLASSIFIED BY		DATE 6/18/86	
SCALE:	NONE		APPROVALS			
DRAWN BY	J. J. J.		DATE	6/18/86		
CHECKED BY	J. J. J.		DATE	6/18/86		
DESIGNED BY	J. J. J.		DATE	6/18/86		
DWG. NO.	9474					
PROJECT NO.	A-00027					
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC						
INSTRUMENTATION ENGINEERING FLOW SCHEMATIC DIAGRAM FOR CONTINUOUS TASK I & II SHEET-1 TASK II REPLACEMENT						
BLDG. NO.	5		DWG. NO.	SK-2-6442		SHEET NO. 2

DECLASSIFIED
APPROVED

SCOPE

NOTE:
1. THE ADDITIONAL LETTER & SYMBOL IDENTIFICATION NOT SHOWN IN LEGEND, REFER TO H.P.D. DEPTING PROJECTS MANUAL FIG. 12.2.4 THRU FIG. 12.2.5.
2. FOR STREAM NUMBER DATA REFER TO DWG. SK-2-6442
3. SIMILAR INSTRUMENTATION FOR HOOD

END
SYSTEM
PNEUMATIC CONVERTER
ALARM LIGHT
ALARM LIGHT
ALARM LIGHT
ALARM LIGHT
ALARM LIGHT
PUMP
CLOSED
OPEN
WABERS
PNE REGULATOR

REVISIONS	
NO.	DESCRIPTION
1	SK-2-6442 INSTRUMENTATION - CHECK FROM SCHEMATIC
2	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.1
3	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.2
4	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.3
5	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.4
6	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.5
7	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.6
8	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.7
9	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.8
10	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.9
11	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.10
12	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.11
13	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.12
14	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.13
15	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.14
16	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.15
17	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.16
18	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.17
19	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.18
20	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.19
21	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.20
22	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.21
23	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.22
24	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.23
25	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.24
26	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.25
27	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.26
28	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.27
29	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.28
30	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.29
31	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.30
32	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.31
33	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.32
34	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.33
35	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.34
36	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.35
37	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.36
38	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.37
39	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.38
40	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.39
41	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.40
42	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.41
43	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.42
44	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.43
45	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.44
46	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.45
47	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.46
48	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.47
49	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.48
50	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.49
51	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.50
52	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.51
53	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.52
54	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.53
55	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.54
56	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.55
57	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.56
58	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.57
59	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.58
60	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.59
61	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.60
62	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.61
63	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.62
64	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.63
65	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.64
66	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.65
67	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.66
68	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.67
69	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.68
70	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.69
71	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.70
72	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.71
73	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.72
74	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.73
75	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.74
76	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.75
77	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.76
78	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.77
79	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.78
80	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.79
81	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.80
82	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.81
83	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.82
84	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.83
85	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.84
86	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.85
87	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.86
88	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.87
89	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.88
90	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.89
91	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.90
92	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.91
93	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.92
94	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.93
95	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.94
96	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.95
97	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.96
98	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.97
99	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.98
100	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.99
101	SK-2-6442 E.C.D. FOR CONTINUOUS TASK 1.2.2.100

PROJECT: A-00027
DATE: 9/74
SCALE: NONE
REVISIONS: NONE
APPROVED: [Signature]
GENERAL ELECTRIC
HAWK ATOMIC PRODUCTS OPERATION
TASK II REPLACEMENT
TASK I & II - SHEET 2
ENGINEERING FLOW SCHEMATIC
DIAGRAM FOR CONTINUOUS

SECTION 'B-B'

CONCRETE WALLS ARE SHADED.
PLASTERED WALLS ARE NOT SHADED.

NOTES:

1. EQUIPMENT SHOWN HEREIN ARE LOCATED ON DATED LINES TO BE REANNEALED BURIED FROM TO DISTURBING HAND N-PA NI 20 REAS. SEE DRAWING SK-2-6007 FOR MORE N-PA LOCATIONS.
2. EQUIPMENT SHOWN HEREIN ARE BURIED ON DATED LINES TO BE CHANGED AND DISPOSED AT THREE MAN IS OPERATING SATISFACTORILY. SEE DRAWING SK-2-6007 FOR LOCATION OF NEW EQUIPMENT FOR THIS AREA.
3. LOCATION OF NEW STORAGE POND.
4. REANNEA SECTION OF D TALL BETWEEN COLUMN LINES 10.911 FOR REANNEALING OF THIS IS BURIED. WILL TO BE REANNEALD LATER.

DECLASSIFIED

APPROVED

NO.		DATE		APPROVED BY		FOR		DATE	
REVISIONS									
PAPER NO.		SK-2-6448				REVISION NO.		DATE	
SCALE: NONE		APPROVAL				DATE		DATE	
DESIGNED BY: 7-12-50		J.R. Smith				7-12-50		7-12-50	
CHECKED BY: 7-12-50									
DRAWN BY: 7-12-50									
JOB NO.: 12-101		12-101							
QTY: 9499									
PART NO.: 10-A-00499									
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC									
PROCESS AREA MODIFICATIONS FOR TASK II REPLACEMENTS									
234-3		SK-2-6448				DATE		DATE	

VIII. BIBLIOGRAPHY

1. HW-28918, Radiation Studies for Task III Design, GL Helgeson, August 26, 1953.
2. HW-42989, Radiation Measurements Task III, FE Owen, May 11, 1956.
3. HW-42997, Basis for Shielding Continuous Task I and Task II, WG Browne, May 9, 1956.
4. SK-2-6407, Task II Replacement Equipment Arrangement.
5. SK-2-6417, Hood 9A & 9B Arrangement.
6. HW-25457 Rev, Manual of Radiation Protection Standards, December 15, 1954.
7. SK-2-6422, Engineering Flow Diagram for Continuous Task I and II, Sheet 1.
8. SK-2-6423, Engineering Flow Diagram for Continuous Task I and II, Sheet 2.
9. SK-2-6418, Pre-Reduction & Filtrate Treatment Hood Arrangement.
10. Letter, JB Fecht to HP Shaw, "Discussion of Improvements to Task II 234-5 Building", dated January 18, 1956.
11. Letter, HA Carlberg to OH Greager, "Request for Project Proposal-- Preparation for an Improved Task II", dated January 13, 1956.
12. Letter, WN Mobley to CE Kent, "Request for Change in Scope Task II Project Proposal", dated February 24, 1956.
13. HW-36173, "Progress Report - Continuous Task II Program--Plutonium IV Oxalate Calcination and Hydrofluorination Studies", WS Figg, dated April 12, 1955.
14. HW-41635, "Continuous Task II - Technical Specification Letter No. 2", by HH Hopkins and WS Figg, dated February 23, 1956.
15. HW-41708, "Technical Specification Letter No. 1 - Continuous Task I", by HH Hopkins and WS Figg, dated February 28, 1956.
16. Letter, RL Lysher to EO Swain, "Cost Estimate - Study Stage Task II Replacement RMA Line - 234-5 Building DO-A-00027", dated March 22, 1956.
17. HW-42440, "Nuclear Safety Relating to Proposed Continuous Tasks I and II", by N. Ketzlach, dated April 9, 1956.
18. Letter, "Design Requirements for Chemical Hazards Control in Continuous Task I", KM Harmon to JB Fecht, dated June 18, 1956.
19. Letter GW Miller to JR Fritz, "Nuclear Safety Aspects - Task II", dated April 29, 1955.
20. SK-2-6410 - Task II Replacement Balance Hood H-9D Arrangement.
21. SK-2-6403 - Task II Replacement Temporary Conveyor Hood Arrangement.

VIII. BIBLIOGRAPHY (Continued)

22. SK-2-6420 - Engineering Flow Sketch For Temporary Hood H-9A Location
23. SK-2-6440 - Electrical Engineering Flow Diagrams for Continuous Task I & II, Shts, 1 & 2.
24. SK-2-6442 - Instrument Engineering Flow Diagram for Continuous Task I & II, Sht. 1
25. SK-2-6443 - Instrument Engineering Flow Diagram for Continuous Task I & II, Sht. 2
26. SK-2-6448 - Process Area Modifications for Task II Replacement

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