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 Chemistry Separation  
 Processes for Plutonium  
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LABORATORY RECORDS  
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PILOT PLANTS SECTION REPORT  
 FOR DECEMBER, 1949

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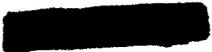


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ORNL 592\*  
Chemistry-Separation  
Processes for Plutonium  
and Uranium

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TECHNICAL DIVISION  
CHEMICAL TECHNOLOGY DEPARTMENT

PILOT PLANTS SECTION REPORT FOR DECEMBER, 1949

D. G. Reid

**DECLASSIFIED**

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0.0 ABSTRACT

The monthly report for the ORNL Chemical Technology Department Pilot Plants Section covering the development of the U<sup>233</sup>, U<sup>235</sup>, Pu recovery, and waste uranium recovery processes for December, 1949 are presented. The progress during the past month includes:

1. Completion of the start-up and testing program for the U<sup>233</sup> Pilot Plant.
2. Starting of the processing for recovery of the plutonium separated during the Redox investigations.
3. Continuation of the radiochemical waste evaporator evaluation.
4. Planning of the processing for separating the plutonium from highly irradiated uranium.
5. Completion of transfer of demineralization operations to the Operations Division.

"25" RECOVERY PILOT PLANT DEVELOPMENT

Technical - Rom

1.0 25 PROCESS

The investigation of the process for recovery of the uranium from the Materials Testing Reactor fuel rods has been essentially completed for the Pilot Plants Section. Some additional analytical procedure development is being done by the Analytical Chemistry Division on samples from the 25 processing. A formal report covering all Pilot Plant effort on the 25 process is being prepared and is scheduled for issuance in about three months.

"23" PILOT PLANT DEVELOPMENT

Technical - Jackson, Ferguson, Hylton, Klotzbach, Lewis, Nicholson

Operators - Davis, Gifford, Caldwell, Summers, Jones, Shipwash, Grizzell,  
Lockmiller

2.0 23 PROCESS DEVELOPMENT

2.1 Progress

Startup operations for the 23 Pilot Plant were completed during December. Six cold runs were completed during the startup and testing program, and the operation of the equipment during the latter runs was smooth and without incident. Hanford irradiated thorium slugs were charged to the dissolver in preparation for the first active material dissolvings early in January.

Orientation Manual for the 23 Pilot Plant, ORNL-565, has been issued describing the chemistry of the process, process equipment, and a tentative program.

23 Process Development (Continued)

The performance of equipment, during plant startup processing inactive material, not previously used in Pilot Plant scale operation is summarized below:

2.11 Bellows Pump Testing

The bellows pumps used for direct pumping of the feed have been satisfactory. Discharge rates vary by less than 2% at constant suction and discharge head. The discharge rate varies with suction head, however, requiring an adjustment of the pump rate about once every eight hours. A plot of discharge rate as a function of suction head is given in Figure I.

2.12 Thermal-electric Flowmeter

The flowmeter used for determining feed rate by a thermal-electric device (See page 24, ORNL-526) has been found to be stable, with an accuracy of better than 2%.

2.13 Electrode-Type Flowmeter

A second method of determining the hot feed rate is by means of a liquid contact, electrode type flow calibrator, located in a 1" diameter standpipe on the outlet of the feed tank. Teflon insulated, horizontal platinum probes are located at 3" intervals in the standpipe. The feed flow rate is determined by valving off flow from the feed tank (permitting feed to be drawn from the standpipe only) and measuring the time required from the sections between probes by means of an electronic device. The measurement of flow by this method is reliable and accurate to better than 2%.

23 Process Development (Continued)

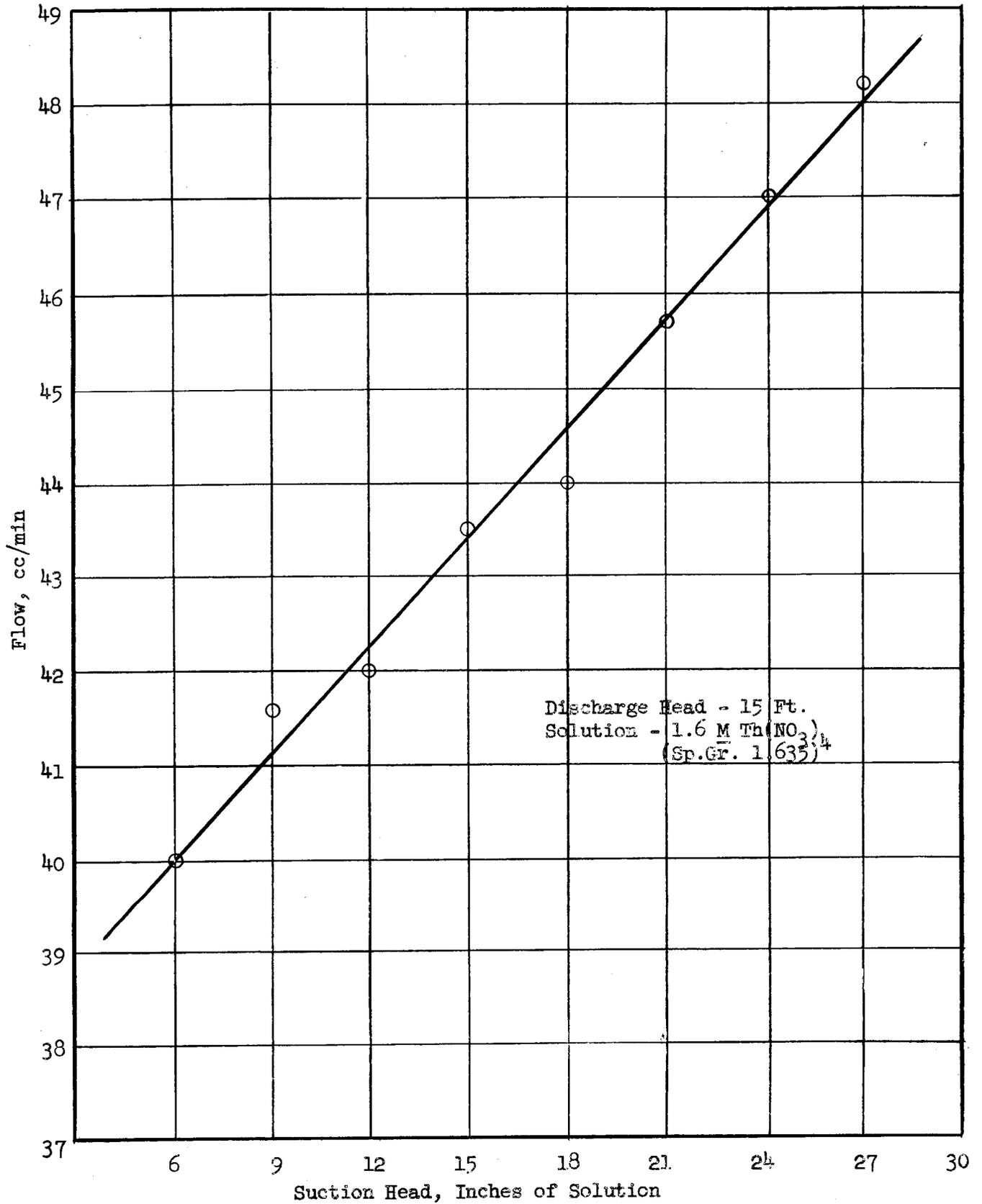
2.14 Process Tubing

Most of the process lines in the cells are constructed of seamless stainless steel tube, using Parker Triple Tube fittings. All fittings were tightened early in the startup program, and since that time no leaks have been detected in either the tubing or fittings.

2.2 Program

A detailed program for the 23 Pilot Plant has been given in ORNL-526. The program consists of twenty hot runs to be made during the first three months of 1950 during which Hanford irradiated thorium metal will be used, and about 280 grams of U<sup>233</sup> will be recovered.

FIGURE I



Bellows Pump Testing - Discharge Rate as a Function  
of Suction Head at Constant Stroke

PLUTONIUM RECOVERY

Technical - Rigstad, Harrington

Operators - Benson, Burnett, Groover, Jennings, Ledbetter, McLellan, Sexton, Shields, Spangler, Strader, Thompson, Wiggins

3.0 PLUTONIUM RECOVERY

Re-processing of the Redox IBP solutions was started during the past period using the conditions as specified in the last Pilot Plant report, ORNL-526. Two first cycle and one second cycle runs have been completed using the 350 gallons of IBP solutions in F-2 as feed material.

Operations were satisfactory with the second cycle product solution being concentrated to approximately 2 liters in the "25" continuous evaporator. The data on these runs are incomplete at the present time but will be included in the report for the next period.

METAL RECOVERY

Technical - Stewart

4.0 TBP METAL RECOVERY

A survey of the processes developed to date, for recovering uranium from the Bismuth Phosphate process, has shown that the TBP (tributyl phosphate) solvent extraction process, is the most desirable. Economic studies for a plant to recover the uranium in the ORNL Tank Farm and to act as a pilot plant for Hanford wastes have shown 750 pounds of uranium per day unit to be most economical for ORNL uranium recovery. The design of the ORNL unit is now in the stage where rough layouts, flowsheets, etc. are being made to permit sizing of the facilities.

WASTE DISPOSAL DEVELOPMENT

Technical - Shank

5.0 WASTE PROCESSING

The ORNL Radiochemical Waste Evaporator during December processed 250,000 gallons of mixed waste consisting of RaLa and miscellaneous laboratory waste and metal waste supernate. The feed to the evaporator contained 580 curies of beta activity, of which 2.1 curies were discharged to the settling basin in the evaporator condensate resulting in an overall decontamination factor of 280 for the month.

Radiochemical and ionic analysis were made on evaporator feed, concentrate, and condensate samples from six runs of which three were metal waste supernate runs and three were normal current waste runs. Iodine, ruthenium, and cesium constitutes approximately 95% of the total beta activity in the feed and condensate. Practically no alpha or gamma activity was observed in the condensate except following a foam-over.

Evaluation of various anti-foam agents has been started by the Laboratory Section. Modifications to the existing low-level activity monitor on the evaporator condensate is in the development stage by the Instrument Department and a method for indicating foam level is being investigated. Proposals for bids on the evaporator condensate ion exchange columns have been sent to vendors. A graphical representation showing volumes and beta curies of activity of evaporator feed, evaporator condensate, settling basin discharge, and White Oak Creek Dam discharge for each month is continuing.

SPECIAL CR SEPARATION

Technical - Sadowski

6.0 CR SEPARATION

A program has been approved whereby the 205 Bldg. Pilot Plant equipment will be used to separate and decontaminate Pu from highly irradiated natural uranium. The separation will be made using the current acid deficient Redox flowsheet in the first cycle and the existing plutonium solvent extraction flowsheet in the second cycle. This processing will consist of one cycle of U/Pu separation and one cycle of Pu separation and will be done in the existing Pilot Plant equipment with additional plutonium processing being done in laboratory equipment. No effort will be made to save the separated uranium.

It is expected that this program will be started approximately March 1, 1950. The necessary additional facilities and modifications that are being planned will consist of a laboratory for handling high levels of plutonium and additional Pilot Plant waste disposal tankage for ultimate recovery of the transuranics and fission products.

Details of the conditions of processing and scheduling are being set up to conform to the desires enumerated in report LAMS-995.

PATROL

Non-Technical - Purkey, Thomas

7.0 DEMINERALIZATION OPERATION AND PATROL

Patrol work has been without incident this past period.

The operation of the water demineralization facilities of the 807 Bldg. have been turned over to the Operations Division effective January 1, 1950, with one Research Operator to assist for one month. The miscellaneous routine services necessary at times other than the normal work week for the various research groups will continue to be performed by Pilot Plant Operators.

DEMINERALIZED WATER BUILDING

Operating Summary 1/12/49 - 1/1/50

Filtered H <sub>2</sub> O to Bldg.	824, 300 gallons
Demineralized water to:	
Bldg. 105	462,420 gallons
Bldg. 205	23,436 gallons
Bldg. 101 & 807	45,934 gallons
Bldg. Mock-Up	<u>37,350 gallons</u>
	TOTAL 569,160 gallons
Operating Efficiency	69.04%
Average pH	5.6
Average Resistance	298,000 ohms