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OPERATIONS DIVISION

MONTHLY REPORT

FOR

MONTH ENDING AUGUST 31, 1949

M. E. RAMSEY
E. J. WITKOWSKI
A. F. RUPP
J. A. COX
L. B. EMLET

LABORATORY RECORDS
1954

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OPERATIONS DIVISION

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for

Month Ending August 31, 1949

by

M. E. Ramsey
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DATE ISSUED

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O A K R I D G E N A T I O N A L L A B O R A T O R Y

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SUMMARY

1. Lost pile operating time averaged 10.3% as compared to 8.1% for July. (Page 4.)
2. Three ruptured slugs were detected and removed from the pile without difficulty. (Page 4.)
3. Difficulties in producing P^{32} continued. Considerable investigational work has resulted in what appears to be an improved process. Equipment will be installed in the new Radioisotope Area. (Pages 7, 8, 9, 10, 11, 12, and 13.)
4. C^{14}, with a soecific activity of 16%, has been isolated from Hanford-exposed Be_3N_2. (Pages 13, 14, and 15.)
5. Approximately 213,000 gallons of waste solution was processed through the Waste Evaporator during the month. Some operating difficulties were encountered. (Pages 19, 20, and 21.)
6. After considerable difficulty, RaLa Run #35 was shipped on August 25, 1949. This batch contained only 1,750 curies of product. (Pages 22, 23, and 24.)
7. There were 534 radioisotope shipments during the month. This constitutes a new monthly high. Since August, 1946, a total of 9,443 shipments have been made. (Page 25.)
8. Recent measurements of the C^{14}/C 12 ratio at Argonne and Y-12 indicate that our previous standard was about 12% low. (Pages 26 and 27.)
9. Construction work on the Radioisotope Area is progressing slowly. The completion date has been steadily pushed back until now it appears to be about the middle of October, 1949. (Pages 27 and 28.)

[redacted] [redacted]

A. PILE DEPARTMENT

I. Operating Data:

	AUGUST 1949	JULY 1949	YEAR-TO-DATE 1949
Total Accumulated KWH	2,332,404	2,459,743	19,921,012
Average KW/operating hour	3494.75	3599.35	3765.89
Average KW/24-hour day	3134.95	3306.11	3415.81
Percent Lost Time	10.3%	8.1%	9.3%
Approx. Excess Pile Reactivity	120-130 inhours	95-105 inhours	
Slugs Charged	168	176	2400
Slugs Discharged	168	178	2350
Product Made (grams)	85.12	89.77	700.04
Product Discharged (grams)	25.98	20.03	188.77

II. Pile Operation:

The pile-down time averaged 10.3% for August compared to 9.3% for the year-to-date. The increase in the pile-down time was due to location and discharge of three ruptured slugs during the month and numerous shutdowns for an experiment being conducted by the Physics Division.

The ruptured slug discharged from metal channel 2161 indicated its presence on the probe and was located by use of the scanner. The other two ruptured slugs did not give any interpretable indication of their presence on the probe and were detected during routine visual scanning of the metal channels. These slug failures have brought the total to sixty ruptures since the pile was put in operation during November, 1943.

These slugs were exposed as follows:

Metal Channel No.	Date Discharged	Days in Pile	Approx. Max. Temp. in Channel
2161	8-8-49	1746	190°C
1762	8-29-49	1767	210°C
1979	8-29-49	1801	150°C

II. Pile Operation: (Continued)

The apparatus containing the enriched uranium for the neutron cryostat was installed in Hole 51-N on August 22, 1949, and has operated satisfactorily since installation. It is equipped with automatic pile trips operated by high activity in the discharge water used for cooling the enriched uranium and a cooling water flow trip.

The equipment for maintaining a very low sample temperature during bombardment will be installed later since it is planned to use this facility without provision for very low temperature work in the immediate future.

The fuel assembly in Hole 11, being evaluated by Argonne National Laboratory, has operated without difficulty since its insertion during June, 1949.

The excess pile reactivity was 120 to 130 inhours at the end of the month. The approximately twenty-five-inhour increase during the month was due chiefly to discharge of sixteen rows of calcium nitrate and to lower outside air temperatures at the end of the month.

III. Filter House:

The following table compares the pressure drop across the exhaust air filters of last month and this month with that experienced immediately after replacement of filters:

	F.G. #50 GLASS WOOL FILTERS		C.W.S. #6 PAPER		ACROSS HOUSE	
Date	Inches w.g.	% Increase	Inches w.g.	% Increase	Inches w.g.	% Increase
Clean Filters	1.1	--	1.0	--	3.3	--
7-31-49	3.5	218%	1.9	90%	6.6	100%
8-31-49	3.7	6%	2.0	5%	6.9	5%

Filter House operation was normal throughout the month.

IV. Fan Operation:

Fan operation was normal during the month.

V. Radioisotopes:

The following table is a comparison of the radioisotope and research samples charged into the pile during August, 1949, with those handled in July, 1949:

	JULY, 1949		AUGUST, 1949	
	Research	Radioisotopes	Research	Radioisotopes
Stringers 13, 14, & 16	44	106	13	163
Hole 22 (Pneumatic Tube)	58	13	64	10
All Other Holes	12	14	10	23
TOTAL BY GROUPS	114	133	87	196
TOTAL FOR MONTH	247		283	

At the end of August, 1949, there were 288 cans of target material in Stringers 13, 14, and 16 compared to 359 cans of target material in these stringers at the end of July, 1949. The decrease of seventy-one cans in the stringers was due largely to the removal of a number of oil samples being irradiated for NEPA.

B. CHEMICAL SEPARATIONS AND ISOTOPE DEVELOPMENT DEPARTMENTS

I. Radioisotopes:

1. Iodine (I^{131} - 8d)

Fifteen X-slugs and two Hanford slugs were processed and 19,214.5 mc shipped. All products were within specifications. The yield from the X-slugs was somewhat lower than normal due to shorter than normal bombardment time.

The Hanford slugs were processed to provide a sufficient supply of I^{131} so that small maintenance jobs on the glassware equipment could be completed. Eight pounds of uranium yielded 35.4 curies of I^{131} about thirteen days after pile discharge time. This was enough product for three weeks of shipment in spite of the high decay losses. The background in the room adjacent to the iodine purification equipment has interfered with some of the research work carried on in Building 706-C. Additional lead shielding has been installed to eliminate this undesirable condition.

2. Phosphorus (P^{32} - 14.3d)

Twenty, 2000-gram cans of irradiated sulfur were processed and 6,571.6 mc shipped.

The process continued to give trouble this month causing low yields. Some of these difficulties were as follows:

a. Several poor extractions were made mainly due to sulfur plugging lines.

b. All products had to be reprocessed through an ion exchange column to remove precipitation which occurred at a pH of 7. It is thought that the precipitate at a pH of 7 is lanthanum, coming from incomplete regeneration of the resin column. Lanthanum is present in small quantities in the effluent

2. Phosphorus (P^{32} - 14.3d) - (Continued)

b. after a liter of hot 6 normal HCl, two liters of ammonium citrate, and copious quantities of water have been put through the column.

c. One can was dropped to the waste line as a result of an operating error.

Some changes are to be made in the glassware process at the beginning of September; it is hoped that lanthanum can be completely dropped from the process as a carrier.

Phosphorus Development Work

Some equipment for the P^{32} processing unit for the new area has been received. Three glass-lined valves were received and thoroughly inspected and tested. No leakage was found up to 60 psi; the expected working pressure of the extractor is 35 psi. The remainder of the glass-lined equipment is expected to arrive within one month. A gold liner, 0.003" thick for the P^{32} final evaporator, was received and inspected. Several defects were found and it was decided to return the liner and have a new one of smaller volume made up with the wall thickness increased to 0.006". The stainless steel body and fluorothene top for the evaporator have been designed and fabricated. The sulfur melter for X-cans has also been fabricated. This unit, like those of all the rest of the extraction equipment, is made up of easily replaceable parts.

Since the Hanford sulfur slugs will not reach the melting point of sulfur, it has been found feasible to pre-cast sulfur sticks a few thousandths inch less in diameter than the internal diameter of the Hanford can. These may be removed from the can

 [redacted]

2. Phosphorus Development Work - (Continued)

after irradiation without melting the sulfur. A tapered stainless steel mold was made and found to be very satisfactory for casting these sulfur sticks.

The comprehensive study of all P^{32} purification process variables was continued for the dual purpose of improving the present process in Cell 5 equipment and to provide design data for the unit in the new area. Attention has been directed toward determining the source of three impurities - Al, Mn, and SiO_2 -, which tend to carry through the process. Practically all SiO_2 originates with the hot sodium hydroxide precipitation step, as shown in the following table:

	Micrograms per ml.	
Process Step	SiO_2	Manganese
P^{32} extract, 0.1 N HNO_3	<1	<50
After NaOH step, neutral solution	20	<50
NH_4OH - La strike filtrate	1	<50
Column effluent, product	<39	<50

Silica is almost quantitatively carried down with the $La(OH)_3$, as indicated by the relative absence of SiO_2 in the filtrate. The sensitivity of the manganese colorimetric procedure is only about 50 p.p.m., but no manganese was found at this level throughout the process; however, it is picked up occasionally in the product solution spectrographically, where the sensitivity is about 1 p.p.m. It is probable that the Mn originates either with the target sulfur or the stainless steel extractor.

[redacted]

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2. Phosphorus Development Work - (Continued)

The origin of the traces of Al has been studied in conjunction with the properties of target sulfur purified by various methods.

Samples of polished 2-S aluminum and others of HNO_3-passivated 2-S with surface areas of six square inches were sealed in glass tubes filled with molten sulfur and held at 130° C. for twenty-four hours. After the aluminum pieces were removed, the sulfur was contacted with 0.2 N HNO_3 for twenty-four hours at 130° C. in glass tubes. The extract was analyzed for aluminum. Results are listed below:

Type Sulfur	Aluminum Strip	Weight Change	Total Al in HNO_3 Extract
City Chem. Special	Polished	0.0 mg	0.09 mg
" " "	Passivated	+ 0.3 mg	0.07 mg
B & A Flowers	Polished	+ 0.2 mg	0.11 mg
" "	Passivated	+ 1.3 mg	0.15 mg

This test is of too short duration to give completely reliable results, but it is suggested that Al has its origin with the original sulfur rather than the aluminum can.

The sealed tube method for testing sulfur quality has proved much superior to other methods usually used in analysis. A comparison was made of various sulfur samples by sealing thirty grams of sulfur and thirty milliliters of 0.2 HNO_3 in glass tubes and heating at 130° C. for twenty-four hours. Results are tabulated below:

Sulfur	Interface Condition	Spec. Analysis	H_2S Gas Pressure
City Chem. Special, Batch 1	Grey Crud	Crud-Ca, Al, Be, C, Fe, Mg, Pb, Sr, Ti, Zn, Zr, Cr Extract-Al, C, Fe	Yes

[redacted]

Sulfur	Interface Condition	Spec. Analysis	H_2S Gas Pressure
City Chem. Special, Batch 2	Grey Crud	Crud-Al,Ca,Fe,Mg,Pb,Si, Ti,Zn,Zr Extract- Al,Fe, Pb	Yes
B & A Flowers	Clear	Extract-Al,Be,Fe,Mg,Pb,Sr,Ti, Zn,Zr	No
B&A Precipitated, U.S.P.	Brown Crud	(*) Al,Fe,Mn,Si,Sr,Ti,Cr	No
B & A Flowers, redistilled	Clear	Extract B,Ca,Cr,Si	No

(*) Crud and extract combined.

These results indicate that City Chem. sulfur being used at the present time contains considerable organic matter, leading to the production of to H_2S, responsible for the swelling of cans in the pile. B & A flowers (sublimed once) contains no organic matter, but has other undesirable impurities, such as lead. However, B & A's top grade, USP precipitated, contains organic matter and a considerable amount of iron. A sample of sulfur was prepared by vacuum distillation of B & A Flowers. This sample is very pure, the traces of Si, Ca, and B being from the Pyrex glass, leaving Cr as the only significant impurity. If a suitable commercial supply of sulfur cannot be found, we will re-purify our own sulfur by vacuum distillation.

The extract from an entire run in Cell 5 was removed for examination. The solution contained a considerable amount of suspended material, which was filtered out. The crud, very similar to that found in test samples, held up about one-third of the P^{32} acitivity. The P^{32} was removed from the crud filter with hot 6 N HCl.

[redacted]

2. Phosphorus Development Work - (Continued)

This condition is responsible for a large, consistent yield loss during the present production runs, and it is of great importance that all extractor crud be eliminated as soon as possible.

One can of sublimed sulfur (2 kilos of B & A Flowers) was irradiated in the pile for one week and extracted with 0.2 N HNO_3 in glass in the pilot extractor in 706-D. A normal extraction yield was obtained (85%) and no foreign activities were found in the extract which might be attributed to activated impurities in the target sulfur. A further examination of the quality of this extract is being made. Two cans containing B & A Flowers are also in the pile for six weeks' irradiation.

Possibly the most significant point uncovered during the month was the fact that it is almost impossible to completely regenerate a Dowex resin column contaminated with lanthanum. Small amounts of La are continuously removed from the column over a very long period during 6 N HCl regeneration. Thus, a column once used for La removal contains La distributed over its entire length after regeneration, allowing La to bleed off continuously the next time it is used to separate La^{+++} from $PO_4^{\equiv}$. The old question of the relative value of iron and lanthanum as carrying agents in this process will be re-examined.

To supplement our P^{32} production, three P_2O_5 samples irradiated at Hanford were processed with the following results:

[redacted]

2. Phosphorus Development Work - (Continued)

Sample No.	1	2	3
Concentration	2.92 mc/ml	2.63 mc/ml	3.46 mc/ml
Specific Activity P^{32}/mg P	---	0.55 mc/mg	0.48 mc/mg
Heavy Metals	$<$10 ppm	$<$10 ppm	$<$10 ppm
Phosphorus	---	4.78 mg/ml	7.20 mg/ml
Chloride	None	None	None

A total of 2,050 mc from P_2O_5 was processed and shipped.

3. Carbon (C^{14} - 5100y)

Approximately 1,330 calcium nitrate slugs were processed. Results have not been received on the last 317 slugs processed. Of the results received, a total of 980.25 mc was produced with an average isotopic ratio of 4.51%. These figures are lower than those for the carbon produced in March of this year, due to the shorter bombardment time in the pile. Of the 1,330 slugs processed, 225 had been in the pile about three years and 1,105 were in about twenty-six months.

Carbon Development Work (Be_3N_2 Process)

Run 18 was made as a final test on the hydrogen peroxide process. While heretofore only half-slug and one-slug runs have been made, this run consumed nine and one-half slugs. The dissolving flask could not accommodate this many slugs so it was recharged several times; the rest of the equipment was undisturbed throughout the run. Each of four scrubbers was charged with 100 ml of 2.5 N NaOH. The function of the various scrubbers is as follows:

Sample Code

S-1	Just after the dissolving flask and before the CuO furnace.
S-2	Immediately after the CuO furnace. Sample taken while the first half of the acid was being added.

3. Carbon Development Work (Be_3N_2 Process) - (Continued)

Sample Code

S-3 Same as S-2, but represents activity obtained during addition of last half of acid.

S-4 Carbonate collected from oxidizing process and final sweeping of dissolving flask.

Sample #	Mg. $BaCO_3$	Mc. C^{14}	Isotopic Abundance	$BaCO_3$ Spec. Analysis
S-1	2437.3	101.1	11.7%	Traces-(Al,Be,Ca,Fe,Mg,Si,Sr
S-2	3715.3	198.0	15.1%	Traces-(Be, Ca, Fe
S-3	2419.9	140.0	16.3%	Traces-(Be,Ca,Fe,Mg,Si
S-4	402.2	11.9	8.3%	Traces-(Al,Be,Ca,Fe,Mg,Si,Sr

Total Wt. $BaCO_3$ - 8974.7 mg
Total C^{14} - 451.0 mc
Calculated C^{14} - 332.7 mc
Yield - 136%

This run showed the variation to be expected in processing Be_3N_2. Some slugs contain much more free Be metal than others, as evidenced by the relative amounts of hydrogen formed, which was oxidized to water in the CuO furnace.

An ion chamber placed in the exhaust line showed some activity escaping when the gas flow rate was excessive. Much of this activity was not $C^{14}O_2$ for there was little drop in activity when another $Ba(OH)_2$ scrubber was placed ahead of the chamber. Some oxidizable material probably is getting by the furnace and it is surmised that the CuO has settled so that a small channel exists across the top of the tube. To prevent this, the tube and furnace will be mounted in a vertical position in any future installations.

3. Carbon Development Work (Be_3N_2 Process) - (Continued)

A tenth of the alkaline solution from scrubber S-1 was acidified and distilled into an acidic solution of silver nitrate. A very faint milky suspension formed and was filtered out on paper. The precipitate was extremely radioactive and it is probably that it is $AgC^{14}N$ of very high specific activity. However, much confirmatory work will have to be done to validate this conclusion.

4. Sulfur (S^{35} - 87d)

None was produced this month, there being an adequate supply on hand.

5. Fission Products

A fire occurred in the F.P. cell on August 2, 1949, which shut down operations. The fire was caused by an electrical defect which developed in a heat lamp socket that had been in constant use for four months. Since a good deal of equipment revision had been planned previous to this incident, it was decided to completely decontaminate the cell and carry out extensive repairs and revisions.

The cell was repainted, new lights installed, and all electrical wiring replaced, covered with asbestos cord. The still was moved so that a bank of heat lamps mounted on a movable base may be hauled on a track up to the high window in the north side of the cell, thus making the lamps readily replaceable. Sockets for these lamps and wiring were carefully selected to stand up under extreme conditions for maximum safety. Column 1-A (second of the Zr-Cb system) was increased in diameter to allow for the greater charge of anion exchanger needed;

5. Fission Products - (Continued)

anion exchange resin has a relatively low capacity. Column 3 (final fractionation) was redesigned, the length being reduced to 60 cm and internal diameter to 10 mm. A precipitator, essentially a Stang reactor, was introduced in order to study group co-precipitation methods in conjunction with ion exchange as a means of speeding up the F. P. separations process. A sampling system has been installed to allow samples to be taken from the main head tank, the evaporator, effluent from Zr-Cb system, and effluent from the finishing column. These samples will enable the operator to maintain better control of the process. The equipment should be ready for operation by September 15, 1949.

a. Zr^{95} - Cb^{95} (Zr^{95}-65d, Cb^{95}-35d)

Five hundred millicuries of purified Zr-Cb were produced during the month. The alpha contamination was exceptionally low, being only 15 counts/minute/mc Zr-Cb. All orders on hand were filled. There are several small unfilled orders for separated Cb^{95} which will be taken care of when a batch is processed the latter part of September.

b. Yttrium (Y^{91} - 57d)

One curie of Y^{91} was produced and put in stock.

c. Praesodymium (Pr^{143} - 14d)

Two hundred millicuries of Pr^{143} were produced and all orders filled.

6. Ruthenium (Ru^{106} - 1y)

There was no work done on Ru^{106} this month.

7. Calcium (Ca^{45} - 180d)

A Hanford-irradiated sample of $Ca^{45}CO_3$ was processed and 500 g. of $Ca^{45}CO_3$ was recovered as by-product from the $Ca(NO_3)_2$ - C^{14} process. Neither sample has been completely analyzed.

8. Strontium (Sr^{89-90} - 55d, 30y)

No runs were made.

9. Iron (Fe^{55-59} - 4y, 44d)

A Hanford-irradiated sample of normal iron was processed, but the analysis has not been completed.

10. Cyclotron Targets

Four Sodium 22, one Beryllium 7, and one Iodine 125 targets have been received. Of these, one Na^{22} target (test sample) has been processed, using the M.I.T. procedure; approximately 2 mc has been recovered. However, only 30% of this amount is carrier-free material. The first full-scale target (long bombardment) is now in process.

11. Miscellaneous

a. Mercury ($Hg^{203-205}$ - 51.5d)

A Hanford irradiated sample was processed and the solution put in stock. Analysis is as follows:

Total Activity	-	553 mc
Concentration	-	4.10 mc/ml
Specific Activity	-	45 mc/gram Hg
Acidity	-	0.12 normal HNO_3

b. Argon (A^{37} - 34d)

Argon 37 was recovered from a Hanford-irradiated $CaCO_3$ sample. The sample was diluted with oxygen and is now awaiting assay by the Chemistry Division.

c. Ten P_2O_5 samples and other miscellaneous units were prepared and sent to Hanford.

 [redacted]

11. Miscellaneous - (Continued)

d. Antimony (Sb^{124} - 60d)

A long-term-irradiated sample of antimony from the X-pile was processed and the solution put in stock.

e. Antimony (Sb^{125} - 2.7y)

An X-pile tin sample was processed and the Sb^{125} distilled from the tin. Full recovery of Sb^{125} has not yet been completed.

II. Tank Farm and Burial Ground:

1. General

a. About 25,200 gallons of precipitated metal supernate were decanted from W-10 to the Chemical Waste System this month. This contained an average of .0158% uranium.

b. The Atomic Energy Commission has agreed to an extension of the present West Burial Ground site. The work fencing in the new area is about 80% complete.

2. Wastes Discharged to the White Oak Creek

About 98.41 curies of beta activity were discharged from the Settling Basin to the White Oak Creek. This is an average of 3.17 curies per day. These figures are higher than last month's discharge due to difficulties experienced in the operation of the Chemical Waste Evaporator.

The following table shows the discharge of activity to the White Oak Creek:

Discharged From	Gallons	Curies
Settling Basin	28,773,000	98.41
Retention Pond	287,680	.09

[redacted]

3. Chemical Waste Evaporator

The evaporator was shut down for four days during this month. While down, the following repairs were made:

a. Leaks in the vapor line and in the cyclone separator were welded.

b. A new valve was installed in the line from the catch tank to W-5 and adjustments made in the gear box extension handle to the valve in an attempt to make this valve operate more easily.

c. The automatic feed valve was repaired and reinstalled.

d. A new condenser thermocouple was installed.

While the evaporator was being repaired, an acid solution, which was used for decontamination, was held in the evaporator to act as shielding for the radiation emanating from the bottom of the tank. When the repairs were completed, the acid was jetted to W-5 before the next evaporation was started.

It is now apparent, however, that the jet did not completely remove the acid from the evaporator and a small heel of acid, below the jet and instrument lines, was left behind. This acidified the first batch of waste charged to the evaporator when operation was resumed. As a result, a large quantity of I^{131}, which was present in the waste from the RaLa run, was released in the condensate discharged to the Settling Badin.

The situation was further aggravated by the high rate of evaporation being carried on at the time which possibly resulted in some foaming over. Under normal conditions, when no RaLa waste is present, the high rate of evaporation

3. Chemical Waste Evaporator - (Continued)

d. is satisfactory and desirable because of the large backlog of waste in the Tank Farm. With RaLa waste, however, it has become evident that the rate must be decreased.

To prevent similar occurrences in the future, plans are being made to institute the following changes:

(1) A better monitoring system will be installed to give an alarm when high level activity wastes are being discharged to the condensate catch tank. (The present alarm is not adequate for high evaporation rates.)

(2) A water spray nozzle is to be installed to investigate the possibility of its use as a foam breaker.

(3) Constant sampling devices will be installed at the Settling Basin. (The present method of sampling indicates high activity discharge many hours after the discharge has begun.)

(4) Residual acid below the liquid level indicator lines will be washed out before a run is started after decontamination work.

A constant sampling device has been installed on the condensate catch tank. However, the validity of the results of the activity in these samples is still in doubt and will be investigated further.

In spite of a few operating difficulties and mechanical troubles, 213,242 gallons of waste were handled by the evaporator this month.

3. Chemical Waste Evaporator - (Continued)

Gallons Fed to Evaporator	Gallons of Concentrate to W-6	Volume Reduction	Beta Curies to Evaporator	Beta Curies to S. B.
213,242	18,312	10.6:1	730.34	38.53

4. Waste Tank Inventory

Tanks	Gallons Capacity	Gallons In	Gallons Out	Discharged To	Free Space
HOT PILOT PLANT STORAGE					
W-3	41,300	592	0	--	12,728
CHEMICAL WASTE STORAGE					
W-5	170,000	253,035	222,240	Evaporator	45,600
EVAPORATOR CONCENTRATE					
W-6	170,000	16,800	0	--	63,600
METAL WASTE					
W-4,7,8,9,10	713,000	11,096	25,200	Evaporator	239,376

5. Special Wastes

a. Three shipments of alpha-contaminated trash were received from Dayton.

b. One pot and six drums of uranium-plutonium waste were received from Chicago.

c. A total of 371.68 kg of uranium was received into the Metal Storage System. Of this, the Technical Division, Section I, transferred 178.6 kg; the I^{131} process, 51.48 kg; RaLa, 141.53 kg; Technical Division, Section IV, .07 kg.

III. RaLa (Ba^{140} - 12.5d):

Los Alamos reported that some difficulty was experienced in processing Run #34. It was caused by some foreign material which was suspected to be silica. Fortunately, there was a large quantity of product which enabled them to separate enough material for their experiments.

No logical explanation could be found in our records for there being any difference in quality between Run #34 and the three previous runs which were reported to be of good quality. The procedures used in these four runs were identical in all respects and there were no changes in equipment. It is seriously doubted that our equipment or process could have been at fault this particular time.

It was suggested to Los Alamos that some attempt be made to save and analyze the impurities (after sufficient decay) before any further steps are taken to change processes to eliminate the troubles. Until the present time, all corrective measures have been attempted on a basis of speculation by Los Alamos on what the foreign material is. These have not been very effective.

The cubicle glassware and Tygon line replacement work was completed early in the month and Run #35 was started on August 14, 1949. Seventy-four, four-inch Hanford slugs were loaded, dissolved, and extracted in two batches.

Although the dissolvings and extractions appeared to be normal, the metatheses would not go to completion. The product was sent to Cell B three times, supposedly in a nitric acid solution only to have it found that the first two transfers were made in the form of sulphate slurries which were leaving portions of the product in every tank through which it passed. Following the second incomplete metathesis and transfer, all product and wastes were returned to the Cell A

III. RaLa (Ba^{140} - 12.5d): - (Continued)

extraction tank where they were evaporated to dryness and digested with fuming HNO_3 to get rid of all organic materials. This treatment was decided upon when it was found that instrument oil and bubbler oil were present in the instrument lines of the extraction tank. The lines were steamed, cleaned, and the fuming treatment performed on the tank and its contents.

A re-extraction of these treated wastes and product was made followed by the usual washes, metathesis, metathesis washes. This time the product did dissolve per procedure and the run was sent on to completion.

The glassware operation was fast although the product solution handled was very dirty from contact with some foreign matter. L.S.T. was reached at 1515 on August 24, 1949. The product with a content of 1,750 curies, as determined by a ten-hour and thirty-minute skyshine, was shipped as a nitrate at 1200 on August 25, 1949.

The material balance for Run #35 was very poor due to the many transfers of product solution from Cell A to Cell B and back through numerous vessels. The decay loss was also very high because of the unusually long time (ten days instead of normal five) taken to complete the run.

Both A-16 off-gas fans burned out during the run and the last four days' operations were made using emergency off-gas facilities into the dissolver off-gas system. No above-tolerance air contamination was encountered despite this temporary emergency system.

III. RaLa (Ba^{140} - 12.5d) - (Continued)

The analytical summary of the run follows:

Slugs Loaded: 74, four-inch, Hanford slugs

Slugs Dissolved: 72.85 Hanford slugs (by analysis)

	CURIES	PERCENT
Total Curies Dissolved	3,948	100.00
Cell A Losses	1,113	28.19
Cell B Losses	306	7.75
Losses Accounted For	1,419	35.94
Material Balance through B-6		68.87
Product Shipped (Skyshine)	1,750	44.33
Material Balance through Skyshine		80.27
Losses Unaccounted For		19.73

Following shipment of the run, work was started immediately on the decontamination and repair of both A-16 fan motors in order to have them ready for the next run. The agitator bearings in A-9 burned out and must be replaced. This requires decontamination of Cell A. It is doubtful if the next run can be started until late in September.

It is planned to steam the instrument lines of all Cell A vessels through which the product passes and to clean the tanks with fuming HNO_3 to insure the removal of all foreign material.

C. ISOTOPE CONTROL DEPARTMENT

I. General:

There were 534 isotope shipments during the month of August, compared with 427 during July. This constitutes a new monthly record.

A shortage of P^{32} continued during part of the month, but material received from Hanford through an irradiation of P_2O_5 has filled most of the outstanding orders. Routine irradiations of P_2O_5 will be made at Hanford until the new processing equipment is installed in the Radioisotope Production Area.

A breakdown of shipments according to separated and unseparated material is as follows:

	JULY 1949	AUGUST 1949	TOTAL August, 1946, to August, 1949, Inc.
Separated Material 706-D Area	328	374	7,241
Unseparated Material 100 Area	99	160	2,202
	427	534	9,443

The breakdown of shipments according to non-project, project, and foreign shipments for July and August is as follows:

	JULY	AUGUST
Non-Project	339	392
Project	73	118
Foreign	15	24
	427	534

II. Phosphorus:

No complaints have been received regarding the specific activity of P^{32} produced at Hanford. This averages about ½ millicurie per milligram of inactive phosphorus. It may be feasible to supply the major portion of our Phosphorus 32 orders with this material.

III. C^{14} Labeled Compounds:

Labeled formaldehyde is again available and outstanding orders have been filled. Labeled sodium formate prepared by the Chemistry Division has been available for distribution for the past two months, but none has been sold. Efforts are being made to have notices inserted in technical journals to acquaint scientists with the labeled compounds which can be obtained.

IV. Hanford Irradiations:

Information has been received from Hanford that our irradiation of sulfur and cobalt will be delayed indefinitely because of the recent ruling of the Atomic Energy Commission limiting the number of special irradiations. Beryllium nitride has also been out of the Hanford pile for the past eight months. Until these three items can be irradiated at Hanford, the isotope program will be severely limited. Many isotopes can be prepared at Hanford by test hole irradiations but the above materials require the irradiation of large quantities of material.

V. Cobalt 60:

During the month a check of the three-month irradiation of cobalt at Hanford showed that the specific activity was not as high as anticipated. Instead of being 1½ curies per gram as hoped, the activity was about .65 curie per gram. Since the cobalt distribution program is based upon the availability of radio-cobalt with a specific activity in the range of 1½ - 3 curies per gram, considerably larger irradiations at Hanford will be necessary.

VI. Carbon 14:

Results obtained at Argonne National Laboratory and Y-12 by mass spectrometer measurements of the Carbon 14 ratio indicated that the original measurement, on which our standards were based, was low by

VI. Carbon 14: - (Continued)

about 12%. A survey by the Chemistry Division indicated that the new values checked the half-life figure of 5,720 years obtained by Libby, et al (Physical Review 75, 1825). This new value is being further checked by the Bureau of Standards before any changes are made.

During the last month a large amount (564 millicuries) of Carbon 14 was distributed and it is expected that this will continue to increase as the sales after Labor Day usually show an upward trend. Since the amount produced in the X-10 pile is only about 200 millicuries a month, it will be necessary to rely on Carbon 14 produced at Hanford. Although a considerable amount of Carbon 14 is now on hand in the form of beryllium nitride (estimated at more than 12 curies), the increase in demand for this isotope may be so great as to create a shortage unless irradiations are started again at Hanford.

VII. Industrial Use of Radio-Barium:

During the month California Research Corporation reported very good results using radio-barium in tracing the flow of fluids through pipe lines. With this newly developed technique, it is found feasible to pump petroleum products having the same density adjacent to each other in pipe lines hundreds of miles long. Previously, this has not been practical since the only way to detect the interface was through gravity determinations. Also, by using this technique it is believed that the waste cuts can be reduced in size.

VIII. Radioisotope Processing Area:

Work continued on all buildings in the Radioisotope Processing Area. In the Analytical Building work continued in the service piping, electrical wiring, hot sinks, lead barricades, interior painting and installation of the laboratory furniture. Also, the cooling system

VIII. Radioisotope Processing Area: - (Continued)

for the counter room air conditioning was installed, and the lumnite cement floor topping was poured in the container inspection and isotope packaging rooms. In the Process Buildings work continued on the electrical wiring, service piping, hot sinks, hot barricades, and interior painting; installation of the laboratory furniture was started. Also, the lumnite cement floor topping was poured in Buildings 905, 906, 907, 908, 909, and 910.

At the exhaust stack installation of the electrical wiring and equipment, and the exhaust blowers was almost completed; the above-ground exhaust ducts were started. Also the underground portion of the 706-C-D exhaust ducts was completed. Top soiling of the area was started and the steeper slopes were grassed.

IX. SF Material Control:

1. One monthly salary employee was added to the organization for the purpose of maintaining the pile process records, which now include U^{235} and plutonium accountability. New records, separate and apart from other SF accountability records, have been established constituting a control ledger and a subsidiary ledger for materials stored in the 105 canal. The subsidiary ledger is subdivided by individual bucket numbers which in turn reflect the content of uranium, U^{235} and plutonium, as well as date of discharge, row number, days in pile, etc.

2. Sixty-two percent of the enriched uranium, above 75% enrichment, in possession of the Laboratory was transferred to the Accountability Office for shipment to the Y-12 Plant for recovery.

3. Two cars were received from Hanford containing material for RaLa work, supernate and sludge for Semi-Works, and the balance of material for Request 52 (enriched U^{235}).

   Notwithstanding the decontamination of the containers at the Laboratory, one of the railroad cars became contaminated upon reloading and was reading 400 mr/hr at three inches.

   Due to the age of the car, several cracks and crevices were prevalent in the floor. Some of the contamination had worked into these crevices and, as a result, approximately ¼" of flooring had to be removed in spots to eliminate the contaminants.

4. At the request of the Atomic Energy Commission the July monthly SF Accountability Report was revised to coincide with the standard form used by K-25 and Y 12. This new form will lend itself to an easier consolidation of a report the Atomic Energy Commission must submit to Washington for all three areas.

IX. SF Material Control: - (Continued)

4. In line with the adoption of the new reporting form, all normal uranium and thorium accounts were converted from kilogram to gram balances. All other SF materials were previously carried on the records in term of grams.

It is expected that minor differences will arise in the normal uranium and thorium accounts due to the effected change; however, this is not considered to be a serious problem. Expressing all materials in an identical term appears to lend to better accounting, both in theory and practice.

5. A review of the SF accounting system was made by Mr. E. J. DuBois, a representative of Lybrand, Ross Brothers and Montgomery, a form of public accounts under contract to the Atomic Energy Commission.

Mr. DuBois expressed great interest in how the monthly SF report was compiled, the source of such data, and how the verification of inventories was obtained. He was informed that the balance of an individual's account, or accounts, by element or compound, constituted the amount of material the individual must account for.

A tour of the Laboratory was started in the afternoon of August 24, 1949, and was completed on the 29th. The tour included visits to the 103 Vault, 105 Pile Department, 205 Process Area, 101-B Metallurgical Process, Tank Farm, Chemical Waste System, 706-A Analytical Laboratory, 706-A Semi-Works, and 101-D Metallurgical Laboratory where discussions were held with individual technical personnel.

IX. SF Material Control: - (Continued)

5. During the tour Mr. DuBois confined his questioning to subjects pertaining to accounting for material. His prime interest was to determine the ramifications in process with particular emphasis placed upon sampling and inventorying SF material.

In the course of the tour Mr. DuBois inspected the type of records kept and collected sample copies of various forms used, other than regular SF forms. These consisted of various log sheets and analysis sheets. A brief non-technical description of such forms and the purpose of usage was verbally given by individuals submitting the forms.

6. In connection with our efforts to establish the feasibility of placing limits of error on material accountability, two statisticians from K-25 visited the Laboratory and reviewed our material accountability of processes and research laboratories.

Discussions were held with members of the SF Accountability Office, the Pile Department, and the Technical Division.

Available information and experience on the calculation of plutonium in slugs in the pile was quite valuable to the visitors. Likewise, the work that the Technical Division had accomplished in their studies of material balances across processes was very helpful in orienting the statisticians to some of the peculiarities of our work.

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IX. SF Material Control: - (Continued)

Following is a summary of receipts and shipments of SF Materials for the month of August, 1949:

RECEIPTS

Received From	Material	Content
Argonne National Laboratory	Waste Solution (Uranium)	23.73 kg. 450.00 mg.Pu
C&CCC, K-25 Area	UO_3 (Normal)	26.00 gm.
" " "	Uranium Metal Waste Solution	16,200.00 gm. 90.00 mg.Pu
" " "	UNH Solution (Normal)	13,306.00 gm.
C&CCC, Y-12 Area	1 Batch UBr_3, 1 Batch UCl_4 1 Batch $UO_2Cl_2 \cdot H_2O$ (Normal)	38.90 gm.
" " "	Enriched Uranium Slugs (93.5%)	135.50 gm.
" " "	Uranium Metal	2.622 gm.
" " "	UCl_3 (Normal)	15.20 gm.
" " "	Uranyl Nitrate Crystals (Normal)	91,150.40 gm.
" " "	" " " "	49,299.30 gm.
" " "	" " (Normal)	69,264.70 gm.
Hanford Engineer Works	Enriched Uranium (93.5%)	853.811 gm.
" " "	Hot Uranium Slugs (Depleted)	135,133.54 gm. 23.24 gm.Pu
" " "	Enriched Uranium (93.3%)	.816 gm.
" " "	" " (38.0%)	2.037 gm.
" " "	Depleted Uranium	2.817 gm.

[redacted]

IX. SF Material Control: - (Continued)

SHIPMENTS

Shipped To	Material	Content
Argonne National Laboratory	Normal U/Zr Alloy	1.0 gm.
C&CCC, K-25 Area	UNH Solution (Normal)	13.35 kg.
" " "	3 Pieces U Size Slugs (Normal)	5.67 kg.
" " "	4 Pieces NUH Metal (Normal)	1,010.00 gm.
C&CCC, Y-12 Area	UNH (Normal)	35.01 kg.
Fairchild Engine and Airplane Corporation	Thorium Acetate	4.00 gm.
Los Alamos Scientific Laboratory	U-Al-Alloy (28.9%) (Depleted)	0.664 gm.

L. B. Emlet, Director
Operations Division

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