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ENGINEERING STUDY - INCREASED PROCESSING FLEXIBILITY - PUREX
PART II

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Page 1

ENGINEERING STUDY - INCREASED PROCESSING FLEXIBILITY - PUREX
PART II

By

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Process Design Engineering
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June 24, 1964

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ENGINEERING STUDY - INCREASED PROCESSING FLEXIBILITY - PUREX
PART II

I. INTRODUCTION

Reference 1 presented the design criteria for the modifications to the Purex dissolver and head-end systems. This document is an engineering study which has been performed to cover the remaining modifications to the Plant which are required for increased processing flexibility.

II. SUMMARY

This document defines the additional changes required for increased processing flexibility at the Purex Plant beyond those presented in Reference 1. These changes are as follows:

- (1) Installation of two new tanks in the F7 Canyon location for 1WW and 1WF holdup and supplementary routings to permit usage of TK-F12 and E-F11-1 for 3WB storage between processing campaigns.
- (2) Installation of a new critically safe 2AF tank.
- (3) Modifications to Canyon Sumps SJ and SK to permit higher nuclear safety limits.
- (4) Installation of sump piping and instrumentation for the new SNA Sump in N Cell.
- (5) Installation of additional weight factor controls for each of the two uranium concentrators.
- (6) Installation of back-up flow measuring instrumentation and additional flow alarm systems (for critical process streams).
- (7) Installation of nuclear blanks to prevent the addition of extraneous precipitating agents to the process.

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1. HW-80407 Ptl, "Design Criteria - CGC-124 - Increased Processing Flexibility - ~~Purex~~, Part 1 - Dissolver System Modifications," by RD Ehrlich, JR LaRiviere, and JC Willi, dated January 17, 1964. (Secret)

III. DESIGN PHILOSOPHY

The information presented in this document is intended to provide a basis for further design of Purex systems for increased processing flexibility. The design philosophy presented in Reference 1 is intended to apply to the work delineated in this document also. Drawings are included which are an integral part of this engineering study and are as follows:

Drawings

<u>No.</u>	<u>SK-2-</u>	
19958	Sh. 2	Engineering Flow Diagram - Notes, Index & Legend
19960		Engineering Flow Diagram - 2AF Tank
19963		Engineering Flow Diagram - 3WB Storage
19964		Arrangement - Tanks TK-F7 & TK-F26
19973		N-Cell Sump Modification
19974		2AF Tank - TK-J5
19975		Hydraulic Schematic - 2AF Tank
19976		Sump Modifications - J and K Cells
19977		Knock-Out Pot for 2AF Vent

Drawing SK-2-19972, Canyon Sump Information, is included in this document for general information only.

IV. PROCESS DESIGN AND DESCRIPTIONA. Additional 3WB Storage

When the Purex Plant is routinely processing a variety of fuels, it will be necessary to have adequate storage capacity for backcycle, flush, and rework solutions in order to maintain a satisfactory over-all production rate. The rework, flush, and backcycle solutions are combined into the 3WB backcycle system which presently contains but one backcycle solution storage tank, TK-J1. Hence, when the Plant is processing three uranium fuels of different U-235 enrichments, on a campaign basis, a minimum of two additional 3WB backcycle storage tanks will be needed in the canyon. These tanks will also be used on occasion for general F-Cell waste handling operations. The tanks will provide F Cell with sufficient routing flexibility so that the scheduling problems under the new production plans will (1) be no greater than are currently being experienced, and (2) minimize routine downgrading of uranium products.

During processing, the backcycle streams from the extraction and purification cycles are routed to TK-F10, the 3WF collection and 3WB concentrator feed tank. The 3WF stream is then routed to

the E-H4-1 Concentrator, and the concentrated stream, 3WB, is collected in TK-J1, the 3WB backcycle tank. From TK-J1 the 3WB is fed back to either the HA Column or the 3A Column. Whenever the extraction and purification cycles are in operation, the 3WF stream is generated. In the future, various equipment will be flushed at the end of a processing campaign to reduce cross-contamination of the products. These flushes will be routed to the 3WF-3WB system for rework, together with the backcycle solutions, and then stored until the next processing campaign is commenced on the same type of uranium fuel.

Of the two additional storage tanks required for storage of rework and backcycle solutions, one can be provided by using the E-F11-1 Concentrator (or a new TK-F11 which may be used in the future for storage or boildown service). Several jumper additions are required to tie in E-F11-1 to the 3WB system.

The second 3WB storage tank is to be provided through the addition of a new tank to the canyon. As canyon space is limited, the most feasible method for providing another tank is to change the function of Tank TK-F12 from its present LWF holdup to 3WB storage, and the LWF holdup function would be combined with the LWW holdup function in the F7 location. Thus, it is proposed to "split" Tank TK-F7, presently used for LWW holdup, by installing a pair of tanks, of 4,000-gallon capacity each, in the F7 position. One tank, to be designated Tank TK-F7, is to have the function of LWF collection and holdup; and the other, to be designated Tank TK-F26, is to function as the LWW concentrator-rundown-and-holdup tank. Hence, the vessels used for processing the current backcycle stream would be the TK-F10 Tank, the E-H4-1 Concentrator, and the TK-J1 Tank; and the 3WB storage vessels would be the E-F11-1 Concentrator and the TK-F12 Tank. Various jumper additions are required for new routings between these vessels and others related to the 3WB system to provide adequate routing flexibility.

B. 2AF Tank

In the present Purex process the various plutonium-bearing streams which require recycle or rework are returned to the process in the first decontamination and partition cycle. When enriched metal is being processed in the Plant, this portion of the process will be operated under concentration control because the equipment pieces

are not geometrically favorable. This necessitates a new approach to the recycle of the two streams having the highest and most unpredictable plutonium concentration. These streams, the product rework from the PR Room and the combined N-Cell backcycle (XAW, XSW, and XPD overhead) are presently returned to the head-end of the process via Tanks TK-E6 and TK-J1 respectively. The new method for accomplishing the recycle and rework of these streams is to be furnished by returning them to the process at the beginning of the second plutonium cycle in the 2AF tank, TK-J5 (Reference 2).

A new 2AF tank is required to handle these plutonium streams as the existing tank is not geometrically favorable. New routings are required to carry these streams from L Cell, where they enter the canyon from the PR Room and N Cell, to Tank TK-J5 in J Cell. The equipment downstream of the 2AF tank was designed to be geometrically favorable and thus does not require replacement as a result of this change.

The 2AF tank has two functions in the Purex process. First, it serves as a reaction vessel for the oxidation of aqueous Pu (III), the product of the LBS Column, to aqueous Pu (IV), the feed required for the 2A Column. Second, it provides an inventory of feed for the 2A Column, the first step in the second plutonium cycle, at the desired operating conditions (Reference 3). The proposed 2 1/2-inch annular 2AF tank design provides a geometrically favorable capacity of 330 gallons for the collection and storage of feed solution at the desired operating conditions and allows adequate hold-up time and mixing of the reactants for the oxidation of Pu (III) by sodium nitrite, NaNO_2 . To insure proper mixing, the streams containing Pu (III), LBP and PG-J4 piston leakage, and the oxidizing agent, NaNO_2 , will be introduced together into the annular vessel. This will be accomplished by the manifold under the inlet nozzles of these streams, as shown on Drawings SK-2-19960 and SK-2-19974. Also, the tank contents will be agitated by sparging with air.

A knock-out pot is to be included in the tank vent jumper to prevent process solution from being air-lifted through the vent jumper and into the vessel vent system. A velocity drop and change

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2. HW-79665, "Preliminary Study of Multiple Fuel Processing at the Purex Plant," JB Kendall, RW Lambert, and SM Nielson, dated November 26, 1963. (Secret)
 3. HW-31000, "Purex Technical Manual," pp. 1305-7. (Secret)

of direction will allow liquid to drop out of the air and a liquid drain will return the process solution to the 2AF tank.

A steam coil is required to heat the inlet streams from 20° to 55°C and maintain the vessel contents at 55°C. Adjustments in the nitric acid concentration can be made as necessary by adding nitric acid to the tank via the chemical addition line. Standard specific gravity, weight factor, and temperature instrumentation are to be provided. Sample facilities are to be provided for the tank contents and the LBP stream.

If it becomes necessary to empty or flush the 2AF tank, a jumper containing a jet is to be installed so that the tank contents can be routed to Tank TK-J1. This should be done under concentration control because Tank TK-J1 is not geometrically favorable.

At times the nuclear safety limits on the existing 2AF tank (Reference 4) have restricted operations under the present process conditions. The installation of a new geometrically favorable tank of greater capacity, as proposed herein, provides one and one-half times the capacity of the existing tank and should considerably ease operational restrictions, especially during future campaigns when the Plant will be processing enriched uranium.

In these design criteria, the new routings which are required to return the N-Cell backcycle and the plutonium product rework to the new 2AF tank are dependent on the design and installation of the new L-Cell package. This L-Cell work is a separate program to modify L Cell, providing plutonium product and rework storage facilities. Because these modifications which are to be made in L Cell involve the same routings that are needed to route the two streams to the 2AF tank, the necessary work should be done in the L-Cell package modifications. If the L-Cell package is not designed to provide these routings, they must be provided by this project and a supplement to these design criteria would be required, which would be issued as an additional part of this document.

The most feasible method of providing the required routings is to combine the various streams in L Cell which are to be returned to the 2AF tank and use the one available hot pipe trench route from L Cell to J Cell. This line will be used for routing the following streams to the new 2AF tank: N-Cell backcycle, plutonium product

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4. HW-71625, "Process Specifications for Critical Mass Control, Purex Plant, Revision No. 3," BF Judson and GC Oberg, dated October 15, 1962. (Secret)

rework, piston leakage from pulse generator, PG-L2, and alternate 2BP. This will be accomplished by a common header arrangement (shown schematically, in part, on the Engineering Flow Diagram, Drawing SK-2-19960) as part of the new L-Cell package.

At present the N-Cell backcycle stream is combined in L Cell with the 3XW stream from Q Cell and returned to Tank TK-J1. The 3XW stream is a batch transfer of about 500 gallons of waste solution which has a very low plutonium concentration. Because of the large batch volume, the 3XW must be returned to a large vessel in the process. Thus, to separate the N-Cell backcycle and the 3XW streams, a new jumper to accomplish this is to be included in the L-Cell package work. The 3XW is to be returned to Tank TK-J1 as in the existing operation, and the N-Cell backcycle stream is to be returned to the 2AF tank via the new L-Cell header mentioned above.

C. Sump Modification

1. J- and K-Cell Sump Modifications

The routing of concentrated plutonium-bearing recycle and rework streams to the new 2AF tank in J Cell necessitates the modification of the J- and K-Cell sumps, SJ and SK. These sumps are to be modified to be critically favorable for solutions of the highest plutonium concentration which could be routed to the new 2AF tank and hence to either of these sumps. Because it would be possible for the rework stream to be highly concentrated, a plutonium concentration of 250 gm per liter is the design basis for the sump modifications.

This design will make the sumps and trough between the east-west trough on the cell centerline and the sump critically favorable. The volume of highly concentrated plutonium solution that can be held safely in the sump will be limited by the long trough which runs the length of the cell on the cell centerline as this trough is not of favorable geometry. It is not economically feasible to modify this long trough as it would require the temporary removal of the equipment in the cell in order to gain access to the trough. This is one of the longest cells in the canyon, 116 feet, and the equipment which would have to be removed includes the HA, HS, 1BX, and 1BS Columns, the H4 Concentrator, and the J-Cell package. Above a liquid level in the sump of 13 inches, solution will flow into the unmodified center trough. For solutions concentrated to 250 gms plutonium

per liter, the safe volume would be limited to 80 gallons. This effect can be more easily understood with the Canyon Sump Information Drawing SK-2-19972. Additional discussion of this limitation appears in the nuclear safety section of this report.

2. N-Cell Sump Modifications

Tank TK-N1 could be a limiting factor in the processing of NPR fuels in the Purex Plant due to the present plutonium concentration limits on this tank. This limit is not based on the tank design but is based on the limitations of the N-Cell hood sump. According to the present flowsheet and the predicted plutonium content of NPR fuels, the normal concentration of plutonium in Tank TK-N1 when processing NPR fuels at 3.0 capacity factor will be greater than 80 percent of the maximum concentration allowable in TK-N1 (Reference 4). Since this would not provide a reasonable safety factor for operation, N-Cell sump modifications are necessary which will permit raising the concentration limit on Tank TK-N1 (Reference 2).

As shown on Drawing SK-2-19973, a new sump, SNA, is to be provided on the floor under Tank TK-N1, which will be isolated from the existing sump, SN, under the ion-exchange columns. The new sump will be emptied by vacuum transfer to Tank TK-L11 in the PR Room. A conductivity-type liquid level alarm is to be included in the installation to detect and warn of leakage from Tank TK-N1 or associated piping. A screen is to be provided around the suction point to prevent resin from being transferred out of the hood and into other piping systems. All necessary valving is to be located in the PR Room so that the sump could be emptied without entry into N Cell.

The type of modification to the N-Cell hood floor presented in these design criteria will allow the limit on the plutonium concentration in Tank TK-N1 to be raised at least 35 percent, which is the requirement for processing flexibility (Reference 2). As the capacity of the new sump is small, 42 gallons, a high liquid level alarm is to be added to Tank TK-N1.

D. Additional Instrumentation for Critical Process Streams

Because of the additional amounts of U-235 which will be present when processing E-Metal fuels rather than normal fuels, the partition cycle, particularly the LBX and the LBS Columns, will be operated under close concentration control. Some of the equipment in this portion of the process is of unfavorable geometry and thus subject to the always safe concentration limit of 8 gm plutonium (or grams of U-235 as equivalent plutonium) per liter of solution (Reference 4). To aid in keeping within this limit when processing E-Metal, the following steps are required:

- (1) A high-level alarm is to be added to the LBXP neutron monitor to call attention immediately to any plutonium buildup in the partition cycle.
- (2) To help minimize the loss of plutonium to the second uranium cycle, a low-level alarm is to be added to the LBXP neutron monitor which detects plutonium concentration in the partition cycle.
- (3) As an additional aid in the detection of excessive plutonium reflux in the first decontamination and partition cycle, a flow recorder is to be installed on the LBP stream, and high specific gravity alarm is to be installed on the LBS Column.
- (4) Excessive loss of plutonium to the aqueous 2AW stream could occur if the plutonium were not oxidized to the +4 valence state in the 2AF tank because of loss of sodium nitrite flow into the 2AF tank. To aid in the detection of this situation, a low flow alarm is to be added to the sodium nitrite flow instrumentation, and the flow meter is to be changed to a more reliable type (see Drawing SK-2-19960).
- (5) Large losses of uranium to the organic systems could occur through loss of dilute nitric acid in the LCX or 2EX streams. To aid in calling attention to these situations, low flow alarms are to be installed on the nitric acid flow instrumentation of both streams. To insure that an instrument failure would not permit this situation to go unnoticed, alarms will also be added to the loading pressure on the valves of these two streams.

E. Uranium Concentration Controls

When processing enriched metal fuels which contain at least 0.94 percent U-235, the safe UNH concentration limits in the uranium concentrators, E-J8-1 and E-K4-1, will be lower than those presently employed in the use of this equipment for processing natural uranium. To provide additional protection against overconcentration of the UNH solutions, the present weight factor instrumentation is to be supplemented with a similar back-up instrument in each of the two uranium concentrators. The two sets of dip tubes will be located in different sections of each concentrator to minimize the potential simultaneous plugging of both dip tubes.

F. Routings for Processing PRTR and D-Metal Fuels

It is planned to process PRTR and D-Metal (depleted metal) fuels through the Purex Plant (Reference 2). The scheme for processing the dissolved PRTR and D-Metal fuels generally will employ the normal Purex Plant flowsheet on a campaign basis. Future minor plant modifications, mostly the installation of temporary jumpers for the campaign, along with some cold-side modifications will be required to process these materials.

Present production plans for processing PRTR fuels includes receiving only small amounts of Pu-Al and UO₂ fuel elements. The bulk of the PRTR fuels which are to be received are the PuO₂-UO₂, mixed oxide fuels. As mentioned in Reference 1, the process flowsheet for the mixed oxide fuels is not complete. Development work is yet in progress. Also, no commitment has been made for processing D-Metal fuels at this time. Hence, the design of these modifications is not included in this engineering study at this time.

G. Other Required Work

To assure criticality control in the canyon vessels during the processing of uranium of 0.94 percent U-235 or greater, the method of operation by concentration control will be invoked. The increased amount of U-235 which will be present in the process solutions will not always permit operational control by the method of always safe ratios of U-238 to fissile materials which is presently in use. As concentration control does not prevent criticality

should precipitation of plutonium and uranium occur, additional means of protection are required to prevent extraneous precipitating agents from being introduced into the process. The philosophy to be adopted is the installation of nuclear blanks in all cold-side chemical lines that could contain precipitation agents and which lead to process vessels. A nuclear blank consists of the physical removal of a spool-piece or a section of line together with blanking the ends of the fixed piping.

All connections to the canyon from the following cold-side headers, except to Cells A, B, and C, are to be modified with nuclear blanks:

<u>Header</u>	<u>Normal Service</u>
205	NH ₄ F-NH ₄ NO ₃
206	Metathesis Reagent
7003	Utility Header
7005	Utility Header
7006	Caustic Header
7007	Utility & Flushing Header
7008	Sodium Carbonate Header

V. DESCRIPTION OF WORK TO BE PERFORMED

A. Additional 3WB Storage Provisions

1. New 1WF-1WW Tanks

The new 1WF-1WW tanks, designated as Tanks TK-F7 and TK-F26, respectively, are shown on Drawing SK-2-19964 at the F7 position, including a proposed arrangement of the pertinent jumpers. The present TK-F7 Tank is to be removed, and its position used for the new tanks. The two new 304-L stainless steel tanks, each of 4,000 gallons capacity (nominal), are to be mounted on a single dunnage, which is to be handled by an existing lift yoke. However, the two vessels should be essentially independent of each other due to the excessive stresses which would otherwise occur at the weld joints, caused by the temperature difference of the solutions in the two tanks. It is proposed to leave an

air gap (ambient cell temperature assumed to be 80°F) between the two tanks except for small pad supports bracing the flat sides of the vessels and thus minimize the bending stresses at the joints as well as the undesirable transfer of heat from one tank to the other. The pad supports would be welded to the flat side plate of one tank and would rest against the flat side of the other tank.

Each of the two new tanks is to have its own coil. The criteria for the coil design are as follows:

- (1) The cooling duties of the coils in the TK-F7 and TK-F26 Tanks are to be 525,000 BTU/hr and 796,000 BTU/hr, respectively.
- (2) The coils in both tanks are to be designed to allow the placement of the tank nozzles so that as many existing jumpers as is possible can be reused and that the maximum flexibility of use for each tank nozzle is obtained for possible future dipleg additions.
- (3) The design of the coils in both tanks should follow the basic criteria for heat transfer coil installations, established in Reference 5, where possible.

The existing A-F7 Agitator on the present TK-F7 Tank is to be reused as the A-F26 Agitator. The present P-F12 Pump is to be transferred to the new TK-F7 Tank and redesignated as the P-F7 Pump.

It is important that the design of the new vessels and pertinent jumpers follow existing canyon design practices wherever possible. Also, it is desirable that the nozzles on the tanks be so located as to permit the use of existing jumpers and existing designs for the new jumpers as indicated on Drawing SK-2-19964. Tank Nozzles M, N, KK, and MM are to be 4-inch-diameter nozzles, and all other tank nozzles on the TK-F7 and TK-F26 Tanks are to be 3-inch-diameter nozzles. The coil inlet and outlet nozzles on TK-F7, D and Q respectively, are to be equipped with dust caps.

2. Routing Changes

A number of miscellaneous routing changes, not directly a part of the new TK-F7 and TK-F26 Tanks, are necessary to properly utilize the new tanks and to use the TK-F12 Tank for 3WB storage. The routing changes, which require new jumpers as shown on the Engineering Flow Diagram - 3WB Storage, Drawing SK-2-19963, are as follows:

5. HW-69959, "Process and Detail Design Criteria - Heat Transfer Coil Installations, Chemical Processing Department," JB Fecht, dated June 16, 1961.

- (1) Provide a route for short period use at the beginning of a campaign from Tank TK-D4 to Tank TK-E6, bypassing Tank TK-D5. This is provided by temporarily reversing the existing route from Tank TK-E6 to Tank TK-D5 and by installing the following new jumpers: a jumper from Tank TK-D4, Nozzle T to Wall Nozzle D-T9, containing a dipleg and a new Group 1, 75-gpm jet, J-D4-3; and a steam supply jumper from Wall Nozzle D-G20 to the J-D4-3 Jet. A blank connector is to be installed on the motive steam nozzle of the J-E6-1 Jet whenever the line is to be operated from Tank TK-D4 to Tank TK-E6. Note that the two new jumpers and the blank connector are to be provided but not immediately installed.
 - (2) Provide a route from Tank TK-F12 to Tank TK-D5. This route, for alternate use, is completed by a new jumper from Wall Nozzle F-T127 to F-T120; all other piping already exists. The new jumper is to be built but not installed.
 - (3) Provide a route from Tank TK-F8 to Concentrator E-F11-1 by installing two new jumpers: one from Wall Nozzle F-G159 to Tank TK-F8, Nozzle J, containing a dipleg, and a new Group 1, 75-gpm jet, J-F8-3A; and a "flex" jumper from a discharge nozzle on the jet to Wall Nozzle F-T126. The flex jumper is to be usable also for the route from Tank TK-F8 to Tank TK-D5 via Wall Nozzle F-T120.
 - (4) Provide a route from Tank TK-F10 to Concentrator E-F11-1, requiring a new jumper from Nozzle A of the TK-F10 Tank to Nozzle U of the E-F11-1 Concentrator with a dipleg and a Group 1, 75-gpm jet, J-F10-4; and a new steam supply jumper from Wall Nozzle F-G119 to the new J-F10-4 Jet.
- NOTE: Since the present F-11 Concentrator is out of service, detail design of Items 3 and 4 is to be withheld until a replacement vessel has been designated.
- (5) Provide a route from Tank TK-F12 to Tank TK-F10. This is accomplished by reversing the existing Tank TK-F10 to Tank TK-F12 route. The jumpers used for the existing route are to be removed and saved for intermittent use as conditions require. The new jumpers required are:
 - 1) a jumper from Nozzle T of Tank TK-F12 to Wall Nozzle F-T76 containing a dipleg and a Group 1, 75-gpm jet, J-F12-3;
 - 2) a steam supply jumper from Wall Nozzle F-G89 to the J-F12-3 Jet; and 3) a jumper from Wall Nozzle F-T104 to

Nozzle P of Tank TK-F10. A blank connector is to be installed on either Wall Nozzle F-G89 or Wall Nozzle F-G127 depending upon whether the F10-to-F12 or the F12-to-F10 route is in use.

- (6) Provide a route for the HAW stream to Tank TK-F7. This route, which replaces the existing route for the HAW to Tank TK-F12, is provided by a new "hairpin" jumper from Wall Nozzle F-T84 to Wall Nozzle F-T87. The existing jumper from Wall Nozzle F-T84 to Tank TK-F12 is to be removed.
- (7) Discontinue the existing route from the present P-F12 Pump to Concentrator E-F6. This is accomplished by removing the jumper which presently connects the P-F12 pump discharge to Wall Nozzle F-T88 and the jumper which presently connects Wall Nozzle F-T131 to the E-F6 Concentrator and by installing blank connectors on Wall Nozzles F-T88 and F-T131.
- (8) Provide a route from Tank TK-F10 to Tank TK-G1. This route is provided by removing the existing "Y" jumper between Wall Nozzles F-T70 and F-T71 and Tank TK-F13 and installing a new jumper from Wall Nozzle F-T70 to Tank TK-F13 and a new hairpin jumper from Wall Nozzle F-T71 to Wall Nozzle F-T58. The remaining piping for this route presently exists.
- (9) Provide a route from Tank TK-H1 to Tank TK-J1. This route may be provided by jetting from Tank TK-H1 to Wall Nozzle H-T45, reversing the route from Tank TK-J1 to Tank TK-H1. The new jumpers required are: a jumper from Tank TK-H1, Nozzle R, to Wall Nozzle H-T45, containing a dipleg and a Group 1, 75-gpm jet, J-H1-1; and a steam supply jumper from Wall Nozzle H-G85 for the new J-H1-1 Jet. However, since this line will be used in both directions, a blank connector is to be installed on the steam supply nozzle of the unused jet.

3. Cold Side Modifications

Modifications will be required in the Pipe and Operating Gallery and the Central Control Room to provide the necessary instrumentation and cold-side services. As shown on the Engineering Flow Diagram - 3WB Storage, Drawing SK-2-19963, the following Pipe and Operating Gallery modifications are necessary:

- (1) Install a new jet gang valve via D-G20 for the J-D4-3 Jet to transfer metal solution from Tank TK-D4 to Tank TK-E6.
- (2) Reroute from F-G96 to F-G181 the signal lines from the rotameter to the flow recorder-controller, FRC-F12, which is to be renumbered FRC-F7 (see Central Control Room changes below).
- (3) Reroute the existing jet gang valve from F-G168 to F-G177 for the J-F26-1 Jet to transfer 1WW to Tank TK-F13.
- (4) Provide via F-G175 lines for new weight factor - specific gravity recorders for Tank TK-F26. The new weight factor and specific gravity recorders are to be located in the Central Control Room as described below.
- (5) Install a new jet gang valve via F-G174 for the J-F26-2 Jet to transfer 1WW to Tank TK-F15.
- (6) Provide, via F-G173, air, steam, and water service to the coil of Tank TK-F26, with a local pressure indicator and also flow indicators with readouts located in the Central Control Room. Install a diaphragm-operated valve (DOV-F26-1) to control the steam flow, sized for a flow range of 0 to 3,100 lbs per hour of 100-psig steam. Install a diaphragm-operated valve (DOV-F26-2) to control the water flow, sized for a flow range of 0 to 125 gpm. Install a diaphragm-operated, on-off valve to control the air flow, sized same as the existing air-flow control valve (DO 1.2F1108) at F-G162. All three valves are to be remotely controlled by a valve selector switch in the Central Control Room.
- (7) Reroute from F-G170 to F-G172 the motor power leads for the A-F7 Agitator, which is to be renumbered the A-F26 Agitator.
- (8) Reroute from F-G172 to F-G170 the present Tank TK-F7 temperature and microphone ("mike") signal lines which will be used for the new Tank TK-F26.
- (9) Reroute from F-G173 to F-G168 the existing chemical addition line. Also, reroute to F-G168 the chemical addition line presently at F-G89, providing a locally operated valve to separate the two systems.

- (10) Install via F-G164 new electrical leads for a new temperature element and a new microphone for the new Tank TK-F7. The temperature recorder and speaker receiving these signals will be in the Central Control Room.
- (11) Reroute to F-G161 the two 1/2-inch lines of the organic detector system presently at F-G175. Also, reroute to the third 1/2-inch line at F-G161 the air signal to DOV-F7-3 presently at F-G166.
- (12) Reroute to an unused 1/2-inch line of F-G157 the existing 1/2-inch line at F-G161.
- (13) Install a new jet gang valve via F-G119 for the J-F10-4 Jet to transfer solution from the Tank TK-F10 to the Concentrator E-F11-1.
- (14) Install a new jet gang valve via F-G89 for the J-F12-3 Jet to transfer solution from the Tank TK-F12 to the Tank TK-F10.
- (15) Install a new jet gang valve via H-G85 for the J-H1-1 Jet to transfer solution from the Tank TK-H1 to the Tank TK-J1.

As shown on the Engineering Flow Diagram - 3WB Storage, Drawing SK-2-19963, the following changes are required in the Central Control Room:

- (1) All controls for Tank TK-F26 functions are to be placed on the presently unused F4 Panel Board, relocating as required from the F7 Panel Board.
- (2) The present flow recorder-controller, FRC-F12, is to be relocated from the F12 Panel Board to the F7 Panel Board and renumbered FRC-F7. The present valve pressure recorder, VPR-F7, is to be disconnected from the WFR-F7 Weight Factor Recorder and the solenoid valve and is to be removed. The flow recorder-controller, FRC-F7, is to provide an air signal to DOV-F7-3 via the solenoid valve as presently connected.
- (3) Relocate the jet gang valve switch (presently serving the J-F7-4 Jet) for the J-F26-1 Jet from the F7 Panel Board to the F26 Panel Board.
- (4) A new specific gravity recorder, a new weight factor recorder, and a new weight factor alarm with high and low activation are to be provided for the TK-F26 Tank. The weight factor

alarm is to activate signal lights for either high or low weight factor, and it is to be connected to the MS-A-F26 Motor Switch for the A-F26 Agitator so that the low weight factor alarm signal shuts off the agitator.

- (5) The jet gang valve switch for the new jet gang valve for the J-F26-2 Jet is to be located on the F26 Panel Board.
- (6) The new valve selector switch and the new flow indicators for the TK-F26 coil are to be located on the F26 Panel Board. The flow indicator for steam is to be calibrated for a range of 0 to 3,100 lbs per hour, and the flow indicator for water is to be calibrated for a range of 0 to 125 gpm.
- (7) The motor switch for the present A-F7 Agitator, MS-A-F7, is to be relocated to the F26 Panel Board from the F7 Panel Board and renumbered MS-A-F26.
- (8) The present temperature and microphone signal lines attached to the present TR-F7 Temperature Recorder and the F7 contacts of the speaker selector switch, respectively, are to be disconnected. The temperature leads will be rerouted to a new temperature recorder, TR-F26, located on the F26 Panel Board; and the speaker leads are to be connected to the F4 contacts of the speaker selector switch (not shown on the drawing).
- (9) The present TR-F7 Temperature Recorder is to be connected to the new temperature leads from F-G164, with the new microphone leads being connected to the F7 contacts of the speaker selector switch.
- (10) The existing WFR-F7 Weight Factor Recorder is to be recalibrated for the size of the new TK-F7 Tank. The weight factor alarm is to be adjusted as required.
- (11) Add new jet gang valve switches for the J-F10-4, the J-F12-3, and the J-H1-1 Jets on the F10, F12, and H1 Panel Boards, respectively.

B. 2AF Tank

As shown on Drawing SK-2-19974, the new 2AF tank is to be an annular vessel, 9 feet in diameter, with a capacity of about 330 gallons. The nominal thickness of the annular space which will contain the process solution is to be 2 1/2 inches, and the interior of the tank

is to be moderated by a 6-inch concrete ring. The pump is to be located in the center of the tank in a 5-inch-diameter pump boot. The new tank is to be fabricated using four concentric, stainless steel, cylindrical shells to provide an annular tank for process solution storage, a 1/4-inch air gap to insure drainage of solution out of the vessel should a leak develop in the inner wall of the solution annulus, and an annulus for the enclosure of a concrete moderator. In detail design considerable attention should be given to the design of the top and bottom heads to provide the optimum welding sequence in terms of fabrication cost and weld integrity. Careful consideration should be given to possible thermal stresses due to the different temperatures which will exist in different parts of the vessel. The limits given on the solution annulus of 2 3/4 inches maximum and 2 1/4 inches minimum are absolute and must be held for nuclear safety and minimum volume requirements, respectively.

1. New 2AF Tank Installation

The new 2AF tank is to be installed in J Cell in the same position as the existing 2AF tank. The vessel is to be centered on the cell centerline and the centerline of the J5 locating trunnion guides. The new jumpers required are to be designed and fabricated according to the information given on Drawings SK-2-19960 and SK-2-19974. All jumpers carrying liquid shall be designed to drain to Tank TK-J5. There are several instances where a jumper serves an equipment piece contained in another jumper; for example, the electrical jumper from J-G78 serves the jumper-mounted rotameter, FT-J5-5. In the design of the new jumpers which require auxiliary jumpers, it may be possible to locate the connector for the auxiliary jumper so that the existing auxiliary jumper can be used. Wherever possible and feasible, this should be done in detail design of new jumpers.

Special attention is called to the 2AF tank vent jumper from Nozzle E of Tank TK-J5 to Wall Connector T-J39. This jumper is to contain a geometrically safe knockout pot as shown on Drawing SK-2-19977. The cell layout must be considered in the design of the liquid return jumper from the knockout pot to Tank Nozzle V so that this jumper does not interfere with placement of other jumpers on the removal of the pump from the

2AF tank. Special attention should also be given to the jumper from Nozzle J of T-J4 to Nozzle A of Tank TK-J5. The sample pot required in this jumper must be of safe geometry with the limits on slab thickness and cylinder diameter as stated on Engineering Flow Diagram, Drawing SK-2-19960. The jumper design must also be such that the sample pot is located at least one foot away from the 2AF tank. Specifications for the new 2AF pump, P-J5, and the flow meters and control valves which will be installed in the canyon are included in these criteria.

When the new 2AF tank is received on plant, it and the new vent jumper which contains a knockout pot are to be mocked up in the shop to determine the maximum allowable sparge rate. A restricting orifice will then be added to the sparger air supply in the Pipe and Operating Gallery which will limit the air flow to the allowable rate at the required sparging pressure. (See Paragraph 2, (4) below.) The solution used for this test must have properties of specific gravity, viscosity, and surface tension which are as close as possible to the properties of the 2AF tank process contents.

2. Cold Side Modifications - J Cell

The following modifications are required in the Pipe and Operating Gallery and in the Central Control Room for the new 2AF tank (reference is made to the associated gallery wall nozzles, G76, G77, etc.):

- (1) Install new transmitters, with ranges applicable to the new, deeper vessel, on the J5 weight factor and J5 specific gravity signals from G83. Install a high liquid level alarm with an alarm light and annunciator tie-in on the J5 weight factor signal.
- (2) Add a high temperature alarm to the temperature signal from Tank TK-J5 via G90. The alarm is to have a range of 130° to 180°F.
- (3) Install a recorder-controller, FRC-J5-4, and a control valve, DOV-J5-5, on the nitric acid line to Tank TK-J5 via G95. Use the existing transmitting rotameter, FT-J5-6, and provide a manual bypass around the control valve. The control valve is to be the throttling type with a capacity of from 0.5 to 5.0 gpm with an upstream head of about 35 feet. The nominal flow rate is 2 gpm, and the specific gravity is 1.3.

- (4) Install the piping and instrumentation for the air supply to the sparge ring of Tank TK-J5 to Nozzle G81. A flow indicator, FI-J5-3, pressure indicator, PI-J5-2, and a manual controller for adjusting the setting of the control valve are required in the Central Control Room. The valve is to be sized for a maximum air flow rate of 10 scfm at a sparger discharge pressure of 4.5 psig. Provision should also be made for the addition of a restricting orifice to the air line if sparging tests on the new 2AF tank indicate that the sparge rate must be lower than 10 scfm.
- (5) Replace the existing flow meter in the sodium nitrite line to G94 with a magnetic flow meter and make the necessary revisions to permit the use of the existing flow recorder, FRC-J5-1. Add a low-flow alarm to the sodium nitrite flow signal. The alarm actuation pressure is to be adjustable over the range of 3 to 15 psig. The alarm set-point is to be adjustable locally in the Central Control Room so that it can be kept at a given percentage under the required process flow rate. The alarm light is to be in the nuclear safety alarm panel (see Section V, D).
- (6) Install a new flow recorder, FR-J4-2, in the Central Control Room and provide for routing of the signal from G96.

C. Sump Modifications

1. J- and K-Cell Sump Modifications

a. Detail Design

Detail design of the modifications to the J- and K-Cell sumps, SJ and SK, is to be done according to the following criteria and Drawing SK-2-19976. Boral is a material containing 50 percent B_4C and 50 percent aluminum by volume in the form of a sintered, boron-aluminum mixture (Reference 6). The boron is to contain a concentration of the B-10 isotope which is no less than is present in naturally occurring boron minerals; namely, 18.8 percent. The type of frame used to hold the Boral grids

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6. ORNL-242, "Boral: A New Thermal Neutron Shield," by VL McKinney and Theodore Rockwell, III, dated August 31, 1949, Oak Ridge National Laboratory, p. 19. (Confidential)

shown on the drawing is intended to be functional only and demonstrates that it is feasible to set forth the following requirements which must be met in detail design:

- (1) The distance between adjacent Boral plates shall not exceed 1 1/2 inches.
- (2) The perpendicular distance between the terminating Boral plates and the sump walls shall not exceed 1 inch.
- (3) The distance between the vertical ends of the Boral plates and the south sump wall shall not exceed 3/4 inch.
- (4) The distance between the bottoms of the Boral plates of the bottom section and the bottom of the sump shall not exceed 1/2 inch.
- (5) The vertical distance between the tops of the Boral plates of the bottom section and the bottoms of the Boral plates of the top section shall not exceed 1 inch.
- (6) Where dimensions are referred to Boral plates in 1 through 5 above, these dimensions apply to the Boral sheets and not the stainless steel sheathing which is shown on the drawing.
- (7) The over-all dimensions of the grid with frame shall provide 3/8-inch minimum clearance on the perimeter between the extremities and the concrete sides of the sump.
- (8) The above requirements are based on the sump dimensions as shown on Drawing SK-2-19976.
- (9) The frame shall not be welded to the sheathed Boral plates.
- (10) The above requirements also apply, where applicable, to the section of grid to be designed for the trough.

The detail design shall allow for the placement of service jumpers remotely into the sump without damaging the grid structure. The amount of Boral plate which is to be removed from the grid pattern for this purpose is to be kept to a minimum as shown on Drawing SK-2-19976. The design shall

permit the use of existing service jumpers with the exception of the weight factor jumpers which must be modified by the removal of the bottom portion of the brace bar. It is necessary to use two stacked sections rather than a single taller section of grid because of the drain pipes which project horizontally from the wall above the sump. The sections of the grid shall each have a pair of lifting trunnions or a lifting bail. Lifting trunnions should not be used if a new yoke would also be required. If bails are used, they must be designed so as not to interfere with jumper placement. It is also important that the lifting point be located for proper balance without the use of ballast because ballast cannot be added within the grid structure.

b. Mock-Up and Trial Installation (by Chemical Processing Department upon design completion)

A program to remove the sludge and debris which has collected in the canyon sumps, Sumps SJ and SK, and to determine the condition of their concrete structure is planned as a joint effort by Facilities Engineering Operation and Purex Operation. At the completion of detail design of these modifications, mock-up of the framework, jumper guides, and lifting bails will be made using inexpensive materials. These will be installed in both SJ and SK Sumps to check the dimensions, fit-up, etc. Any changes dictated by the mock-up will be reviewed for effects on nuclear safety, and if acceptable, these changes in design would then be authorized prior to fabrication of the grids.

2. N-Cell Sump Modifications

a. The New Sump, SNA

A field study has been made to determine the general low point of the floor in the portion of the hood under Tank TK-N1. This area as shown on Drawing SK-2-19973 is to be the new SNA Sump. To provide the desired capacity for this new sump, the existing bottom structural angle is to be used as a dam to separate the new sump from the existing SN Sump, which is located in the ion-exchange portion of the hood. The four existing holes in this angle are to be plugged using a small plate on each side. The angle has been notched for the routing of a 1-inch pipe (the pipe centerline is approximately 2 1/4 inches above the floor). This pipe is to be rerouted at a higher elevation and the notch is to be plugged. The pipe can be easily rerouted as it terminates at a bolted flange just beyond the angle, and the other end is outside of the hood where welding is

permitted. All plugs made in the angle are to provide a seal which will prevent liquid seepage and which will withstand concentrated nitric acid solutions. Mechanical gasketing with Teflon may be the best method of providing this seal. Welding within the N-Cell hood must be avoided, but rigid support of the new installation is to be provided.

b. Installation of the Liquid Level Alarms

The liquid level alarm device used in the new SNA Sump is to be the conductivity type. The probes in contact with the solution are to be of a material which will not become insulated due to an excessive collection of corrosion products on the liquid-contacting surface. The alarm is to sound at a liquid depth of 1/2 inch with limits of +0 and -1/16 inch. The level alarm is to be connected to the existing N-Cell Control Room annunciator system and an alarm light which is to be installed on the panel board.

An alarm is also to be added to the Tank N-1 weight factor instrumentation. The alarm set-point is to be set in the field at or below 65 percent of tank capacity.

c. SNA Transfer Line

New piping is to be installed from the new SNA Sump in the N-Cell hood to Tank TK-L11 in the PR Room. The same type of connection to vacuum Tank TK-L11 is to be made as is existing on the line for vacuum transfer of the existing sump, SN, to Tank TK-L11. The valve in this line is to be hand operated, capable of holding against an operating vacuum of 14 psig. The routing of this piping from N Cell to the PR Room will require providing holes through the N-Cell hood wall and through the following concrete walls: 1) between N-Cell and the No. 5 Pipe Chase, and 2) between the Pipe Chase and the PR Room. After piping installation, the holes are to be sealed around the pipes to maintain the proper air balances.

D. Additional Instrumentation for Critical Process Streams

The installation of eight alarms is to be made in the Central Control Room for additional control of critical process areas. The alarm set-points are to be adjustable locally over the range of 3 to 15 psig air pressure for actuation. The installation requires the addition of the corresponding alarm lights on the panel board and tie-ins to

a new annunciator circuit. The alarm lights are to be grouped in a new alarm light panel located above the J6 position on the Central Control Room panel board. This alarm light panel is to be designated Nuclear Safety Alarms, and the lights are to be purple to distinguish them from normal alarm lights. The following work is to be done on the respective instrument systems (reference is made to the corresponding primary elements, FT-J6-1, etc. and to the associated gallery wall connectors, J-G61, K-G70, etc.):

- (1) Install a high-and low-level alarm on the LBXP neutron monitor signal. The LBXP neutron monitor is located in a remote canyon jumper and the signal is received via J-G102.
- (2) Install a high-level alarm on the specific gravity signal from LBS Column via remote connector, J-G107.
- (3) Install a low flow alarm on the LCX stream flow rate signal from FT-J7-1, which is located in the Pipe and Operating Gallery in the dilute nitric acid line to J-G37.
- (4) Install a low pressure alarm on the valve loading pressure line from Controller FRC-J7-1 to Valve DOV-J7-9.
- (5) Install a low flow alarm on the 2EX stream flow rate signal from FT-K3-2, which is located in the Pipe and Operating Gallery in the dilute nitric acid line to K-G70.
- (6) Install a low pressure alarm on the valve loading pressure line from Controller FRC-K3-2 to Valve DOV-K3-9.

E. Additional Instrumentation - Uranium Concentrators

The following work is to be performed on each of the two uranium concentrators, E-J8-1 and E-K4-1:

- (1) Install a second weight factor jumper from Nozzle EE on the concentrator to Wall Nozzle J-G128 (and K-G32 respectively). The jumper is to contain standard concentrator dip tube assemblies.
- (2) Use the low pressure and medium pressure dip tubes for connections to new weight factor instruments. The high pressure dip tube is to be installed with an air purge and will serve as a spare dip tube only.

- (3) Install a new transmitter for the second weight factor system with a range of 0 to 150 inches of water column.
- (4) Install a high and a low weight factor alarm with panel board indicating lights for the new system. The alarm lights are to be grouped in a new alarm light panel located above the J6 position on the Central Control Room panel board together with the eight alarm lights mentioned above in Section V, D. The alarm signals are to be connected to the new annunciator system which is to serve this new alarm light panel. The weight factor air signals are to be used for alarm activation.
- (5) Convert SGRC-J8 and SGRC-K4, respectively, to a two-pen recorder or install a new two-pen recorder, with one pen controlling. Move the functions (pot vacuum) of DPR-J8 and DPR-K4, respectively, to the new two-pen recorder. Record the new weight factor readings with the second pen on WFR-J8 and WFR-K4, respectively.

F. Installation of Nuclear Blanks

The nuclear blanks, which are delineated below, are to be installed in the sections of piping between the headers or tanks and the connections to the process vessels. The nuclear blank is to be a physical removal of a section of pipe or a spool piece with the fixed ends blanked off with blank flanges. These installations should be performed in sections of the line which are readily accessible and as close to the canyon wall connection as is possible. Block valves installed immediately ahead of the nuclear blanks and drain valves may be required, as safe drainage of the nuclear blanks prior to removal must be assured.

Existing piping supplies carbonate to Tanks G5A and R5A via Header 7008 and caustic to Tank E2A via Header 7006. The connections to the tanks are made through inlet manifolds which are also piped up to other AMU headers. To isolate caustic and carbonate from these other headers, the connections from 7008 to TK-G5A and TK-R5A and from 7006 to TK-E2A are to be removed from the manifold piping and piped directly to the tank using a spare tank connection. The new connection from 7006 to TK-E2A is to contain a nuclear blank as noted in the table below.

The following table delineates the nuclear blanks to be installed:

NUCLEAR BLANKS
PUREX CHEMICAL HEADER SYSTEM

<u>No. Nuclear Blanks Required</u>	<u>Header or Tank and Use</u>		<u>Nuclear Blank to be Installed Between Header or Tank and the Following Process Connections</u>
5	205	205 Tank Header for $\text{NH}_4\text{F} - \text{NH}_4\text{NO}_3$ and Utility	E-G94, E-G64, Tank E2A, E-G28 (See Note 1)
4	206	206 Tank Header for Metathesis Reagent	E-G94, E-G64, Tank E2A, E-G28
12	7003	Utility Header	D-G71, D-G57, D-G43, D-G26, D-G12, E-G94, Tank E2A, Tank G3A, G-G171, Tank G5A, J-G140 (See Note 2)
11	7005	Utility Header	E-G64, Tank E2A, F-G215, F-G188, F-G173, F-G155, F-G133, F-G103, F-G25, F-G56 (See Note 2)
4	7006	Sodium Hydroxide Header	E-G64, Tank E2A, F-G42, F-G15
13	7007	Utility and Flushing Header	E-G64, E-G28, Tank E2A, F-G78, H-G91, H-G59, H-G17, J-G167, J-G136, K-G16, Tank L9A, Tank R5A (See Note 2)
4	7008	Sodium Carbonate Header	G-G170, G-G127, R2 (20S Carbonate Line), R1 (10B Carbonate Line)
3	Tank G5A	Sodium Hydroxide	G-G76 (See Note 3), G-G19, G-G12 (See Note 3)
4	Tank R5A	Sodium Carbonate	R1 (See Note 3), R5 (See Note 3), R7 (See Note 3), R8 (See Note 3)

Note 1.- The Tank 205 alternate header, which is blanked off from TK-205 now, is to be removed from its present end near TK-205 to the location where it connects to the 205 Header in the Pipe and Operating Gallery. A nuclear blank is to be installed in Header N-056 where it leaves TK-205.

Note 2.- A valving station is located on the Third Level of Aqueous Makeup which has inlet connections from Tanks 204, 205 and 324 and outlet connections to Headers 7003, 7005 and 7007. Nuclear blanks are to be installed on the Headers 7003, 7005 and 7007 at the point where they leave the valving station.

Note 3.- In these locations a nuclear blank installation can be made by removing a valve from the line and blanking the two ends of piping remaining.

VI. SAFETY

A. Nuclear Safety

1. 2AF Tank

A plutonium concentration of 250 gm per liter was selected as the design objective for nuclear safety. This includes a significant safety factor over the most concentrated plutonium solution which will be routinely contained in the tank. This limit also provides flexibility and a degree of protection from inadvertent overconcentration. To help prevent such an occurrence, an alarm has been added to the temperature instrumentation that will call attention to a temperature rise of 10° above the normal operating temperature, which could occur from improper operation of the heating coil. The possibility of plutonium polymerization in the tank is practically nil since: 1) the normal acidity of the tank contents is 2.7 M HNO_3 , 2) all of the process streams entering the tank are acidic, and 3) there is no practical way that caustic can be added to the tank. Plutonium polymer is precipitated from plutonium solutions if the solution becomes acid deficient.

Neutron moderation is to be provided by a 6-inch-thick concrete ring located on the inner side of the solution annulus.

2. Sump Modifications

a. J-Cell Sump Modification

The design objective for the Boral grids, which are to be used to modify the J-Cell sump, SJ, and the portion of the trough between SJ and the cell centerline, is a plutonium concentration of 250 gm per liter. This is the maximum anticipated concentration of the rework streams which could be routed into or out of the new 2AF tank designed for J Cell, and thus the proposed modification meets the established nuclear safety criteria for modification of sumps at the Purex Plant (Reference 4).

Because it is not economically feasible to add a poison grid to the centerline trough, the favorable capacity of the sump is limited to the volume which will not exceed the safe slab thickness in the unmodified trough. The safe slab thickness is a function of the plutonium concentration; thus at lower concentrations the favorable capacity is higher than for more

concentrated solutions. To operate the sump properly, about 20 gallons could be allowed to accumulate before it is necessary to jet it out. This corresponds to a liquid depth of about 10 inches in the sump proper. The existing sump weight factor alarm will warn operating personnel of high liquid level in the sump. Based on the above considerations, limits will have to be established on the plutonium concentration and batch transfer volume of the product rework stream to be routed to the 2AF tank.

b. K-Cell Sump Modification

The same nuclear safety considerations apply to the modification of the SK Sump as discussed above in regard to the SJ Sump. The only difference is the indirect way in which leakage of concentrated plutonium solutions being sent to the new 2AF tank would have to enter K Cell in order to have any effect on the K-Cell sump. It is possible, however, and would result if the line carrying the rework stream from L Cell to J Cell in the Hot Pipe Trench began leaking at a point adjacent to K Cell. The Hot Pipe Trench drainage system is shown on Drawing SK-2-19972.

c. N-Cell Sump Modifications

The new sump, SNA, permits the raising of the plutonium concentration limits on Tank TK-N1 from the existing 14.5 gm per liter, based on the safety of the existing sump (Reference 4), to at least 20 gm per liter which is required for increased processing flexibility (Reference 2). The liquid depth on the floor under Tank TK-N1 is to be maintained below 1/2 inch by vacuum transfer of the liquid to Tank TK-L11 as often as necessary. A liquid level alarm will sound in the N-Cell Control Room to warn operating personnel whenever the liquid level exceeds 1/2 inch. The height of the partition which separates the new SNA Sump from the existing SN Sump is 3 inches. This provides a capacity of 42 gallons of solution beyond the alarm level in the new SNA Sump. Thus, as long as Tank TK-N1 is operated at less than 42 gallons capacity, a complete tank failure could occur and the entire amount of solution would be contained in the new sump and could not have any effect on the contents of the existing sump. An alarm is to be added to the Tank TK-N1 weight factor instrumentation to warn operating personnel if the tank capacity exceeds 42 gallons.

3. Additional Instrumentation for Critical Process Streams

In regard for the safe operation of certain equipment pieces under concentration control, eight alarms and an additional flow recording system are to be added to the present instrumentation on these equipment pieces. These instrument additions will provide backup for the quick detection of process upsets that could cause reflux of either plutonium or uranium in the portion of the process which will be operated under concentration control.

4. Uranium Concentrators

This engineering study includes additions and modifications which will furnish the Purex Plant with the capability of processing enriched uranium. Since the uranium concentrators are not designed to be always safe by geometry, concentration control is required for safe operation. The additional weight factor controls which have been specified will provide operations with a back-up reading for concentration control. Failure of both weight factor systems would have to occur to permit undetected, inadvertent buildown of the uranium solutions in the concentrators. As an aid to protect against such a simultaneous failure, the second set of dip tubes in each concentrator is to be installed in a location which is higher than and at a distance from the original set of dip tubes.

5. Installation of Nuclear Blanks

The use of nuclear blanks philosophy will help to eliminate the possibility of precipitating uranium or plutonium from solutions in tanks of nonfavorable geometry. Flexibility dictates that certain chemicals which can precipitate uranium or plutonium must be used in the processes at various times in the plant. Hence, the adoption of administrative controls will be necessary for all operations involving such chemicals. In providing flexibility of routings and of processing, inherent hazards are created which can only be checked by proper operation under an administrative control system.

B. General Safety

The additions and modifications proposed in this engineering study do not present any additional operating hazards from chemical reactions or mechanical operations to the general process or to the Plant, respectively.

VII. REFERENCES

1. HW-80407 Ptl, "Design Criteria - CGC-124 Increased Processing Flexibility - Purex, Part I - Dissolver System Modifications," RD Ehrlich, JR LaRiviere and JC Willi, dated January 17, 1964. (Secret)
2. HW-79665, "Preliminary Study of Multiple Fuel Processing at the Purex Plant," JB Kendall, RW Lambert and SM Nielson, dated November 26, 1963. (Secret)
3. HW-31000, "Purex Technical Manual," pp. 1305-7. (Secret)
4. HW-71625, "Process Specifications for Critical Mass Control, Purex Plant, Revision No. 3," BF Judson and GC Oberg, dated October 15, 1962. (Secret)
5. HW-69959, "Process and Detail Design Criteria - Heat Transfer Coil Installations, Chemical Processing Department," JB Fecht, dated June 16, 1961.
6. ORNL-242, "Boral: A New Thermal Neutron Shield," VL McKinney and Theodore Rockwell, III, dated August 31, 1949, Oak Ridge National Laboratory, p. 19. (Confidential)

PROCESS SPECIFICATION CENTRIFUGAL PUMP

G E N E R A L

PROJECT NO.	LOCATION	NO. REQUIRED	ITEM NO.	DATE	SPEC. NO.
CGS-124	202-A	ONE	P-75	1-4-66	P-J5
SERVICE Feed to extraction column					

M A T E R I A L S H A N D L E D

LIQUID PUMPED Aqueous nitrate salt solution			PUMPING TEMPERATURE (P.T.) 130 °F	
@ P.T.	SPECIFIC GRAVITY 1.15	VISCOSITY 1.0 cP @ 1.0 GPM	VAPOR PRESSURE 1.95	PSIA
@ 60° F	SPECIFIC GRAVITY 1.15	VISCOSITY 1.0 cP @ 1.0 GPM	VAPOR PRESSURE 0.5	PSIA
SOLIDS IN LIQUID, WT. %		DENSITY	PARTICLE SIZE	
CORROSIVE COMPOUNDS Nitric Acid				

D E S I G N D A T A FOR INFORMATION ONLY

DESIGN CAPACITY		10	GPM AT		23	PSI DIFFERENTIAL PRESSURE	
MAXIMUM SUCTION PRESSURE		4.4	PSIG	DIFFERENTIAL PRESSURE		23	PSI
MINIMUM SUCTION PRESSURE		-0.2	PSIG	DIFFERENTIAL HEAD		52	FT.
NET POSITIVE SUCTION HEAD		26.7	FT	MAXIMUM DISCHARGE PRESSURE		31.5	PSIG
MAXIMUM DIFFERENTIAL PRESSURE AT SHUT OFF		27.2	PSI				
BRAKE HORSEPOWER		1 @ 20	% EFFICIENCY				
MATERIALS OF CONSTRUCTION							
Stainless Steel Type 304 or 316							
PUMP TO BE		INSULATED	TRACED		WITH		PSIG STEAM
SHAFT SEAL COMMENTS							
FLUSHING REQUIREMENTS		MATERIAL		MAXIMUM FLOW		GPM	
		TEMPERATURE		°F		PRESSURE	
IMPELLER		OPEN		CLOSED		SEMI-ENCLOSED	

C O N N E C T I O N S

SUCTION SIZE	SERIES	FACING	DISCHARGE SIZE	SERIES	FACING
			2" Male Flange to 2" NPS		

M O T O R

440 VOLTS	3 PHASE	60 CYCLES	HP	RPM	TYPE
NON-OVERLOADING FOR FULL RANGE OF THE PUMP					

C A N Y O N P U M P S

REMOTE FLANGE	O.D.	I.D.	SETTING HEIGHT At max. 20'	STD. GROUP NO. Similar to H-2-59375
REMARKS: Pump, P-75, to conform to H-2-59375 and Hamford Standard HWS-5876 Rev. 3 except for:				
1. Pumping Characteristics to be as specified above;				
2. Pump to be installed in 6" ID pump truck;				
3. Setting height to be based on bottom of suction bell located on centerline of 2" lines entering pump truck.				
4. Painting - on all outside carbon steel surfaces use MW-3 system conforming with Hamford Standard HWS-5961, finish coat - gray.				
REFERENCES:				
H-2-59375			SPEC. BY:	
BM-6430-002 (12-63)			J. E. Nordahl	

FOR INFORMATION ONLY

ITEM NO. (FLOW DIAGRAM SYMBOL)	DOV-F7-3	DOV-J4-2
SERVICE	Interfacial Control	Interfacial Control
LOCATION	Canyon - F Cell	Canyon - J Cell
OPERATING CONDITIONS		
FLUID	Aqueous Salt Solution	Aqueous Nitrate Salts
CORROSIVE COMPOUNDS	HVL ₂	Nitric Acid
OPERATING TEMPERATURE, °F	100 to 125	80
DESIGN TEMPERATURE, °F	350	150
OPER. UPSTREAM PRESSURE, PSIG	60	4.5
DESIGN PRESSURE, PSIG	150	150
PRESS. DROP ACROSS VALVE AT MAX. FLOW, PSI	50	
PRESS. DROP ACROSS VALVE AT MIN. FLOW, PSI		
PRESS. DROP ACROSS VALVE AT NORM. FLOW, PSI		3.4
LIQUID		
NORM. FLOW AT OPER. COND., GPM	60	4.5
± % DEVIA. FROM NORM. FLOW, NORM. PLANT OPER.	- 6% to + 6%	- 50% to + 20%
SPECIFIC GRAVITY AT OPER. COND.	1.17	1.25
VISCOSITY AT OPER. COND., CP	0.9	1.0 to 1.5
STEAM		
NORM. FLOW AT OPER. COND., LBS./HR.		
± % DEVIA. FROM NORM. FLOW, NORM. PLANT OPER.		
QUALITY AT OPER. COND., %		
SUPERHEAT AT OPER. COND., °F		
GENERAL		
FLOW COEFF. REQUIRED (SEE NOTE 1)		
VALVE POSITIONER	None	None
WITH AIR FAILURE, VALVE	Close	Close
LINE SIZE, INCHES	2	1
JUMPER NO.	Interfacial Control	Interfacial Control
SPECIAL REQUIREMENTS	See Note 2	See Note 2

NOTE 1 - FLOW COEFF. = WATER FLOW, GPM, THROUGH WIDE OPEN VALVE WITH 1 PSI ΔP. IF VALVE SIZES AVAILABLE DO NOT HAVE COEFF. BETWEEN 90 AND 100% OF FIGURE GIVEN, SUPPLY NEXT LARGEST SIZE VALVE.

2 - Cavity-type diaphragm-operated valve to be Hammel-Dahl Ultra Valve, or approved equal, stainless steel body with linear characteristic trim.

JHN 3-10-64
RDE 2-29-64

DIAPHRAGM OPERATED VALVES
PROCESS SPECIFICATIONS

FOR INFORMATION ONLY

ITEM NO. (FLOW DIAGRAM SYMBOL)	FT-J4-2	FT-J5-5	FT-F7-3
NEW INSTRUMENT PARTS REQUIRED	Flow Meter	Flow Meter	Rotameter
SERVICE	T-J4 to TK-J5	TK-J5 to T-L1	1WF to E-F6
LOCATION	Canyon - J Cell	Canyon - J Cell	Canyon - F Cell
OPERATING CONDITIONS			
FLUID	Aqueous Nitrate Salts	Aqueous Nitrate Salts	Acid Salt Solution
CORROSIVE COMPOUNDS	Nitric Acid	Nitric Acid	HNO ₃
OPERATING TEMPERATURE, °F	80	130	100 to 125
DESIGN TEMPERATURE, °F	150	300	356
OPERATING PRESSURE, PSIG	6	25	60
DESIGN PRESSURE, PSIG	150	150	150
LIQUID			
FLOW AT FULL METER DIFF. & OPER. COND. GPM			
NORMAL FLOW AT OPER. COND. GPM	4.5	5.0	60
±% DEVIA. FROM NORM. FLOW, NORM. PLANT OPER.	-80 to +100	-80 to +100	-100 to +33
SPECIFIC GRAVITY AT OPER. COND.	1.1	1.15	1.07
VISCOSITY AT OPER. COND., CP	1.0 to 1.5	1.0 to 1.5	0.9
STEAM			
FLOW AT FULL METER DIFF. & OPER. COND., LBS/HR			
NORMAL FLOW AT OPER. COND., LBS/HR			
±% DEVIA. FROM NORM. FLOW, NORM. PLANT OPER.			
QUALITY AT OPER. COND., %			
SUPERHEAT AT OPER. COND., °F			
GENERAL			
TYPE OF PRIMARY ELEMENT	Rotameter	Rotameter	Rotameter
TYPE OF INSTRUMENT	Flow Recorder	Flow Recorder-Controller	Flow Recorder-Controller
TYPE OF CONTROL ACTION	None		
DIFF. RANGE, INCHES WATER, DRY			
TRANS. TO BOARD OR LOCAL	Board	Board	Board
WITH AIR FAILURE, VALVE		Closes	
WITH INCREASE IN FLOW, VALVE			
LINE SIZE, INCHES	1"	1"	2"
JUMPER NO.	T-J4 to TK-J5	TK-J5 to J-I35	P-F7 to E-F6
ORIFICE BETA			
SPECIAL REQUIREMENTS	See Note 1	See Note 1	See Note 1

NOTE 1 - Fisher & Porter Electronic Canyon-Type Rotameter or approved equal.

JHN 3-10-64
RDE 2-29-64FLOWMETERS AND FLOWCONTROLLERS
PROCESS SPECIFICATIONS

1. — THERMOWELLS TO BE FABRICATED ACCORDING TO H-2-54704, THERMOHMS TO BE MINNEAPOLIS HONEYWELL R-130441, OR APPROVED EQUAL 0-150°C. W/50 FT. OF LEAD WIRE. THERMOHMS TO BE SUPPLIED & INSTALLED BY PUREX PLANT.
2. — ALL CANYON DIAPHRAM OPERATED VALVES TO BE HAMMEL-DAHL ULTRA VALVES, OR APPROVED EQUAL.
3. — JETS TO BE FURNISHED PER H-2-58078, UNLESS A SEPARATE SPECIFICATION IS INCLUDED IN THE DESIGN CRITERIA.
4. — TYPICAL SEAL POTS SHOWN ON H-2-53313.
5. — TYPICAL JET GANG ASSEMBLIES SHOWN ON H-2-53270.
6. — PIPING MATERIAL CODE TO BE PER H-2-31750.
7. — TYPICAL MICROPHONE & HOUSING SHOWN ON H-2-54703. MICROPHONES TO BE SUPPLIED & INSTALLED BY PUREX PLANT.

T — TEMPERATURE
F — FLOW
P — PRESSURE
SG — SPECIFIC GRAVITY, SIGHT GLASS.
WF — WEIGHT FAIROR
DP — DIFFERENTIAL PRESSURE
A — AMPERE
R — RADIATION
I — INTERFACE
pH — ACIDITY
K — FIRE

A — ALARM, AMMETER
DOV — DIAPHRAM OPERATED VALVE
JGV — JET GANG VALVE
JBV — JET BLOCK VALVE
MIKE — MICROPHONE
PRV — PRESSURE REDUCING VALVE
SPK — SPEAKER
SS — SELECTOR SWITCH
VS — VALVE SELECTOR
MC — VALVE CONTROLLER (MANUAL)
⊖ — PANEL BOARD MOUNTING
○ — LOCAL MOUNTING
⊞ — STEAM TRAP
⊞ — GLOBE VALVE
⊞ — GATE VALVE
⊞ — ORIFICE
⊞ — STRAINER
⊞ — CONNECTOR (USED)
⊞ — CONNECTOR (NOT USED)
⊞ — DOV, PRV. (N.O. — NORMALLY OPEN)
⊞ — JET (N.C. — NORMALLY CLOSED)
⊞ — SIGHT GLASS
SV — SOLENOID VALVE
MS — MOTOR SWITCH
SPL — SAMPLER
⊞ — ROTOMETER
VC — VALVE CONTROLLER
N — CHECK VALVE (→ FLOW)
⊞ (VPR) — VALVE PRESSURE RECORDER
⊞ (CVT) — ELECTRONIC PNEUMATIC CONVERTER
⊞ (MAGNETIC) — MAGNETIC FLOW METER

DRAWING NUMBER	INDEX NO	TITLE
SK-2-19958 SHEET-1	7001	ENGINEERING FLOW DIAGRAM - 'A' CELL
SK-2-19958 SHEET-2	0000, 7001	ENGINEERING FLOW DIAGRAM - NOTES, INDEX & LEGEND
SK-2-19959 SHEET-1	7000	PROCESS FLOW DIAGRAM
SK-2-19959 SHEET-2	7000	PROCESS FLOW DIAGRAM
SK-2-19959 SHEET-3	7000	PROCESS FLOW DIAGRAM
SK-2-19961	7001	ENGINEERING FLOW DIAGRAM - 'D' CELL
SK-2-19962	7001	ENGINEERING FLOW DIAGRAM - 'E' CELL
SK-2-19965	8404	'A' CELL ARRANGEMENT
SK-2-19966	8404	'A' CELL ELEVATION (FROM SOUTH WALL)
SK-2-19967	8404	PLAN OF CATCH TANK & DUNNAGE
SK-2-19968 SHEET-1	2500	ANNULAR DISSOLVER ASSEMBLY
SK-2-19968 SHEET-2	2500	ANNULAR DISSOLVER DETAILS
SK-2-19968 SHEET-3	2500	ANNULAR DISSOLVER INSERT
SK-2-19969	2500	AMMONIA SCRUBBER
SK-2-19970 SHEET-1	8404	'D' CELL ARRANGEMENT
SK-2-19970 SHEET-2	8404	'D' CELL ARRANGEMENT
SK-2-19971 SHEET-1	8404	'E' CELL ARRANGEMENT
SK-2-19971 SHEET-2	8404	'E' CELL ARRANGEMENT
SK-2-19971 SHEET-3	8404	'E' CELL ARRANGEMENT
SK-2-19960	7001	ENGINEERING FLOW DIAGRAM - 2 AF TANK
SK-2-19963	7001	ENGINEERING FLOW DIAGRAM - 3WB STORAGE
SK-2-19964	0404, 2500	ARRANGEMENT OF TANKS TK-F7 & TK-F26
SK-2-19972	0901	CANYON SUMP INFORMATION
SK-2-19973	4700, 8407	'N' CELL SUMP MODIFICATIONS
SK-2-19974	2500	2-AF TANK TK-J5
SK-2-19975	8512	HYDRAULIC SCHEMATIC 2-AF TANK
SK-2-19976	1902, 2500	SUMP MODIFICATIONS 'J' & 'K' CELLS
SK-2-19977	8405	KNOCK OUT POT 2-AF VENT

AS — ALARM SW'CH
RC — RECORDING CONTROLLER
IC — INDICATING CONTROLLER
C — CONTROLLER
R — RECORDER
I — INDICATOR
X — INTEGRATOR
2E — ELEMENT

1	DI-3058 DELETED "SCOPE" (13-6)	REV NO	DATE	APP'D BY	FOR	DATE	REFERENCE DRAWINGS	
2	SYMBOLS & DIM. INDEX 0-34 MADE ADDITIONS TO MISS. 0-34	REV NO	DATE	APP'D BY	FOR	DATE	NEXT USED ON	
3	2220 SLS 19977 (2-18)	REV NO	DATE	APP'D BY	FOR	DATE	DRAWING TITLE	

CHECK PRINT ☐		COMMENT PRINT ☐		APPROVED FOR CONST		U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION					
BY		FOR		DATE		REV					
ISSUE NO 1		DATE 10/24/58		ISSUE NO		DATE		APPROVED FOR PURCHASE			
BY		FOR		DATE							
SCALE NONE		DATE 10/24/58		APPROVED FOR DESIGN							
DRAWN <i>[Signature]</i>		DATE 10/24/58		BY		FOR		DATE			
CHECKED <i>[Signature]</i>		DATE 10/24/58		DATE 10/24/58		FOR		DATE			
DES. NO. <i>[Signature]</i>		DATE 10/24/58		DATE 10/24/58		FOR		DATE			
FACILITY <i>[Signature]</i>		DATE 10/24/58		DATE 10/24/58		FOR		DATE			
CNC-124		3058		CLASSIFICATION		BLDG NO		INSTR NO		1001	
CLASSIFIED BY <i>[Signature]</i>		DATE 10/24/58		NONE		DWS NO		SK-2-19958		2 2	

NOTES:

1. THESE JUMPERS TO BE INSTALLED WHEN NECESSARY TO FLUSH 2AF TO TK-J1. DESIGN & FABRICATE, DO NOT INSTALL.
2. SEE SK-2-19958, SHEET #2, FOR LEGEND, SYMBOLS & NOTES ON INSTRUMENTS, VALVES, ETC.
3. THE PORTIONS OF THE L-CELL PACKAGE & ASSOCIATED ROUTINGS SHOWN ARE FUNCTIONAL ONLY. ROUTINGS ARE THOSE PROPOSED FOR RETURNING PLUTONIUM REWORK TO THE 2AF TANK & ARE PART OF THE SCOPE DESIGN OF THE PLUTONIUM REWORK PACKAGE FOR 'L'-CELL.

SK-2-19960-2

CHECKED BY: DATE: SCALE: NONE DRAWING NO: REVISIONS:				APPROVED FOR CONST. DATE: APPROVED FOR PURCHASE DATE: APPROVED FOR DESIGN DATE:				U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC ENGINEERING FLOW DIAGRAM-2AF TANK INCREASED PROCESSING FLEXIBILITY 202-A 7001 SK-2-19960			
NO. DESCRIPTION REV. DATE				NO. DESCRIPTION REV. DATE				NO. DESCRIPTION REV. DATE			
NO. DESCRIPTION REV. DATE				NO. DESCRIPTION REV. DATE				NO. DESCRIPTION REV. DATE			

M	D.I. 3356 APP NOTE B (D-1)	BHL 6-10-69	2-1-74 1-1-74 1-1-74	AND APR 1-1-74	1-1-74 1-1-74 1-1-74	1 SK-2-19950 SHEET 2 DRAWING INDEX
NO	DESCRIPTION	REV BY	APP BY	FOR	DATE	REFERENCE DRAWINGS
	REVISIONS

SECTION A-A
PARTIAL PLAN TKS. F7 & F26 - NOMINAL 4,000 GAL CAPACITY, EACH SIDE - TKS ARE SEPARATE, BUT MOUNTED ON COMMON DUNNAGE. STRAIGHT SIDES OF TANKS TO BE FASTENED TOGETHER WITH SPACERS SO THERE WILL BE AIR SPACE BETWEEN.

SECTION ELEVATION
1/4" = 1'-0"

SK-2-19964

GENERAL NOTES

- TOP OF TANKS TK-F26 & TK-F7 TO BE 684'-3 1/2" (NOM.) SO THAT EXISTING PUMPS, AGITATORS & JUMPERS CAN BE UTILIZED TO THE FULLEST EXTENT.
- VESSELS TO BE BUILT OF 304-L SST CONFORMING TO ASTM-A240 (PLATE), PIPE & FITTINGS ASTM-A312 (PIPE) & WELD ROD ASTM-A208, A371.
- FABRICATION TO CONFORM TO HWS-5530, HWS 8241 & HWS 8225 FOR QUALITY CLASS WELDING.
- ALL DUNNAGE TO BE OF CARBON STL CONFORMING TO ASTM-A36 - PAINTING OF CARBON STL SHALL CONFORM TO HWS-5562, MV-3 SYSTEM, FINAL COAT BLACK.
- ALL SST WELDS SHALL BE CHECKED BY FLUORESCENT DYE - PENETRANT METHOD ACCORDING TO HWS 8226.
- HYDROSTATICALLY TEST COMPLETED VESSEL & COILS.
- COIL DESIGN FOR TANKS F26 & F7 SHALL BE GENERALLY IN ACCORDANCE WITH HW-6959.

- OPERATING CONDITIONS: (BOTH TKS UNLESS OTHERWISE STATED)
INTERNAL PRESSURE - -5 INCHES WATER GAUGE @ TOP TO 5 PSIG @ BOTTOM
EXTERNAL PRESSURE - ATMOSPHERIC
TEMPERATURE - 65° TO 236°F (F-26) - 65° TO 150°F (F-7)
FLUID - AQUEOUS SOLUTION OF NITRIC SALTS.
- DESIGN CONDITIONS: (BOTH TKS UNLESS OTHERWISE STATED)
INTERNAL PRESSURE - -10 INCHES WATER GAUGE TO 7.5 PSIG
EXTERNAL PRESSURE - -1 INCH WATER GAUGE
TEMPERATURE - 300°F
CORROSION ALLOWANCE - 1/8"
- TOLERANCES:
CONNECTORS: ± 8"
FLANGE DOWELS: ± 2"
TRUNNIONS: ± 1/2"
- NOZZLES M, N, KK & MM ARE TO BE 6". ALL OTHER NOZZLES ON THE TANKS ARE TO BE 5".
- THE NEW P-F7 PUMP IS THE PRESENT P-F7 PUMP RELOCATED. THE A-F26 AGITATOR IS THE PRESENT A-F7 AGITATOR REUSED.

- THE PIPING ATTACHED TO NOZZLE 'MM' ENTERS TANK TK-F7 & TANK TK-F26.
- NOZZLE 'QQ' RESTS ON TANK TK-F26 BUT ENTERS TANK TK-F7 ONLY.

LEGEND

- NEW JUMPERS.
- EXISTING JUMPERS.

CHECK POINT		COMMENT		APPROVED FOR CONST.		U. S. ATOMIC ENERGY COMMISSION	
DATE	TIME	DATE	TIME	DATE	TIME	HANFORD ATOMIC PRODUCTS OPERATION	
SCALE 1/4" = 1'-0"				APPROVED FOR PURCHASE		GENERAL ELECTRIC	
DRAWN BY LAYFIELD				APPROVED FOR DESIGN		ARRANGEMENT OF TANKS	
CHECKED BY				DATE		TK-F7 & TK-F26	
PROJECT NO. H-2-5531				DRAWING TITLE		INCREASED PROCESSING FLEXIBILITY	
NEXT USED ON				REFERENCE DRAWINGS		H-2-5531	
REV. BY				DATE		NONE	
REV. BY				DATE		SK-2-19964

SECTION-XX
DEEP SUMPS SH & SUB

SUMP SLA (K&L CELL)

SECTION-DD

SECTION -YY

TRENCH & TUNNEL DRAINAGE

TABLE I 202-A CANYON SUMPS					
	DATE	TIME	WIND DIRECTION	WIND VELOCITY	WAVE HEIGHT
1	7-18-69	0800	SSE	10	1.5
2	7-18-69	0900	SSE	10	1.5
3	7-18-69	1000	SSE	10	1.5
4	7-18-69	1100	SSE	10	1.5
5	7-18-69	1200	SSE	10	1.5
6	7-18-69	1300	SSE	10	1.5
7	7-18-69	1400	SSE	10	1.5
8	7-18-69	1500	SSE	10	1.5
9	7-18-69	1600	SSE	10	1.5
10	7-18-69	1700	SSE	10	1.5
11	7-18-69	1800	SSE	10	1.5
12	7-18-69	1900	SSE	10	1.5
13	7-18-69	2000	SSE	10	1.5
14	7-18-69	2100	SSE	10	1.5
15	7-18-69	2200	SSE	10	1.5
16	7-18-69	2300	SSE	10	1.5
17	7-18-69	2400	SSE	10	1.5
18	7-18-69	2500	SSE	10	1.5
19	7-18-69	2600	SSE	10	1.5
20	7-18-69	2700	SSE	10	1.5
21	7-18-69	2800	SSE	10	1.5
22	7-18-69	2900	SSE	10	1.5
23	7-18-69	3000	SSE	10	1.5
24	7-18-69	3100	SSE	10	1.5
25	7-18-69	3200	SSE	10	1.5
26	7-18-69	3300	SSE	10	1.5
27	7-18-69	3400	SSE	10	1.5
28	7-18-69	3500	SSE	10	1.5
29	7-18-69	3600	SSE	10	1.5
30	7-18-69	3700	SSE	10	1.5
31	7-18-69	3800	SSE	10	1.5
32	7-18-69	3900	SSE	10	1.5
33	7-18-69	4000	SSE	10	1.5
34	7-18-69	4100	SSE	10	1.5
35	7-18-69	4200	SSE	10	1.5
36	7-18-69	4300	SSE	10	1.5
37	7-18-69	4400	SSE	10	1.5
38	7-18-69	4500	SSE	10	1.5
39	7-18-69	4600	SSE	10	1.5
40	7-18-69	4700	SSE	10	1.5
41	7-18-69	4800	SSE	10	1.5
42	7-18-69	4900	SSE	10	1.5
43	7-18-69	5000	SSE	10	1.5
44	7-18-69	5100	SSE	10	1.5
45	7-18-69	5200	SSE	10	1.5
46	7-18-69	5300	SSE	10	1.5
47	7-18-69	5400	SSE	10	1.5
48	7-18-69	5500	SSE	10	1.5
49	7-18-69	5600	SSE	10	1.5
50	7-18-69	5700	SSE	10	1.5
51	7-18-69	5800	SSE	10	1.5
52	7-18-69	5900	SSE	10	1.5
53	7-18-69	6000	SSE	10	1.5
54	7-18-69	6100	SSE	10	1.5
55	7-18-69	6200	SSE	10	1.5
56	7-18-69	6300	SSE	10	1.5
57	7-18-69	6400	SSE	10	1.5
58	7-18-69	6500	SSE	10	1.5
59	7-18-69	6600	SSE	10	1.5
60	7-18-69	6700	SSE	10	1.5
61	7-18-69	6800	SSE	10	1.5
62	7-18-69	6900	SSE	10	1.5
63	7-18-69	7000	SSE	10	1.5
64	7-18-69	7100	SSE	10	1.5
65	7-18-69	7200	SSE	10	1.5
66	7-18-69	7300	SSE	10	1.5
67	7-18-69	7400	SSE	10	1.5
68	7-18-69	7500	SSE	10	1.5
69	7-18-69	7600	SSE	10	1.5
70	7-18-69	7700	SSE	10	1.5
71	7-18-69				

CELL	LENGTH	SUMP	TYPE	W	POINT ON REFERENCE	E	EL J	EL K	REFERENCE
A	35'-0"	SA	1	—	COL 42	12'-6"	673-95	673-97	H-2-520B3
B	35'-0"	SB	1	7'-6"	COL 41	—	673-92	673-93	H-2-520B5
C	35'-0"	SC	1	—	COL 39	11'-6"	673-98	673-99	H-2-520B3
D	65'-0"	SD	1	—	COL 37	7'-3"	673-05	673-08	H-2-520B3
E	71'-0"	SE	3	6'-9"	COL 35	—	673-78	673-78	H-2-520B6
F	151'-0"	SFA	1	2'-9"	COL 30	—	673-62	673-64	H-2-520B7 & 8
F	65'-0"	SFB	1	—	COL 25	4'-5"	673-63	673-64	H-2-520B7
G	109'-0"	SG	1	—	COL 22	9'-3"	673-72	673-73	H-2-520B7
H & J	117'-0"	SU	2	—	COL 16	4'-9"	673-77	673-68	H-2-520B6 & 7
J & K	111'-6"	SK	2	—	COL 10	5'-9"	673-77	673-68	H-2-520B6
K & L	60'-0"	SLA	SPECIAL SUMP (SEE SKETCH ABOVE)				H-2-520B5, H-2-520B7

—PLAN—
TYPICAL CELL

SECTION - AA

SECTION-"BB"

TYPE I

TYPE II

TYPE III

—DETAIL I—

FOR INFORMATION ONLY

CHECK PRINT ☐ COMMENT PRINT ☐		APPROVED FOR COMBAT ☐ YES ☐ NO		U S ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC	
Issue No DATE	Issue No DATE	APPROVED FOR PURCHASE ☐ YES ☐ NO		SCALE NONE	
MEASUREMENT <i>Handwritten</i>		APPROVED FOR DESIGN ☐ YES ☐ NO		CANYON SUMP	
DIVISION <i>Handwritten</i>		<i>Handwritten</i>		INFORMATION	
GGC-124 3058		INCREASED PROCESSING FLEXIBILITY Model 202-A		Model 0901	
NONE		NONE		SK-2-19972

SECTION "AA"
REQUIRED (3) PLACES

1. PROVIDE HOLES IN CONCRETE & HOOD FOR ROUTING OF LINES AS SHOWN. SEAL AROUND LINES AFTER INSTALLATION.
2. ALL NEW PIPING TO BE 304-L STAINLESS STEEL.
3. VACUUM TRANSFER SUCTION PIPE & LIQUID LEVEL ALARM INSTRUMENT TO BE RIGIDLY SUPPORTED. SUPPORTING HARDWARE TO BE DESIGNED TO CLAMP OR BOLT IN PLACE INSIDE HOOD.
4. METAL PARTS USED IN PLUGS TO BE 304 OR 316 S.S. PLUGS ARE TO PROVIDE A SEAL TO PREVENT LIQUID SEEPAGE. GASKET MATERIAL TO BE TEFLON.

SK-2-1997E

NEW _____
EXISTING _____
ELECTRICAL—E—E—

[illegible]

NOZZLE SCHEDULE			
NOZZLE	SIZE	FUNCTION	RELATED JUMPERS
A	2	1BP INLET	NEW DESIGN
B	2	P6-J4 PISTON LEAKAGE	NEW DESIGN
C	2'	COMBINED RECYCLE INLET	NEW DESIGN
D	3	1B MT OUT INLET	NEW PER H-2-53551 ★
F	4	VESSEL VCNT	NEW DESIGN
F	2	PROCESS SPARE	NOZZLE TO BE BLANKED
G	3	COIL OUTLET	NEW PER H-2-53551 ✓ IMPROVED
H	2	J5 MT OUT. OUTLET	NEW DESIGN NOZZLE NORMALLY BLANKED
J	3	COIL INLET	NEW PER H-2-53551 ★
K	1	AIR SPARGE INLET	NEW DESIGN
L	2	SP GR & WF	NEW DESIGN
M	2	SAMPLER	NEW DESIGN
N	2	TEMP & MIKE	NEW DESIGN
P	2	CHEM ADD	NEW DESIGN
R	3'	NA ₂ O ₂ INLET	NEW PER H-2-53551 ★
S	2 3/4 FLG	PUMP FLANGE (H-2-59352)	NEW DESIGN OF DISCHARGE & SERVICE JUMPERS FROM PUMP
T & U	2'	SPARE	NOZZLE TO BE BLANKED
V	2'	LIQUID RETURN	NEW DESIGN

★ EXISTING JUMPER DRAWINGS USED ARE TO BE REVISED TO SHOW UPDATED MATERIAL & FABRICATION SPECIFICATIONS

GENERAL NOTES

1. RELATIVE POSITIONS OF NOZZLES, PIPING, ETC. SHOWN ON THIS DRAWING TO BE HELD IN DETAIL DESIGN FOR PROCESS & NUCLEAR SAFETY CONSIDERATIONS. BOTTOM OUTLETS TO PUMP BOOT TO BE LOCATED SO THAT THEY ARE A MINIMUM OF 6" FROM NEAREST HOLE IN SPARGE RING.
2. ENTIRE VESSEL EXCEPT DUNNAGE & MODERATOR SNAILS TO BE BUILT OF TYPE 304-L 5 STL. CONFORMING TO NUGS-826RS SPECIFICATION. MODERATOR SNAILS TO BE TYPE 304-L 5 STL. CONFORMING TO ASTM-A-240.
3. DUNNAGE SHALL BE BUILT FROM ASTM-A-86 CARBON STEEL. ALL EXPOSED CARBON STEEL SURFACES SHALL BE PAINTED WITH 5 COATS AMERCOAT 74, OR 5 COATS LANXIDE 1000, OR APPROVED EQUAL IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS. FINAL COLOR SHALL BE BLACK.
4. FABRICATION SHALL CONFORM TO NUGS-593B & NUGS-8241. ALL WELDS SHALL BE SHOWN WITH SYMBOLS PER ASME-193.3. ALL WELD JOINTS EXPOSED TO PERCESS SOLUTION SHALL BE FULL PENETRATION WELDS TO PROVIDE A HOMOGENEOUS AND EQUAL TO THE THINNEST SECTION BEING JOINED. COIL WELDS TO BE RADIOGRAPHED ACCORD TO NUGS-8227. ALL OTHER WELDS EXPOSED TO PERCESS SOLUTION TO BE INSPECTED BY INDICENT OR PENETRANT METHOD ACCORDING TO NUGS-8226.
5. HYDROTEST COMPLETED VESSEL & COIL.
6. DESIGN CONDITIONS:
 - INTERNAL PRESSURE - $-20^{\circ}\text{H}_2\text{O}$ 10.5 PSIG.
 - EXTERNAL PRESSURE - ATM.
 - TEMPERATURE - 340°F
 - CORROSION ALLOWANCE - $\frac{5}{64}$
7. TOLERANCES:
 - CONNECTORS: $\pm \frac{1}{8}$
 - FLANGE DOWELS $\pm \frac{1}{32}$
 - TRUNNIONS: $\pm \frac{1}{32}$
8. OPERATING CONDITIONS:
 - INTERNAL PRESSURE - $-10^{\circ}\text{H}_2\text{O}$ TO 4 PSIG @ BOTTOM.
 - EXTERNAL PRESSURE - ATM.
 - TEMPERATURE - 131°F .
 - FLUID - AQUEOUS SOLUTION OF NITRIC SALTS 17% HNO_3

PARTIAL ELEVATION
FOR TRUE ORIENTATION SEE PLAN VIEW
COIL & SPARGE RING DETAIL

-SECTION-'AA'-
FOR TRUE ORIENTATION SEE PLAN

— ELEVATION —

[illegible]

HW-84085
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GENERAL NOTES:

- 1 THE AMOUNT OF BORAL PLATE REMOVED FROM THE PATTERN FOR JUMPER WELLS IS NOT TO EXCEED THAT ACTUALLY REQUIRED FOR THE MINIMUM ADEQUATE DIP LEG CLEARANCE.
- 2 JUMPER WELL LOCATIONS ARE NOT THE SAME FOR S-J & S-K (SEE DIMENSION TABLE)
- 3 BORAL SHEETS TO BE SHEATHED IN 16 GAUGE S ST, TYPE 304-L. SHEATHING TO BE SEALED BY WELDING. WELDS TO BE CHECKED BY FLUORESCENT DYE PENETRANT METHOD ACCORDING TO HWS-8226
- 4 ALL MATERIAL OTHER THAN BORAL, TO BE TYPE 304-L S ST. FABRICATION TO CONFORM TO HWS-5938, HWS-8241 & HWS-8225
- 5 EXISTING JET OUT & SAMPLER JUMPERS ARE TO BE USED. WT FACTOR & SG JUMPERS WILL REQUIRE MODIFICATION
- 6 A PLANT INVESTIGATION IS TO BE MADE TO DETERMINE THE CONDITION OF THE CONCRETE SUMP STRUCTURE. DIMENSIONS MAY HAVE TO BE ALTERED AS A RESULT OF THIS INVESTIGATION TO OBTAIN SATISFACTORY POSITIONING.

SUMP		A	B	C
S-K	X	-	0	6'
	X ₁	6	-	-
	Y	18	4 1/16	4 1/16
S-J	X	-	-	0
	X ₁	5 7/16	6	-
	Y	15 1/4	4 1/16	4 1/16

INFO. FOR ARCH. ENGR.

CUT OUT SECTIONS OF BORAL PLATES (BOTH TOP & BOTTOM SECTIONS) TO ALLOW CLEARANCE FOR JUMPER DIP LEGS (SEE NOTE #1)

PROVIDE GUIDES IN UPPER SECTION FOR EASE OF JUMPER INSTALLATION

JET OUT SAMPLER
WT FTR, SG, & CELL D.P.

GUIDES FOR DIP LEGS
SEE NOTE ABOVE

PROVIDE LIFTING TRUNNION OR BAIL ON EACH SECTION

PROVIDE GUIDES TO INSURE PROPER ALINEMENT OF STACKED SECTIONS

SEE DETAIL I

SECTION-AA

SECTION-BB
SHOWING BOTH SECTIONS
IN POSITION

SK-2-19976

CHECK PRINT	COMMENT PRINT	APPROVED FOR CONST	U S ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC
DATE	DATE	DATE	DATE
SCALE	APPROVED FOR PURCHASE	APPROVED FOR DESIGN	SUMP MODIFICATIONS
CHECKED	DATE	DATE	J & K CELLS
DATE	DATE	DATE	INCREASED PROCESSING FLEXIBILITY
DATE	DATE	DATE	202-A
DATE	DATE	DATE	2500, 1902
DATE	DATE	DATE	SK-2-19976
DATE	DATE	DATE	DATE

QTY.	PT. NO.	DESCRIPTION
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- NOTE:**
1. POT TO BE INCLUDED IN VENT JUMPER FROM TK-U5 NOZ. "E" (SK-2-19974) TO WALL CONNECTOR J-739. LIQUID RETURN TO NOZ. "V" MAY BE PART OF VENT JUMPER ASSY. OR SEPARATE JUMPER.
 2. SEE DWG. SK-2-19974 FOR GENERAL NOTES.

SK-2-19977 / 0

NO.	DESCRIPTION	REV. BY DATE	APP'D BY	FOR DATE	NEXT US

DRAWING TITLE
REFERENCE DRAWINGS
ON

CHECK PRINT	COMMENT PRINT	APPROVED FOR CONST.		U. S. ATOMIC ENERGY COMMISSION HANFORD ATOMIC PRODUCTS OPERATION GENERAL ELECTRIC	
ISSUE NO.	DATE	ISSUE NO.	DATE	APPROVED FOR PURCHASE	KNOCK OUT POT FOR 2AF VENT
SCALE NONE				APPROVED FOR DESIGN	
DRAWN BY L. B. BROWN				DATE 6-11-64	
CHECKED	DATE	DATE	DATE	DATE	INDEX NO. 8405
ISSUED	DATE	DATE	DATE	DATE	SK-2-19977
PROJECT	INST. NO. 3956	CLASSIFICATION	NONE		