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SERIES A:

OPERATIONS DIVISION

MONTHLY REPORT
FOR
MONTH ENDING NOVEMBER 30, 1948

BY

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OAK RIDGE NATIONAL LABORATORY

OPERATED BY
CARBIDE AND CARBON CHEMICALS CORPORATION
FOR THE
ATOMIC ENERGY COMMISSION
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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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Carbide and Carbon Chemicals Corporation
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SUMMARY

1. The pile was shut down for approximately seven days to tie in the new filter house to the exhaust air duct from the pile.
2. The air pressure drop across the new filter installations averaged about 3.6 W.G. for the last two weeks of the month. An increase of about 11% occurred in this two-week period.
3. Lost operating time averaged 31.1%, largely due to the shutdown for the tie-in of the filter house.
4. No appreciable decrease in pile power was realized from the filter installation but the fan load has increased about 12%.
5. No quantitative figures are available at this time on the efficiency of the new filter installation.
6. Particulate matter is being carried into the building whenever graphite stringers or other materials are removed from the pile. Steps are being taken to reduce this hazard.
7. The pile excess reactivity is about 140 to 150 inhours.
8. No swollen or ruptured slugs were detected during the month.
9. The bearings on the #3 fan were replaced early in the month. These bearings had been in service about six months.
10. Radioisotope production continued normally but with lowered yields because of excessive pile down time.
11. The fission product ion exchange column is working satisfactorily. All back orders of Zr-Cb have been shipped.
12. Development work on the Be_3N_2 process for C^{14} is progressing satisfactorily.
13. RaLa run #28 was shipped on November 22, 1948. The product measured 1,380 curies, which was lower than expected. Hanford slugs were used for this run.

SUMMARY - Continued

14. A total of 377 isotope shipments were made during November, 1948. This is the greatest number shipped in any month. The next high was June, 1948, with 327 shipments. This brings the total to date, since August, 1946, to 5,383.

15. The construction of the Isotope Production Area is progressing. The brick work for the stack is to a height of five feet, footings have been poured for the service and column buildings and excavations are being made for the remainder of the structures.

A. PILE DEPARTMENT

I. Operating Data:

	November 1948	October 1948	1948 Year-to-Date
Total Accumulated KWH	1,678,903	1,785 217	25,212,678
Average KW/operating day	3384.41	3695.57	3708.16
Average KW/24-hour day	2331.81	2399.49	3135.91
Percent Lost Time	31.1%	35.1%	15.4%
Approx. Excess Pile Reactivity	140-150 inhours	130-140 inhours	
Slugs Charged	1,101	129	10,182
Slugs Discharged	1,103	128	7,569
Product Made (grams)	61.27	65.16	920.18
Product Discharged (grams)	81.18	0.96	278.27

II. Pile Operation:

The pile was down during the period November 8 through November 14, 1948, inclusive, for the installation of the required duct connections to route the pile exhaust air through the new filter house. Lost operating time averaged 31.1% as compared with 35.1% for October, 1948. The major portion of the time lost during November was caused by the extended shutdown mentioned above.

The pressure losses encountered in the filter house at date of initial use and at the end of the month are as follows:

Date	American Filter Co. Glass Wool Filters(FG-50)	CWS Filters #6	Total Filter House
11-15-48	1.1-1.2 inches of water	1.0-1.1 inches of water	3.3-3.4 in.of water
11-30-48	1.5-1.6 inches of water	1.0-1.1 inches of water	3.7-3.8 in.of water.

The expected pressure loss through the glass wool filters was six-tenths of an inch of water, while the measured loss at time of installation was twice this amount. The anticipated and measured pressure losses across the CWS filters were in agreement. The increase in pressure drop across the glass wool filters has increased to its current value in approximately a linear fashion.

The addition of the filter system has not reduced the pile power level appreciably. However, the fan motors are being operated currently at nearer rated motor load due to the cooling of the pile exit air stream to below 160°F. Approximately 5 gal./min. of water is introduced to cool the air. This cooling is necessary because the CWS filters start to deteriorate at temperatures above 160°F.

Since the pile exit air has been routed through the filter house, the discharge of slugs from the pile is no longer limited by the prevailing meteorlogical conditions. The removal of this limitation to the operation has allowed research work, radioisotope production, and slug discharges for this, as well as other A.E.C. installations.

The Technical Division is evaluating the particle removal efficiency of the new air filtration system. The results of this work will appear as soon as available in a later report.

The design work required for the installation of cyclone separators between the pile and the filter house is continuing. However, the current feeling is that construction should not be started until the life of the filters indicate that it is necessary. It is recognized that the amount of activity collected on the filters may ultimately be the deciding factor in how long a set of filters may be used instead of excessive resistance to air flow through the filter.

The pile was visually scanned daily prior to the installation of the filtration system and weekly thereafter. There were no swollen or ruptured slugs detected during the month.

Two new instruments for detection of ruptured slugs were described in the report for last month. Even though these instruments were in service during this month, they still are to be evaluated as to slug

rupture detection characteristics when a slug ruptures.

During the month it was found that the removal of sulful cans, graphite stringers, and other miscellaneous materials from the pile, even including regulating rods, is accompanied with varying amounts of radioactive particulate matter. These particles are eventually spread through the Pile Building. Brushes, adjacent to vacuum channels, has been installed in the lead shield used in removal of graphite stringers. Sulfur cans are now pulled through an enclosed trough equipped with arrangements for an air sweep at one point underneath the can. Preliminary data indicate that the above program reduces the amount of radioactive particulate matter from bring liberated into the building. An accurate evaluation of these precautions is not yet available. Additional changes required to reduce the spreading of radioactive particulate matter throughout the Pile Building will be undertaken as soon as proper equipment can be designed.

The excess pile reactivity is 140-150 inhours. This represents an approximate 10-inhour increase during the month.

III. Fan Operation:

The No. 3 fan was shut down on November 2, 1948, for a fan bearing replacement. Each bearing contained a badly damaged ball. These bearings had been installed on this fan May 4, 1948.

The pile was operated at approximately one-half power for thirty-three hours during the bearing replacement.

IV. Radioisotopes:

The following table is a comparison of the radioisotope and research samples charged into the pile during November, 1948, with those handled in October, 1948:

	OCTOBER, 1948		NOVEMBER, 1948	
	Research	Radioisotopes	Research	Radioisotopes
Stringers 13, 14, and 16	23	86	11	110
Hole 22 (Pneumatic Tube)	25	0	28	5
All Other Holes	3	13	11	18
TOTAL BY GROUPS	51	99	50	133
TOTAL FOR MONTH	150		183	

At the end of November, 1948, there were 350 cans of target material in Stringers 13, 14, and 16, compared to 362 cans of material in those stringers at the end of October, 1948.

V. Experimental Work:

The rerouting of the pile cooling air through the filter house made it necessary to by-pass the venturi that was used for measurement of pile exit air. These measurements were reasonably accurate and were used in heat power calculations which in turn were used for adjustment of differential chambers used in conjunction with the galvanometers for pile power measurements.

Straightening vanes were placed in the exit air duct as close to the pile as possible and a bank of five pitot tubes installed in the duct just inside of the Pile Building. The pitots have been calibrated by use of the venturi readings prior to the by-passing of the venturi. Data indicate that the error in the pitot readings is no greater than plus or minus five percent at approximately full air flow.

The retesting of 2,000 slugs which had already been accepted for pile loading indicated 0.2% failure by the modified bubble test. The remainder of the "accepted" slugs will be retested prior to charging into the pile.

B. CHEMICAL SEPARATIONS AND ISOTOPE DEVELOPMENT DEPARTMENTS

I. Radioisotopes:

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

Sixty-five, eighty-gram cans of irradiated tellurium and twenty-one uranium slugs were processed; approximately 7,855 millicuries were shipped. All products were within specifications. Low yields are a result of pile down time.

During the early part of the month, before the new equipment was installed to filter the pile exhaust gases, uranium slugs could be discharged only when favorable weather conditions prevailed. For this reason no uranium slugs were available for this process and it was necessary to temporarily return to the processing of irradiated tellurium.

Iodine Development Work

Six batches of slugs were dissolved during the month. Some of the metal was relatively cool because of pile down time. Overall iodine recovery was about 80%, excluding losses due to decay.

Training of Chemical Separations Department personnel continued. One Chief Operator from 706-D is being trained in addition to the two Operators who are now regularly assigned to the process.

The process and equipment will be transferred to the Chemical Separations Department during December, 1948.

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

Fifteen, 2000-gram cans of sulfur were processed and approximately 3,662 millicuries were shipped. All products were within specifications. Lower yields were a result of pile down time.

Operation of the equipment was made difficult by the plugging of the sulfur transfer lines. This, however, did not result in low product yields.

Phosphorus Development Work

Pyrex glass tube liners in various sizes were fabricated for use in the steam autoclave experiments on extraction of P^{32} from sulfur. The rest of the equipment was tested and made ready for use as soon as some irradiated sulfur may be spared for experimental work. It is hoped that some sulfur will be available during the first part of December, 1948.

3. Carbon (C^{14} - 5100y) (From $Ca(NO_3)_2$

No runs were made.

Beryllium Nitride Development Work

Two runs of one slug each were made on Hanford-irradiated Be_3N_2 which had been canned at Chicago. One slug was from the end of a row and one from the center of the same row. A marked difference in hardness of the pellets was noted, the center slug pellets being so hard that it was necessary to attach an air hammer to the pellet crusher plunger (ordinarily operated by hitting with a small hammer) to grind up the pellets. It is believed that this condition is a result of excessive pressure (75 tons/sq. in.) used in preparing the pellets. It is much too early to say whether neutron irradiation has a hardening effect on the Be_3N_2 pellets.

In Run #1 on the "end" slug (17 slug lengths from the center) 800 milligrams of $BaCO_3$ was obtained with a maximum isotopic C^{14} ratio of 5.6% and a minimum of 2.9%. The total amount of C^{14} obtained was 11.7 millicuries of which 50% was of the highest isotopic ratio mentioned above. The chemical purity of the product was equivalent to reagent grade $BaCO_3$ as shown by spectrographic analysis.

In Run #2 (center slug) 1,719 milligrams of $BaCO_3$ was obtained containing 15.78 millicuries of C^{14}. A summary of the results is given below.

Sample No.	mg $BaCO_3$	mc	Isotopic Ratio
27	207.7	.33	.45%
60	653.7	7.71	3.30
45	639.1	6.84	3.02
* 68	219.3	.90	1.12
TOTAL	1,719.8	15.78	

Average specific activity 2.59%.

* Chromic acid fraction contained 5.7% of total C^{14} and contributed 12.8% of total $BaCO_3$.

In both runs, the yield was slightly more than 100%, based on estimated Hanford nvt. The yield agrees well with the theoretical calculated from row position also.

It is encouraging to note that these slugs were exposed to only about one-third the number of neutrons that slugs irradiated for six months in the most favorable locations will receive.

It was noted that a considerable amount of hydrogen was formed during the processing, which was oxidized to water in the CuO furnace and trapped out before entering the drying chain. This must result from beryllium metal which was not converted to the nitride during the manufacturing of Be_3N_2.

The disposal of beryllium waste by precipitating as beryllium hydroxide has proved to be quite slow, because of the gelatinous nature of the hydroxide. The waste beryllium hydroxide slurry is being stored in stainless steel drums.

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

No S^{35} was produced this month.

5. Fission Products

A half-scale run was made during the first part of the month. Although a crack developed in the glass evaporator which necessitated immediate discharge of most of the crude fission product fraction to the drain, a considerable amount of Zr-Cb had already been obtained from the pre-columns. This Zr-Cb was of sufficient purity for shipment. The average Pu content was 20 alpha counts per millicurie Zr-Cb. About 400 millicuries were produced and all outstanding orders were shipped.

A new type of heating, combining immersion heaters and heat lamps, is being used on the evaporator. This change should afford safer and more efficient operation than the previous pot heater.

During this short shutdown period a new type of joint was made in the main resin column. MFP-10 plastic rings were used to hold the sintered glass filter disc in place. The assembly is working satisfactorily and should be more free of strains than the previous all-glass assembly.

Another full-scale run is now in progress.

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

No purified ruthenium was produced during the month there being an adequate supply on hand. Work is in progress to find a satisfactory oxidizing agent for pre-oxidation of ferrous iron which will not interfere with K MnO_4 oxidation in the subsequent ruthenium distillation. Potassium persulfate and potassium bromate are being investigated for this purpose.

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

Two runs were made on 0.3 g. and 0.2 g. Sc_2O_3 samples for extraction of carrier-free Ca^{45}. These scandium samples were old ones which had not been pre-purified, necessitating a complicated purification of product Ca^{45} from other radiochemical impurities, present in much larger amount than the Ca^{45}. Data on two product samples are given below.

Run No.	1	2
Total vol.	25 ml	20 ml
Ca^{45}	7.3 microcuries	4.2 microcuries
Total Solids	1 mg/ml	0.5 mg/ml.

Radiochemically pure Ca^{45} and negative to important contaminants on spectrographic analysis.

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

No runs were made.

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

No iron was processed this month.

10. Zinc (Zn^{65} - 250d)

Analysis of the Hanford-irradiated zinc which was processed and reported last month is as follows:

Concentration	-	1.5 mc/ml
Total Activity	-	186 mc
Specific Activity	-	229 mc/gram Zn
Zinc	-	6.5 mg/ml
Total Solids	-	10.8 mg/ml
Free Acid (HCl)	-	0.074 Normal.

11. Potassium (K^{40} - 4×10^8 y)

Work is in progress on developing methods of removing contaminating activities from K^{40} obtained as a by-product in the production of S^{35} and Cl^{36} from Hanford-irradiated KCl. A ferrous sulfide scavenging step was used to remove most of the contaminants and a series of KCl re-crystallizations is being made for final purification.

12. Chlorine (Cl^{36} - 10^{6}y)

About thirty microcuries of Cl^{36} was separated during the month. Specific activity was 142 microcuries per gram Cl.

II. Tank Farm and Burial Ground:

1. Special Wastes

Other than the routine disposal of plant wastes discharged into the chemical system, the following wastes were handled:

a. Five shipments were received from Dayton for burial.

b. Thirteen pots and eleven drums were received from Chicago. Three of the drums contained a uranium solution; seven drums and the thirteen pots contained fission activity in an aqueous solution; one drum contained hexone.

c. K-25 transferred 2,160 gallons of chemical waste to the Tank Farm and thirteen cans of contaminated trash to the Burial Ground.

d. Approximately 17,465 gallons of precipitated metal supernatant were decanted from W-3 to the Chemical Waste System. This contained about .0058% uranium.

e. A total of 1311.70 kg of uranium was added to the metal waste storage tanks. Of this, 204.14 kg was received from the Semi-Works; 62.89 kg from 706-D; 945.00 kg from the Hot Pilot Plant; 45.79 kg from the Radioisotope Development Department; and 53.88 kg from Chicago.

f. About 1,750 gallons of 50% caustic were added to W-3 tank this month in an attempt to dissolve more of the aluminum in this tank. This will be diluted with water and jetted to the Chemical Waste System.

2. Chemical Wastes Discharged to the White Oak Creek

On November 11, 1948, J. A. Jones Construction Company broke a 6" water line north of the 105 Building. This water entered the open exit air duct of the pile and drained into the pile canal, carrying in a large amount of mud. To remove the mud the canal was flushed with large volumes of water. This large volume of water plus the activity picked up from the canal floor caused the amount of activity discharged from the Settling Basin to exceed the five-curies-per-day limit for November 12, 13, and 14, 1948. The flow was diverted through the East Pond in an attempt to lower the amount entering the creek on November 12, 1948. This, however, was unsuccessful; the activity discharged in this manner was as high or higher than through the Settling Basin.

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

Discharged From	Gallons	Curies
Settling Basin	16,509,000	93.95
East Pond	199,000	3.62
Retention Pond	494,800	.13
TOTAL	17,202,800	97.70

3. Waste Tank Inventory

Tanks	Gallons Capacity	CHEMICAL WASTE Gallons In	Gallons Out	Discharged To	Free Space
W1,2,5, 6	348,800	297,850	217,380	White Oak Creek	97,600
		METAL WASTE			
W3,4,7, 8,9,10	754,300	12,790	17,465	White Oak Creek	191,500

4. Maintenance

a. The Settling Basin project has not yet been closed out. Clean-up work remains.

b. All the walks have been paved in the Tank Farm Area. About 75% of the roads have been finished.

5. General

a. The experiment at W-4 tank to determine the feasibility of shipping Chicago wastes by tank truck has been discontinued for the present. The tank from which radiation readings were being made was found to be too large and needed too much shielding. The radioactive liquid in the tank was transferred to W-4 tank.

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

Run #28, the first one using Hanford slugs, was started on November 17, 1948, and shipped on November 22, 1948.

The quantity of product shipped was only 1,380 curies instead of the 2,000 to 2,200 curies requested. This was caused by the low product content of the slugs. According to our chemical analyses, each slug contained only 119 curies at the time of discharge while the calculations made at Hanford indicate that 213 curies should have been present. The pile from which these slugs were discharged was recently flooded by water from a ruptured tube and it appears possible that the resulting abnormal operation accounts for poor irradiation of the slugs we received. This matter is being investigated with Hanford.

The analytical summary of the run is given below. All values are corrected to LST on November 21, 1948.

Slugs Loaded - 36 (Hanford Irradiated)

	Curies	Percent
Total Curies Dissolved	2619 *	100.0
Cell A Losses	681	26.0
Cell B Losses	201	7.7
Losses Accounted For	882	33.7
Product Shipped (Skyshine)	1380	52.7
Product Shipped (Radiochemical)	1459	55.7
Material Balance		89.4
Loss Unaccounted For		10.6

* Based on dissolver solution analysis.

The transfer of product from the electrolysis cell and the subsequent product evaporation created a high air count. The activity appeared to be coming from the 706-D stack which discharges the cell ventilation air. Plans are now being made to install filters in this system before the January run.

Temporary glass wool filters were installed and used in both off-gas lines during the entire run. The data on the efficiency of the filters, collected during the run, is not yet evaluated.

At a meeting with representatives from Los Alamos, it was decided to run some tests to determine the source of impurities in the product. To accomplish this, four dummy runs were made through the final purification equipment and the results indicated that the source of some of the impurities may have been the Tygon tubes used for transfer lines. Before the start of Run #28 one of the main lines was replaced with a MFP-10 plastic tube and after the run was completed, the cubicles were completely decontaminated so that all product Tygon transfer lines may be replaced with the same plastic tubing which is exceptionally resistant to acids and solvents.

C. ISOTOPE CONTROL DEPARTMENT

I. General:

During the month of November there were 377 isotope shipments, an increase of 90 compared with October. This is the largest number of isotope shipments in any month since the start of the Isotope Program in August, 1946. The increase was obtained in spite of continued shutdowns of the pile during November which resulted in the delay of a number of shipments.

	OCTOBER 1948	NOVEMBER 1948	TOTAL August, 1946, to November, 1948, Inc.
Separated Material 706-D Area	254	308	4107
Unseparated Material 100 Area	33	69	1276
	287	377	5383

The breakdown according to non-project, project, and foreign for October and November is as follows:

	October	November
Non-project	207	286
Project	49	56
Foreign	31	35.

II. Radioiodine:

Iodine production has finally caught up with the demand again due to the larger amounts of iodine which can be produced from uranium fission products, compared with production from tellurium. It is interesting to note that the amount of radioiodine shipped was approximately double that shipped in October.

III. Radiophosphorus:

A severe shortage of phosphorus existed during most of the month of November due to the pile shutdown. At the end of the month there

were still approximately 700 millicuries of phosphorus orders outstanding.

It had been hoped that irradiated P_2O_5 at Hanford would be helpful in making up for the shortage here, but, unfortunately, delays occurred at Hanford also which prevented this material reaching Oak Ridge in time to be of help. It is now expected December 1, 1948.

IV. Cobalt:

Approval has not been obtained for the irradiation of cobalt at Hanford but we have recently received information from Hanford to the effect that this request may be delayed due to more urgent irradiations.

A number of cans of cobalt have been inserted in the X-10 pile and will be available to supply requests in the order of 100 millicuries to 1 curie of cobalt. Such sources are expected to be useful in a number of industrial and medical applications. Larger sources are expected to be supplied from the material irradiated at Hanford.

V. Air Shipping Regulations:

The visit of the airline representatives took place on November 16, 1948, as scheduled and the representatives of the airlines were shown the precautions taken in packing and shipping radioisotopes. It is hoped that this will assist the airline people to adopt the recently proposed shipping regulations.

It will be a considerable advantage in shipping of radioisotopes if the proposed new regulations are adopted since rail and air shipments would then be on a uniform basis.

VI. Outstanding Orders:

Orders for approximately 90 microcuries Ca^{45} are outstanding. Some special Fe^{59} produced from isotopicly enriched Fe^{58} is expected to be

received from Hanford soon. About 600 millicuries of Y^{91} is awaiting production of material before shipment can be made. Only a few other shipments are outstanding because the materials are not available.

VII. Source and Fissionable Accountability:

A new procedure recommended by the Methods and Procedures Group has been put into effect for handling source and fissionable material accountability and it is hoped this will somewhat reduce the amount of work involved.

VIII. Antimony - Beryllium Neutron Sources:

Work is continuing on developing Sb-Be neutron sources for distribution in the Isotope Program.

IX. Isotope Production Area:

Basic design data of the packing, shipping, and storage areas are being completed for transmission to Patchen and Zimmerman.

The brickwork for the 250-foot stack was started on November 29, 1948. Foundations have been poured for the service and column buildings and excavations are underway for the remaining structures of the area.

X. Source and Fissionable Material Accountability:

Following is a summary of shipments and receipts of S.F. Materials for the month of November, 1948:

RECEIPTS

Received From	Material	S.F. Content
Argonne National Laboratory	Normal Uranium	53.88 kg.
C&CCC - K-25 Area	Normal Uranium	12.00 gm.
" " "	" "	8.00 gm.
" " "	" "	5.00 gm.
C&CCC - Y-12 Area	U_3O_8	107.34 gm.
Fairchild Eng. & Airplane Corp.	Thorium Salt	3.93 gm.
General Electric Company	Normal Uranium	247.34 kg.
" " "	Plutonium	53.00 gm.
" " "	Normal Uranium	67.74 kg.
" " "	Plutonium	9.30 gm.
U.S.A.E.C. - Dayton Area	Normal Uranium	.71 kg.

SHIPMENTS

Shipped To		
Argonne National Laboratory	Normal Uranium	41.97 kg.
" " "	Thorium Oxide	75.74 kg.
" " "	Normal Uranium	27.98 kg.
" " "	" "	10.49 kg.
" " "	" "	1.75 kg.
C&CCC - Y-12 Area	Thorium	12.00 lbs.
U.S.A.E.C. - Office of New York Directed Operations	"	2.92 gm.