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DESIGN SCOPE OF THE Z PLANT PLUTONIUM RECLAMATION FACILITY

PROJECT CAC-880

BY

D. E. BRADEN

PRODUCTS DESIGN AND DEVELOPMENT
FACILITIES ENGINEERING OPERATION
CHEMICAL PROCESSING DEPARTMENT

OCTOBER 17, 1960

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By

D. E. Braden

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

Submitted by

J. B. Fick, Manager
Process Design and Development
Facilities Engineering Operation

10/18/60
Date

Approved by

H. H. Shaw, Manager
Facilities Engineering Operation
Chemical Processing Department

10/24/60
Date

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I. INTRODUCTION

The need for a Plutonium Reclamation Facility was first described in document HW-59181, "New Recuplex Facility, Z-Plant, FY-1961 Budget Study Report." Budget data sheets were subsequently submitted in documents HW-59350, "CPD Budget for FY-1961 P.A. & C. Budget," and HW-61392, "CPD Revision to FY-1961 P.A. & C. Budget, Plutonium Reclamation Facility, 200 Areas." Document HW-61777, "Preliminary Project Proposal, Plutonium Reclamation Facility, Z Plant," requested Title I design funds. Document HW-64941, "Basis for Design Scope, Plutonium Reclamation Facility, Z Plant, Project CAC-880," described the basis for Title I scope design. A request for funds for the initiation of Title II detail design prior to the completion of Title I scope design was contained in document HW-66305, "Project Proposal, Revision 1, Plutonium Reclamation Facility, Z Plant."

II. PURPOSE

The purpose of this document is to present the Title I scope design which will constitute the basis for Title II detail design of the Plutonium Reclamation Facility.

III. SUMMARY AND CONCLUSIONS

The facility shall be housed in a new building, 236-Z, approximately 65 feet by 79 feet, located at the southeast corner of the 234-5 Building, as shown on the attached drawing SK-2-6683. The building arrangement is shown on attached drawing SK-2-3404. All major process vessels shall be located in a Zone IV process cell with two-feet thick concrete walls and ceiling serviced by a crane remotely-operated through water-filled viewing windows. All valves, flowmeters, in-line pumps, and interconnecting piping which may contain plutonium-bearing solutions and which require routine maintenance shall be installed in glove boxes located on the exterior walls of the process cell. All areas within the building except the process cell and glove boxes shall be considered Zone III.

The major pieces of process cell equipment shall include:

1. Two critically-favorable continuous dissolvers with an overflow receiver and three extraction column feed preparation tanks;
2. A solvent extraction battery consisting of a pulse-type extraction column, a pulse-type stripping column, and a packed organic wash column;
3. An evaporator and accessory vessels for concentration of Task I filtrate and internal recycle streams;

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4. An evaporator and accessory vessels for concentration of the product stream prior to transfer to Task I processing; and
5. Vessels as required for batch organic washing, solution receipt from the Miscellaneous Treatment Room and the PR Room, overflow receivers, sump receivers, vent traps, etc.

Composite data for all process vessels is given on attached drawing SK-2-18328. The process flow diagram, instrument engineering diagram, and engineering flow diagram are shown on attached drawings SK-2-18400, SK-2-6712, Sheets 1-3, and SK-2-18304, Sheets 1-5, respectively. The major service rooms shall include:

1. Chemical preparation and storage facilities;
2. PR Room for unloading solution received from the Redox and Purex Plants, the Incinerator facility, and miscellaneous sources, and for loading-out product solution for shipment to other HAPO departments or off-site;
3. Miscellaneous Treatment Room for: (a) treatment of solid feeds, other than slag and crucible fragments prior to routing to the process cell for dissolution and/or solvent extraction processing; and (b) miscellaneous leaching and other operations as required; and
4. Maintenance facilities.

The design capacity of the new facility shall be 3,600 kilograms per year of plutonium with an instantaneous design rate of one kilogram per hour of plutonium. All permanent parts of the new facility, such as the process cell walls and ceiling, shall be provided with shielding for processing 10,000 MWD/T plutonium; those portions to which shielding can be readily added at a future date, such as the glove boxes, shall be shielded only for 2,000 MWD/T plutonium processing capability.

A preliminary project cost estimate is \$2,900,000 with \$550,000 required for Title I, II and III design activities; the project cost estimate is shown in Appendix B. The preliminary project schedule is given in Appendix C; all testing and startup activities shall be completed by June 30, 1963.

IV. DISCUSSION

A. DESIGN CAPACITY

The design capacity of the Plutonium Reclamation Facility will be 3,600 kilograms per year of plutonium. The make-up of feed material will be assumed as follows for the design basis, realizing that the

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actual feed composition may be slightly, if not appreciably, different:

<u>Type of Material</u>	<u>Plutonium Kgs/Yr</u>	<u>Dissolver Feed Cans/Yr</u>
Slag and Crucible	180	11,900
Metal	630	630
Skulls	1,370	1,370
Powders	600	1,500
Liquids	820	--
Total	3,600	15,400

It should be emphasized that the subject facility, as the name implies, must be extremely flexible in its ability to handle a wide variety of feed materials. The new facility will be designed to process the above quantities of materials when operating on a three-shift day, five-day week, 40-week year with an over-all efficiency of 75 percent; twelve weeks per year have been allowed for "turnaround" time to enable campaign operation for segregation of feed plutonium by isotopic content, if and when required.

The basis for estimating feed materials to the subject facility as a function of the amount of virgin feed material to Z Plant is shown in attached Figure 1. This average material balance results in the following amounts of plutonium recycled to the new facility, expressed as percentages of the virgin feed material supplied to Z Plant:

Slag and Crucible	2.0%
Metal	7.5%
Skulls	16.0%
Powders	7.0%
Filtrates	4.3%
Misc. Liquids	<u>5.2%</u>
Total Recycle	42.0%

The virgin feed load to Z Plant, as forecasted in document HW-62764, "Bases for Preparation of Plant Improvement Programs, Chemical Processing Department," will result in the following loads to the

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FIGURE 1
Z-PLANT MATERIAL BALANCE

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new facility by using the material balance percentages shown on attached Figure 1:

<u>Type of Material</u>	<u>¹Hanford</u>	<u>²Other</u>	<u>Total</u>
Slag and Crucible Kg/yr	140	18	158
³ Dissolver Feed Cans/yr	9,870	1,230	11,100
Metal Kg/yr	530	66	596
Dissolver Feed Cans/yr	530	66	596
Skulls Kg/yr	1,140	142	1,282
Dissolver Feed Cans/yr	1,140	142	1,282
Powders Kg/yr	500	62	562
Dissolver Feed Cans/yr	1,250	155	1,405
Liquids Kg/yr	675	84	759
Total Kg/yr	2,985	372	3,357
Cans/yr	12,790	1,593	14,383
Button Line Load Kg/yr	9,869	1,227	11,096
Virgin Feed Load Kg/yr	⁴ 7,100	883	7,983

1 Includes Normal, E, and NPR plutonium.

2 Includes NPF, PRTR, and UK plutonium.

3 Based on present can size (4-1/16"D x 5-9/16"), fragments from a 2 kilogram reduction are packaged in 2 cans.

4 Expansion case; base production is 6,100.

If capacities and processing capabilities significantly greater than the above are required to process off-site plutonium scrap other than that included in the "Other" column in the preceding tabulation, a design scope change would be required and additional funds, as needed, requested from the A.E.C. However, minor quantities can be prepared for solvent extraction processing in facilities to be provided in the Miscellaneous Treatment Room.

B. DESIGN PHILOSOPHY

The new Plutonium Reclamation Facility shall be designed so that all major vessels are located in a Zone IV process cell which has normal maintenance access by remotely-operated crane. This Zone IV cell shall be isolated from the remainder of the building by two-foot thick concrete walls and ceiling. In order to eliminate the

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expense of remote jumpers, all piping, instrument, and electrical connections to the process vessels shall be located outside the concrete wall. All valves, in-line pumps, flowmeters, and inter-connecting lines which contain or may contain plutonium-bearing solutions and which require routine maintenance shall be installed in glove boxes located in a Zone III area adjacent to the concrete vault. All areas within the building itself except the Zone IV process cell and the glove boxes themselves shall be considered Zone III areas in which personnel who normally occupy these areas will require shoe covers and laboratory coats as a minimum requirement in protective clothing. The semi-remote maintenance philosophy to be used in the new facility was selected over three other basic design approaches which were considered. The alternate design approaches considered were:

1. Complete Remote Maintenance

This is the design philosophy followed in Redox and Purex buildings in which all of the vessels, piping, primary elements for instrumentation, etc., are located in a canyon cell that has access by a remotely-operated crane only. Although this philosophy has been proven by many years of experience in the primary separations plants and would completely eliminate any problem on radiation exposure to personnel, the high cost associated with the many remote jumpers and connectors that would be required would make it impossible to meet the capital and operating cost goals that were established for the new facility. Also entirely new techniques would have to be developed and proved for miniaturizing the remote maintenance techniques employed at Purex and Redox.

2. Hood Cell

Although there have been no plutonium production facilities that have been built and operated based on the hood cell philosophy, it has been theorized that this approach could be successfully employed in cases where the glove box is no longer practical because of shielding requirements or because of the size of the equipment. The process equipment itself is located in an unshielded Zone IV cell. All equipment and piping inside the cell would be shielded individually and access for either operating or maintenance of the equipment would be by use of the plastic man. This approach was not employed since the techniques of maintaining proper comfort, mobility, and reliability of the plastic man suit have not yet been far enough advanced. Also since the degree of contamination of the hood cell itself cannot be predicted, it is possible that all the surface within the cell could become a significant radiation source if suitable decontamination and cell clean-up procedures could not be developed.

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3. Contact Maintenance

If all of the process solutions and materials could be kept inside hermetically sealed equipment and the integrity of the hermetically sealed barrier could be insured, it would then be possible to design plutonium processing equipment in which contact maintenance could be used without the need for a plastic man. All glove boxes could be eliminated and the only Zone IV areas would be those inside the pipes and vessels. All equipment would be completely accessible and a high degree of flexibility in its design could be achieved. Although it appears that there is presently available commercial equipment of the type that would make possible a completely hermetically sealed system, the reliability of much of this equipment is unknown and more important there has been little or no operating experience with it on concentrated plutonium solutions under pressure. Since this design approach holds considerable promise of making possible a major breakthrough on the cost of plutonium processing facilities, it has been made the subject of a separate design and development program.

The semi-remote maintenance approach to be employed in the new facility gains many of the radiation advantages of the complete remote system by eliminating the radiation exposure from the vessels and cells. The high capital cost associated with the remote jumpers has also been eliminated at the cost of purchasing glove boxes and coping with the accessibility and hand exposure problems of glove box operation. The facility, however, is highly flexible for future process equipment changes or additions and provides a high degree of safety to personnel in the event of uncontrolled chemical or nuclear reactions.

C. STANDARD DESIGN CRITERIA

Design of the Plutonium Reclamation Facility shall be in accordance with the Hanford Standard Design Criteria, HWS-10006, and shall utilize all applicable Hanford Standard Design Criteria, Design Guides, Standards, and Standard Specifications.

The following applicable Standard Design Criteria shall be used:

1. SDC-1.1 Standard Design Criteria, General;
2. SDC-1.2 Standard Design Criteria for Codes, Standards, and Specifications;
3. SDC-2.1 Standard Design Criteria, Architectural, General;
4. SDC-4.1 Standard Structural Design Criteria for Conventional Construction;

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5. SDC-7.1 Standard Electrical Design Criteria, General;
6. SDC-7.4 Standard Design Criteria for Underground Power Distribution Systems;
7. SDC-7.5 Standard Electrical Design Criteria for Interior Power and Lighting Systems;
8. SDC-7.7 Standard Electrical Design Criteria for Plant Telephone System; and
9. SDC-7.8 Standard Electrical Design Criteria for Fire Alarm Systems.

D. DEVIATION FROM SCOPE BASIS DOCUMENT

Document HW-64941, "Basis for Design Scope, Plutonium Reclamation Facility, Z Plant, Project CAC-880," defined the scope design basis for the subject facility. Only one deviation from the above-defined basis shall be made: shielding design. The reference document stated that shielding would be provided for the capability of processing approximately 10,000 MWD/T exposure plutonium. However, the initial shielding design will only provide capability for processing approximately 2,000 MWD/T exposure plutonium. Hence, all permanent parts of the new facility, such as the process cell walls and ceiling, shall be provided with shielding for processing 10,000 MWD/T plutonium while those portions to which shielding can be readily added at a future date, such as the glove boxes, shall be shielded only for 2,000 MWD/T plutonium processing capability.

E. PROCESS DESCRIPTION

The reclamation process is defined in documents HW-64705, "Continuous Dissolver Flowsheet, New Plutonium Recovery Facility," HW-64851, "Solvent Extraction Flowsheet for New Plutonium Reclamation Facility," and in the attached process flow diagram, SK-2-18400.

Feed to the new facility will consist of both solid and liquid streams. The major solid feeds are:

1. Task III slag and crucible fragments;
2. Task III reject buttons;
3. Task I, II and III powders (hood sweepings);
4. Task III pressure vessel lids;
5. Task IV casting skulls;

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6. Incinerator ash; and
7. Miscellaneous solids from other HAPO departments and off-site.

The main liquid feeds are:

1. Task I filtrate;
2. Off-standard Redox and Purex solutions;
3. Incinerator leach solution;
4. Waste Treatment Facility product stream; and
5. Miscellaneous solutions from other HAPO departments and off-site.

All solid feeds will be dissolved for solvent extraction processing. Task III slag and crucible fragments will be charged directly to the large continuous dissolvers located in the process cell for dissolution in HNO_3 -HF. The continuous dissolver overflow, treated immediately with aluminum nitrate solution for HF complexing to minimize corrosion of succeeding vessels, is mixed with other liquid feeds for solvent extraction processing. Task III reject buttons will be charged to small continuous dissolvers in the Miscellaneous Treatment Room for dissolution in HNO_3 -HF. The dissolution procedures for Task I, II, and III powders, Task III pressure vessels, Task IV casting skulls, and incinerator ash are not firm at this time; dissolving methods will be established by the Research and Engineering Operation, CPD, on or before January 1, 1961. The dissolution of miscellaneous solids from other HAPO departments and off-site will be dictated by composition and quantity. After HF complexing with aluminum nitrate solution, all solutions from the Miscellaneous Treatment Room are transferred to a process cell vessel for solvent extraction feed preparation.

Depending upon plutonium concentration, liquid feeds may or may not be concentrated prior to blending with dissolver products for solvent extraction processing. Normally, Task I filtrate, Waste Treatment Facility product, incinerator leach solution, and batch-accumulated internal recycle streams will be concentrated. Off-standard Redox and Purex solutions will normally be blended directly with other liquids. The treatment of miscellaneous solutions from other HAPO departments and off-site will be governed by composition.

Three parallel-operated tanks will be provided for chemical adjustment of solvent extraction column feed, formed by blending of all liquid feeds, with aluminum nitrate, nitric acid, and water.

After chemical adjustment, the liquid feed is pumped continuously to the solvent extraction battery, composed of three columns: (1) a compound extraction pulse column; (2) a simple stripping pulse

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column; and (3) a simple organic wash packed column. In the extraction column, the plutonium is transferred to the tributyl phosphate-carbon tetrachloride solvent with aluminum nitrate as the salting agent. The aqueous waste overflows to a packed column to be provided in the proposed Waste Treatment Facility for further reduction of its plutonium content. The organic plutonium-bearing stream flows by interface control to the top of the stripping column where it is stripped of its plutonium by the upward-flowing dilute nitric acid extractant. The plutonium-bearing aqueous overflow stream from the stripping column is split, with the bulk being returned to the extraction column for reflux after treatment with sodium nitrite solution for plutonium valence adjustment, and the remainder, constituting the product stream butted with nitric acid to prevent plutonium polymer formation, concentrated and shipped to Task I for processing. The organic stream flows by interface control to the top of the organic wash column where it is stripped of its remaining plutonium by the upward-flowing ferrous sulfamate-sulfuric acid extractant. The aqueous overflow stream from the organic wash column is continuously recycled. The organic stream flows by interface control to tanks from which it is pumped to the solvent extraction column as extractant. Depending upon dibutyl phosphate content, a deleterious decomposition product of tributyl phosphate, the organic extractant is batch-washed with dilute sodium carbonate at intervals for its removal. The aqueous stream from the batch-washing operation is sent to the waste sump tanks for underground disposal.

F. EQUIPMENT CRITERIA

1. Main Process Glove Boxes and Contained Equipment

Process piping, instrument tubing and electrical lines from each canyon vessel will pass through the dunnage plugs to the main process glove boxes. All interconnecting piping, instrument and electrical connections will be made in the glove boxes.

To cover the upper and lower sets of plugs on each side of the process cell, four main process glove boxes will be installed on the cell walls, as shown on the attached drawing SK-2-3404, on the first and second floor levels. Each of the four glove boxes will be made up of three modular sections as shown on attached drawing SK-2-18473. Interconnecting piping between glove boxes on different floor levels will be provided as required. During construction, the glove boxes will be installed without the front panels in place to permit free access to the interior during piping and equipment installation. Each glove box section will have three panels which will be bolted in place. This technique will allow installation of only acrylic resin panels (not shown) in those areas where no equipment will be installed in the cell.

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After assembly of the front panels, those sections which have equipment installed opposite them in the cell will be shielded with 1-inch of high density (6.2 specific gravity) lead glass or 1/2-inch of lead applied directly to the glove box. A cross-section view, attached drawing SK-2-18473, shows a detail of the window whereby 1/4-inch of safety plate glass will serve as the prime wall barrier, and the lead glass can be installed or removed separately, held in place by an outer flat frame. The depth of the frame welded to the glove box will allow installation of a 2-inch thickness of lead glass, although only a 1-inch thickness will be installed initially.

No glove box drains will be provided. Instead, the floors will be sloped slightly with a critically-safe sump located at the lower end. Liquid will be removed from the sump by vacuum to a sump receiver located in the glove box itself.

The main functions of the process glove boxes are as follows:

- a. Provide means to interconnect cell vessels;
- b. Provide a location for performing necessary process sampling; and
- c. Contain equipment subject to maintenance servicing and repair in a readily accessible location.

Equipment which will be located in the main process glove boxes includes valves, flowmeters, instrument components, vent traps, in-line filters, mixers, samplers, in-line pumps, and receivers for overflow and sump wastes. In addition, a hand-operated hoist will be provided on a driven monorail to permit movement of equipment to a bag-out port. All piping 1/2-inch and under will utilize Koncentric fittings while larger piping will employ flanges to facilitate maintenance and minimize leaks.

Although the typical glove box section is defined on attached drawing SK-2-18473, a full scale mockup of a section along with installed equipment is being fabricated in order to provide definition as to the glove box depth and location of glove ports, windows and equipment to afford adequate vision and access to all equipment which will require maintenance servicing. Final definition of these critical dimensions will await completion of mockup testing in November, 1960.

2. Process Cell Vessels

All vessels to be used in the facility are listed by number and service on attached drawing SK-2-18328. All vessels located in the process cell, as shown on attached drawings SK-2-6693,

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SK-2-6719, and SK-2-6720, will be installed and removed remotely. Hence, all process cell vessels will be mounted on a stainless steel dunnage, attached drawing SK-2-6707, which will be transported by a remotely-operated crane, described later in this section. In general, all vessels, piping, dunnage and appurtenances will be fabricated of Type 304-L stainless steel unless otherwise specified. To facilitate procurement, vessel dunnage will be made from plate formed to channels. For non-critical service, such as vessel dunnages and glove boxes, the applicable ASTM specification shall be used for the construction material. For critical services, such as process vessels and piping, construction materials and welding shall conform to the applicable Hanford Standard Specification. Process vessels shall be fabricated in accordance with specification HWS-5796.

The width of the vessels, dunnage and piping will be held to a minimum to permit a maximum clear space between adjacent tanks, consistent with the 32-inch module wall spacing between the center lines of the vessels, to facilitate placement of a vessel between two installed vessels. Piping will be mounted on the vessel dunnage assembly to minimize snagging possibilities.

Experience with vessels in the existing Recuplex facility indicates a minimum of three to five years service life for the majority of the vessels. For this reason and to minimize leak sources, piping from the dunnage plugs to the vessels will, in general, be welded in place. The vessel and dunnage will be discarded as a unit when the vessel fails if it cannot be economically repaired at the maintenance station. Exceptions will include such items as instrument dip tubes which tend to plug; piping for this and similar services will be provided with connectors to permit unplugging the line at the maintenance glove box. Components of vessels subject to earlier failure such as the dissolvers and evaporators will be constructed as bolted assemblies to permit replacement of a part of a vessel at the maintenance station.

Sizing of condensers and reboilers on vessels, where applicable, will be made in accordance with heat balance requirements defined in the attached process flow diagram SK-2-18400, unless otherwise noted.

Vessel dunnage assemblies will be designed to permit full access to all components which require maintenance when an assembly has been located at the maintenance station.

All vessels in the process cell will be designed to be geometrically-favorable with the exception of the CAX and Miscellaneous Wash Tanks. A description of the major vessels follows:

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a. Receiver and Storage Tanks - SK-2-6708

These tanks will be made by manifolding four pieces of 5-inch diameter type 304-L stainless steel Schedule 40 pipe. To meet the necessary volume requirements, two tank heights will be used: 4 feet and 16 feet. Tank agitation will be provided by an in-line pump which will be located in the process glove box with recirculation lines running to and from the tank through the wall plugs. Practicability of this type of agitation for manifolded tanks is being proved out in testing being performed by the Hanford Laboratories Operation.

Approximately one-half of the process cell vessels will be of this general type.

b. Columns - SK-2-6694

Three columns will be provided as shown: an extraction pulse column, 4-inches diameter by 50 feet, a stripping pulse column, 3-inches diameter by 40 feet, and a Raschig ring packed organic wash column, 3-inches diameter by 25 feet. All columns will be made of Type 304-L stainless steel Schedule 40 pipe with the extraction pulse column only having a glass disengaging section at the top for viewing.

The pulse columns will be constructed in the form of a "U" tube which will permit the pulser to be located at the top of the column on a pulser leg, thereby eliminating the problem of a bellows under pressure. Pulsing action will be transmitted to the column by a piston which will be located at approximately the mid-point of the pulser leg. The design of the pulse columns shall permit changeover to the air pulser type should the latter prove feasible in the future.

The pulse columns will require a remote flange which can be broken from the column glove box when it becomes necessary to replace a column. The column internals will be removed at the column glove box. Upper column sections will then also be removed at this point, followed by breaking the section at the remote flange and withdrawing it to the column glove box. Finally, the portion of the column remaining in the process cell will be removed and transported by the remotely-operated cell crane.

Column and pulser specifications are given in document HW-66864, "Technical Specifications for Solvent Extraction Columns in the New Plutonium Reclamation Facility."

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c. Dissolver Assembly - SK-2-18472

This assembly consists of a dissolver, remotely-operated solid feed ball valves, and a condenser mounted on a common dunnage. Canned solids will be fed to the dissolvers by a retractable chute from a glove box above the process cell. In practice, the upper valve would be opened to receive a can after which it would be closed and the bottom valve open to allow the can to drop into the dissolver. At no time will both valves be open at the same time to allow fumes to escape into the process cell or the can dispenser, located on the fourth floor.

Fabrication and testing of a prototype dissolver are being done by the Hanford Laboratories Operation. Results of this prototype testing will determine:

- (1) The number of dissolvers required: Only two dissolvers will be installed by the project although the attached engineering flow diagram SK-2-18304, Sheet 1, shows a future installed spare and process cell space has been provided for a total of six.
- (2) The need and, if required, the method of heating and/or cooling the dissolver pot; and
- (3) The construction material for the dissolver pot, preliminarily indicated as Type 309 sCb stainless steel or Teflon-lined stainless steel.

The dissolver overflow piping to the dissolver receiver vessel will be Teflon-lined stainless steel to withstand the corrosive effect of the hot HNO_3 -HF solution.

d. Scrubber Assembly - SK-2-6724

The scrubber vessel proper will be fabricated from 6-inch diameter Schedule 40, Type 304-L stainless steel pipe, packed with Type 304 stainless steel Raschig rings. The external annular heat exchanger will be fabricated from Type 304-L stainless steel Schedule 40 pipe.

e. CCP Stripper - Evaporator and Condenser Assembly - SK-2-18493

The assembly consists of a Raschig ring packed stripper-evaporator and a horizontal condenser mounted on a common

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dunnage. The stripper will be fabricated per specification HWS-7441 of 4-inch diameter titanium pipe with a 6-inch diameter steam jacket. Although shown as being made of titanium, the jacket can be made of Type 304-L stainless steel provided a practical sealing solution is available where the different metals are joined. The condenser will be fabricated from Type 304-L stainless steel.

f. Filtrate Evaporator and Condenser - SK-2-18495

This assembly will consist of an evaporator with replaceable heat exchanger, de-entrainment section and a horizontal condenser, all mounted on a common dunnage. All vessel components will be made of Type 304-L stainless steel.

3. Remote Cell Crane

This crane, the heart of maintaining equipment in a remotely-operated process cell, must perform the following functions:

- a. Pick up a vessel-dunnage assembly from the wall at either wall hook level and move it to the center aisle without snagging vessels or appurtenances on either side.
- b. Move the vessel-dunnage assembly the length of the cell to mount the vessel-dunnage assembly in the maintenance station.
- c. Move component parts or whole assemblies to and from the cell bag-in port located adjacent to the cell maintenance station as shown on attached drawing SK-2-3404.

All motions of the crane are to be actuated from two control stations located in the crane control and observation gallery.

The crane must be ruggedly constructed to minimize maintenance down-time. In this regard, permanently lubricated bearings will be utilized wherever possible. All components subject to wear and failure will be located such that they can be serviced at the maintenance station or, where impossible at this location, by platform access at the north end of the process cell.

One crane concept is shown on attached drawing SK-2-6686. The crane bridge is mounted from rails attached to the cell ceiling to allow longitudinal motion. Mounted to the bridge is a trolley with a vertical leg which will permit movement back and forth on the bridge for transverse movement. A second trolley equipped with dual probes similar to a fork lift truck will move

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up and down the vertical leg. In addition, the vertical leg will be equipped with a joint so that it can turn 180° to service either side of the cell. Electrical and control wiring will be attached to the crane through a fixed crane leg mounted to the bridge and closed track pickup mounted on the floor.

It is planned, however, to consult with crane fabricators for adaptation of their products such that the vendor will actually supply the detail design for the crane.

4. Cold Chemical Preparation Facilities

As shown on attached drawing SK-2-3404, the cold chemical preparation room will be located on the fourth floor of the building. Sixteen tanks for uses as defined on the attached engineering flow diagram, SK-2-18304, will be located in this room, serviced by an overhead monorail to facilitate loading.

Cold chemical storage space will be provided in the center of the preparation room itself as well as in an adjacent room. Special exhaust venting will be provided for handling chemical fumes from all make-up tanks. Wash-down facilities shall be provided for the chemical preparation room floor.

Since the Miscellaneous Treatment Room is located on the same floor, provision will be made for either vacuum or pump transfer of all chemical solutions to that facility from the chemical preparation room.

With the exception of one tank being fabricated from polyvinyl chloride (PVC), all tanks will be stainless steel construction; it is planned that these latter tanks will be provided from on-site facilities where they are no longer required.

Five other vessels may be located in the cold chemical preparation room: the two dissolver cold feed heaters (D1 and 2) and the cold feed pump tanks to the columns (E29, 30 and 31). An alternate location for these vessels will be in the third floor crane control and observation gallery. The ultimate location will be a detail design decision.

G. ARCHITECTURAL CRITERIA

1. General

The building covers an area 67'-0" x 79'-0" long and is four (4) stories high in the service and operating corridors. The clear height of the cell is 32'-0" with the fourth floor extending over the cell. Attached drawing SK-2-3404 shows the building arrangement.

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2. Building Construction

- a. The building is to be of reinforced concrete construction with the exception of the roof.
- b. The roof is to be of open web steel joist framing, steel decking, rigid insulation and graveled built-up roofing. The fourth floor ceiling will be wire lath and plaster.
- c. Non-bearing partitions are to be 2-inch thick solid metal lath and plaster.
- d. All interior surfaces are to be painted with enamel except the cell interior and as noted in (e) below.
- e. Floors in the control room, offices, and glove box areas will receive vinyl-asbestos tile.
- f. The process cell floor is to be covered with a stainless steel liner extending 18-inches up the side walls. The remaining cell wall and ceiling surfaces are to receive a chemical-resistant coating.
- g. Interior concrete surfaces are to have F-4 and U-3 concrete finishes per HAPO specification HW-4798-S. Exterior concrete surfaces are to have F-3 and U-3 finishes except exposed slabs which will receive a U-5 finish, per the latter HAPO specification.
- h. Doors will be steel flush panel hollow metal type. Door glazing where required will be in the upper panel only. Double strength "B" quality glass is to be used.
- i. All doors will be equipped with closers except the janitor closet and offices. Panic hardware is to be used on doors at required exits. Locks shall fit the 234-5 Building master keying system.
- j. The elevator is to be 4000 pound capacity hydraulic type suitable for passenger service, with control stations at each floor.
- k. Water-filled windows, framed to allow replacement from the corridor, shall be provided for cell viewing.
- l. Safety showers per specification HWS-10001, Section B-3-7, shall be installed at locations to be determined during Title II detail design.

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3. Service Roads

Service roads will conform to Hanford Standard Specification HWS-6135-S for light bituminous surface treatment paving.

E VENTILATION AND AIR CONDITIONING CRITERIA

1. Purpose

The ventilation supply and exhaust systems for the 236-Z Building have two primary functions: (1) to provide air flow control and air decontamination as a protective measure for the building occupants and environs against release of radioactive contamination; and (2) to provide air conditioning within acceptable limits established for occupant comfort and process control. The ventilation air flow diagram is shown on attached drawing SK-2-6670.

2. Air Flow Control and Air Decontamination Criteria

The entire 236-Z facility is a controlled access area with regard to potential for radioactive contamination. However, since the different operations performed in the various building spaces have different potentials for contamination hazard, a high degree of compartmentalization has been provided to isolate the various spaces in the event of a contamination incident. The ventilation supply and exhaust systems must satisfy the concept of space isolation while maintaining preferred air flow patterns result in air flow (controlled or leakage) from spaces of lower radioactive contamination potential to spaces of higher potential.

All occupied spaces of the building will be ventilated with 100 percent fresh air at a design rate of not less than fifteen (15) air changes per hour. Each space will be provided with stable, measurable air flows of supply air and exhaust air to obtain effective air balance. The air balance design criteria for the 236-Z Building are based upon air flow concepts rather than direct static pressure control although maintenance of preferred static pressures is a necessary consequence of air balance design. (The exception to the air flow balance technique will be the process cell and glove boxes where automatic static pressure control techniques will be applied.) Air balance by air flow will generally result in supply air deficiencies to a building space compared to exhaust air quantities. The building air-tightness will govern the actual air balance relations between supply and exhaust air to yield an infiltration effect on all building exterior surfaces. Furthermore, air balance of adjacent spaces in the building will yield a net air leakage

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effect from spaces of lower contamination hazard to spaces of higher hazard. To facilitate air balance procedures, the supply and exhaust systems will be equipped with convenient air flow control devices and measuring stations and the systems will be designed for a high degree of operational stability.

All exhaust air from the 236-Z Building will be decontaminated by one or more stages of high efficiency filtration before release to the atmosphere. Governing criteria for the exhaust systems are presented in Paragraph 5.

3. Air Conditioning Criteria

The supply air system for the 236-Z Building will perform the air conditioning functions of filtering, heating, humidification, cooling, and air distribution. Heating will be adequate to maintain building temperatures uniformly at 72°F minimum at design outdoor conditions of minus 20°F. The summer cooling function will be obtained by use of evaporatively cooled supply air to maintain space temperatures at a maximum of 85°F at summer outdoor design conditions. Air distribution will be accomplished by use of conventional low pressure duct systems designed for a high degree of inherent stability.

4. Supply Air Distribution System

The supply air for the 236-Z Building will be furnished by the supply ventilation units in the 234-5 Building. An insulated supply duct will connect the 234-5 Building supply air plenum with the distribution system in the 236-Z Building as shown on attached drawing SK-2-6692. The general supply air distribution scheme in the building itself is shown on attached drawing SK-2-6682. Zoned distribution ducts equipped with reheat steam coils will be installed to maintain uniform temperature control. The nominal capacity of the supply air system is 50,000 SCFM.

5. Exhaust Air Systems

The exhaust air systems for the 236-Z Building fall into two categories. The Zone III exhaust air will include all building exhaust air except the Zone IV category which includes the exhaust air from glove boxes, process cell, and the process vacuum system. All building exhaust air (Zone III and Zone IV) will combine at the final high efficiency filter banks for subsequent discharge to the 291-Z Building exhaust plenum and stack as filtered exhaust air. Zone III exhaust air will receive one stage of high efficiency filtration (in the final filter banks) preceded by one stage of prefiltration at the room outlet to reduce the dust loading on the final filter banks. Zone IV exhaust air from glove boxes and process cell will receive three

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stages of high efficiency filtration (including the final filter bank). Zone IV primary high efficiency filters will be located in the glove box from which the exhaust air originates; each secondary high efficiency filter will decontaminate the exhaust air from one or more glove boxes before the air is discharged to the final filter banks. All Zone IV exhaust systems will be fabricated of stainless steel materials. All Zone III exhaust air flows will be static pressure controlled to maintain the glove boxes at 0.5 to 1.0 inches water vacuum with respect to the room containing the glove box.

I. ELECTRICAL CRITERIA

1. Electrical Power Service

- a. The normal power supply will be obtained from a new 400 ampere circuit breaker to be installed in the 480 volts, 3 phase, 60 cycle, A.C. switchgear located in the 291-Z Building. The circuit breaker will be installed in a spare space in the switchgear supplied from the No. Six 1000 KVA transformer as shown on the attached one line diagram, SK-2-6680.

The feeder will be installed in an underground duct and will terminate in a motor control center located in the new facility.

- b. Emergency power for process instrumentation and control panel lighting will be obtained from the emergency section of the 480 volt switchgear in the 234-5 Building, Room 266.
- c. The 480 volt power will be distributed from feeder breakers in the motor control center. Secondary voltages will be obtained from dry type transformers installed within the new building.

2. Lighting and Convenience Outlets

- a. Lighting and receptacle circuits will be supplied from dry type transformers and circuit breaker type panel boards.
- b. In general, lighting fixtures will be the latest type fluorescent fixtures except that in high bay areas mercury vapor and incandescent fixtures will be considered.
- c. Lighting levels will be designed to meet the latest recommendations of the Illuminating Engineering Society of America.
- d. Hood lighting will be provided based on the seeing task. Consideration will be given to mounting lighting fixtures inside the hood.

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- e. Emergency lighting for corridors, stairways, etc., to facilitate exit in the event of power failure will be supplied from battery operated units.

3. Constant Voltage

Constant voltage circuits to "Poppies" and instruments requiring same will be supplied from constant voltage transformer.

4. Communications

- a. Plant telephone - Eight spare lines are available in the 234-5 Building. Service to the new facility will be obtained by connecting to the spare lines at the 234-5 Building.
- b. House telephone service will be furnished by connecting to the 234-5 Building system.
- c. Building sound-powered telephone and speaker-microphone systems will be furnished.

5. Fire Protection System

Auxiliary pull boxes, sprinkler system pressure switches, automatic detector heads and hood fire detection systems will be furnished and connected to the 234-5 Building master panel.

6. Alarm Systems

- a. Two critical incident monitors similar to those now installed in all 200 Area facilities shall be installed in: (1) the process cell; and (2) the Miscellaneous Treatment Room, with alarm extensions installed on all building floors.
- b. All floors of the building shall be equipped with alarm extensions from the 234-5 Building evacuation system.

J. INSTRUMENTATION CRITERIA

1. General

Instrumentation requirements are defined on the attached instrument engineering diagrams, SK-2-6712, Sheets 1-3.

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2. "Cold" Vessels and Streams

Instrumentation for the "cold" (non-contaminated) vessels and streams will use conventional pneumatic or electronic components. The individual instruments shall be specified by the Design Engineering Operation, CE & UO, during Title II detail design.

3. "Hot" Vessels and Streams

a. General

Instrumentation for the "hot" (contaminated and potentially-contaminated) vessels and streams will utilize electronic components wherever possible to eliminate the possibility of contamination spread through the use of pneumatic components. If pneumatic components are used, air lines to the control room panels shall be isolated from those to the glove boxes by transmitters located outside the control room.

b. Flowmeters

The primary elements for all flow measurements shall be magnetic flowmeters with the exception of the CAX organic extractant stream for which an electronic rotameter shall be used since it has insufficient conductivity for using a magnetic flowmeter.

c. Interface Control

The two pulse columns, extraction and stripping, shall be equipped with capacitance probes as the primary elements for interface control. The Raschig ring packed organic wash column shall use a simple jackleg for interface control.

d. Weight Factor, Specific Gravity, and Differential Pressure

Air-purged dip tubes shall be used as the primary elements for measurement of vessel weight factor, specific gravity, and differential pressure. If acceptable electronic components can be developed for these applications at comparable cost, serious consideration shall be given during Title II detail design for their use as replacements for the above-specified pneumatic components.

e. Temperature

The primary elements for temperature measurement shall be either thermocouples or resistance bulb thermometers as specified during Title II detail design by the Design Engineering Operation, CE & UO.

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f. Neutron Monitors

Neutron monitors shall be used for both process and criticality control:

(1) Process Control

- (a) CAF pump tanks
- (b) Extraction Column (top)
- (c) Stripping Column (top and bottom)

(2) Criticality Control

- (a) Cell Continuous Dissolvers
- (b) CAX and Miscellaneous Wash Tanks

Installation of a primary element on a cell vessel shall be such that it can be replaced from the corridor glove box without removal of the vessel itself. The specifications for all neutron monitor components shall be furnished by Process Design and Development, Facilities Engineering Operation, CPD.

K. PIPING SERVICES CRITERIA

1. Sanitary Water - Underground Service

The sanitary water underground service will be supplied from the Z Area underground sanitary water loop. The line will be 3-inch B&S cast iron with a post indicator valve at the main connection. The underground sanitary water will enter the building in the service area for subsequent distribution as hot and cold sanitary water and process water.

2. Sanitary Water - Building Service

Sanitary water for building service will be supplied directly by the underground sanitary water service main. The sanitary water system will serve the water requirements of the restroom and drinking fountains. Hot sanitary water for the restroom will be provided by an electric water heater. No unprotected cross connections shall exist between the sanitary water system and any other piping service.

3. Process Water - Building Service

Process water for building service will be supplied by the underground sanitary water service main through a backflow

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preventer. The process water system will serve all building process water requirements including, by indirect connection, the protected process water system(s).

Conventional sanitary air gap practice will be observed between process water and waste connections; however, process water may be connected directly (without air gap or vacuum breaker protection) to equipment inlet points provided outlet points are protected with an air gap at the waste connection.

4. Protected Process Water - Building Service

The protected process water system will be a hydropneumatic water system(s) serving process water requirements in radioactively contaminated glove boxes and cells. The protected process water system(s) will be supplied from the building service process water system via an air gap float valve and vented supply tank. All protected process water system entries to glove boxes and cells will be equipped with double check valves to reduce the risk of backflow.

5. Fire Water - Underground Service

The fire water underground service will be supplied from the Z Area underground sanitary water loop. The line will be 4-inch B&S cast iron with a post indicator valve at the main connection. The fire water will enter the building in the service area for subsequent distribution to safety showers, first aid hose racks, and the automatic sprinkler system.

6. Fire Protection Water - Building Service

Fire protection water in the building will be supplied from the underground fire water service without intermediate valves. Fire protection water will be supplied to safety showers, first aid hose racks, and the alarm valve for the interior sprinkler system. An ordinary hazard wet pipe automatic sprinkler system will be provided to protect all building spaces with little or no potential for development of radioactive contamination or critical mass. A sectionalized, manually controlled water fog deluge system will be provided to fight fire in the process cell.

7. Steam - Underground Service

Heating and process steam for the entire facility will be supplied by an underground 2-inch steam supply main connecting to the existing 225 psig steam service in the 291-Z Building. The underground main will be an insulated conduit-protected line without provision for condensate return.

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8. Steam - Building Service at 225 Psig

The 225 psig building service steam will connect the underground steam terminus in the building to the primary steam pressure reduction station from which all other building steam systems will originate. The primary reduction station will reduce the steam pressure from 225 psig to 100 psig. The primary station will be equipped with a relief valve set at 125 psig.

9. Steam - Building Service at 15 Psig

Saturated steam at 15 psig will be furnished by a secondary reducing station for the ventilation reheat coils and building service heating steam. The 15 psig system will be protected with safety valves set at 40 psig. All building heating steam piping and equipment will be selected and designed for a minimum working pressure of 40 psig.

10. Steam - Process Service at 30 Psig

Saturated steam at 30 psig will be furnished by a secondary reducing station for all process steam requirements. The 30 psig process steam system will be protected with safety valves set at 40 psig. All process steam piping and equipment (including steam heated process vessels) will be selected and designed for a minimum working pressure of 40 psig. The process steam system will be provided with a vacuum breaker assembly to limit the minimum pressure to atmospheric pressure. All process steam entries to glove boxes and cells will be equipped with double check valves to reduce the risk of backflow.

11. Steam Condensate - Building Service

The condensate system will collect all steam condensate except condensate originating from equipment in glove boxes and cells. The condensate system will be an open (vented) gravity line discharging to the clear process waste (D-2) after cooling to 170°F maximum.

12. Sanitary Sewer - Underground

An underground sanitary sewer of 6-inch VCT will be provided to conduct sanitary waste to the existing Z Area septic tank and disposal field.

13. Sanitary Waste and Vent - Building Service

Interior building service for waste and vent of restroom fixtures and drinking fountains will be provided. Sanitary waste will discharge to the underground sanitary sewer.

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14. Non-Contaminated Process Sewer - Underground

A non-contaminated process sewer of 6-inch VCT with chemical joints will be provided to conduct chemical and clear process wastes not subject to radioactive contamination (D-1 and D-2). The process sewer will originate at a new chemical manhole adjacent to the new 236-Z Building and will terminate at an existing chemical manhole in the Z Area process sewer.

15. Clear Non-Contaminated Process Waste - Building Service

Clear wastes not subject to radioactive contamination will be conducted via galvanized steel and/or cast iron for discharge into the non-contaminated process sewer manhole. This waste system will receive cooled waste from the building steam condensate system. Conventional sanitary practices for traps and venting will be observed for this waste system. This waste system is designated (D-2).

16. Chemical Non-Contaminated Process Waste - Building Service

Chemical wastes not subject to radioactive contamination will be conducted via stainless steel and/or silicon cast iron for discharge into the non-contaminated process sewer manhole. Conventional sanitary practices for traps and venting will be observed for this waste system. This waste system is designated (D-1).

17. Potentially Contaminated Process Waste - Building Service and Underground

All cooling water and steam condensate wastes from glove boxes, cells, and equipment therein which will not suffer gross radioactive contamination in the event of equipment failure will be discharged via stainless steel piping to the existing process waste sewer to the Z Area retention basin (D-3). The existing retention basin system has provision for ultimate discharge to either the non-contaminated process waste (D-1 and D-2) or the contaminated process crib systems depending upon activity level of the D-3 waste stream.

18. Contaminated Process Waste - Building Service and Underground

Radioactively contaminated process wastes will be discharged via stainless steel piping to the existing sump tank and crib system for the Z Area (D-6). These wastes include all water and steam condensate waste from equipment which will become grossly contaminated with radioactive material in event of equipment failure. The contaminated process waste will also include spent dissolver scrubber caustic and aqueous organic-wash solutions.

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19. Contaminated Process Waste - Cavern

Plutonium-bearing process wastes including spent organic and silica slurries will be discharged to the existing Z Area underground cavern disposal system. Cavern waste lines will be stainless steel. Tie-in points will be provided by the Project CGC-912 Waste Treatment Facility.

20. Fire Protection Water Waste System

Room drains for fire water waste will be provided to dispose of all automatic sprinkler, safety shower, and first aid hose water discharge. The room drains will discharge to the underground exhaust duct for retention and collection. The duct contents will be jetted optionally to the non-contaminated process sewer or the contaminated process waste depending upon the amount of radioactive contamination in the waste water.

21. Compressed Air - General Purpose Underground

A general purpose compressed air service at 90 psig will be provided from the existing service in the 291-Z Building via underground 2-inch galvanized steel (protected) main.

22. Compressed Air - General Purpose - Building Service

General purpose compressed air at 90 psig will be distributed in the building areas to serve pneumatic tools, valve testing, cylinder operators, and standby connections to the dry compressed air services. Manually adjustable pressure reducing valves will be provided at each terminal.

23. Compressed Dry Air - Building Service

A compressed dry air primary system will be installed in the 236-Z Building to supply the instrument air systems. The system will incorporate dual equipment for compressing and drying for storage in a receiver at 90 psig. Oil-free type compressors and chemical dryers will be provided. Each half of the compressor dryer assembly will be rated at 75 SCFM.

24. Instrument Dry Air - Building Service

The instrument dry air system will supply compressed air to instruments not subject to radioactive contamination. The system will be supplied at a reduced pressure of 30 psig from the primary compressed dry air system. No storage receiver will be included in this system; however, an automatic filtered standby connection to the general purpose compressed air system will be provided. Standby instrument air will be supplied from the 234-5 Building 30 psig instrument air system.

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25. Process Instrument Dry Air

A separate instrument dry air system will distribute compressed air to instruments in radioactively contaminated glove boxes and cells. This 30 psig system will be similar to the instrument dry air system except that it will incorporate a 30 psig receiver isolated from the other compressed air systems by a pipe line absolute filter. A general purpose compressed air automatic standby connection will be provided.

26. Compressed Purge Air

A separate compressed air system supplied at 30 psig from the process instrument air system will be provided for purge flows on instrument dip tubes. This system will include a 30 psig receiver and absolute filter isolation from the process instrument air system. In addition, each purge connection on the system will be equipped with an absolute filter.

27. Breathing Air - Underground Service

An underground breathing air service will be provided from the existing breathing air service in the 291-Z Building. The underground line will be 2-inch galvanized steel (protected).

28. Breathing Air - Building Service

A breathing air distribution system will be provided to all potentially contaminated areas of the building including entry stations to the main process cell. Each breathing air terminal will be equipped with a standard regulating valve and manifold.

29. Argon Gas - Hood Atmosphere

An argon gas system at 30 psig will be provided for atmosphere control in the Miscellaneous Treatment glove box area. The argon gas system will be supplied from the 234-5 Building. Argon gas connections to glove boxes will be automatic valve controlled with absolute filters provided.

30. Argon Gas - Welding

An argon gas manifold for inert gas welding will be furnished in a cylinder station adjacent to the maintenance shop. The system will terminate at the welding bench and in the maintenance hood.

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31. Process Vacuum

The process vacuum system will consist of a distribution system and a vacuum source in the 236-Z Building. The process vacuum system will be operated at 26 inches of mercury vacuum. Each vacuum service connection will be equipped with liquid receiver-separators. The vacuum source will be a dual system consisting of receivers, absolute filters, and steam jet vacuum pumps with surface condensers. The pumps will discharge to the hood exhaust system prior to the terminal exhaust filters.

32. Vacuum Air Sampling

A complete vacuum air sampling system will be provided in the 236-Z Building. The system will include distribution piping to room and duct samplers and dual vacuum assemblies of absolute filters and multistage centrifugal fans. The air sampling system will discharge to atmosphere.

33. Concentrated Nitric Acid - Transfer

A concentrated nitric acid (60 percent) supply line will be provided to connect the existing line to the Project CGC-912 Waste Treatment Facility to a nitric acid storage tank provided in the chemical preparation room of the 236-Z Building. Piping will be 3/4-inch stainless steel.

34. Sodium Hydroxide - Transfer

A sodium hydroxide (50 percent) supply line will be provided to connect the existing line to the Project CGC-912 Waste Treatment Facility to a sodium hydroxide storage tank provided in the chemical preparation room of the 236-Z Building. Piping will be 1-inch carbon steel, steam traced.

35. ANN Solution - Transfer

An ANN solution supply line will be provided to connect the existing line to the Project CGC-912 Waste Treatment Facility to an ANN storage tank provided in the chemical preparation room of the 236-Z Building. Piping will be 3/4-inch stainless steel, steam traced.

36. Plutonium Process Streams - Interprocess Transfer

Interprocess piping to connect Task I filtrate and Task I feed streams to the new facility will be provided. These process lines will be double-contained lines. All interprocess lines will be stainless steel. Interprocess piping will be provided to the new Waste Treatment Facility adjacent to the 236-Z Building.

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37. Cold Process Streams - Interprocess Transfer

Interprocess piping to connect the chemical preparation room with the Waste Treatment Facility shall be provided.

L. MAINTENANCE CRITERIA

1. General

The new facility will be designed and built for semi-remote maintenance with maintenance requirements and ease of access given full consideration for all components subject to wear, failure, or replacement due to obsolescence. In this regard the process cell, crane, and vessel mountings will be designed so that maintenance personnel will not have to enter the process cell to perform work on process equipment.

Equipment will be removed from, and brought into, the process cell through a bag-out hatch adjacent to the cell vessel maintenance glove box, as shown on the attached drawing SK-2-18505. Hatch access will be on the first floor of the building. Platforms will be provided to facilitate required bag sealing.

Provision will be made for access to the process cell by the plastic man technique for emergency maintenance work or for non-routine service to crane components inaccessible at the cell maintenance hood.

Maintenance on hot process equipment will be performed in three main locations: cell vessel maintenance glove box, main process glove boxes, and hot maintenance glove box. Cold maintenance work will be performed in a cold maintenance shop.

2. Cell Vessel Maintenance Station

This station will be located at the north end of the cell as shown on the attached architectural drawing SK-2-3404 to service the wall "position" which will be reserved for cell vessel maintenance. In normal operation, a piece of equipment will be positioned at the maintenance wall position by the remotely-operated crane.

As shown on attached drawing SK-2-6721, the station is essentially an eight foot wide "wall" extending the height of the cell. The "wall" will be shielded with 1-inch of high density (6.2 specific gravity) lead glass or 1/2-inch of lead.

It is intended that the cell vessel maintenance station will be utilized mainly for servicing plugged dip tubes, replacement of capacitance probes, servicing the crane, and for replacing failed components of vessel assemblies such as the dissolvers or

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evaporator tube bundles. Since work will not be required routinely at this location, removable aluminum platforms which mount on racks on either side wall will be employed to permit access to any glove port height rather than a more expensive elevator. A hand-operated elevator will be located on the cell side of the wall to assist movement of tools, parts, etc., to any level. Tool trays will be mounted on the cell side of the wall at each glove level. A bag-in port will be located in the lower level near the hand elevator.

Tank flushing and pressure testing facilities will be provided at the maintenance station as well as arc welding outlets through the wall at each floor level.

3. Main Process Glove Boxes

These glove boxes are described separately under "Equipment Criteria." Through knowledge to be gained by a full scale mockup, the location of equipment within the glove box itself as well as the glove port locations on the panels will be tailored specifically for ease of maintenance. Maintenance work within these glove boxes will consist mainly of repairing process piping leaks and adjustments to, or replacement of, pumps, valves, flowmeters, etc.

4. Hot Maintenance Shop

As shown on the attached architectural drawing SK-2-3404, a hot maintenance shop will be provided on the second floor of the new facility. The shop will be equipped with a glove box, as shown on attached drawing SK-2-6709, approximately 3 feet by 16 feet similar to the existing Room 170, 234-5 Building, glove box for repairing components such as valves, flowmeters, and pumps removed from the main process glove boxes. The glove box will be initially shielded with 1/4-inch of X-ray glass, but will be designed to permit shielding up to 2-inches of high density (6.2 specific gravity) lead glass or 1-inch of lead. It will be equipped with a heavy stainless steel plate on the floor. An argon, acetylene, and oxygen supply, as well as an arc welding and electrical outlet will be provided in the glove box wall. A 500 pound capacity monorail will be mounted from the roof of the glove box to move heavy items, such as pumps and control valves, to and from a bag-in port located at one end.

5. Cold Maintenance Shop

As shown on the attached architectural drawing SK-2-3404, space has been provided for a cold maintenance shop as well as a maintenance foreman's office on the first floor of the new building.

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No equipment for this shop will be provided by the project, but electrical and gas services for arc and gas welding will be provided as well as electrical outlets for equipment.

M. SITE LOCATION

The new Plutonium Reclamation Facility will be located south of the present 234-5 Building, near the east end, as shown on attached drawing SK-2-6683. Studies made on this location as well as an alternate location proximate to the Incinerator Facility fixed the planned location. Pertinent factors involved include:

1. Significant reduction in outside service line construction costs can be realized when considering the facility either independently or in connection with the proposed Project CGC-912 Waste Treatment Facility;
2. Area to the south of the building site is clear for future unrestricted expansion;
3. Construction site can be readily "locked out" of the Z Plant exclusion area by fencing which will permit lower classification on security clearance for workers;
4. Construction activity will not be hampered by closeness to other buildings and will itself not interfere with operational deliveries to the rear of the building;
5. Site is clear of buried piping and other obstructions except for a 15-inch VP and an 8-inch waste water pipe which will be relocated;
6. Gravity discharge to the CAW Cavern is feasible;
7. Closeness enhances use of existing change room and lunch room facilities in the 234-5 Building;
8. Fire control will be less of a problem with the structure being clear of other buildings; and
9. When completed, the closeness of the facility to the Waste Treatment Facility will permit the latter to obtain cold chemicals from the reclamation facility rather than from 234-5 facilities.

The exact location of the reclamation facility will be closely integrated with the location of the proposed Waste Treatment Facility as shown on drawing SK-2-6683 so that full utilization can be made of the covered walkway to the 234-5 Building and other services which will be earlier installed by the latter project.

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As noted above, it will be necessary to relocate an existing 15-inch VP and an 8-inch steel line, so as not to interfere with future expansion of the facility to the south.

Service line runs to the facility will be relatively short. Water is available from an 8-inch loop just east of the new facility. It will probably be necessary to relocate a fire hydrant to avoid interference with new access roadways. Other services including steam, electrical power, and exhaust fan capacity are available from the 252-291-Z Area, approximately 100-125 feet east of the new facility.

N. SOLIDS FEED HANDLING SYSTEM

1. Functional Criteria

The primary function of the system is to provide a means of transferring solid feed materials from the 234-5 Building generation points to the new facility. In addition, the system must provide adequate in-line and emergency storage as well as a means to transfer materials within the new facility itself. The transfer of material between the various stations must provide adequate critical safety as well as acceptable radiation exposure levels to operating and maintenance personnel.

In-line storage equivalent to one day design rate production shall be provided to compensate for differences in the instantaneous rates of production in the 234-5 Building and the dissolver output rates in the new facility. Emergency storage shall be provided primarily for the purpose of accumulating feed materials in the event of maintenance down-time on the process cell or Miscellaneous Treatment Room dissolvers.

Materials to be transferred are slag and crucible, casting skulls, powders, hood sweepings, and reject buttons with the greatest volume load being slag and crucible. The transfer of these materials from the various sending points to the central storage area must be designed for maximum flexibility so that any given material can be fed to either dissolver to meet process requirements. Slag and crucible will normally be routed direct to process cell dissolver in-line storage, casting skulls to the Miscellaneous Treatment Room for steam oxidation, powders (hood sweepings) to the Miscellaneous Treatment Room for batch dissolution, and reject buttons to the Miscellaneous Treatment Room for continuous dissolution. Attached drawing SK-2-18437 shows the various feed transfer routes and a schematic representation of the in-line and emergency storage points.

2. Operating and Maintenance Philosophy

Accurate process and inventory control makes it desirable that all material transfer controls be maintained at a central point,

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preferably in an area adjacent to the dissolver feed and storage area. A single operator at the control point shall be able to transfer material from the 234-5 Building or the Miscellaneous Treatment Room to the in-line storage tubes at his convenience. Furthermore, he shall be able to select feeds from any one of five in-line storage tubes for dispensing into either dissolver; hence, he shall have visibility of the storage and dispensing area. Fail-safe controls shall be provided so that it is mechanically impossible for the operator to feed cans from more than one storage tube at a time into a given dissolver. Contact maintenance techniques for repair or replacement of all equipment and components parts shall be used. The equipment will not be housed in glove boxes; the equipment itself will provide the contamination barrier. Standard maintenance procedures as well as the double sleeve bag-out procedures, outlined on drawing SK-2-31547 (not attached), shall be utilized.

3. Design Criteria

Because of the great conveying distances involved, a pneumatic tube system has been selected as the transfer method. Attached drawing SK-2-18437 outlines the general requirements and specifications for the system. This drawing was prepared for submittal to several pneumatic tube manufacturers to obtain comments as to the adaptability of a standard commercial system. A standard 3-inch diameter by 3 to 6-inch long can was selected because of its compatibility with the standard 4-inch pneumatic system. The exact makeup and final specifications for the solids feed handling system will depend to a large extent on the preliminary proposals received from several vendors with whom the over-all problem has been discussed. In general, each vendor is basing his proposal on two separate transfer systems with a central storage point in the solids feed and storage area. This storage area will be composed of five storage tubes with flexibility for receiving material from either the 234-5 Building or Miscellaneous Treatment Room transfer system. Capability for dispensing from any one of the five storage points to either dissolver shall also be provided. Emergency storage shall be provided by diversion of any given feed material to emergency storage cylinders which can be bagged out, stored and then bagged back into the system at the Miscellaneous Treatment Room sending station. An addendum Title I scope document will be issued at a later date on the subject system with detail design to be performed by an off-site vendor.

0. PR ROOM

1. Functional Criteria

This facility will be used primarily for unloading PR cans of off-specification material received from the Purex and Redox

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Plants and for unloading RC cans of material received from the Analytical Control Laboratory and the Project CGC-813 Incinerator Facility. Storage space for 6 RC or PR cans will be required to accommodate differences in receiving and handling capacities. The solutions received in the PR cans will be weighed, transferred to Miscellaneous Storage tanks E-25 and E-26 in the process cell, and sampled. Periodically, it will be necessary to transfer material from the process cell PR Load-Out tank E-48 to PR cans for shipment to other HAPD departments and off-site; weighing of these solutions will also be necessary.

2. Design Criteria

The necessity of using the existing PR and RC cans directs the design towards use of components which would not necessitate extensive modifications in either the PR (RC) can or its shipping container. As shown on attached drawing SK-2-18425, a hand truck will be used to move the shipping container from the storage area to the unloading area. The shipping container lid latches will then be released by hand. A chain hoist will be used to lift the lid from the PR (RC) can container and place it on a lid rack. The proper hook adapter will then be connected to the chain hoist for removal of the container lid. After removal of the container lid and connection of the proper adaptor to the chain hoist, the hoist will then be used to remove the PR (RC) can and place it on the scale where a weight measurement is made. After weighing, the stopper will be removed from the PR (RC) can and the unloading head inserted. The can contents will then be vacuum-transferred to the proper process cell tank and the can subsequently rinsed. After weighing, transferring its contents, and rinsing, the PR (RC) can is returned to its shipping container and the lid replaced with the chain hoist. A decontamination station shall be provided for cleaning contaminated external surfaces of the PR (RC) can prior to its return to the shipping container.

The initial design of the facility shall be compatible with the addition at a future date of: (1) shielding for handling 10,000 MWD/T exposure plutonium; (2) a remotely-controlled chain hoist for the lifting operations; and (3) a remote manipulator for chain hoist hook adaptor and PR (RC) can stopper handling and PR (RC) can exterior surface decontamination.

P. MISCELLANEOUS TREATMENT ROOM

1. Design Criteria

A Miscellaneous Treatment Room will be provided to perform the following functions:

- a. Dissolution of Task III reject buttons;

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- b. Dissolution and/or other pretreatment of Task I, II, and III powders (hood sweepings), Task III pressure vessel lids, Task IV casting skulls, and incinerator facility ash, prior to routing to the process cell;
- c. Miscellaneous chemistry operations such as leaching, chloride removal, partitioning, etc.; and
- d. Storage, canning, and decanning operations.

Since the process technology for most of these functions is still being developed, there is a relatively high risk that equipment provided on the basis of criteria issued at this time would be obsolete by the time it was placed in operation. Hence, the scope of the Miscellaneous Treatment Room shall be:

- a. Six conveyor-connected glove boxes shall be provided as shown on attached drawing SK-2-6722;
- b. The two Dissolver and the Receiving-Decanning glove boxes shall be shielded with 1-inch of high density (6.2 specific gravity) lead glass or 1/2-inch of lead with all other glove boxes to be unshielded;
- c. The present hood HC-42 dissolvers, two batch and one continuous, shall be relocated to the two dissolver glove boxes;
- d. Electrical, mechanical, and other required services shall be provided for all glove boxes; and
- e. Glove box equipment, with a maximum direct cost of \$10,000, shall be provided in accordance with requirements to be defined during Title II detail design.

The two General Chemical and the Receiving-Decanning glove boxes shall be similar in design to those now used in the 234-5 Development Laboratory with provision for the future addition of bottom wells and penthouses. The two Dissolver and the Autoclave glove boxes shall be similar in design to the existing Hood HC-42.

2. Functional Criteria

A small critically-safe continuous dissolver and accessory equipment, similar to that installed in Hood HC-42 on Project CG-734, will be provided for the dissolution of Task III reject buttons. The present Hood HC-42 continuous dissolver will, if in operable condition at that time, be moved to a new glove box in the Miscellaneous Treatment Room.

Task I, II and III powders (hood sweepings) are currently dissolved in the two large Recuplex facility batch dissolvers

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along with slag and crucible fragments. If dissolution is not feasible in the process cell continuous dissolvers, it will be necessary to provide batch dissolving equipment in the Miscellaneous Treatment Room. If required and provided they are in operable condition at that time, the two existing Hood HC-42 batch dissolvers will be moved to a new glove box in the Miscellaneous Treatment Room.

It is expected that autoclave dissolution will be required for the ash produced in the high temperature incinerator facility. However, the possibility exists that dissolution in the large continuous critically-favorable process cell dissolvers will be feasible. The 234-5 Development Operation, CPD, is planning to prototype an autoclave installation for this application. Present plans are to move this prototypical autoclave and accessory vessels to a glove box, provided by the subject project, in the Miscellaneous Treatment Room if their use proves necessary.

Task IV casting skulls are presently dissolved in batch dissolvers located in Hood HC-42. The predicted increased rate of skull generation makes this method of dissolution impractical for the new facility. Preliminary studies conducted by the 234-5 Development Operation, CPD, show that the dissolution rate of low-temperature steam-oxidized plutonium skulls is extremely rapid; dissolution in the large continuous critically-favorable process cell dissolvers will be feasible. The Finished Products Technology Operation, CPD, is planning to prototype a steam-oxidizer installation immediately. Present planning is to transfer this prototypical steam-oxidizer installation to a glove box, provided by the subject project, in the Miscellaneous Treatment Room.

Plutonium recovery from scrap materials, liquid and solid, received from other HAPO departments and off-site will undoubtedly require special pretreatment operations such as leaching, chloride removal, partitioning, etc. The subject project will provide hood space only for these miscellaneous chemistry operations with the required equipment to be provided and installed by the Finished Products Technology Operation, CPD.

All feed to the large continuous critically-favorable process cell dissolvers will be charged in commercial steel cans. A glove box will be provided in the Miscellaneous Treatment Room for non-routine storage, canning, and decanning operations.

Q. SHIELDING CRITERIA

The new Plutonium Reclamation Facility shall be designed so that it is fully adaptable for eventual processing of high isotope

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plutonium received from the power reactors throughout the country. It shall be assumed that this material has been exposed at about 10,000 MWD/T and has the following isotopic content by weight:

Pu-238	< 0.1%
Pu-239	> 65
Pu-240	< 20
Pu-241	< 10
Pu-242	< 5

The initial design, however, will be based on processing material that has been exposed at about 2,000 MWD/T with the following isotopic content by weight:

Pu-238	< 0.02%
Pu-239	> 85
Pu-240	< 11
Pu-241	< 3
Pu-242	< 1

Accordingly, all permanent parts of the new facility, such as the cell walls and ceiling, shall be designed for the 10,000 MWD/T material. In those places where shielding can be readily added at a later date, such as on the glove boxes, shielding will be provided only for 2,000 MWD/T material.

The basic criteria for specifying the amount of shielding used throughout the new facility will be that the feeds described above can be processed continuously without radiation exposure to personnel becoming a factor in the number of people required to operate the facility. Generally, all glove box areas will be shielded so the whole body dose rate is less than 1 mrem/hour. All non-glove box areas, such as control room, will be shielded to reduce dose rates to less than 0.5 mrem/hour.

The minimum shielding thicknesses, as specified in documents HW-65153, "Scope Basis, Shielding, Plutonium Reclamation Facility, Project CAC-880," and HW-66861, "Shielding Requirements for Equipment Handling Slag and Crucible Fragments," shall be:

1. Process cell walls and ceiling - two feet of concrete;
2. Corridor, column and Miscellaneous Treatment Room glove boxes - one inch of high density (6.2 specific gravity) lead glass or 1/2-inch of lead; and
3. Slag and crucible handling equipment - 1/4-inch of steel and 1/2-inch of lead.

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R. CONTAMINATION CONTROL

The following contamination control items will be incorporated into the design of the new facility:

1. All instrument air lines to the control room panels will be separated from those to the glove boxes by transmitters located outside the control room;
2. All cold chemical addition lines to the glove boxes will be designed to prevent back-up of contamination by the use of vented seal pots located in the Zone IV process cell or other means;
3. All process lines passing between glove boxes will be encased with no fittings permissible so that leakage will not contaminate the Zone III area;
4. All glove boxes will be designed for a maximum inleakage rate of 10 cubic feet per hour per 1,000 cubic feet of hood volume at 4 inches of water differential pressure;
5. All piping entering or leaving a Zone IV area will be designed to eliminate contamination of Zone III areas;
6. The ventilation system will be designed to maintain a Zone IV negative pressure relative to Zone III;
7. Air sampling facilities will be provided for monitoring of all Zone III areas;
8. Sinks will be provided for flushing contaminated wounds in all potentially contaminated portions of the building; and
9. Breathing air stations shall be provided in all potentially contaminated areas of the building.

S. CHEMICAL HAZARDS

1. General

Many of the chemicals used or which are by-products of the process are hazardous. The following data are provided to define these hazards and to give the limits within which control must be maintained to assure chemical safety.

2. Carbon Dioxide

Carbon dioxide is used as an inert gas purge for the dissolvers. It is heavier than air, colorless, odorless, and dissolves in

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water to make a weak acid. A carbon dioxide atmosphere will not support life and concentrations in air as low as 10 percent may cause unconsciousness. It is received in cylinders, liquified under pressure. Accident Prevention Bulletin No. C-10 shall be followed in cylinder handling. The maximum ambient temperature of cylinders shall be 120°F. The maximum allowable concentration in air of working areas shall be 5,000 ppm.

3. Carbon Monoxide

Carbon monoxide is evolved in the evaporation of Task I filtrate by plutonium oxalate decomposition. The lower and upper explosive limits in air are 12.5 and 74 volume percent, respectively. It is toxic in concentrations in excess of 0.01 volume percent in air. A concentration of 0.20 - 0.25 volume percent in air will usually produce unconsciousness in about 30 minutes. The maximum allowable concentration in air of working areas shall be 0.0025 volume percent. The maximum allowable concentration in air in process equipment shall be 12 volume percent.

4. Carbon Tetrachloride

Carbon tetrachloride is received in drums as a liquid. It is potentially toxic by inhalation, prolonged or repeated contact of the liquid with the skin or the mucous membranes, or by ingestion. After a short time, general symptoms of toxicity appear as a result of damage to the liver, kidneys, heart, adrenal glands, and nervous system. Ingestion of more than 3 or 4 cubic centimeters may cause death. The limit for prevention of acute poisoning is 1,000 ppm in air and for continuous exposure is 100 ppm in air. The minimum concentration which can be detected from its odor is 72 ppm in air. Non-flammable at ordinary temperatures, it can decompose at high temperatures with the evolution of small but possibly toxic quantities of hydrochloric acid and phosgene. The maximum allowable concentration in air of working areas shall be 25 ppm; the present detector shall be relocated to the new facility. Accident Prevention Bulletin No. H-4 shall be followed in its usage.

5. Hydrogen

Hydrogen is evolved in the dissolution of plutonium metal and calcium in nitric acid and in the oxidation of plutonium metal with steam. The explosive limits in air are 4.1 and 74.2 volume percent. The maximum allowable concentration in air in process equipment shall be 3 volume percent.

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6. Hydrofluoric Acid

Hydrofluoric acid is received as an aqueous 48 weight percent solution in one pound polyethylene bottles. It attacks the skin vigorously, causing slow healing sores. Inhalation of the vapor creates a sense of constricted breathing, coughing, and irritation of the throat. The vapor causes ulceration of the mucous membranes and may cause chemical pneumonia and conjunctivitis. The maximum allowable concentration in air of the working areas shall be 3 ppm. Contact with all parts of the body and absorptive clothing of workers shall be avoided.

7. Nitric Acid

Nitric acid is received as a 60 weight percent aqueous solution by tank truck. It is hazardous not only because it is corrosive, but also increases the flammability of many organic materials and can cause explosions when mixed with many chemicals. When taken internally or brought into contact with the skin or eyes, it causes severe burns and intense pain, with possible loss of sight in the case of the eyes and possible death if ingested. Contact with all parts of the body and absorptive clothing of workers shall be avoided. Contact with cotton or other forms of cellulose or other organic material shall be prevented.

8. Nitric Acid - Plutonium Nitrate - Tributyl Phosphate

Task I filtrate and final product evaporation involve the concentration of an aqueous solution of nitric acid, plutonium nitrate, and tributyl phosphate in carbon tetrachloride. Violent reactions or explosions have occurred in plants and laboratories when this concentration has been excessive. During an attempt to reproduce these conditions in the laboratory, a violent reaction resulted when the solution temperature reached 150°C. The solution temperature of the Task I filtrate and final product evaporators shall never exceed 135°C.

9. Nitrogen Oxides

Nitrogen oxides are always produced in reactions involving nitric acid except in carefully controlled nitration reactions with organic materials. The nitrogen oxides produced have no uniform composition, being a mixture of five oxides in varying proportions. They are among the most treacherous of the noxious gases because of the unpredictable and sometimes long-delayed onset of fatal lung congestion following breathing of concentrations as low as 25 ppm. The maximum allowable concentration in the air of working areas shall be 5 ppm.

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10. Plutonium

Plutonium is approximately as radiotoxic as radium. The deposition of plutonium upon entering the body occurs mainly in the bone, marrow, and several organs, including the liver, spleen, and lymph nodes. In its metallic form, plutonium is pyrophoric. In the absence of oxygen, it reacts with moisture to form an extremely pyrophoric substance which will ignite on subsequent exposure to an oxidizing agent such as air. Plutonium metal shall be stored in non-flammable containers. The moisture concentration in the atmosphere contacting plutonium metal shall be no greater than that of air having a dewpoint of -20°F.

11. Sulfuric Acid

Sulfuric acid is received as a 96 weight percent aqueous solution in glass bottles. The dilution of sulfuric acid with water evolves a large heat of solution. It causes burns to the skin and eyes upon contact and, if ingested, causes burns inside the body. Dilute solutions shall be made by adding concentrated acid slowly to water with rapid agitation. Never add water to concentrated acid; steam generation and dangerous splattering of the acid will result.

12. Tributyl Phosphate

Tributyl phosphate is received in drums as a liquid. It is a flammable material and will react violently with powerful oxidizing agents. Although the effects from bodily contact or ingestion are not reported in the usual references, it is likely that its solvent properties would be harmful. It presents a hazard to direct maintenance of glove box equipment as it will cause neoprene rubber gloves to disintegrate. Contact with all parts of the body and absorptive clothing of workers shall be avoided.

13. Miscellaneous Chemicals

The following general rules apply to the handling of any chemicals not specifically listed above:

Toxicity -	Keep from contact with all parts of the body and absorptive clothing of workers; prevent breathing of mists, vapors, and dusts;
Explosion or Fire -	Store in such a way as to minimize all fire and explosion hazards; prevent spillage on absorbent combustible materials; and

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Mixing -

Prevent mixing of any chemicals in any manner not specified in approved process specifications.

T. ACCOUNTABILITY CRITERIA

1. General

The plutonium reclamation operation will be a separate material balance area. Residues generated in button line and fabrication processing will pass continuously by mechanical means into reclamation equipment such that lag inventory of process residues will be practically non-existent.

2. Batch Transfer Measurements

For accountability control, five separate material balance areas will be established in the Finished Products Operation, as shown on attached drawing SK-2-18488: Processing, Recovery, Fabrication, Control Laboratory, and the 234-5 Development Laboratory. All material entering or leaving each of these areas will be measured by the best means available. Batch dissolutions, at a statistical frequency, shall be made on all solid feed materials in a small dissolver to be installed in the Miscellaneous Treatment Room for the establishment of calibration factors for routine measurement methods. All batch transfer points between material balance areas are shown on attached drawing SK-2-18488.

3. Inventory Measurements

Inventory in all areas will be taken by procedures and methods similar to those now in use. The major inventory advantage with the new facility will be the reduction of the large residue inventory. Although there will be considerable uncertainty in the residue inventory, the total inventory and hence the actual grams uncertainty will be relatively small. Inventory measurements will be taken on all vessels shown on attached drawing SK-2-18488.

U. FIRE PROTECTION CRITERIA

1. General

Fire protection for a chemical processing facility for radioactive materials requires careful consideration of the fire hazard and associated problems of radioactive contamination and critical mass. The application of automatic sprinklers is a sound fire protection technique in building areas not normally subject to radioactive contamination, electrical hazard, or critical mass. However, the special and possibly disastrous

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consequences of uncontrolled automatic water discharge in the latter areas requires that fire protection methods be limited to manual water fog or carbon dioxide applied by trained personnel.

2. Fire Detection

Each building space will be equipped with one or more (as required) thermal detector devices to signal the fire alarm and to annunciate the space location. Glove boxes will be equipped with detectors which will signal the fire alarm, annunciate the room location, and release carbon dioxide gas to the glove box. Exhaust filter manifolds will be equipped with ionization detectors to detect a filter fire; annunciation will identify filter room and manifold.

3. Automatic Sprinkler Protection

In general, all building spaces with little or no potential for development of radioactive contamination or critical mass will be protected by an automatic wet pipe sprinkler system for ordinary hazard occupancy.

4. Automatic Sprinkler Areas

First Floor

1. Maintenance Shop
2. Office
3. Airlock
4. Stairways

Second Floor

1. Stairways

Third Floor

1. Equipment Room
2. Storage Room
3. Restroom
4. Stairways

Fourth Floor

1. Office
2. Chemical Storage
3. Chemical Preparation
4. Elevator Shaft
5. Stairways

Fifth and Sixth Levels

1. Stairways

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will be provided with manually controlled carbon dioxide gas flooding.

9. Fire Protection Water Waste

Room drains for fire water waste will be provided to dispose of all automatic sprinklers, safety shower, and first aid hose water discharge. The room drains will discharge to the underground exhaust duct for retention and subsequent suitable disposal. Drains from the cell will be jetted from floor receptors in the same manner as process spills.

U. CRITICALITY CRITERIA

Nuclear chain reactions may occur spontaneously when plutonium solutions, dry plutonium compounds and/or metallic plutonium are accumulated under unsafe conditions of geometry, concentration, foreign atoms, isotopic content, and nuclear tampering. It is imperative that all processes involved in the new facility be so limited by equipment design, including sumps, and process conditions that such reactions cannot take place.

The primary criterion for criticality control shall be based upon equipment design: geometrically-favorable by dimensions for the process conditions anticipated, or established safe by use of neutron poisons (e.g. control rods), "built-in" voids, etc.

Typical equipment with geometrically-favorable dimensions are:

1. Three vertical tank banks, 16 feet high, using four 5-inch Schedule 40 pipes for each bank, per attached drawing SK-2-6708;
2. A group of 4 foot high tank banks, consisting of four 5-inch Schedule 40 pipes in each bank, per attached drawing SK-2-6708;
3. Five-inch inside diameter single vertical tanks, such as the continuous dissolvers shown on attached drawing SK-2-18472; and
4. Six-inch Schedule 40 single vertical tanks such as the dissolver scrubbers shown on attached drawing SK-2-6724 and the column disengaging sections, shown on attached drawing SK-2-6694.

The over-all cell array must meet the dimensions shown on attached drawing SK-2-6693.

With present day knowledge, certain processes are not practical with use of the above criteria. These are:

1. Organic batch washing; and
2. Skull and button dissolution.

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For these processes, the process flowsheet and equipment must be specified such that: (1) the accumulation of plutonium as a heel; (2) the formation of a light liquid phase containing plutonium; (3) the formation of plutonium precipitate; and (4) the interaction between geometrically-favorable and geometrically-unfavorable vessels cannot lead to problems in nuclear safety.

In all cases, administrative control must guarantee the process assumptions, since even in the geometrically-favorable tanks, unusual plutonium accumulations could occur. As a secondary control, a neutron counter will be used for providing a warning signal to define accumulations of plutonium in the equipment. In no case will the safety of routine production operations in geometrically-unfavorable vessels be solely based on instruments that measure and warn of the approach to criticality.

Equipment must be designed such that complete cleanout of plutonium can be accomplished.

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9. HW-65153, "Scope Basis, Shielding, Plutonium Reclamation Facility, Project CAC-880," H. A. Moulthrop, May 19, 1960.
10. HW-66305, "Project Proposal, Revision 1, Plutonium Reclamation Facility, Z Plant," D. R. Gustavson, August 9, 1960.
11. HW-66861, "Shielding Requirements for Handling Slag and Crucible Fragments," H. A. Moulthrop, September 27, 1960.
12. HW-66864, "Technical Specifications for Solvent Extraction Columns in the New Plutonium Reclamation Facility," L. E. Bruns, October 14, 1960.

DECLASSIFIED

DECLASSIFIED

HW-66916
Page 53

APPENDIX B

PLUTONIUM RECLAMATION FACILITY - Z PLANT
PROJECT CAC-880
PROJECT COST ESTIMATE

<u>Item</u>	<u>Estimate</u>
Structure and Outside Lines	\$ 384,000
Process Glove Boxes, Complete	370,000
Process Cell Crane	50,000
Process Vessels and Dunnage	175,000
Maintenance Glove Boxes	45,000
PR Room	8,000
Chemical Preparation Room	15,000
Miscellaneous Treatment Room	67,000
Dissolver Solid Feed System	74,000
Piping	128,000
Ventilation	115,000
Electrical	60,000
Instrumentation	200,000
General Contractor Mark-Up	152,000
Plant Forces and Minor Construction	<u>22,000</u>
Sub-total	\$1,865,000
General Overhead	90,000
Engineering (Title I, II, and III Design)	<u>550,000</u>
Contingency, Escalation, and Start-up	<u>395,000</u>
Total	\$2,900,000

DECLASSIFIED

APPENDIX C
 PROJECT CAC-880
 PLUTONIUM RECLAMATION FACILITY Z-PLANT
 PRELIMINARY PROJECT SCHEDULE

DECLASSIFIED

HW-66916

Page 55

APPENDIX D

DRAWINGS

<u>Drawing Number</u>	<u>Title</u>
SK-2-3404	Architectural Plans and Sections
SK-2-6670	Ventilation Flow Diagram
SK-2-6680	Electrical One-Line Diagram
SK-2-6682	Ventilation Schematic Arrangement
SK-2-6683	Plot Plan
SK-2-6686	Cell Vessel Maintenance Crane
SK-2-6692	Ventilation Supply Duct from 234-5 Building
SK-2-6693	Process Cell Vessel Arrangement and Sections
SK-2-6694	Solvent Extraction Columns
SK-2-6707	Cell Vessel Plugs and Dunnage Assembly
SK-2-6708	Typical Cell Vessels
SK-2-6709	Maintenance Glove Box
SK-2-6712 Shts. 1-3	Instrument Engineering Diagram
SK-2-6719	Process Cell Vessel Arrangement - West Side Isometric
SK-2-6720	Process Cell Vessel Arrangement - East Side Isometric
SK-2-6721	Cell Maintenance Station
SK-2-6722	Miscellaneous Treatment Room Glove Boxes - Arrangement
SK-2-6724	Dissolver Scrubber
SK-2-18304, Shts. 1-5	Engineering Flow Diagram
SK-2-18328	Vessel Data Sheet
SK-2-18400	Process Flow Diagram
SK-2-18425	PR Room
SK-2-18437	Dissolver Solid Feed System - Schematic
SK-2-18472	Cell Dissolver and Condenser
SK-2-18473	Process Glove Box Module
SK-2-18488	Accountability Flow Diagram
SK-2-18493	CCP Stripper - Evaporator and Condenser
SK-2-18495	Filtrate Evaporator and Condenser
SK-2-18505	Cell Area Bag-Out Opening and Procedure

DECLASSIFIED

FLOOR PLAN @ 0'-0"

SCALE 0 10 FT.

FLOOR PLAN @ 1'-0"

SCALE 0 10 FT.

FLOOR PLAN @ (+)34'-0"

SCALE 0 10 FT.

CROSS SECTION

SCALE 0 10 FT.

CELL

SSY RM

BAG-OUT HATCH

10 FT

12'-0"

FLOOR PLAN

24'-0"

SCALE 1" = 10 FT

APPROVED

SCOPE

DESCRIPTION REVISIONS CLASSIFICATION NONE	REV BY DATE APP'D BY DATE FOR DATE										
SK-2-3404											
SCALE: AS NOTED											
DRAWN BY: DATE 8-24-60 CHECKED: DATE 7-18-60 ISSUED: DATE 7-18-60 DES BY: DATE 7-18-60 UNIT NO: 2299 PROJECT NO: CAC-880											
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ST.	DATE										
DES	9-5-60										
CHK	10-10-60										
ISS	10-10-60										
APP	10-10-60										
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC											
ARCHITECTURAL PLANS AND SECTIONS											
PROPOSED PLUTONIUM RECLAMATION FACILITY											
SHEET NO: 236 INDEX NUMBER: 0801	SK-2-3404

APPROVED

SCOPE

NO.	DESCRIPTION	REV. BY	DATE	APP. BY	DATE
REVISIONS DWG. NO. SK-26670 SHEET NO. 1 OF 1 SHEETS SCALE: NONE DRAWN: W. J. L. / 11/16/64 DATE: 11/16/64 CHECKED: W. J. L. / 11/16/64 DATE: 11/16/64 DES. ENG. W. J. L. / 11/16/64 DATE: 11/16/64 PROJ. NO. 10569 PROJECT CGC880					
APPROVALS BY W. J. L. DATE 11/16/64 BY W. J. L. DATE 11/16/64 BY W. J. L. DATE 11/16/64 BY W. J. L. DATE 11/16/64					
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION 8900-01 GENERAL ELECTRIC					
VENTILATION FLOW DIAGRAM PLUTONIUM RECLAMATION FACILITY - E PLANT BLDG. NO. 2362 DWG. NO. SK-26670 SHEET NO. 1 OF 1 SHEETS					

PLUTONIUM RECLAMATION FACILITY - E PLANT DRAWING NO. SK-26670 SHEET NO. 1 OF 1 SHEETS CLASSIFICATION NONE
--

FIRST FLOOR

0 1 FT

SECOND

FOURTH FLOOR

PENTHOUSE

2 FLOOR

THIRD FLOOR

LEGEND

- REHEAT COIL
- SUPPLY DIFFUSER
- SUPPLY GRILLE
- PERFORATED SUPPLY DIFFUSER
- ROOM EXHAUST VIA PRE-FILTER INTO EXHA SHAFT
- SUPPLY TO PROCESS CELL VIA ABSOLUTE FILTER

APPROVED
FOR DESIGN
NOT FOR CONSTRUCTION

SCOPE

VENTILATION FLOW DIAGRAM	
REFERENCE DRAWINGS	
NEXT USED ON	
CLASSIFICATION	NONE

DESCRIPTION		REV. BY	APP'D BY	FOR	DATE												
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REVISIONS		DATE	BY	FOR	DATE												
NO.	DESCRIPTION																
DWG. NO. SK-26682	SHEET NO. 1	SHEETS 1	REV. NO. 0														
SCALE: 3/4" = 1'-0"		APPROVALS															
DRAWN BY: DATE 8/16/60		BY	FOR	DATE													
CHECKED BY: DATE 10/1/60	DATE																
DESIGNED BY: DATE 10/1/60	DATE																
DWG. NO. 10569	PROJECT NO. CAC 880	DATE															
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION 0900-01 GENERAL ELECTRIC																	
VENTILATION SCHEMATIC ARRANGEMENT PLUTONIUM RECLAMATION FACILITY - 2 PLANT																	
BLOCK NO. 236Z	DWG. NO. SK-26682	SHEET NO. 1	SHEETS 1

SECTION "A-A"
8'-10"

APPROVED

SCOPE

DESCRIPTION		REV. NO.	DATE
SK-26683		0	
SCALE: 1"=10'	APPROVALS		
DESIGNED BY: [Signature]	CHECKED BY: [Signature]	DATE: 10/10/60	DATE: 10/10/60
PROJECT NO. 10569		PROJECT NAME: CAC 880	PROJECT LOCATION: [Blank]
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION 0110-01 GENERAL ELECTRIC			
PLOT PLAN			
PLUTONIUM RECLAMATION FACILITY			
BLDG. NO. 236Z	DWG. NO. SK-26683	SHEET NO. 60	TOTAL SHEETS 60

NO.	REV. BY	APPD. BY	FOR	DATE
REVISIONS				
SCALE: NONE				
NEXT USED ON				
APPROVALS	FOR	DRAWN <i>Richards</i> DATE 6-22-60		
<i>Eng/W</i>	DES	CHECKED <i>Richards</i> PROJ. NO. CGC 880		
<i>McGraw</i>	PCD	ISSUED <i>Richards</i> INST. NO. 7253		
<i>Richards</i>	FPO	DES. ENG. <i>M. J. N. T. L.</i> UNIT E. L. DES.		
BLDG. NO.	236-Z		INDEX NUMBER	7201
DWG. NO.	SK-2-6680		SHEET NO.	SHEETS
			-	-

DWG. NO.	DRAWING TITLE		
REFERENCE DRAWINGS			
CLASSIFICATION	CLASS. BY	DATE	
NONE	<i>Richards</i>	6-22-60	
U. S. ATOMIC ENERGY COMMISSION			
HANFORD ATOMIC PRODUCTS OPERATION			
GENERAL ELECTRIC			
ELECTRICAL			
ONE LINE DIAGRAM			
PLUTONIUM RECLAMATION FACILITIES			

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SIDE ELEVATION

GEAR BOX
DETAIL - A
SCALE 3" = 1'-0"

APPROVED
FOR DESIGN
NOT FOR CONSTRUCTION

NO.	DESCRIPTION	REV.	DATE	APPROVED BY	DATE
REVISIONS		CLASSIFIED BY T. Delmonico			
NONE		DATE 10/16/60			
SK-2-6686		REV. NO. 0			
SCALE: 1" = 1'-0"		APPROVALS			
DRAWN	DATE 9-16-60	BY	DATE	REV.	DATE
CHECKED	DATE	BY	DATE	REV.	DATE
ISSUED	DATE 11/16/60	BY	DATE	REV.	DATE
DES. ENG.	UNIT	BY	DATE	REV.	DATE
8746		BY	DATE	REV.	DATE
PROJECT NO.	CAC-880	BY	DATE	REV.	DATE
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC					
CELL VESSEL MAINTENANCE CRANE					
PLUTONIUM RECLAMATION FACILITY 2 PLANT					
SLIP NO.	236-Z	INDEX NUMBER	3900	REV. NO.	0
SK-2-6686					

ELEVATION

DATE	NO.	DRAWING TITLE
		REFERENCE DRAWINGS
NEXT USED ON

APPROVED
 FOR DESIGN
 NOT FOR CONSTRUCTION

REVISIONS		REV. NO.	DATE	BY	CHKD.
CLASSIFICATION		CLASSIFIED BY <i>PLC/tyg</i> DATE <i>8/1/65</i>			
NONE					
SK-2-6692		- - 0			
SCALE: AS NOTED		APPROVALS			
DRAWN BY <i>PLC</i> DATE <i>8-29-65</i> CHECKED BY <i>PLC</i> DATE <i>9-1-65</i> DESIGNED BY <i>PLC</i> DATE <i>8-29-65</i> EST. BY <i>PLC</i> DATE <i>8-29-65</i> PROJECT NO. <i>10369</i> PROJECT NAME <i>General Electric</i>		APPROVED BY <i>PLC</i> DATE <i>8/1/65</i> PROJECT NO. <i>CAC 800</i> PROJECT NAME <i>EEG 104160</i>			
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC					
VENTILATION SUPPLY DUCT FROM 234-5 BLDG.					
PLUTONIUM RECLAMATION FACILITY - 2 PLANT					
SK-2-6692 PLOT PLAN SHEET NO. 1 OF 1 DATE 8/1/65		DRAWN BY <i>PLC</i> DATE <i>8-29-65</i> CHECKED BY <i>PLC</i> DATE <i>9-1-65</i> PROJECT NO. <i>10369</i> PROJECT NAME <i>General Electric</i>			

SK-2-6692 PLOT PLAN		SHEET NO. 1 OF 1	
DATE 8/1/65		DRAWN BY PLC	
CHECKED BY PLC		DATE 9-1-65

APPROVED

SCOPE

DESCRIPTION		REV	BY	DATE
REVISIONS				
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DRAWING NO. SK-2-6693		REVISION	DATE	REV. NO.
SCALE: 1/4" = 1'-0"		APPROVALS		
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CHECKED BY: <i>[Signature]</i>	DATE: 9/6/60	FOR: <i>[Signature]</i>	DATE: 10-10-60	
DESIGNED BY: <i>[Signature]</i>	DATE: 9/6/60	FOR: <i>[Signature]</i>	DATE: 10-11-60	
DESIGNED BY: <i>[Signature]</i>	DATE: 9/6/60	FOR: <i>[Signature]</i>	DATE: 10-11-60	
PROJECT NO. 10569		PROJECT NO. 905		
PROJECT NO. CAC 880		PROJECT NO. 905		
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC &				
PROCESS CELL VESSEL ARRANGEMENT & SECTIONS				
PLUTONIUM RECLAMATION FACILITY - Z PLANT				
DRAWING TITLE ENGINEERING FLOW DIAGRAM		BLANK NO. 236-3	INDEX NUMBER 2404-01	
REFERENCE DRAWINGS		DWG NO. SK-2-6693	REV. NO. 01	
NEXT USED ON

SCOPE

E-32

APPROVED
FOR DESIGN
NOT FOR CONSTRUCTION

DESCRIPTION		REV	BY	DATE
REVISIONS				
CLASSIFICATION		T. D. D. D. D.		
NONE		DATE Aug 16, 60		
SK-2-6694		0		
SCALE 1" = 1'-0"		APPROVALS		
DRAWN BY DATE 6-16-60		BY	FOR	DATE
CHECKED BY DATE 9/1/60		BY	FOR	DATE
ISSUED BY DATE 9/1/60		BY	FOR	DATE
DES. ENG. 8746		BY	FOR	DATE
PROJECT NO. CAC-880		BY	FOR	DATE
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC				
SOLVENT EXTRACTION COLUMNS				
PLUTONIUM RECLAMATION FACILITY - 7 PLANT				
2362		2500		
SK-2-6694				

E-34

E-33

MOUNTED AND SEATED

SCALE: 0 1 2 3 FT

MOUNTED NOT SEATED

SCALE: 0 1 2 3 FT

PLAN

SCALE

PLAN

PLUG

SCALE 1 0 1 2 3 4 5 IN

SCOPE

APPROVED

No.	DESCRIPTION	REV OF DATE	APPROVED BY	PAGE	CHECKED BY
REVISIONS					
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CNS NO.	SK-2-6707	GROUP NO.	-	SUBGR.	REV NO. 0
SCALE NOTED		APPROVALS			
DRAWN BY <i>J. Hannon</i>	DATE <i>8-29-66</i>	DESIGNED BY <i>J. Hannon</i>	CHKD BY <i>W.D.</i>	DATE <i>9-2-66</i>	
ENGINEER	JATE	INSTRUMENTED BY <i>J. Hannon</i>	TESTED BY <i>W.D.</i>	DATE <i>10-10-66</i>	
ISSUED BY <i>J. Hannon</i>	DATE <i>9/14/66</i>	FOR <i>EPO</i>	DATE <i>10/30/66</i>		
BY <i>W.D.</i>	DATE <i>10/10/66</i>	FOR <i>EPO</i>	DATE <i>10/10/66</i>		
UNIV. FILE # <i>44-38861-1000</i>		FOR <i>EPO</i>	DATE <i>10/10/66</i>		
CONTRACT NO. 8746		FOR <i>EPO</i>	DATE <i>10/10/66</i>		
PROJECT NO. CAC-880		FOR <i>EPO</i>	DATE <i>10/10/66</i>		
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC					
CELL VESSEL PLUGS + DUNNAGE ASSEMBLY					
PLUTONIUM RECLAMATION FACILITY - PLANT					
FILE NO. 8562	DRAWING NUMBER 4701				
REF ID: SK-2-6707			Rev No.	Date	

CEPTACLE

TYPICAL WASH TANK
VOLUME = 350 LITERS APPROX.
SCALE: 0 1 2 3 4 5 6 7 8 9 10 11 12 IN.

TYPICAL RECEIVER TANK "A" = 5'-0" VOLUME = 52 LITERS
TYPICAL CAF PUMP TANK "A" = 17'-0" VOLUME = 255 LITERS
SCALE: 0 1 2 3 4 5 6 7 8 9 10 11 12 IN.

TYPICAL SINGLE VERTICAL TANK
VOLUME = 17 LITERS
SCALE: 0 1 2 3 4 5 6 7 8 9 10 IN.

APPROVED

DESCRIPTION		REV	BY	DATE
REVISIONS				
CLASSIFICATION		T. D. L. L. L.		
NONE		DATE Aug 26, 66		
SK-2-6708				
SCALE NOTED		APPROVALS		
DRAWN BY: J. D. L. L. L.		BY	FOR	DATE
CHECKED BY: J. D. L. L. L.		BY	FOR	DATE
DESIGNED BY: J. D. L. L. L.		BY	FOR	DATE
PROJECT NO. 8746		U.S. ATOMIC ENERGY COMMISSION		
PROJECT NO. CAC 880		HANFORD ATOMIC PRODUCTS OPERATION		
		GENERAL ELECTRIC		
TYPICAL CELL VESSELS				
PLUTONIUM RECLAMATION FACILITY - 2 PLANT				
2362		2500		
SK-2-6708				

SCOPE

DATE	DRAWING NO.	DRAWING TITLE
		REFERENCE DRAWINGS
NEXT USED ON

APPROVED
FOR DESIGN
NOT FOR CONSTRUCTION

SCOPE

REV.	DESCRIPTION	REV. BY	DATE
REVISIONS		APPROVED BY	DATE
CLASSIFICATION NONE		CLASSIFIED BY T. Deane DATE Sept. 6, 60	
SK-2-6709		REV. NO.	REV. DATE
SCALE: NONE		APPROVALS	
DRAWN: A. HETE DATE: 9-4-60		BY	DATE
CHECKED: J. HETE DATE: 9-14-60		BY	DATE
DESIGNED: J. HETE DATE: 9-14-60		BY	DATE
APP. ENG. J. HETE DATE: 9-14-60		BY	DATE
APP. MFG. J. HETE DATE: 9-14-60		BY	DATE
APP. QA J. HETE DATE: 9-14-60		BY	DATE
PROJECT NO. CAC-080		EEO 12101-1	
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC			
MAINTENANCE GLOVE BOX			
PLUTONIUM RECLAMATION FACILITY			
DRAWING NO. 2332		ITEM NUMBER 4700	
NEXT USED ON		SK-2-6709	

REV.	ENG. NO.	DRAWING TITLE
1		REFERENCE DRAWINGS
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APPROVED
FOR DESIGN
NOT FOR CONSTRUCTION

NOTE:
SEE SHEET NO. 3 OF THIS DRAWING
FOR LEGEND.

NO.	DESCRIPTION	REV.	BY	DATE
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CLASSIFICATION				
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DATE 9/13/60				
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CHECKED BY: [Signature] DATE: 9-22-60				
ISSUED BY: [Signature] DATE: 9-22-60				
FOR ENG. DIV. (PLUTONIUM RECLAMATION)				
PROJECT NO. 7266				
PROJECT NAME CAC-880				
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC				
INSTRUMENTATION ENGINEERING DIAGRAM SCOPE				
PLUTONIUM RECLAMATION FACILITY				
SHEET NO. 236-Z				
INDEX NUMBER 7002				
SK-2-6712 1 3

APPROVED
FOR DESIGN
NOT FOR CONSTRUCTION

NOTE:
SEE SHEET NO. 5 OF THIS DRAWING
FOR LEGEND.

NO.	DESCRIPTION	REV.	DATE	APP'D.	FOR	DATE
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<p>7266</p> <p>CAC-880</p> <p>U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC</p> <p>INSTRUMENTATION ENGINEERING DIAGRAM SCOPE</p> <p>PLUTONIUM RECLAMATION FACILITY</p> <p>236-Z 7002</p> <p>SK-2-6712</p>

INSTRUMENT IDENTIFICATION LETTERS

FUNCTION	INSTRUMENT								
	RECORDER	RECORDER CONTROLLER	INDICATOR	TRANSMITTER	HIGH LEVEL ALARM	LOW LEVEL ALARM	CONVERTER	MONITOR	DETECTION ELEMENT
TEMPERATURE	TR	TRC	—	TT	—	—	—	—	TE
FLOW	FR	FRC	—	FT	—	—	—	—	FE
DIFF. PRESSURE	DPR	DPRC	—	DPT	—	—	—	—	—
SPECIFIC GRAVITY	SGR	SGRC	—	SGT	—	—	—	—	SGE
WEIGHT FACTOR	WFR	WFRC	—	WFT	HLA	LLA	—	—	—
ELECTRIC - PNEUMATIC	—	—	—	—	—	—	EPC	—	—
NEUTRON	—	—	—	—	—	—	—	NM	ND
INTERFACE	—	IRC	—	IT	—	—	—	—	CP
LIQUID LEVEL	LLR	LLRC	LLI	LLT	HLA	LLA	—	—	CP

LEGEND

- 120 - COOLING
- 121 - CRIB WASTE
- 122 - HEATING
- 123 - CONDENSATE
- 124 - OVERFLOW
- 125 - VENT
- 126 - VACUUM
- 127 - COMPRESSOR
- 128 - CO₂
- 129 - CAVERN
- 130 - TASK I
- 131 - PR CAN
- 132 - MISC. TRAP

SYMBOLS

- E — ELECTRICAL, INSTRUMENT CONTROL LINE
- CAC — COMR AIR CONTROL, INSTRUMENT LINE
- X — MANUAL VALVE
- || — ORIFICE
- MFM — MAGNETIC FLOWMETER
- T — STEAM TRAP
- JET — JET
- VALVE, REMOTELY CONTROLLED, "ON-OFF"
- CAC — D.O.V., INSTRUMENT CONTROLLED
- VALVE, REMOTELY CONTROLLED, 3-WAY
- IN LINE PUMP
- E — CAPACITANCE PROBE (CP)
- E — VARIABLE VOLTAGE TRANSFORMER
- E — HEATING ELEMENT

DESCRIPTION		REV BY	APP'D BY	FOR	DATE
REVISIONS					
CLASSIFICATION		APPROVED BY			
NONE		DATE 9-14-60			
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DRAWN T. Richards DATE 9-14-60		BY	FOR	DATE	
CHECKED P. Richards DATE 9-23-60		P. Richards	PCO	10-10-60	
ISSUED P. Richards DATE 9-23-60		P. Richards	PCO	10-11-60	
DES. ENCL. D. L. AND UNIT. DES.		P. Richards	PCO	10-11-60	
WKT. NO. 7266					
PROJECT NO. CAC-880					
U. S. ATOMIC ENERGY COMMISSION					
HANFORD ATOMIC PRODUCTS OPERATION					
GENERAL ELECTRIC					
INSTRUMENTATION					
ENGINEERING DIAGRAM					
SCOPE					
PLUTONIUM RECLAMATION FACILITY					
NO. 236-2				7002	
SK-2-6712				3 3	

FOR REFERENCE DRAWINGS SEE SHEET NO. 1

NO.	DATE	DESCRIPTION
1		REFERENCE DRAWINGS

APPROVED
FOR DESIGN
NOT FOR CONSTRUCTION

SCOPE

1	SK-2-6719	ENGINEERING FLOW DIAGRAM
DWG. NO.	236-Z	DRAWING TITLE
REF.		REFERENCE DRAWINGS
NEXT USED ON		

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REVISIONS		DATE			
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DWS NO. SK-2-6719		SHEET NO.	SHEET	REV. NO.	
SCALE: NONE		APPROVALS			
DRAWN: AMETZ DATE: 9-29-60		BY	FOR	DATE	
CHECKED	DATE	<i>[Signature]</i>	9/29	10-10-60	
DESIGNED	DATE	<i>[Signature]</i>	9/29	10/10/60	
REVIEWED	DATE	<i>[Signature]</i>	9/29	10/10/60	
UNIT	UNIT	<i>[Signature]</i>	9/29	10/10/60	
UNIT	UNIT	<i>[Signature]</i>	9/29	10/10/60	
PROJECT NO. CAC-880		U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC PROCESS CELL VESSEL ARRANGEMENT WEST SIDE ISOMETRIC PLUTONIUM RECLAMATION FACILITY-PLANT Z			
DWS NO. SK-2-6719		SHEET NO. 236-Z SHEET NUMBER 8404.01

SECTION 'A-A'

SK-2-6721

SCOPE

☐ APPROVED FOR CONSTRUCTION ☐ APPROVED FOR PURCHASE		U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL PLANTING	
SCALE 1"=1'-0"		CELL MAINTENANCE STATION	
APPROVED FOR DESIGN W. H. DAVENPORT DATE 11/1/60		PLUTONIUM RECLAMATION FACILITY - B. B. ANT 236 Z 4700	
T. DENSON DATE 01-6-60		NONE	
SK-2-6721		SK-2-6721

MISC. TREATMENT ROOM
REF. SK. 2-3404

QTY.	PT. NO.	DESCRIPTION
		HW-66916
		PAGE 74

SCOPE

APPROVED
FOR DESIGN
NOT FOR CONSTRUCTION

NO.	DESCRIPTION	REV. BY	DATE	APP'D BY	FOR	DATE
REVISIONS						
CLASSIFICATION		CLASSIFIED BY				
NONE		T. Deussen				
DATE		Oct 2, 60				
DATE	SK-2-6722	REV. NO.				
10-2-60		1				
SCALE: AS NOTED		APPROVALS				
DRAWN BY: [Signature]		BY: [Signature] FOR: [Signature]				
CHECKED BY: [Signature]		DATE: 10-2-60				
ISSUED BY: [Signature]		DATE: 10-2-60				
REV. NO. 8746		REV. NO. 880				
PROJECT NO. 880		REV. NO. 880				
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC						
MISC. TREATMENT ROOM GLOVE BOXES ARRANGEMENT PLUTONIUM RECLAMATION FACILITY						
FILE NO.	236-2	WORK NUMBER	4700			
DATE	SK-2-6722	REV. NO.				

NO.	DATE	DRAWING TITLE
		REFERENCE DRAWINGS
		NEXT USED ON

HW - 66916
PAGE 73

SK-2-6724

SCOPE

[illegible]

1		WAS E-48 ZONE H-B		HOLAND					
		ZONE H-E, LINES TO E-49		9-20-60					
		LINE TO E-27 WAS E-55							
DESCRIPTION		REV. BY		DATE		APPROVED BY		DATE	
REVISIONS		NONE				J. B. Hansen		3-16-60	
CLASSIFICATION		NONE							
DATE		SK-2-18304		1		5		1	
SCALE									
DRAWN		HOLAND		DATE		8-16-60		BY	
CHECKED		J. B.		DATE		1-1-60		BY	
ISSUED		J. B.		DATE		9-2-60		BY	
DES. ENG.		J. B.		UNIT		HSD		REV. NO.	
1554									
PROJECT NO.		CAC-880							
U. S. ATOMIC ENERGY COMMISSION		HANFORD ATOMIC PRODUCTS OPERATION							
GENERAL ELECTRIC									
ENGINEERING		FLOW DIAGRAM							
(DISSOLUTION)									
PLUTONIUM RECLAMATION FACILITY									
SCALE		2 3/4" = 1'							
INDEX		7000							
DATE		SK-2-18304		1		3

QTY.

DESCRIPTION

HW-66916
PAGE 77

NOTE:
SEE SHT 5 FOR GENERAL NOTES,
INSTRUMENT IDENTIFICATION
LETTERS & SYMBOLS.

SCOPE

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CHANGED ON STREAMS TO D-17 1 HAS 3-6" x 4-0" (D) FV. NOST (B) LINES 2-15, 2-17, 2-18, 2-19		NOV AND 9-28-60	NO	NO	NO
NO	DESCRIPTION	REV BY	DATE	APP BY	FOR DATE
REVISIONS					
CLASSIFICATION		CLASSIFIED BY			
NONE		DATE 7-23-60			
SK-2-18304		25		1	
SCALE: NONE		APPROVALS			
DRAWN BY: J. A. T. DATE: 2-23-60		ST		DATE	
CHECKED BY: J. A. T. DATE: 7-2-60		PDD		3-31-60	
DESIGNED BY: J. A. T. DATE: 7-2-60		PDD		3-31-60	
DES. ENG. JEB. UNIT PDD		PDD		3-31-60	
UNIT 1554		PDD		3-31-60	
PROJECT NO. CAC-880		PDD		3-31-60	
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC					
ENGINEERING FLOW DIAGRAM (FEED PREPARATION)					
PLUTONIUM RECLAMATION FACILITY					
1 SK-2-18304 PROCESS FLOW DIAGRAM		SLIP NO. 234-5		INDEX NUMBER 2000	
NEXT USED ON		DATE		BY	
SK-2-18304		25		1

NOTE:
SEE SHT. 5 FOR GENERAL NOTES,
INSTRUMENT IDENTIFICATION LETTERS
& SYMBOLS.

SCOPE

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GREATER THAN E-22 STREAMS WHERE NO. WAS (1) CHANGED TANK NOS ON WAS E-23 THRU E-26 E-23 WAS 1-6'x4-0' (1) HAD (2) E-24 WAS 1-6'x4-0' (1) HAD (3) E-25 WAS 1-6'x4-0' (1) HAD (4) E-26 WAS 1-6'x4-0' (1) HAD		REVISIONS	REV BY DATE	APPR BY DATE	FOR DATE
NONE		CLASSIFIED BY DATE 1-13-66			
SK-2-18304		3 5 0			
SCALE: DRAWN: HOLLAND DATE 5-17-60 CHECKED: JAG DATE 7-1-60 REVISOR: JAG DATE 7-1-60		APPROVALS BY DATE JAG 5-17-60 JAG 7-1-60 JAG 7-1-60			
DESIGN: JAG INSTR. NO. 1554 PROJECT NO. CAC-880		U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC			
ENGINEERING FLOW DIAGRAM (FILTRATE CONCENTRATION)		PLUTONIUM RECLAMATION FACILITY			
SK-2-18400 PROCESS FLOW DIAGRAM		DRAWING TITLE 236-2			
REFERENCE DRAWINGS		HUNDRED NUMBER 7000			
NEXT USED ON		SK-2-18304

SCOPE
APPROVED
FOR DESIGN
NOT FOR CONSTRUCTION

6'-0" W45 1-5'-0" 4'-0" TWO(1) 1-5'-0" 2'-5'-0" TOWNS 2-25 INCHES 350 OF 1/2" IN 1/2" 350 OF		NOLAND 7-29-64		30	20	10
NO.	DESCRIPTION	REV BY DATE	APP'D BY	FOR	DATE	
REVISONS						
CLASSIFICATION		CLASSIFIED BY				
NONE		B. Braden				
		DATE 1-25-64				
NO.	DESCRIPTION	REV BY DATE	APP'D BY	FOR	DATE	
SK-2-18304		4	5			
SCALE		APPROVALS				
DRAWN NOLAND DATE 8-1-64		BY	DATE	FOR	DATE	
CHECKED DATE 9-2-64		BY	DATE	FOR	DATE	
REVISED DATE 9-2-64		BY	DATE	FOR	DATE	
WORKING SET		W.H. Braden				
UNIT		DD				
NO.		1554				
PROJECT NO.		C. C. 380				
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC CO.						
ENGINEERING FLOW DIAGRAM (SOLVENT EXTRACTION)						
PLUTONIUM RECLAMATION FACILITY						
SCALE		HOURS				
236-Z		7000				
NO.		SK-2-18304				
NO.		45

[illegible]

--- E --- ELECTRICAL, INSTRUMENT CONTROL LINE
 --- CAC --- COMP AIR CONTROL, INSTRUMENT LINE
 --- MAIN PJ STREAM
 --- OTHER STREAMS
 --- MANUAL VALVE
 --- ORIFICE
 --- MFM --- MAGNETIC FLOWMETER
 --- H₂O --- WATER HEADER
 --- STEAM --- STEAM HEADER
 --- DRAIN* --- TO DITCH & SWAMP (234-S BLDG. D-2 SYSTEM)
 --- DRAIN* --- TO RETENTION BASIN (236-S BLDG. D-3 SYSTEM)
 --- VENT --- VENT HEADER
 --- O.F. --- OVERFLOW HEADER
 --- CRIB --- TO WASTE SUMP TANKS (234-S BLDG. D-6 SYS.)
 --- SPV --- SAMPLER
 --- J --- STEAM TRAP
 --- JET
 --- VALVE, REMOTELY CONTROLLED, "ON-OFF"
 --- CAC ---
 --- VALVE, INSTRUMENT CONTROLLED
 --- VALVE, REMOTELY CONTROLLED, 3-WAY
 --- IN-LINE PUMP
 --- AGITATOR
 --- ELECTRONIC ROTAMETER
 --- COLUMN PULSER

APPROVED
FOR DESIGN
NOT FOR CONSTRUCTION

1. All glove-box transfer and recirculation pumps shall be in-line Model CF or TF Chempumps modified per Sanford Laboratories operation recommendation with tapered bearings and cyclone separators for recirculated bearing lubricant stream.
2. All glove-box off-on valves shall be ball valves with those operated routinely equipped with remotely-controlled operators.
3. All glove-box flow-control valves shall be Ultra Hanne-Dahl diaphragm-operated valves.
4. All glove-box flowmeters shall be Foxboro magnetic flowmeters with the exception of the CAK flowmeter which shall be an electronic rotameter.
5. All glove-box samplers shall be "in-line" samplers located on in-line pump recirculation lines where feasible.
6. Vessel construction material shall be Pyrex glass where feasible for glove-box vessels and Type 304L stainless steel for all cell vessels except as indicated for process control and/or corrosion conditions.
7. Glove-box and cell piping shall be tubing, 0.040" minimum wall thickness, Type 304 stainless steel with concentric fittings up to and including 1/2" diameter psi/rq; for piping greater than 1/2" diameter Schedule 40 Type 304L stainless steel with welded flanges shall be used.

INCREASED BY TWO TR. NO. 1. GREATER THAN R22 WAS 3-6-64 @ 12.11 @ JANF-60 2-23 @ 11.44		NOLAND 9-28-60		20		100		10-1-60	
NO. DESCRIPTION		REV DATE		APP'D DATE		FOR		DATE	
REVISOR'S									
CLASSIFICATION NONE				CLASSIFIED BY DR. Brown DATE 7-23-66					
NO. SK-2-18304		DRAFT NO. 5		REV. NO. 5		REV. DATE			
SCALE: NONE				APPROVALS					
DRAWN: PORTER		DATE: 8-20-60		BY: J. Anderson		FOR: J. L. Hays			
CHECKED: CAC		DATE: 7-2-60		BY: J. L. Hays		FOR: J. L. Hays			
DESIGNED: CAC		DATE: 7-2-60		BY: J. L. Hays		FOR: J. L. Hays			
USED: WEB		UNIT: PDD		WILL: Brown		FOR: J. L. Hays			
UNIT NO. 1554									
PROJECT NO. CAC 880		ORIGINAL TO SURFACE		REV. NO. 500		DATE: 8-4-60		FOR: J. L. Hays	
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC									
ENGINEERING FLOW DIAGRAM (PRODUCT CONCENTRATION)									
PLUTONIUM RECLAMATION FACILITY									
ALLOD 239-5		HOUSE NUMBER 7000							
NO. SK-2-18304		DRAFT NO. 5		REV. NO. 5		REV. DATE			

VESSEL NO.	SERVICE	SIZE	ORIENTATION			RADIATION LEVEL	PV CONTENT	GRAVITY FEED TO:	LOCATION		FEEDS TO:
			HORIZONTAL	VERTICAL	PUMP				ZONE III		
									CELL	HOOD	
		DIA. x LGTH			HIGH	MEDIUM	LOW				
A-101	DISSOLVER FEED	4'-0" x 5'-0"	X	X			X	D-1, D-2, D-3	X		D-1, D-2, D-3
A-102	"	"	X	X			X	"	X		"
A-103	50% NaOH	"	X				X	D-10, D-12	X		D-10, D-12
A-104	WATER	"	X				X	D-10, D-12, D-11, D-13, D-14, D-15, D-16, D-17, D-18, D-19, E-48	X		D-10, D-12, D-11, D-13, D-14, D-15, D-16, D-17, D-18, D-19, E-48
A-105	60% HNO ₃	"	X				X	"	X		"
A-106	61.7% AMN	"	X				X	D-14, D-17, D-18, D-19	X		D-14, D-17, D-18, D-19
A-107	MISC.	1'-6" x 2'-0"	X	X			X	D-15, D-11, D-13, D-19, E-40	X		D-15, D-11, D-13, D-19, E-40
A-108	CAS MAKE-UP	2'-0" x 4'-0"	X	X			X	E-29	X		E-29
A-109	CCX MAKE-UP	3'-0" x 4'-0"	X	X			X	E-30	X		E-30
A-110	COX MAKE-UP	"	X	X			X	E-31	X		E-31
A-111	NaNO ₂	1'-6" x 3'-0"	X	X			X	E-35	X		E-35
A-112	"	"	X	X			X	"	X		"
A-113	CAS WASH	2'-0" x 4'-0"	X	X			X	E-37, E-38	X		E-37, E-38
A-114	TBP	"	X				X	"	X		"
A-115	CCl ₄	"	X				X	"	X		"
A-116	HNO ₃ - ANTI-FOAM	"	X	X			X	E-20, E-21, E-42	X		E-20, E-21, E-42
D-1	HEATER	1'-2" x 3'-0"	X				X	D-4	X		D-4
D-2	"	"	X				X	D-6	X		D-6
D-3	"	"	X				X	D-8	X		D-8
D-4	DISSOLVER	5' x 10'-0"	X				X	D-14	X		D-5, D-14
D-5	CONDENSER	6' x 4'-0"	X				X	D-4	X		D-4, D-10, D-12
D-6	DISSOLVER	5' x 10'-0"	X				X	D-14	X		D-7, D-14
D-7	CONDENSER	6' x 4'-0"	X				X	D-6	X		D-6, D-10, D-12
D-8	DISSOLVER	5' x 10'-0"	X				X	D-14	X		D-9, D-14
D-9	CONDENSER	6' x 4'-0"	X				X	D-8	X		D-8, D-10, D-12
D-10	SCRUBBER	6' x 10'-0"	X				X	E-27, CRIB	X		D-11, E-27, CRIB
D-11	VENT TRAP	6' x 2'-0"	X				X	E-27	X		E-27
D-12	SCRUBBER	6' x 10'-0"	X				X	E-27, CRIB	X		D-13, E-27, CRIB
D-13	VENT TRAP	6' x 2'-0"	X				X	E-27	X		E-27
D-14	MIXER	4' x 2'-0"	X				X	D-15	X		D-15
D-15	DISSOLVER RECIPER	(4) 5' x 4'-0"	X	X			X	D-16	X		D-16
D-16	FILTER	(2) 6' x 2'-0"	X	X			X	D-17, D-18, D-19, E-28	X		D-17, D-18, D-19, E-28
D-17	CAS PUMP	(4) 5' x 16'-0"	X	X			X	E-32	X		E-32
D-18	"	"	X	X			X	"	X		"
D-19	"	"	X	X			X	"	X		"
E-20	FILTRATE FEED	(4) 5' x 4'-0"	X	X			X	E-23, E-24	X		E-23, E-24
E-21	FILTRATE EVAPORATOR	6' x 12'-0"	X				X	CRIB	X		CRIB
E-22	CONDENSER	6' x 4'-0"	X				X	D-15	X		D-15
E-23	FILTRATE CONC. REC'R	(4) 5' x 4'-0"	X	X			X	"	X		"
E-24	"	"	X	X			X	"	X		"
E-25	MISC. STORAGE	"	X	X			X	D-15, E-20, E-32	X		D-15, E-20, E-32
E-26	"	"	X	X			X	"	X		"
E-27	WASTE RECYCLE	"	X	X			X	CRIB	X		D-15, E-20, E-32, CRIB
E-28	SOLIDS RECYCLE	"	X	X			X	CAVERN	X		D-15, E-20, E-32, CAVERN, MISC. TREATMENT
E-29	CAS PUMP	"	X	X			X	"	X		D-16, E-32, E-39, E-41, SUMP FILTERS
E-30	CCA PUMP	"	X	X			X	E-33	X		E-33
E-31	COX PUMP	"	X	X			X	E-34	X		E-34
E-32	CA COLUMN	4' x 10'-0"	X				X	E-33, WASTE TREAT FAC'T.	X		E-28, E-33, WASTE TREATMENT FACILITY
E-33	CC COLUMN	3' x 40'-0"	X				X	E-34, E-35, E-42	X		E-28, E-34, E-35, E-42
E-34	CO COLUMN	5' x 18'-0"	X				X	D-15, E-37, E-38	X		D-15, E-37, E-38
E-35	MIXER	4' x 2'-0"	X				X	E-36	X		E-36
E-36	CAS PUMP	(4) 5' x 4'-0"	X	X			X	E-32	X		E-32
E-37	CAS WASH	2'-0" x 4'-0"	X	X			X	CAVERN	X		E-38, E-39, E-40, E-41, CAVERN
E-38	"	2'-0" x 4'-0"	X	X			X	"	X		E-37, E-39, E-40, E-41, CAVERN
E-39	FILTER	(2) 6' x 2'-0"	X	X			X	E-27, E-32	X		E-27, E-32
E-40	MISC. WASH.	2'-0" x 4'-0"	X	X			X	CAVERN	X		E-41, CAVERN
E-41	CAS WASH REC'R	(4) 5' x 4'-0"	X	X			X	CRIB	X		E-20, CRIB
E-42	CCP EVAP FEED	"	X	X			X	E-43	X		E-43
E-43	CCP STRIPPER - EVAP	6' x 10'-6"	X				X	E-45, E-46	X		E-44, E-45, E-46
E-44	CCP CONDENSER	5' x 3'-0"	X				X	D-15	X		D-15
E-45	CONCENTRATE RECIPER	(4) 3' x 4'-0"	X	X			X	E-47	X		E-47
E-46	"	"	X	X			X	"	X		"
E-47	FILTER	(2) 6' x 2'-0"	X	X			X	E-27, E-40, TASK I	X		E-27, E-40, TASK I
E-48	PR LOAD-OUT	5' x 14'-0"	X	X			X	PR CAN	X		PR CAN

HW - 66.916
PAGE 87

RECEIVES FROM :

INSTRUMENTATION

SAMPLER
WEIGHT FACTOR
SPECIFIC GRAVITY
FLOW
DIFFERENTIAL PRESSURE
TEMPERATURE
NEUTRON MONITOR
INTERFACE

MISC.

SCOPE

APPROVED
FOR DESIGN
NOT FOR CONSTRUCTION

DESCRIPTION		REV BY	APPROV BY	POB	DATE
REVISIONS		DATE			
CLASSIFICATION		CLASSIFIED BY			
NONE		DATE 7-9-60			
ENGINE NO.	SK-2-18328		ENGINE NO.	- - 0	
SCALE: NONE		APPROVALS			
DRAWN BY	PORTER	DATE	9-2-60	BY	FOR
CHECKED	WPA	DATE	10-15-60	W. Brown	P23
ISSUED	WPA	DATE	10-15-60	W. Brown	P23
DES. ENG.	WPA	UNIT	Y50	W. Brown	P23
INSTR.	1554			W. Brown	P23
PROJECT NO.	CAC-880			W. Brown	P23
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC					
VESSEL DATA SHEET					
PLUTONIUM RECLAMATION FACILITY					
SLIP NO.	234-5	INDEX NUMBER	7000	DATE	NO.
ENGINE NO.	SK-2-18328		ENGINE NO.	- - 0	

SECRET

STREAM	SOLIDS	DISTOLVER FEED	DISTOLVER OFF-GAS	SCRUBBER FEED	SCRUBBER OFF-GAS	SCRUBBER WASTE	DISTOLVER OVER FLOW	CREMA ADD.	TASK I FILT. FLOW	FILT. EVAP. CONCENTRATE	FILT. EVAP. CONCENTRATE	FILT. EVAP. NON- CONDENSABLE	PR CAN	CAF	CAS	CAX
STREAM NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE	SOLID	LIQUID	GAS	LIQUID	GAS	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	GAS	LIQUID	LIQUID	LIQUID	LIQUID
SP. GR.	-	1.28	-	1.33	-	1.56	1.41	1.34	1.06	1.01	1.11	-	1.52	1.51	1.03	1.47
COMPONENTS	G/NR	WT %	G/NR	WT %	G/NR	WT %	G/NR	WT %	G/NR	WT %	G/NR	WT %	G/NR	WT %	G/NR	WT %
1. MgO	1000	11.7%														
2. CaF ₂	2170	33.9%														
3. CaF ₂	88	1.25														
4. Ca	270	3.85														
5. Fe	625	8.90														
6. H ₂ O		29696	5.20		3187	10.0			3340	5.20	32929	9.79				
7. HNO ₃		24907	14.80						7665	11.6%						
8. Al(NO ₃) ₃		3300	5.7						17877	16.2						
9. NaOH				1366	30.0				683	16.20						
10. Mg(NO ₃) ₂									11037	17.32						
11. Ca(NO ₃) ₂									5715	8.92						
12. Fe(NO ₃) ₃									2107	4.21						
13. AlF(NO ₃) ₃									1430	2.23						
14. HF									944	1.47						
15. H ₂ O ₂									105	0.16						
16. H ₂				35	4.26		35	100%								
17. NO ₂				786	95.70											
18. CO																
19. CO ₂																
20. H ₂ C ₂ O ₄																
21. NaNO ₂																
22. NaNO ₃									726	11.20						
23. MIST/FOAM									589	16.81						
24. H ₂ SO ₄																
25. NH ₄ OH/44.2M																
26. Fe(NO ₃) ₃																
27. NH ₄ SO ₄																
28. Na ₂ CO ₃																
29. TBP																
30. DBBP																
31. CC ₂																
32. ANTI-FOAM																
33. Pu		50	0.71													
34. PuO ₂		817	11.60													
35. Pu(NO ₃) ₄									1570	2.45						
TOTAL	7020	100%	57905	100%	821	100%	4553	100%	55	100%	5339	100%	64102	100%	50786	100%
L/NR	-	654	1000	5.42	470	3.42	85.6	37.9	62.5	47.5	15.0		4.60	0.25	116.9	62.5
TEMP °C	25	25	110	25	25	25	25	25	25	25	25	25	110	25	25	25

SCOPE

NOTES:

1. CANS CONTAIN MATERIALS THAT ARE RADIOACTIVE & TOXIC.
2. SENDING STATIONS ARE GLOVE BOX TYPE ENCLOSURES. ALL OTHER ENCLOSURES ARE SEALED.
3. ENTIRE SYSTEM MUST BE LEAK TIGHT TO CONFINE CONTAMINATION IN CASE OF CAN RUPTURE.

APPROVED
FOR DESIGN
NOT FOR CONSTRUCTION

SK-2-18433	SCHEMATIC - AIR TUBE MAT'L HANDLING SYS
DATE	DATE
BY	BY
CHECKED	CHECKED
ISSUED	ISSUED
REV. NO.	REV. NO.
REV. DATE	REV. DATE
REV. BY	REV. BY
REV. DATE	REV. DATE

DESCRIPTION		REV BY	APP'D BY	FOR	DATE
REVISIONS					
CLASSIFICATION		CLASSIFIED BY			
NONE		L.M. Jorgensen			
DATE		12-18-60			
SK-2-18437					
SCALE: NONE		APPROVALS			
DRAWN: J.M. Jorgensen		BY	FOR	DATE	
CHECKED: J.M. Jorgensen		J.M. Jorgensen	EDT	12-18-60	
ISSUED: J.M. Jorgensen		J.M. Jorgensen	EDT	12-18-60	
REV. NO. 1		J.M. Jorgensen	EDT	12-18-60	
REV. DATE		J.M. Jorgensen	EDT	12-18-60	
REV. BY		J.M. Jorgensen	EDT	12-18-60	
REV. DATE		J.M. Jorgensen	EDT	12-18-60	
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC					
SCHEMATIC AIR TUBE MATERIAL HANDLING SYSTEM					
SK-2-18433		INDEX NUMBER 1902		REV. NO. 1	
DATE		DATE		DATE	
BY		BY		BY	
CHECKED		CHECKED		CHECKED	
ISSUED		ISSUED		ISSUED	
REV. NO.		REV. NO.		REV. NO.	
REV. DATE		REV. DATE		REV. DATE	
REV. BY		REV. BY		REV. BY	
REV. DATE		REV. DATE		REV. DATE

- NOTES:**
1. TENTATIVE DISSOLVER CONSTRUCTION MATERIAL TO BE TYPE 309 S2B STN. STL., PENDING RESULTS OF PROTOTYPE TESTING.
 2. DISSOLVER OVERFLOW PIPING TO BE TEFLOM LINED STAINLESS STEEL WITH FLANGED FITTINGS.
 3. CONDENSER CONSTRUCTION MATERIAL TO BE TYPE 304-L STN. STL.
 4. ALL TUBING TO BE TYPE 304 STN. STL. X .065" MINIMUM WALL THICKNESS WITH "CONCENTRIC" FITTINGS.
 5. ALL PIPING TO BE TYPE 304-L STN. STL. WITH FLANGED FITTINGS.

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DESCRIPTION		REV BY	APP BY	FOR	DATE
CLASSIFICATION		CLASSIFIED BY			
NONE		DATE 9-1-60			
DRAWING NO. SK-2-18472		REVISION NO.		REV NO.	
SCALE: NONE		APPROVALS			
DRAWN: <i>Standard</i> DATE: 8-30-60		BY: <i>W. B. Brown</i>		FOR: <i>993</i> DATE: 12-12-60	
CHECKED: <i>W. B.</i> DATE: 12-12-60		BY: <i>W. B. Brown</i>		FOR: <i>100</i> DATE: 12-12-60	
DESIGNED: <i>W. B.</i> DATE: 12-12-60		BY: <i>W. B. Brown</i>		FOR: <i>100</i> DATE: 12-12-60	
UNIT NO. <i>1556</i>		BY: <i>W. B. Brown</i>		FOR: <i>100</i> DATE: 12-12-60	
PROJECT CAC-880		U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC			
DISSOLVER & CONDENSER ASSEMBLY D-4-D-5, D-4-D-6, D-4-D-7					
PLUTONIUM RECLAMATION FACILITY					
DRAWING NO. <i>256</i>		INDEX NUMBER <i>2500</i>		UNIT NO. <i>1556</i>	
DRAWING TITLE		REFERENCE DRAWINGS		NEXT USED ON	

QTY.	DESCRIPTION
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HW-66916
PAGE 86

KEY ELEVATION

SCOPE

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NOT FOR CONSTR. 10N

DESCRIPTION	REV BY	APP'D BY	FOR DATE
REVISIONS	DATE		
CLASSIFICATION		CLASSIFIED BY	
NONE		DATE 1-18-60	
DWS NO. SK-2-18473 - - 0			
SCALE: 1" = 1'-0"		APPROVALS	
DRAWN: J. J. J.	DATE: 1-18-60	BY: J. J. J.	FOR: J. J. J.
CHECKED: J. J. J.	DATE: 1-18-60	BY: J. J. J.	FOR: J. J. J.
DESIGNED: J. J. J.	DATE: 1-18-60	BY: J. J. J.	FOR: J. J. J.
DES. ENG. J. J. J.	UNIT: YED	BY: J. J. J.	FOR: J. J. J.
INVT. NO. 556		BY: J. J. J.	FOR: J. J. J.
PROJECT NO. CAC-380		BY: J. J. J.	FOR: J. J. J.
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC			
PROCESS GLOVE BOX MODULE			
PLUTONIUM RECLAMATION FACILITY			
DWS NO. SK-2-18473	REVISION NUMBER 4700	BY NO.	DATE

DWS NO.	DRAWING TITLE
SK-2-18473	REFERENCE DRAWINGS

QTY.	REV.	DESCRIPTION
		HW-66916
		PAGE 57

LEGEND

— PRIMARY PRODUCT STREAM
 - - - PRIMARY RECYCLE STREAM
 . . . SECONDARY RECYCLE STREAM
 - . - ALTERNATE ROUTE OF FLUSH
 ● BATCH TRANSFER POINT
 ○ POTENTIAL MEASUREMENT POINT

SCOPE

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NO.	DESCRIPTION	REV.	BY	APP'D.	FOR	DATE
REVISIONS						
CLASSIFICATION		CLASSIFIED BY				
NONE		J. B. Brien				
DATE		DATE 9-25-60				
SK-2-18488		-				
SCALE: NONE		APPROVALS				
DRAWN: PORTER		DATE 8-25-60				
CHECKED: J. B. Brien		DATE 10-18-60				
ISSUED: J. B. Brien		DATE 10-18-60				
DES. ENG. J. B. Brien		DATE 10-18-60				
HWT. NO. 1554		DATE 10-18-60				
PROJECT NO. CAC 880		DATE 10-18-60				
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC						
ACCOUNTABILITY SCHEMATIC FLOW DIAGRAM						
PLUTONIUM RECLAMATION FACILITY						
BLDG. NO. 234-5		INSTR. NUMBER 7000				
DWS. NO. SK-2-18488		REV. NO. -				

DRAWING TITLE
 REFERENCE DRAWINGS
 NEXT USED ON

LINE	SIZE	PIPE	TUBING	SERVICE	CONDENSER	STRIPPER
1	3/4"	X		COOLING H ₂ O OUTLET	X	
2	3/4"	X		VENT	X	
3	1/2"	X		TEMP.	X	
4	1/2"	X		COOLING H ₂ O INLET	X	
5	1/2"	X		CONDENSATE OUTLET	X	
6	1/2"	X		TEMP.		X
7	1/2"	X		SOLUTION FEED		X
8	1/2"	X		STEAM JACKET INLET		X
9	1/2"	X		STEAM FEED		X
10	1/2"	X		PRODUCT OUT		X
11	1/2"	X		JACKET COND. OUTLET		X

SCOPE

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DESCRIPTION		REV	APPROV	DATE
REVISIONS		BY	BY	DATE
CLASSIFICATION		CLASSIFIED BY		
NONE		DATE 9-1-60		
SK-2-18493		-		
SCALE:		APPROVALS		
DRAWN: NOLAND DATE 5-1-60		BY: J. B. B. DATE 5-1-60		
CHECKED: J. B. B. DATE 5-1-60		BY: J. B. B. DATE 5-1-60		
DESIGNED: J. B. B. DATE 5-1-60		BY: J. B. B. DATE 5-1-60		
REVISED: 1554		BY: J. B. B. DATE 5-1-60		
PROJECT NO. CAC-880		BY: J. B. B. DATE 5-1-60		
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC				
E-43 & E-44 CCP STRIPPER-EVAPORATOR AND CONDENSER				
PLUTONIUM RECLAMATION FACILITY				
DRAWING NO. 236-2		REVISION NO. 2500		
SK-2-18493				

DATE	DATE
236-2	2500
SK-2-18493

NOTES:

1. EXCEPT AS OTHERWISE SHOWN,
ALL PIPING & FITTINGS IN CONTACT WITH PRODUCT
TO BE 304-L STN. STL. ALL OTHER TO BE ANY 300
SERIES STN. ST.

LINE NO.	SIZE	PIPE TUBING	SERVICE	CONDENSER	INT. PMP.
1	1"	X	VENT	X	
2	1"	X	COOLING H ₂ O OUTLET	X	
3			TEMP.	X	
4	1"	X	COOLING H ₂ O MLET	X	
5	1"	X	CONDENSATE OUTLET	X	
6	1/2"	X	CHEM. ADD.		X
7	1/2"	X	DIFF. PRESS.		X
8			TEMP.		X
9	1"	X	W.F. & DIFF. PRESS.		X
10	1"	X	S.A.G.R.		X
11	1"	X	S.A.G.R. & W.F.		X
12	1/2"	X	STEAM		X
13	1/2"	X	PRODUCT OUTLET		X
14	1/2"	X	FEED INLET		X
15	1/2"	X	CONDENSATE OUTLET		X
16	1/2"	X	DRAIN		X

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NOT FOR CONSTRUCTION

SCOPE

DESCRIPTION		REV. BY	APP'D BY	FOR	DATE
REVISIONS					
CLASSIFICATION		CLASSIFIED BY			
NONE		DATE 9-7-60			
DWG. NO. SK-2-18495		DESIGN NO.	REVISION	REV. NO.	
SCALE:		APPROVALS			
DRAWN: NOLAND DATE 9-7-60		BY: J. J. J.	FOR: PPD	DATE: 10-15-60	
CHECKED: J. J. J. DATE 10-15-60		DESIGN: J. J. J.	FOR: PPD	DATE: 10-15-60	
DESIGN: J. J. J. UNIT: PPD		DESIGN: J. J. J.	FOR: PPD	DATE: 10-15-60	
UNIT: 1554		DESIGN: J. J. J.	FOR: PPD	DATE: 10-15-60	
PROJECT NO. CAC-880		DESIGN: J. J. J.	FOR: PPD	DATE: 10-15-60	
U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC					
FILTRATE EVAPORATOR "E-21" AND CONDENSER "E-22"					
PLUTONIUM RECLAMATION FACILITY					
DRAWING TITLE		ALIAS	NUMBER	DATE	REVISION
236-2			2500		
REFERENCE DRAWINGS		DWG. NO. SK-2-18495			
NEXT USED ON

ALTERNATE BAG-OUT COVER
 BE USED IF BAG-OUT OPENING IS CIRCULAR
 'D MAY ALSO BE USED ON RECTANGULAR OPENING.

PROCEDURE:

- STEP #1. APPLY TAPE LAYER #1 TO JOINTS OF BAG-OUT COVER AND CONTAINER LID.
- " #2. APPLY FILM WITH TAPE LAYERS #2 & #3 EACH COVERING ONE-HALF OF THE WIDTH OF 1ST LAYER. LEAVE ROLL OF TAPE & CUTTING BLADE INSIDE THIS FORMED SLEEVE.
- " #3. SLIT TAPE LAYER #1 WITH BLADE AT JOINTS. PROVIDE COVER FOR BLADE TO PREVENT DAMAGE TO FILM.
- " #4. LIFT BAG-OUT COVER WITH ATTACHED CONTAINER LID INTO CELL AREA AND CLEAR OF OPENING.
- " #5. TRANSFER EQUIP. OR MATERIAL.
- " #6. REPLACE COVER & LID.
- " #7. APPLY TAPE LAYER #4

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SCOPE

DESCRIPTION		REV. BY	APP'D BY	FOR	DATE
REVISIONS					
CLASSIFICATION		CLASSIFIED BY			
NONE		DATE 9-21-60			
DRWG. NO.	SK-2-18505	REV. NO.	-	REV. DATE	0
SCALE:		APPROVALS			
DESIGNED BY	EDS	UNIT	1554	DATE	10/10/60
CHECKED BY	EDS	DATE	10-10-60	FOR	10-10-60
ISSUED BY	EDS	DATE	10-10-60	FOR	10-10-60
U. S. ATOMIC ENERGY COMMISSION		GENERAL ELECTRIC			
HANFORD ATOMIC PRODUCTS OPERATION		CELL AREA			
BAG-OUT OPENING & PROCEDURE		PLUTONIUM RECLAMATION FACILITY			
DRWG. NO.	SK-2-18505	REV. NO.	-	REV. DATE	0

DRWG. NO.	SK-2-18505
REV. NO.	-
REV. DATE	0

END

DATE

FILMED

4/6/94