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PILOT PLANTS SECTION REPORT FOR JULY-AUGUST, 1950

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ORNL-850
Chemistry-Separation
Processes for Plutonium
and Uranium

Contract No. W-7405-eng-26

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28 pages. Copy 10 of 123,
Series A.

CHEMICAL TECHNOLOGY DIVISION

PILOT PLANTS SECTION REPORT FOR JULY-AUGUST, 1950

D. G. Reid

DATE ISSUED

OCT 10 1950

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TABLE OF CONTENTS

		Page Number
0.0	Abstract	4
1.0	Purex Process	5
2.0	Chalk River Separations	11
3.0	Radiochemical Waste Processing	17
4.0	ORNL Metal Recovery Unit	20
5.0	23 Pilot Plant	23
6.0	Miscellaneous	23
Appendix I - 205 Pilot Plant Equipment Changes		24
Appendix II - 706-HB Pilot Plant Equipment Changes		27
Appendix III - 205 Pilot Plant Dissolver Modifications		28

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0.0 ABSTRACT

Report for the Pilot Plants Section of the ORNL Chemical Technology Division for the period of July-August, 1950 is presented. The information contained in this report includes:

1. Status of the decontamination and conversion of the 205 and 706-HB Pilot Plants preparatory to engaging in Purex process developmental work.
2. Summary of processing results for the six batches of CR fuel rods and one batch of Hanford material.
3. Additional information on developments of the ORNL Chemical Waste Evaporator.
4. Status of the ORNL Waste Uranium Recovery Unit whose construction was authorized in the past period.

[redacted]

PUREX PROCESS

Technical - Jackson, Harrington, Hylton, Landry, Lewis, Lindauer, Sadowski, Ullmann, Winget

Non-Technical - Benson, Davis, Grizzell, Groover, Jennings, Ledbetter Lockmiller, McLellan, Purkey, Sexton, Shields, Shipwash, Spangler, Strader, Summers, Thomas, Thompson, Wiggins

1.0 PUREX PROCESS

1.1 Summary

The ORNL Pilot Plants in Buildings 205 and 706-HB, previously used for Redox and 23 Process Development, are now being converted for Purex Process Development. The conversion work is being done by the ORNL Maintenance Department at an estimated cost of 180,000 dollars including labor, material and overhead. The major conversion changes include lining the cells with stainless steel, installing equipment for recovering nitric acid from extraction raffinates, adding additional columns for scrubbing traces TBP from BP streams, installing improved samplers on first cycle tanks, and substituting recording instruments for indicating instruments on most of the catch tanks and feed makeup tanks.

The conversion work is now about 35% complete. Testing of certain portions of the plant has already started, and the entire plant is scheduled to be completed and tested by early December.

1.2 Decontamination

1.21. Decontamination of First Cycle Equipment

The dissolver, first cycle feed makeup equipment, and first cycle extraction column are located in Cells I and IA of Bldg. 205. The equipment changes required in these cells for Purex Conversion are minor, and these

changes could have been made without extensive decontamination. However, it has been obvious for several years that the cost of lining these cells with stainless steel would be far less than the cost of a single decontamination of the cells in their present condition. Therefore, a decision was made to decontaminate the cell, to cover the floor with 1/8" stainless steel, and to cover the walls with 1/16" stainless steel. To accomplish this job it will be necessary to remove eight tanks, the extraction column, and the structural iron in Cells I and IA, to chip the floor and wall concrete, and to pour fresh concrete on the floors and sections of the walls.

Details of the decontamination of Cells I and IA will be covered in a separate memorandum. Only the general features of the decontamination will be given in this report.

In order to decontaminate the columns, each of the following solutions were pumped through each column: water, 10% nitric acid, 2% oxalic acid, 10% ferrous sulfate, 0.5% ammonium bifluoride, 2% versene, 10% citric acid, and water. The volume of the solutions varied from 100 to 400 gallons for the IA column, and from 25 to 200 gallons for the other columns. This treatment was adequate to reduce the contact radiation level on the IA column from greater than 80 R to 1500 mr/hr, on the IB column from 5 R to 750 mr/hr, and on the IC, ID and IE columns to less than 200 mr/hr. These levels were sufficiently low to permit removal of the columns without further decontamination. Most of the fission product activity remaining on the interior surfaces of tanks after the Chalk River cleanup runs was removed by washing each tank with approximately 400 gallons of each of the solutions used for column decontamination.

The outside of tanks in Cell I were decontaminated by repeating the following treatment 10 to 15 times:

(1) One gallon of concentrated HCl was poured over the tank. After 15 minutes the tank was washed with 5 gallons of water.

(2) One gallon of 70% HNO_3 was poured over the tank. After 15 minutes, the tank was washed with 5 gallons of water.

In order to remove some of the activity from the painted surfaces of the cells, about 500 gallons of 10% sodium hydroxide was sprayed on the walls of the cells.

At the conclusion of the decontamination measures given above, the radiation in the lower 20' of Cell I, where the tanks are located, varied from 5 R/hr to greater than 80 R/hr, and the radiation at tank flange level averaged about 8 R/hr, equivalent to 30 seconds working time. Activity levels greater than 80 R/hr were due to activity absorbed on concrete surfaces, and were caused by several small leaks which have occurred over a period of three years of pilot plant operation at high activity levels. The structural steel platform used to support three of the tanks was a source of a wide 10 R/hr beam. Since the activity contributed by the tanks was less than the background activity of the cell, the unbolting of flanges and burning of lines was started preparatory to removing the tanks from the cells. Three tanks and all of the structural steel have been removed from Cell I, and the remaining tanks should be removed by the middle of September.

1.22 Decontamination of Second Cycle Equipment

The decontamination of second cycle equipment was essentially the same but less intense as that for first cycle. The contact activity of second cycle equipment after decontamination was in the order of 50-150 mr/hr.

1.3 Conversion of Building 205 Pilot Plant

The Pilot Plant in Building 205 will be used for the first uranium-plutonium cycle, the second uranium cycle, and acid recovery from extraction raffinates. All of the existing equipment in Cells I, II and III will be used with the new acid recovery equipment installed in Cell IV. The conversion changes in Bldg. 205, enumerated in Appendix I, are now about 35% complete.

1.4 Conversion of Bldg. 706-HB Pilot Plant

The Pilot Plant in Bldg. 706-HB, formerly used for the 23 Process Development, will be used for the second plutonium cycle. The conversion changes in this building, enumerated in Appendix II, have been completed.

The cost of converting the Bldg. 706-HB Pilot Plant was $14,000, including labor, material and overhead (100% of labor). This equipment will be operated during September as a service to the Laboratory Section, since adequate height is not available to the laboratory to determine plutonium loss in the IB column. A simulated IAP solution containing plutonium at 40% of Hanford level (but no fission products) will be prepared, and this solution will be processed in the three 706-HB columns.

1.5 Equipment Development

1.51 Samplers

New samplers for the first cycle tanks are being designed and fabricated. The samplers previously in use were satisfactory except that personnel were subjected to excessive radiation exposure while a sample was drawn or

when maintenance was performed.

Of the design criteria established for the improved sampler the most important are:

(1) Low radiation exposure for personnel.

(2) Ease of operation, maintenance and decontamination.

(3) Adaptability to various size samples.

(4) Remote visual inspection of sample.

(5) Sample representative of tank or stream sampled.

(6) Positive attachment of sample container to sampling line.

(7) Reasonable cost (not to exceed $1000 per unit).

The sampler being designed to meet these specifications employs air jet recirculation as in the past. The sample bottle in a lead carrier is introduced into the shield, and the bottle is removed from the carrier and held under the sample line tips by means of externally operated clamps. The operations are observed through a zinc bromide window. The bottle is returned to the carrier by the clamps, and the carrier is removed. Illumination and facilities for washing down the interior of the sampler are provided. Sample sizes are adjusted by means of a set screw which alters the position of the sample tips within the bottle. An access door to the shield is placed to permit the breaking of two tube fittings following which the entire sampling assembly can be removed for decontamination or replacement. The overall dimensions of the sampler are 12" x 12" x 25", including 1 1/2" of lead shielding. The estimated cost of fabrication of the first sampler is $1000. Unit cost of the additional samplers is expected to be somewhat lower.

1.52 Dissolver Equipment and Instrument Changes

The 205 Bldg. Dissolver (A1) and Off-Gas Condenser (A2) are to be altered to permit automatic instrument control of dissolvings and to provide for greater refluxing of nitric vapors by reducing the A2 vapor load. These changes, enumerated in Appendix III, will also provide a means of pilot plant testing the dissolving procedure for the Chemical Processing Plant at Arco.

1.6 Program

Testing of the 706-HB Bldg. Pilot Plant will be started early in September, after which this plant will be used for several weeks to make service runs for the Laboratory Section. During October the testing of the 205 Bldg. Pilot Plant will begin, except for the first cycle feed makeup and acid recovery equipment. The entire plant should be completed and tested by early in December. A six months experimental program at activities up to Hanford level will then be conducted.

CHALK RIVER SEPARATIONS

Technical - Rigstad, Gresky

2.0 CHALK RIVER SEPARATIONS

2.1 Results of Run 7

Run 7, using highly irradiated uranium supplied by Hanford and including process equipment cleanout with dead UNH and $Al(NO_3)_3$ solutions, was completed July 6. This completes the Pilot Plant processing phase of the Chalk River program. Equipment decontamination for conversion to the Purex process has been started.

Product losses for Run 7 through two extraction cycles and final concentration were 0.89% with a material balance of 99.4%. Two cycle plutonium decontamination factors were 6×10^5 for beta and 5×10^5 for gamma. The final product contained 0.16 gm. U/gm. Pu. Omission of the $NaNO_2$-Acetone pretreatment of the feed resulted in a decrease in Ru decontamination by a factor of 10.

2.2 Summary of Results for all Runs

Adjustments in Pu content of feed, IAW and IIAW raffinates, and products for each run were made after careful re-check of all analytical data on the basis of statistical averages. Results are shown in Table I.

Product losses by process analysis through two extraction cycles and final product concentration varied from 1 to 2.5% with material balances of 99-104%, averaging 101.9%. The overall Pu balance for all 7 runs was 99.3% of the theoretical calculated Pu content (based on pile irradiation data). An overall uranium material balance of 98% (based on analysis of feed of all 7 runs) indicates a loss of approximately 2% of the Chalk River uranium which is equivalent to approximately 1/4" x 8" of each rod section. This is due to shattering and fragmentation of the ends of the rod sections as a result of the cutting or shearing operation.

Plutonium decontamination factors after two cycles ranged from 5×10^5 to 1.3×10^6 for beta and from 4×10^5 to 1.8×10^6 for gamma. A summary of Pu decontamination is given in Table II. Uranium in the product varied from 0.03-4.0 gms./gm. Pu. Analysis of feeds and products are given in Table III.

During the previous period, samples taken from the ICU uranium product stream of each run were further decontaminated by TBP extraction and submitted for spectrographic analysis at Y-12. Results are shown in Table IV. Burnup of 25 ranged from 3.4 to 14.8%.

2.3 Laboratory Purification Status

Products from all runs have been transferred to S. F. Accountability pending final laboratory purification which is in progress.

The Laboratory Section has completed purification of Batch No. 1 (LAMS-995, Batch No. 6). A uranium separation factor of approximately 7000 was obtained, the final product containing 1-2 mg. U/gm. Pu. Ion chamber D.F. of 3 was obtained in purification. Batch No. 6 (LAMS-995, Batch No. 1) is in process of purification. No analytical results are available.

2.4 Miscellaneous

Twenty milliliters of dissolver solution from each batch of material are in storage at the request of Los Alamos. Also 500 ml samples of the ICU uranium product stream are being stored.

Preparation of the final report on the Chalk River Separations Program is approximately 25% complete. This report will summarize the objectives, results, processing difficulties, and points of interest as encountered during processing of the material.

[redacted]

TABLE I

205 Pilot Plant

Chalk River Separations Process

Summary of Product Losses and Material Balance in Runs 1-7

Run No.	LAMS-995 Batch No.	No. Slugs	Section of Rods	Wt. U(1) Kg.	Gms. Pu in Process			Mat. Bal. %	% Loss in Various Streams						
					Feed	Product	Waste		IAW	ICU	ICW	IIAW	IIBW	Evap.	Total
1	6	40	1,13	137.5	33.0	32.4	0.4	99.4	0.11	0.05	0.001	0.54(2)	0.03	0.51	1.24
2	5	40	2,12	139.1	62.6	61.7	0.7	99.7	0.22	0.02	0.002	0.74(3)	0.02	0.09	1.09
3	4	40	3,11	145.7	91.8	93.4	2.3	104.2	1.02(4)	0.13	0.011	1.26(5)	0.005	0.05	2.48
4	3	40	4,10	148.3	115.7	114.2	2.5	100.9	1.28(6)	0.03	0.002	0.76(7)	0.002	0.12	2.20
5	2	40	5,9	143.2	126.0	123.9	3.2	100.9	0.45	0.02	0.001	1.96(8)	0.003	0.07	2.50
6	1	58	6,7,8	218.2	218.2	216.1	3.8	100.8	1.37(9)	0.03	0.001	0.31	0.001	0.04	1.76
7	HEW	70	(4")	155.3	96.3	95.0	0.7	99.4	0.48	0.06	0.001	0.30	0.001	0.05	0.89

(1) Calculated
(2) 65% of loss occurred during recycling of IIBP ($U\text{-}Al(NO_3)_3$ contaminated)
(3) 74% of loss occurred during 22% of operating time (mechanical difficulties, H_2O in hexone)
(4) 35% of loss occurred during 20% of operating time (mechanical difficulties, H_2O in hexone)
(5) 77% of loss occurred during primary batch (incomplete oxidation of Pu)
(6) 52% of loss occurred during 11% of operating time (start-up difficulties)
(7) 91% of loss occurred during recycling of IIBP
(8) 66% of loss occurred during 14% of operating time (hexone pump off)
(9) Sporadic high losses due in part to high uranium feed and consequent interface control difficulties.

[redacted]

[redacted]

TABLE II

205 Pilot Plant

Chalk River Separations Process

Summary of Plutonium Decontamination in Runs 1-7

Run No.	D.F.'s (x 10^{-4}) in First Cycle						Overall D.F.'s (10^{-6}) in Two Cycles					
	β	γ	Ru	Zr	Cb	Ce	β	γ	Ru	Zr	Cb	Ce
1	14.1	4.2	0.6	2.7	12.0	420.0	1.3	0.8	0.3	-	-	-
2	1.3	1.0	0.12	1.0	2.0	51.0	0.6	0.7	0.009	0.8	1.4	100.0
3	0.8	0.3	0.009	0.4	0.3	4.4	0.5	0.4	0.06	-	-	-
4*	6.8	1.6	1.0	1.4	1.3	150.0	0.8	1.9	0.6	0.6	0.6	16.0
5*	4.5	1.0	2.1	1.1	1.8	48.0	0.8	1.4	0.1	0.7	1.0	36.0
6*	4.1	0.7	1.0	0.5	0.5	45.0	0.9	1.8	0.5	0.4	0.3	20.0
7	1.3	0.4	0.1	0.2	0.3	100.0	0.6	0.5	0.004	0.6	0.2	10.0

* $NaNO_2$-Acetone feed pretreatment used in primary batches of these runs.

[redacted]

[redacted]

TABLE III

205 Pilot Plant

Chalk River Separations Process

Analysis of Feeds and Final Product in Runs 1-7

Run No.	FEED				PRODUCT			
	Tot. Pu (IAF) Gms.	Pu/U Ratio Gm./Kg.	β/Pu Ratio c/m/gm.	γ/Pu Ratio c/m/gm.	Tot. Pu. Gms.	U/Pu Ratio Gms./gm.	β/Pu Ratio c/m/gm.	γ/Pu Ratio c/m/gm.
1	33.0	0.24	2.4×10^{13}	4.9×10^{10}	32.4	5.06(1)	1.6×10^{7}	2.5×10^{4}
2	62.6	0.45	2.0×10^{13}	4.6×10^{10}	61.7	0.82(2)	3.5×10^{7}	5.0×10^{4}
3	91.8	0.63	1.8×10^{13}	4.0×10^{10}	93.4	0.40(3)	4.0×10^{7}	1.8×10^{4}
4	115.7	0.78	1.6×10^{13}	2.8×10^{10}	114.2	0.14(4)	2.9×10^{7}	3.2×10^{4}
5	126.0	0.92	1.3×10^{13}	0.8×10^{10}	123.9	0.05(5)	3.5×10^{7}	1.5×10^{4}
6	218.2	1.0	1.7×10^{13}	0.7×10^{10}	216.1	0.03(6)	4.6×10^{7}	1.5×10^{4}
7	96.3	0.74	2.8×10^{13}	2.5×10^{10}	95.0	0.16(7)	5.0×10^{7}	4.7×10^{4}

(1) Analyzed at 0.005 thru first cycle - U apparently introduced as cross-contamination (ICU transfer thru B30).
(2) Analyzed at 0.02 thru first cycle. No apparent reason for contamination.
(3) Analyzed at 0.17 thru first cycle. Apparently due to B-column difficulties.
(4) Analyzed at 0.015 thru first cycle. No apparent reason for contamination.
(5) Analyzed at 0.017 thru first cycle. No apparent reason for contamination.
(6) Analyzed at 0.002 thru first cycle. No apparent reason for contamination.
(7) Analyzed at 0.16 thru first cycle. Attributable to B-column difficulties in clean-out run. No pickup on second cycle as occurred sporatically in previous runs.

[redacted]

[redacted]

TABLE IV

205 Pilot Plant

Chalk River Separations Process

Uranium Isotopic Analysis

Batch No.		Rod Sect.	Irradiation (MWD/T)		Wt. %				% Burnup
ORNL	LAMS-995	Numbers	Max.	Ave.	U-234	U-235	U-236	U-238	U-235
1	6	1,13	360	220	≦ 0.01	.687	≦ 0.05	99.25	3.4
2	5	2,12	610	490	≦ 0.01	.664	≦ 0.02	99.30	6.7
3	4	3,11	830	720	≦ 0.01	.638	≦ 0.02	99.33	10.3
4	3	4,10	1010	920	≦ 0.01	.618	≦ 0.02	99.35	13.1
5	2	5,9	1130	1080	≦ 0.01	.610	≦ 0.03	99.35	14.3
6	1	6,7,8	1205	1180	≦ 0.02	.606	≦ 0.03	99.34	14.8
7	HEW	HEW	800	700	≦ 0.01	.651	≦ 0.05	99.27	8.5
Natural Uranium					0.006	.7115	-	99.28	-

[redacted]

RADIOCHEMICAL WASTE PROCESSING

Technical - Shank

3.0 RADIOCHEMICAL WASTE PROCESSING

3.1 Evaporator Operating Summary

The ORNL Radiochemical Waste Evaporator processed 428,700 gallons of mixed wastes during July and August with an average overall beta decontamination factor of 3×10^3 and average condensate discharge activity of 3.5×10^{-10} curies/cc.

3.2 Evaporator Development Progress

The installation of an evaporator condensate conductivity cell (ORNL-774) has permitted greater ease and control in operation of the evaporator. The recording instrument (L and N strip chart Micromax) has been permanently installed in the panel board, replacing the Brown radiation monitor recorder.

The procurement of the steam and water recording-integrating instruments have delayed a cost and efficiency investigation. These instruments are scheduled to be shipped during September and will be installed upon arrival.

The installation of an eight-point electronic probe assembly for foam level indication is pending arrival of the probes on about October 1. The associated instruments are now ready for installation.

3.3 Evaporator Vapor Scrubber

Purchase Inquiries have been sent to vendors for bid on a 5' diameter, 5 plate, bubble cap vapor scrubber. Details of the scrubber are given below:

The scrubber is an all welded cylindrical vertical vessel 5' in diameter by approximately 15' high with standard dished ends and constructed entirely of 3/16" Type 304 stainless steel. Each plate is welded in place, with two foot

spacing, and having 59-4" OD individually held caps. Each cap has a serrated edge with a total serrated area equal to the 2-3/4" diameter riser area. Each plate will contain 2" of liquid and will provide a 7/8" cap edge submergence. A 6" diameter downspout, a 1" IPS drain nozzle, and a 2" IPS spare nozzle is provided for each plate. Reflux of fresh water is provided to plates 1 and 2 with the reflux volume determined by conductivity probes to be installed on each plate. A 10" ID side flange bottom vapor inlet and a 12" ID side flange top vapor outlet is provided.

Figure I is a sketch of the vapor scrubber.

3.4 Program

The program for the next four months is given below with the anticipated completion dates. All completion dates will be dependent upon equipment procurement.

(1) Installation of the eight-point electronic probe in the evaporator will be made upon arrival of equipment (October 15).

(2) Investigation as to automatic steam control and anti-foam injection by means of foam level indication (October 15 - November 1).

(3) Investigation of foaming characteristics of various types feeds (November 1).

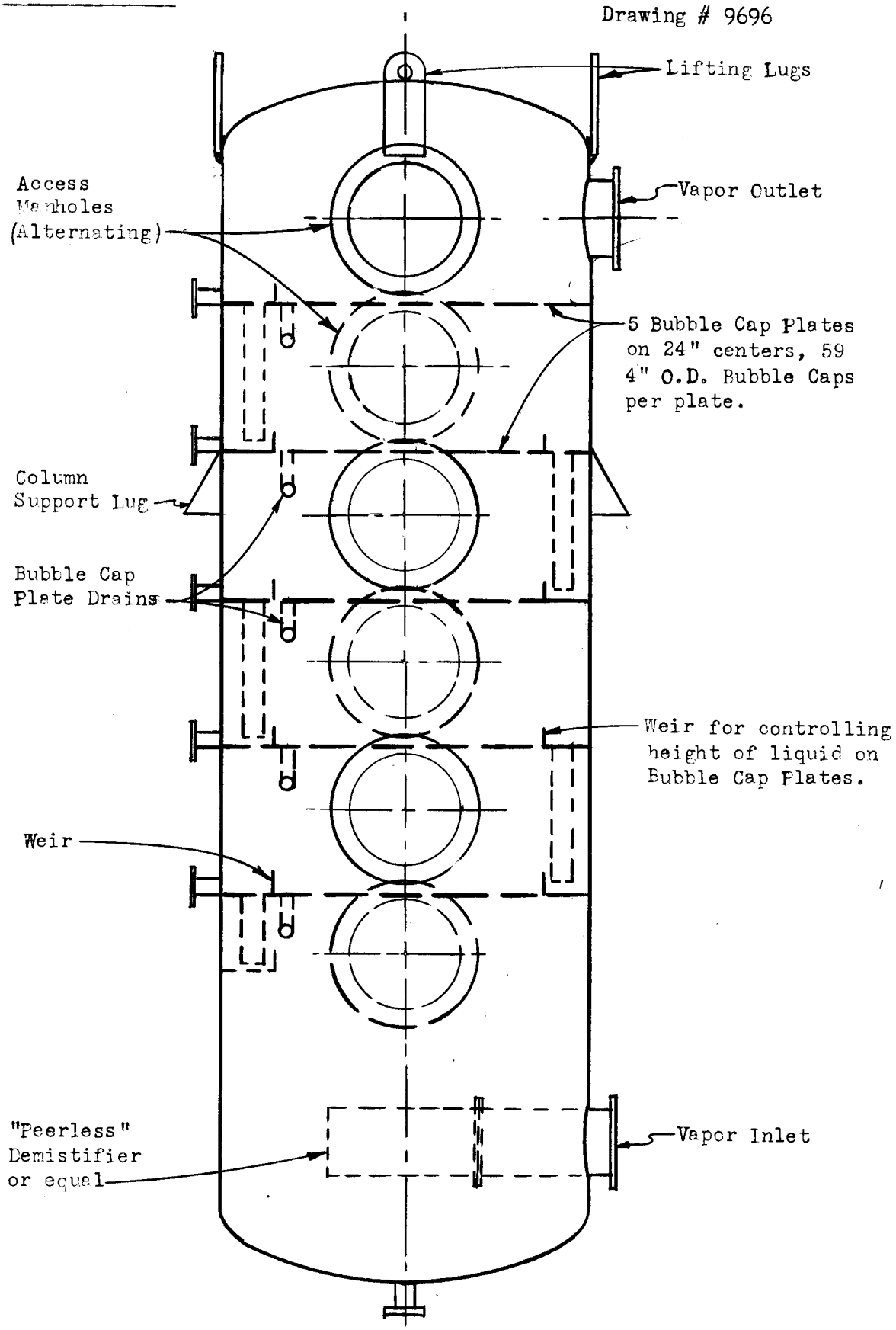
(4) Field evaluation of various anti-foam agents (November 1).

(5) Cost and efficiency determinations of the evaporator upon installation of the required instruments (October 15).

(6) Purchase, installation, and investigation of the evaporator vapor scrubber (January 1, 1951).

(7) Preliminary drafting of the ORNL Waste Evaporator Investigation Terminal Report (January 15, 1951).

Drawing # 9696



BUBBLE CAP VAPOR SCRUBBER ASSEMBLY

5'-0" O. D. x 16'-0" high

ORNL METAL RECOVERY UNIT

Technical - Stewart

4.0 ORNL METAL RECOVERY UNIT

4.1 Progress

The construction of the ORNL Metal Recovery Plant was started August 8, 1950 by the J. A. Jones Construction Company. Progress has been rapid. Footing and grade beams were completed to grade elevation two weeks after work had started. Forms for the largest cell (A) have been erected and concrete will be poured September 1.

The actual purchase of some equipment has begun though some inquiries are still outstanding.

The engineering phase has been nearly completed. The major effort will be the coordination of the purchasing along with minor revisions to equipment and methods of installation.

4.2 Building Description

The approximate building floor plan is shown in Figure 1. The building is of single story construction having two concrete hot cells, three concrete isolation cells, make-up area, control room, storage room with balcony, and locker room. Portions of the building which are not concrete are insulated metal siding and metal deck roof.

The overall size of the building is approximately 57' x 57' which will provide adequate working space for all phases. The two hot cells (A & B) have 2 ft. walls that will provide more than adequate shielding for the current program. The isolation cells (C, D & E) are of 8" thick concrete which is minimum structure

thickness for the height of 16 feet. The control room (K) houses the electrical distribution panel and the process control panel. The rest of the room will be office space. The locker room (L) has facilities for 16 men. Room (M) is approximately 30' x 30' and provides adequate space for the scrub, mix and head tanks, a laboratory bench, and future equipment.

4.3 Program

The program calls for coordination of the remaining work so as to be able to permit ORNL forces to work in the building as soon as the Jones Company has completed their work on November 1, 1950.

Much of the shop work is expected to be completed by November 1.

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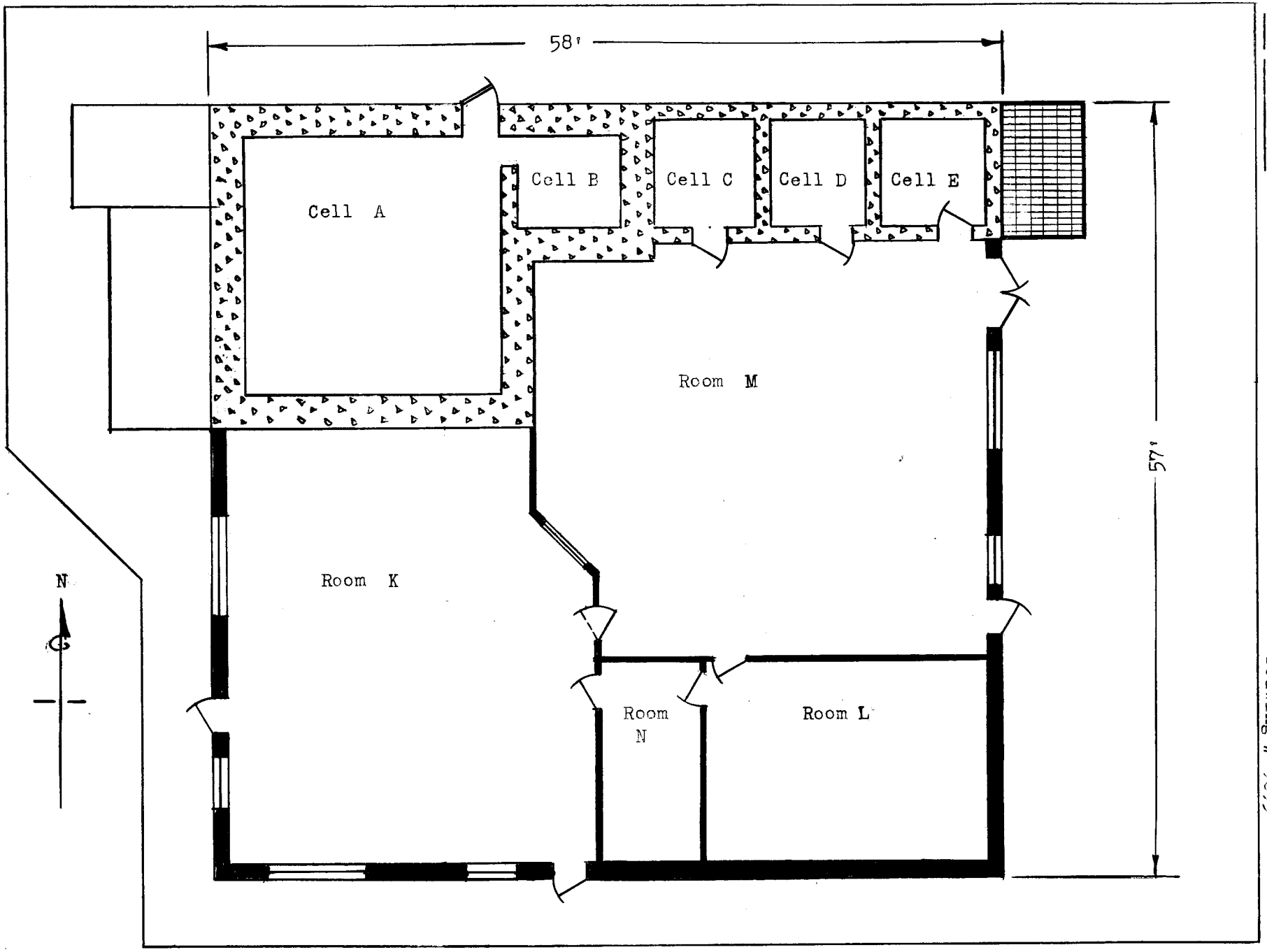

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ORNL METAL RECOVERY BUILDING
FLOOR PLAN

23 PILOT PLANT

Technical - Jackson

5.0 23 PILOT PLANT

ORNL-715, Summary Report for the 23 Pilot Plant Program, was issued in July. A set of typical run sheets was issued separately as ORNL Central Files Memo #50-7-22. The Cost Center for this program, 3370-43, was closed out in August.

The final purification by the Laboratory Section has been completed.

6.0 MISCELLANEOUS

Permanentization of the 205 Bldg. is approximately 75% complete. All exterior construction except grading is complete. Occupancy of the offices and two of the four analytical laboratories is expected to be made before the end of September. Construction should be essentially complete by November 1, 1950.

A. E. Hair, Secretary, was transferred from the Division Director's office to the Pilot Plants Section effective 8/28/50.

H. R. Thomas, Research Operator, was terminated 8/14/50 to enter the Armed Forces with the 194th Combat Engineers of the National Guard.

The following samples were sent out during the past period:

Sample	Run No.	Sample Size	Batch No.	Shipped to
4 aqueous raffinates (IAW)	6RC	50 ml.	LAMS-995 No. 1	KAPL

APPENDIX I

205 Pilot Plant Equipment Changes

The equipment modifications and additions being made in the 205 Pilot Plant before starting Purex process developmental work are as follows:

(1) Stainless steel floors and wainscoting will be installed in Cells I through IV. The floors will be covered with 1/8 inch sheets and the walls with 1/16 inch sheets to a height of 6 feet in Cells II, III, IV and to about 20 feet in Cells I and IA. This work is 40% complete.

(2) Drilling operations will be required to provide additional holes in the cell floor, for lengthening the columns, and to provide additional holes through walls from gallery to cells, roof to cells, and pipe tunnel to cells for additional piping. Four holes have been drilled for column extension sections: two holes 6" in diameter and 20 feet deep, and two holes 8" in diameter, 16 feet deep. Twenty additional holes extending through 5 ft. of concrete from the gallery to the cells are required for service piping. Drilling operations are 95% complete.

(3) Solution makeup equipment, consisting of five tanks and four pumps, will be moved from the operating gallery to an adjacent room in order to separate the solution makeup area and operating area. A new acid head tank with larger capacity will be installed. This work is 20% complete.

(4) Replacement of indicating instruments with recording instruments on eighteen services and installation of six new recorder-controllers for new equipment is being done. This work is 20% complete.

(5) An additional column, catch tank, Milton Roy pump, and pump head tank is being installed to provide facilities for stripping traces of TBP from the IBP stream. This work is 10% complete.

(6) Remotely operated equipment will be installed in a stainless steel room in Cell III for the concentration of the plutonium (IBP) stream between the first and second cycle. This work is 60% complete.

(7) A condenser will be added to an existing tank for the concentration of second cycle uranium product to 2 M UNH before withdrawal from the system. This work has not been started.

(8) An acid recovery system to be installed in Cell IV will consist of an evaporator, concentrating tower with reboiler, and catch tanks for water and concentrated acid. The evaporator will be shielded from the rest of the cell by a 3 foot concrete block wall. A pump will return recovered acid to the dissolver. The control part of the system includes service panel, instrument panel and two Milton Roy pumps and head tanks. This work is 25% complete.

(9) Fourteen tanks and five columns will be temporarily removed from Cells I, IA and II, to facilitate lining of these cells with stainless steel. This work is 20% complete.

(10) The length of the IB column will be increased from 28 ft. to 43 ft., and the IC and IE columns will be increased to 4" diameter. This work is 5% complete.

(11) The sampling area will be changed to include installation of seven new samplers and relocation of many existing samplers. This work is still in the design stage.

(12) Miscellaneous changes to adapt the existing tanks to the new process include changes to the solvent system, pump head tanks, and two Cell II tanks. Except for the installation of two strip head tanks, these are all piping changes. This work is 70% complete.

APPENDIX II

706-HB Pilot Plant Equipment Changes

(1) Displacement pumping of the feed was substituted for the bellows pumps used previously for direct feeding. This change required the installation of a displacement fluid feed tank, a Milton Roy pump, and a displacement fluid overflow tank.

(2) A new column was installed for the purpose of scrubbing the IIBP stream to remove traces of TBP prior to boildown. This change required a Milton Roy pump, a feed tank, two samplers, a catch tank, and the necessary instrumentation.

(3) A stainless steel hood to facilitate product withdrawal was installed.

(4) The floor in the cell containing the columns was covered with 1/8" stainless steel, and the walls were covered to the 6 ft. level with 1/16" stainless steel.

APPENDIX III

205 Pilot Plant Dissolver Modifications

The alterations to be made on the 205 Pilot Plant Dissolver and Dissolver Condenser (A1 and A2) are as follows:

(1) A 12" high jacket above the present A1 jacket for partial condensation of dissolver vapors. This should decrease the A2 condenser load, reduce vapor losses, and permit easier dissolver control.

(2) Approximately three cubic feet of 1" x 1" x 1/16" Raschig ring packing in A2. This should decrease the nitric oxide loss by increasing the nitric oxide to nitrogen dioxide conversion.

(3) A 1/4" IPS air bleed into the bottom of A2 for possible increase of nitric oxide conversion.

(4) A spray ring into the top of A2 for vapor washing and decontamination purposes.

(5) Consolidation of the present Taylor liquid level recorder and Hagan specific gravity ring balance into one Hagan two-pen recording ring balance for liquid level and specific gravity.

(6) Installation of a Brown temperature indicator-recorder-controller connected by means of a selector switch to the A1 solution IC thermocouple and the A2 off-gas IC thermocouple. The Brown instrument will operate three air driven diaphragm valves on A1 jacket water supply, jacket steam supply, and jacket drain lines.

(7) Installation of a 0-20" of water Taylor vacuum recorder-controller instrument connected to a throttling type air driven diaphragm valve for controlling the A2 vacuum.