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TITLE

CONTINUOUS TASK I - II

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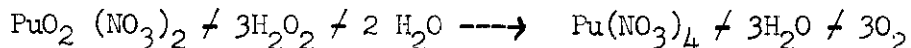
CONTINUOUS TASK I - II

Process Description

The new Task I - II facility for processing plutonium nitrate includes equipment for pre-reduction of the nitrate, precipitation of the plutonium as the oxalate, filtration and calcination of the oxalate to PuO₂, and hydrofluorination of the PuO₂ to PuF₄. The pre-reduction step is batch-wise while all other steps are performed continuously. Refer to drawings H-2-22912 and H-2-22913.

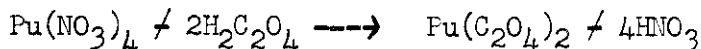
Pre-reduction

The plutonium nitrate feed solution is reduced from hexavalent (Pu VI) to tetravalent plutonium (Pu IV) with hydrogen peroxide in the pre-reduction tank (PRT).



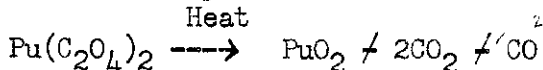
Precipitation & Filtration

The reduced solution is then transferred from the Pre-reduction Tank (PRT) to the Transfer Head Tank (THT) where it is fed continuously to the Reactor (RCTR). In the Reactor, the plutonium nitrate is converted to a plutonium oxalate slurry by the metered addition of oxalic acid.

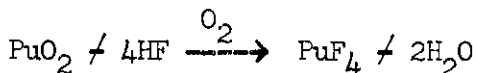


The resultant oxalate slurry overflows from the Reactor to the Vacuum Drum Filter (VDF) where the plutonium oxalate is separated from the filtrate solution. The plutonium oxalate is fed to the Calciner (CLNR) while the filtrate solution is transferred to the Vacuum Receiver (VR).

The plutonium oxalate is converted to plutonium dioxide in the Calciner which is maintained at a temperature of 350°C - 400°C.



The plutonium dioxide flows from the Calciner to the Fluorinator (FLJR) which is maintained at a temperature of 450°C - 500°C. The plutonium dioxide is converted to plutonium tetrafluoride in an atmosphere of gaseous hydrogen fluoride and oxygen. The oxygen maintains an oxidizing atmosphere to insure the complete formation of the tetrafluoride rather than the tri-fluoride.



The plutonium tetrafluoride powder is then batch transferred to Task III for reduction to metal.

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Filtrate

The filtrate and wash solution, which contain approximately one percent of the plutonium introduced to the system, is transferred from the Vacuum Receiver Tank (VRT) to the Filtrate Kill Tank (FKT). Potassium permanganate is added continuously to the Filtrate Kill Tank to destroy excess oxalic acid and plutonium oxalate solids. The decomposed filtrate is continuously treated in a Filtrate Catch Tank (FCT) with hydrogen peroxide to destroy excess permanganate ion and any resulting manganese dioxide. The treated filtrate is transferred to the Recuplex evaporator for volume reduction and plutonium recovery.

Equipment Description

The new Task I - II processing equipment is housed in Hoods H-7 and H-9. Hood H-7 contains the equipment for reducing the plutonium nitrate feed solution, decomposing the oxalate and manganous ions in the filtrate solutions, and transferring solutions to Hood H-9 and to the Recuplex concentrator. Hood H-9 contains the equipment for precipitating the plutonium nitrate as oxalate, filtering and calcining the plutonium oxalate to plutonium oxide, and converting the plutonium oxide to plutonium tetrafluoride. The remainder of the equipment in Hood H-9 is for collecting the filtrate and condensates, transferring these solutions to Hood H-7, and transferring the plutonium fluoride powder to Task III.

Hood H-7 - Pre-reduction and Filtrate Treatment

The Pre-reduction Tank (PRT) is constructed of double strength glass pipe and has a nominal volume of 15 liters. It is equipped with a propeller type agitator and associated piping for additions of plutonium nitrate feed, hydrogen peroxide, nitric acid and distilled water. The hydrogen peroxide line is equipped with a measuring chamber which automatically refills. All additions into the Pre-reduction Tank are made by either vacuum or gravity flow. Transfers out of the Pre-reduction Tank are by gravity flow.

The Transfer Head Tank (THT) is constructed of stainless steel pipe and has a nominal volume of 15 liters. It is equipped with a level indicator, high level alarm, sampler, and associated piping. Potassium permanganate may be introduced to the system at this point. All transfers out of the Transfer Head Tank are by means of a metering pump.

The Filtrate Kill Tank (FKT) and the Filtrate Catch Tank (FCT) are the principle components of the filtrate treatment system. These tanks are both constructed of double strength glass pipe and are connected through bottom coupling by means of two 90° elbows. One of the elbows is constructed of double strength glass for visibility in case of solids build-up, and the other of stainless steel pipe. The Filtrate Kill Tank is equipped with an agitator, immersion heater, high temperature cut-out, metered potassium permanganate addition line, and a filtrate addition line. The decomposed filtrate is transferred from the bottom of the Filtrate Kill Tank into the bottom of the Filtrate Catch Tank.

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The Filtrate Catch Tank is equipped with a metered hydrogen peroxide addition line which feeds the hydrogen peroxide into the bottom of tank concurrent with the filtrate flow. The filtrate is discharged from the Filtrate Catch Tank through a $1\frac{1}{2}$ inch overflow line into the Filtrate Storage Tank (FST).

The stainless steel coupling elbow is equipped with two half-inch stainless steel lines. One line is located at the bottom of the elbow and the other at the top of the elbow and they are interconnected by means of a pump for recycling purposes.

The Filtrate Storage Tank (FST) is constructed of double strength glass pipe with a nominal volume of 30 liters. This tank is equipped with a pump-actuating float switch for transferring the filtrate to the Recuplex evaporator. The transfer line between the Filtrate Storage Tank and the pump is equipped with a sampler. The Filtrate Storage Tank is also equipped with a hydrogen peroxide addition line.

Hood H-9 (Task I and II)

The Reactor (RCTR) is constructed of double strength glass and has a nominal volume of 36 liters. The reactor is equipped with a mechanical agitator, metered plutonium nitrate and oxalic acid feed lines, a $1\frac{1}{2}$ inch overflow line to the Vacuum Drum Filter, and recirculation lines coupled through a pump. The plutonium oxalate formed in the reactor is overflowed continuously to the filter. The reactor cleanout solutions are heated by an in-line heater in the recirculation lines.

The Vacuum Drum Filter (VDF) is constructed of stainless steel and is equipped with a pan to hold the slurry. The overflow volume of the filter pan is 4 liters. The filtering medium of the vacuum drum filter is Dynel cloth. The slurry in the filter pan is constantly agitated by means of a variable speed drive which also turns the filter drum. In order to control the critical mass volume of the filter drum and pan, the void spaces inside the filter drum are filled with paraffin and the slurry pan is equipped with a high level alarm and an overflow line at 4 liters. The plutonium oxalate cake is washed on the filter drum by means of a spray head.

The Calciner (CINR) is constructed of stainless steel and consists of a horizontal trough, screw conveyor, conveyor drive, heaters, insulation jacket, off-gas condensor, filters, and air supply. The plutonium oxalate is fed into the calciner through a rotary feed valve, and the resultant plutonium oxide is collected in a stainless steel hopper equipped with calcium fluoride sight glasses. The air enters the discharge end of the calciner and flows counter-current to the product flow in order to insure a dry plutonium oxide powder. The condensate from the off-gas condensor is collected in the Condensate Receiver. The Calciner is vented to the 26-inch vacuum system.

The Fluorinator (FLUR) consists of an oval-shaped fluorinator tube, vibrator, heaters, piping, and valves. The Fluorinator tube is fabricated from inconel and is lined with platinum. It is also

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equipped with calcium fluoride sight glasses at both ends. The plutonium oxide is fed into the Fluorinator through a rotary feed valve and is then moved through the Fluorinator by intermittent vibration. The resultant plutonium tetrafluoride is collected in a stainless steel hopper equipped with calcium fluoride sight glasses and is then fed to a powder pan by means of a rotary discharge valve. The gas flow through the Fluorinator is countercurrent to the powder flow. The hydrogen fluoride gas is introduced at the outlet end of the Fluorinator after it has been pre-heated by passing it through a line encased within the heater jacket. The oxygen is introduced into the system at the Fluorinator discharge hopper. The gas flow rates are controlled by means of rotameters. The fluorinator off-gasses are exhausted through a filter and a condenser by means of a water aspirator. Water from the aspirator and the off-gas condenser are discharged to the D-6 drain.

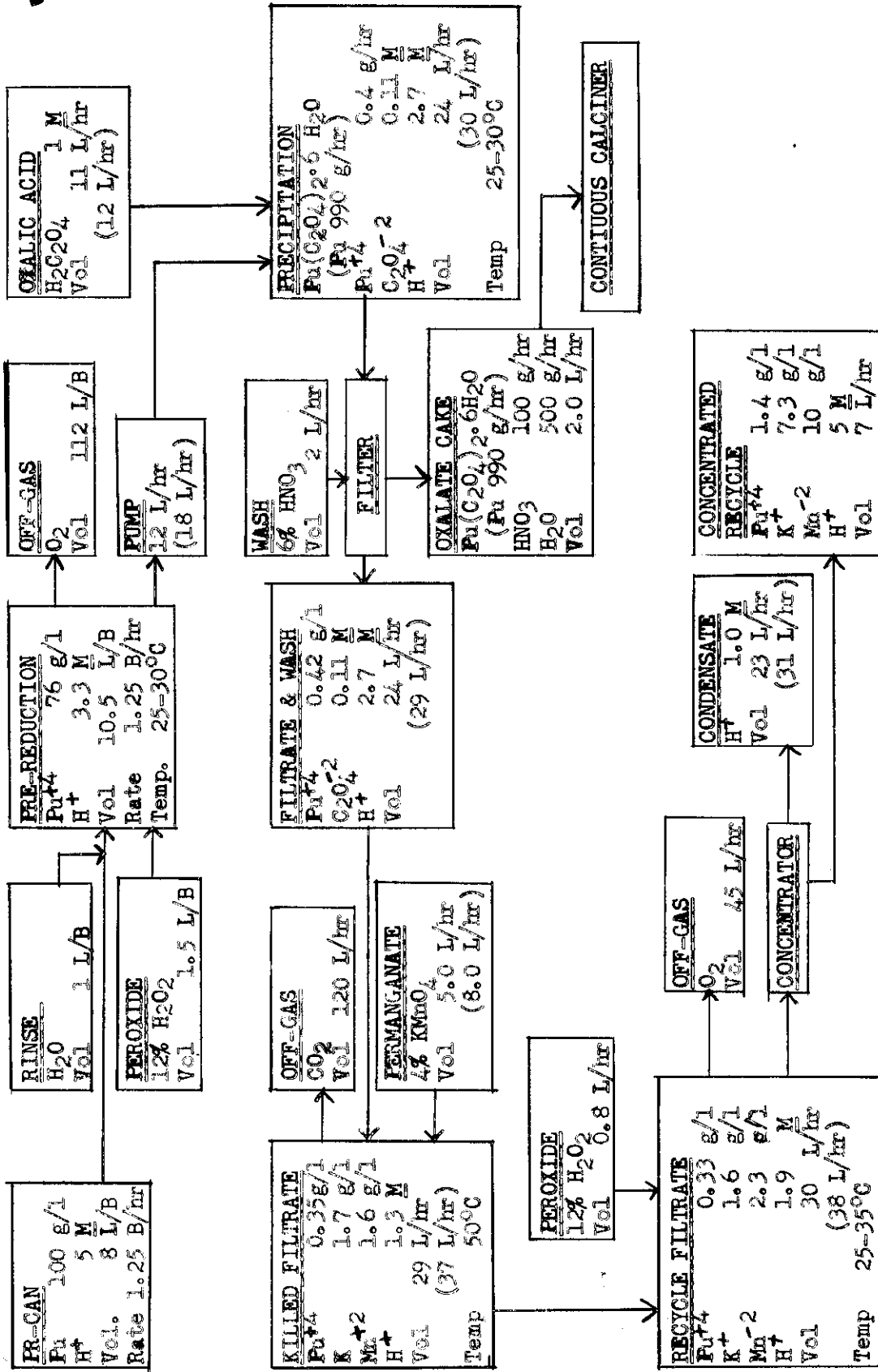
The Vacuum Receiver Tank (VRT), the Overflow Tank (OT), and the Condensate Receiver Tank (CRT) comprise the filtrate receiving system for Hood H-9. All three tanks are constructed of 6-inch diameter glass pipe with stainless steel flanges.

The Vacuum Receiver Tank is equipped with a vacuum and vent line, vacuum gauge, a level control for the outlet pump, a 10-inch stand pipe, and two inlet lines (one extending to the bottom of the tank). All transfers to the Vacuum Receiver Tank are made by vacuum. Filtrates and slurries may be received into the Vacuum Receiver Tank from the Vacuum Drum Filter, the Overflow Tank, the Condensate Receiver Tank, and from the bottom section floor sump of Hood H-9. The piping is so arranged that filtrates may be pumped out of the bottom of the Vacuum Receiver Tank to the Filtrate Kill Tank in Hood H-7 (normal routing), or recycled from the Vacuum Receiver Tank by means of the dip leg and a pump back to the Reactor or Vacuum Drum Filter.

The Overflow Tank is equipped with two inlet lines, one outlet line, and an agitator. The inlet lines receive plutonium oxalate slurry from the Vacuum Drum Filter and solutions from the top section floor sump of Hood H-9. The material in the Overflow Tank is transferred out of the tank through a dip leg to the Vacuum Receiver Tank by vacuum or to the Reactor or Vacuum Drum Filter by means of a pump.

The Condensate Receiver Tank is equipped with an inlet line and an outlet line (dip leg). The inlet line receives the condensate from the Calciner off-gas condenser. The Condensate Receiver Tank is periodically emptied to the Vacuum Receiver Tank.

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NOTE: Values in parentheses indicate maximum flow rates.

FIGURE I
CONTINUOUS TASK I FLOWSHEET

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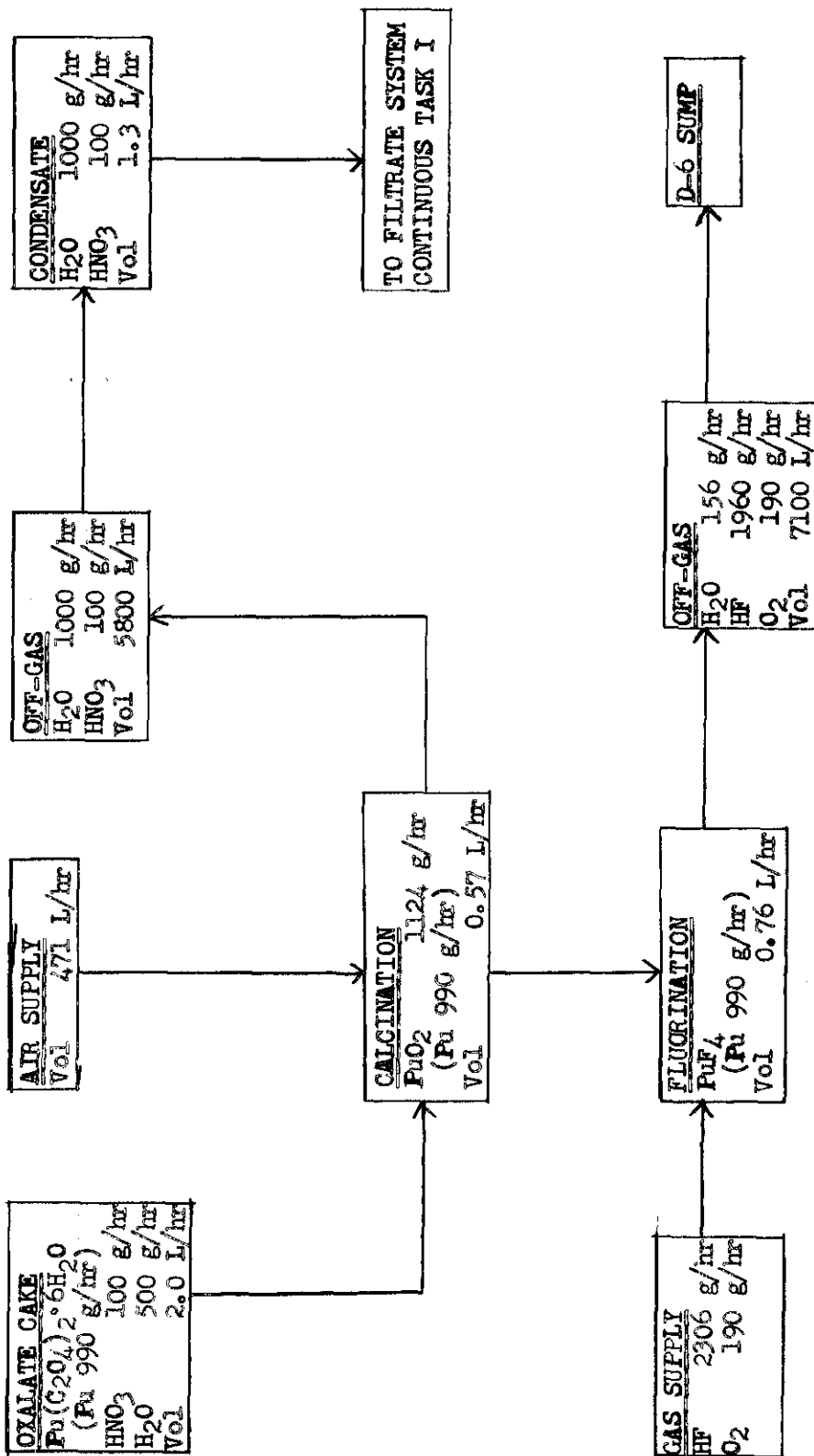


FIGURE II
CONTINUOUS TASK II FLOWSHEET

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