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SERIES A:

AEC RESEARCH AND DEVELOPMENT REPORT

OPERATIONS DIVISION

MONTHLY REPORT

FOR

MONTH ENDING SEPTEMBER 30, 1949

BY

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

OAK RIDGE NATIONAL LABORATORY

OPERATED BY
CARBIDE AND CARBON CHEMICALS CORPORATION
FOR THE
ATOMIC ENERGY COMMISSION
POST OFFICE BOX P
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OPERATIONS DIVISION

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SUMMARY

1. Lost pile operating time averaged 8.3% as compared to 10.3% for August, 1949. (Page 4.)
2. One ruptured slug was detected by visual scanning and discharged without difficulty. (Page 4.)
3. Construction work on a new change house and storage area , which is essentially the expansion of the existing core annex, was started during September, 1949. (Page 4.)
4. Rerouting of pipe lines and electrical circuits along the south face of the pile was started prior to replacement of the experimental and operating balconies. (Page 5.)
5. Temporary P^{32} extraction equipment was set up in the Tank Farm Area and the 205 Building because of the breakdown of the Building 205-Cell V equipment. (Pages 7 and 8.)
6. The fission product equipment has been rebuilt and placed in operation after the fire which caused the shutdown early in August. (Page 9.)
7. Approximately 258,000 gallons of chemical waste were processed through the Tank Farm Evaporator during the month. (Page 12.)
8. The agitator bearing on the extraction vessel (A-9) of Cell A RaLa equipment failed and required decontamination of all equipment. RaLa Run #36 is scheduled to start October 9, 1949. (Page 15.)
9. There were 441 radioisotope shipments during the month compared to 534 for August, 1949. (Page 16.)
10. The major portion of the Radioisotope Area is expected to be completed by October 15, 1949. (Page 18.)

A. PILE DEPARTMENT

I. Operating Data:

	SEPTEMBER 1949	AUGUST 1949	YEAR-TO-DATE 1949
Total Accumulated KWH	2,290,313	2,332,404	22,211,325
Average KW/operating hour	3470.51	3494.75	3733.13
Average KW/24-hour day	3180.99	3134.95	3390.01
Percent Lost Time	8.3%	10.3%	9.2%
Approx. Excess Pile Reactivity	130-140 inhours	120-130 inhours	
Slugs Charged	131	168	2531
Slugs Discharged	114	168	2464
Product Made (grams)	83.59	85.12	783.63
Product Discharged (grams)	4.64	25.98	193.41

II. Pile Operation:

The pile-down time averaged 8.3% compared to 9.2% for the year-to-date.

A ruptured slug was located in Metal Channel 1971 by visual inspection on September 6, 1949, and discharged without difficulty. It had been in the pile 202 days at a metal temperature of approximately 200°C. The probe gave no indication of the presence of the ruptured slug.

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

The excess pile reactivity was 130 to 140 inhours at the end of the month. The ten-hour increase during the month was due principally to lower outside air temperatures at the end of the month.

Construction of a new change house and storage room in the area west of the Pile Building and north of the core annex was started by J. A. Jones Construction Company, Inc. on September 26, 1949. The small amount of demolition and the necessary excavation was practically completed by the end of the month. Most of the concrete footings also were poured.

[redacted]

II. Pile Operation: (Continued)

The south face of the pile is being cleared of experimental equipment so that the existing balconies on the south side of the pile can be removed and new steel and concrete balconies built. This work is to start on October 11, 1949. However, excavation for two footings are being made currently in the Pile Building in order to shorten the time required when the major construction work is started.

The rebuilding of the south balconies is scheduled for eight weeks' duration from the October 11 starting date if the construction work is done on a one-shift basis and six weeks if it is done on a two-shift basis. Current plans specify that the work be done on a two-shift basis.

It is anticipated that considerable overtime work will be required from the crafts when the south balconies are completed in order to get the experimental equipment reinstalled promptly.

The pile will be operated during this period, and the insertion and removal of radioisotopes will be done each Monday as is current practice. The construction firm is to install temporary balconies and the samples for isotope production will be inserted or removed between 4:00 a.m. and 8:00 a.m. on Monday to avoid interference with construction.

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:

[redacted]

III. Filter House: (Continued)

Date	F.G. #50 GLASS WOOL FILTERS Inches w.g.	% Increase	C.W.S. #6 PAPER Inches w.g.	% Increase	ACROSS HOUSE Inches w.g.	% Increase
Clean Filters	1.1	-	1.0	-	3.3	-
8-31-49	3.7	236%	2.0	100%	6.9	109%
9-30-49	3.9	5%	2.0	0%	7.2	4%

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 September, 1949, with those handled in August, 1949:

	AUGUST, 1949		SEPTEMBER, 1949	
	Research	Radioisotopes	Research	Radioisotopes
Stringers 13, 14, and 16	13	163	5	88
Hole 22 (Pneumatic Tube)	64	9	32	5
All Other Holes	10	24	5	17
TOTAL BY GROUPS	87	196	42	110
TOTAL FOR MONTH	283		152	

At the end of September, 1949, there were 358 cans of target material in Stringers 13, 14, and 16, compared to 288 cans of target material in these stringers at the end of August, 1949.

B. CHEMICAL SEPARATIONS AND ISOTOPE DEVELOPMENT DEPARTMENTS

I. Radioisotopes:

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

Fifteen X-slugs were processed and 17,810 mc shipped. All products were within specifications. Higher than usual yields were experienced this month due to a longer bombardment period in the center of the pile. This longer irradiation time was possible because of the large amount of iodine made from the two Hanford slugs processed last month. It was not necessary to make any I^{131} for three weeks after the Hanford run was made.

Lead shielding, one inch thick, was installed between Rooms 10 and 11 in Building 706-C to reduce the radiation level in Room 11 from the I^{131} glassware equipment. The radiation from the glassware was especially high in Room 11 during the Hanford run. As the result of the shielding, no radiation has been found in subsequent runs, using X metal.

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

Because of breakdown of P^{32} equipment in Cell 5, an emergency P^{32} program was started September 6, 1949, to provide temporary facilities for P^{32} production until new equipment is ready in the Isotope Area.

An enlarged and improved P^{32} extractor, similar to the pilot extractor in 706-D, was designed and two units were installed in the Tank Farm, east of the ruthenium plant. The balance of the design work included a concrete pad, piping, sulfur melting apparatus, and instrumentation. Operation of these extractors (in which the sulfur is extracted with 0.2 N HNO_3 at 130°C. in 4" diameter by 26" long Pyrex tubes) was

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

started September 26, 1949. Part of the exhaust piping on extractor #2 was re-routed because of loss of acid by condensation.

Glassware and special equipment for P^{32} purification was designed and installed in Building 204, after the C^{14} equipment was removed from that site.

The entire emergency P^{32} installation will serve as a pilot model for our new equipment.

During the interval when the emergency equipment was being fabricated and installed, the P^{32} was extracted in the 706-D pilot extractor and purified by straight laboratory techniques in Building 807. A total of 7,000 mc of P^{32} was purified during the month (6,265 mc from X-10 sulfur and 735 mc from Hanford P_2O_5). Approximately 4,800 mc of this material was shipped, the remainder being held over for October shipments.

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

The 317 slugs processed last month, but not reported, yielded 433.6 mc of C^{14} with an average isotopic ratio of 4.31%. No runs were made this month.

Carbon Development Work (Be_3N_2 Process)

Chemical development work was completed on the Be_3N_2-C^{14} process; the equipment in Building 204 was removed to make way for the emergency P^{32} purification apparatus. A report is being written on this phase of the Be_3N_2-C^{14} process.

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

None produced; adequate supply in stock.

5. Fission Products

After extensive repairs and alterations, the fission product apparatus was started up again on a three-shift basis September 27, 1949. The operation is routine and operators from the Chemical Separations Department will be trained to take over this work as soon as possible.

There were no fission product purifications made this month.

The Zr-Cb purification unit was completed and installed in the North Hot Lab. This equipment will allow one to make remote control separations of Zr-Cb, and Cb from traces of Pu by three methods (ion exchange, MnO_2 precipitation, and TTA extraction), or various combinations of the methods.

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

A source consisting of 1.19 mc Ru^{106} plated on a 1" diameter copper disc and covered by a 0.001" gold plate was made and shipped to the K-25 Plant for use in a beta thickness gage.

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

The Ca^{45} recovered from the C^{14} process (reported last month) had a specific activity of 0.6 mc/gram Ca; 69.8 mc was produced. A total of 69.3 mc of high specific activity Ca^{45} (39 mc/gram Ca) was produced from the Hanford-irradiated $CaCO_3$ reported last month.

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

No runs were made.

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

The analysis for the batch reported last month has not been completed. A possible error in the Fe^{55}/Fe^{59} ratio was noted and the sample was returned to the laboratory for re-checking.

10. Cyclotron Targets

The first full-scale separation of Na^{22} was started. The procedure is being varied from that used at M.I.T. The target was dissolved in HCl instead of acetic acid and the magnesium separated as the carbonate. Very little of the Na^{22} is carried by the magnesium carbonate. Purification will be completed on a small ion exchange column. Part of this solution was transferred to the Chemistry Division for further experimental work on the ion exchange method.

The test sample of Be^{7} (lithium target) is being processed by a different method than the one used by Bolomey and Whitney on an earlier target. An alkaline hydroxide precipitation was made with no loss of Be^{7}; the copper contamination and unknown activities were removed by electroplating from an ammoniacal solution. However, the Be^{7} final purification will probably be done by TTA extraction.

Several samples of irradiated iron have been received for processing to separate Co^{57}. Work has been started on one of these targets.

11. Miscellaneous

a. Selenium (Se^{75} - 125d)

A selenium preparation in sulfuric acid was made. A total of 1,440 mc was obtained from one target; part of

11. Miscellaneous - (Continued)

this material was shipped and the rest put in stock. Indications are that the published cross section for selenium is low by a factor of 6.

II. Tank Farm and Burial Ground:

1. General

a. A spill occurred in the east side of the South Tank Farm which made it necessary to remove several cubic yards of the surrounding earth to the Burial Ground. This spill occurred at a vent in the three-inch stainless steel line from Buildings 706-C - 706-D to W-12 tank, when the line became temporarily plugged. This has never happened since the lines were installed when the Tank Farm was built; the reason for the temporary plugging of the line is not known. An order has been placed to weld a blind flange on the opening to prevent a similar occurrence in the future.

b. Approximately 62,400 gallons of metal waste were jetted from W-8 tank to W-10 for precipitation. The jet moving the waste from W-8 failed at 2'11", making it necessary to lower an air-driven pump into the tank to remove the remaining waste. This transfer is not yet complete.

2. Wastes Discharged to White Oak Creek

About 61.7 curies of beta activity were discharged from the Settling Basin this month. This is an average of 2.2 curies per day. This figure is 26.8% lower than last month's discharge, but is higher than normal due to the necessary fire hose decontamination of Cell A, Building 706-D. Such

2. Wastes Discharged to White Oak Creek - (Continued)

large volumes of water were used that it became necessary to send it directly to the Settling Basin without processing it through the evaporator.

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

Discharged From	Gallons	Curies
Settling Basin	23,412,000	61.7
Retention Pond	265,300	.06

3. Waste Evaporator

In general, volume reductions were low this month due to the high specific gravity feed solution which consisted mainly of metal waste supernatant.

A special run was made using the supernatant from Tank W-6, the evaporator concentrate storage tank. A volume reduction of 2:1 was realized indicating that much more space can be made available for future wastes by a re-concentration of this solution.

Approximately 258,170 gallons of waste were handled by the evaporator this month.

Gallons Fed to Evaporator	Gallons of Concentrate to W-6	Volume Reduction	Beta Curies to Evaporator	Beta Curies to Settling Basin
258,170	34,885	8.4:1	935.6	12.0

[redacted]

4. Waste Tank Inventory

HOT PILOT PLANT STORAGE

Tanks	Gallons Capacity	Gallons In	Gallons Out	Discharged To	Free Space
W-3	41,300	0	0	---	12,778
CHEMICAL WASTE STORAGE					
W-5	170,000	280,945	258,143	Evaporator	22,800
EVAPORATOR CONCENTRATE STORAGE					
W-6	170,000	34,800	1,200	Evaporator	28,800
METAL WASTE STORAGE					
W-4,7,8, 9,10	713,000	3,896	46,800	Evaporator	239,800

5. Special Wastes

a. Approximately 46,800 gallons of precipitated uranium supernate were jetted from W-10 to W-5 tank. This contained an average of .0046% uranium.

b. A total of 184.58 kg of uranium was received into the Metal Storage System this month; of this, 133.1 kg was transferred to the Technical Division, Section I, and 51.48 kg from the I^{131} separation process.

c. The Technical Division, Section I, received from Tank W-10, 1.1 kg of metal waste for metal recovery studies.

d. Three shipments of alpha contaminated trash from Dayton were buried.

e. Eight hundred and fifty drums of contaminated trash from Y-12 were buried.

f. One shipment of trash from K-25 was buried.

5. Special Wastes - (Continued)

g. About 350 gallons of waste containing uranium were received from K-25.

h. A 45,210-pound shipment of thorium waste was received and buried for the Ames Laboratory.

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

Both A-16 off-gas fans, which had failed during Run #35 in August, were decontaminated and repaired early in September. One fan motor was rewound and reinstalled while a spare non-enclosed motor was installed on the other fan. The overload relays were replaced with lower capacity overloads to prevent burning out of the motor windings under heavy loads.

All instrument lines to all Cell A tanks were steam cleaned to remove bubbler oil. A fuming HNO_3 treatment of all tanks in Cell A through which the product passes was not performed because a cell decontamination became a necessity when the A-9 agitator shaft was found immovable.

Following decontamination of Cell A, which was one of the most difficult ever made, and the removal of the A-9 extraction tank, the cause of the agitator failure was found to be a frozen bearing which was corroded by acid fumes.

While Cell A was open for repairs to the A-9 tank, many other minor repairs to Cell A equipment were made. Several alterations and additions were also made to the equipment for the attachment of experimental resin columns and filters.

Because of the equipment breakdown of the A-9 agitator, Run #36 was postponed from September 25, 1949, to October 9, 1949. This, apparently, will not interfere with the Los Alamos schedule since they also requested that this run not be started before this date.

C. ISOTOPE CONTROL DEPARTMENT

I. General:

There were 441 radioisotope shipments during the month of September compared with 534 during August. The decrease is due mainly to the fact there were effectively only four weeks in September compared with five in August.

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

	AUGUST 1949	SEPTEMBER 1949	TOTAL August, 1946, to September, 1949, Inc.
Separated Material 706-D Area	374	338	7,579
Unseparated Material 100 Area	160	103	2,305
	534	441	9,884

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

	AUGUST	SEPTEMBER
Non-Project	392	347
Project	118	68
Foreign	24	26
	534	441

II. Phosphorus:

A shortage of P^{32} continued during most of the month and amounted to approximately 1,300 millicuries at the end of the month. The P^{32} produced from the irradiation of P_2O_5 at Hanford has been used to increase the supply of P^{32}. No objections have been received concerning the low specific activity of this material which analyzed between one and two milligrams of inactive phosphorus per mc of P^{32}. Compared with the specific activity in our regular product of 25 micrograms/mc this is quite low. [redacted]

III. C^{14} Labeled Compounds:

Several shipments of sodium formate were made during the month.

IV. Hanford Irradiations:

The Atomic Energy Commission has been requested to provide more irradiation facilities for the Radioisotope Program at Hanford; otherwise, three important radioisotopes cannot be produced in enough quantity to meet anticipated demands - these are C^{14}, P^{32}, and Co^{60}.

V. Cobalt 60:

In order to check the low yield obtained at Hanford from a three-month irradiation of cobalt, arrangements have been made to have samples checked by the Bureau of Standards. Also, as soon as facilities are available, some of the radioactive cobalt will be dissolved and the beta radiation counted to give a more reliable check of the activity.

VI. Industrial Use of Radioactive Ruthenium:

An inquiry has been received from the General Electric Company concerning the use of radioactive ruthenium plated on metal discs as a source for thickness gages. A considerable quantity of ruthenium would be needed for this purpose and to encourage such large sales, a reduction in the price of radioactive ruthenium and other fission products was submitted to the AEC for approval. Under this new pricing schedule, the present price of Ru^{106}, Cs^{137}, Nd^{147}, Pr^{143}, and Cb^{95} would remain unchanged on amounts up to 100 millicuries, while on all amounts of 101 millicuries and above, the price would be reduced to 25% of the present figure.

VII. Radioisotope Processing Area:

Construction work continued on all buildings in the Isotope Processing Area and in the Analytical Building. The service piping, electrical wiring, and installation of the hot sinks and barricades, and the laboratory furniture were completed except for minor details. Also, the exhaust ducts for the isotope storage barricade, the lumnite cement floors, and the tile floors were completed. In the Process Buildings installation of the electrical wiring, service piping, hot sinks and barricaded, and the laboratory furniture were completed except for minor details. Installation of the duct work over the twenty-foot hot barricaded was started. In the Service Building the distilled water equipment was put into operation and flushing of the lines started.

At the exhaust stack installation of the exhaust ducts and auxiliary equipment was continued. Topsoiling and seeding of the area were completed.

L. B. Emlet, Director
Operations Division

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VIII. SF Material Control:

1. Arrangements were completed with the Chemistry Division to effect a procedure for the handling of laboratory counting discs. Due to the smallness of the amount of material involved, the philosophy of this procedure will be that each disc or sample should be accounted for by a number rather than by quantity of material.

2. Discussions were held with all supervisors of the Chemistry Division's analytical laboratories relative to handling the fissionable samples in and out of the laboratory. The discussions were quite thorough in every respect and dealth with several problems which the supervisors felt might arise in the establishment of such a program. At the conclusion of the meeting a general agreement had been reached on these problems; and the Sf accountability representatives distributed all of the required forms to be used under this new procedure.

3. Preliminary discussions were held with the Director and technical personnel of the Metallurgy Division regarding the possibility of establishing a procedure for the handling of metallographic samples. Several points were agreed upon by both the representatives of the Accountability Office and the Metallurgy Division. A formal procedure for the handling of these samples will be completed during the month of October, 1949.

4. Last month we were investigating differences of uranium and plutonium which occurred on a total of three shipments of uranium supernate from Hanford. Our figures, which were by

VIII. SF Material Control: -(Continued)

4. analysis, differed considerably with the amounts which Hanford said they had shipped to us. This investigation has been completed; it was found that the differences occurring were a result of Hanford's procedure for determining the amount of material by estimate, and our determination, which was by analysis. The Hanford Accountability Office agreed that our analysis was probably the more accurate figure and further stated that they would be agreeable to any adjustment in line with our analysis. A full report of this transaction is contained in a letter from Mr. C. N. Rucker to Dr. A. H. Holland, dated September 21, 1949.

5. During the month of September, 1949, the SF Accountability Office, in conjunction with other divisions in the Laboratory, established an inventory value on plutonium heretofore unreported; namely, plutonium produced and discharged from the X-10 pile. This work entailed assignment, by calculation, of plutonium values to slugs stored in the 105 Canal, underground vault, Tank Farm, and the Chemistry Division's Semi-Works.

Although plutonium produced in the pile had not been previously reported, a complete record had been maintained since November, 1943, as to the amount discharged from the pile and the disposition made therefor; consequently, these records were very valuable in computing the plutonium inventory in lieu of sample analyses when representative samples could not be obtained.

VIII. SF Material Control - (Continued)

5. On September 1, 1949, the SF accountability procedure was modified to include transferring and inventorying of all plutonium, irrespective of its origin. Personnel handling SF materials have been notified accordingly.

6. One car was received from Hanford which contained supernate and sludge for the Semi-Works operation and other materials for the Metallurgy and Operations Divisions. A new system of unloading the car was tried for the first time. The car was spotted inside the K-25 Area alongside one of the warehouses. K-25 personnel were used in unloading the car; however, Health Physics, Transportation, and Accountability representatives from Oak Ridge National Laboratory were present for the unloading. This was a trial case in that we were trying to determine whether or not it is more feasible and will cause less contamination by unloading at K-25 on a platform than unloading at the regular Blair siding.

7. A program of collecting scrap source and fissionable materials was initiated during the month for the purpose of getting these materials back into AEC production channels. This work should be completed in the very near future.

8. Discussions were held with statistical representatives of the K-25 Plant relative to the feasibility of establishing a limit of error for the processing of HEW-52 material. At this writing a report has not yet been received; however, it is expected within the next few days.

VIII. SF Material Control: - (Continued)

9. Six bureau chiefs of the Federal Bureau of Investigation visited the Accountability Office on an educational tour. There was one representative from Knoxville, Santa Fe, Chicago, Washington, and two from New York. One afternoon was devoted to discussions of the general accounting system, our plutonium accounting system and the handling of shipments, receipts, storage, etc.. They expressed a keen interest in our storage facilities and were particularly interested in how we might determine substitutes of material. They were accompanied by accountability representatives of both the Oak Ridge and Washington Operations Offices.

10. On September 22, 1949, Mr. E. J. DuBois, representative of Lybrand, Ross Brothers and Montgomery - a public accounting firm under contract with the Atomic Energy Commission - returned to the Laboratory for a meeting with the SF Accountability Group. He was accompanied by a representative of the Oak Ridge Directed Operations SF Accountability Office.

The purpose of the meeting was to further discuss and clarify some complex problems which he (DuBois) encountered while conducting a review of SF accouting methods and procedures at the Laboratory. This review took place in August, 1949. In general, it appeared that he had a good conception of the situation and the meeting evidently clarified his problems.

11. AEC representatives of the SF Accountability Offices for the Oak Ridge Operations, and a representative of the Research and Medicine Division visited the Laboratory for the purpose

VIII. SF Material Control: - (Continued)

11. of making their quarterly survey. The survey lasted for three days; the locations visited were: 706-C, 706-D, Semi-Works, 105 Building, Pilot Plant Operations, Metallurgy Division 101-D, Metallurgy Division Rolling Mill, and SF Accountability storage facilities. The present SF Accountability Representative of the Oak Ridge Operations will be leaving soon; this was more of a "break-in" for his replacement who was present during the survey.

12. Following is a summary of receipts and shipments of SF materials for the month of September, 1949:

RECEIPTS

Received From	Material	Content
C&CCC, K-25 Area	UNH Solution (Normal)	20,136.00 gm.
" " "	Hanford Waste Scrap (Radioactive Glass and Paper)	12.00 gm.
C&CCC, Y-12 Area	Uranyl Formate (Normal)	1,842.60 gm.
" " "	Uranyl Nitrate (Normal)	64,163.30 gm.
" " "	Uranyl Nitrate (Normal)	44,585.40 gm.
" " "	Uranyl Sulfate (Normal)	1,127.90 gm.
" " "	Contaminated Uranium Metal	900.842 gm.
" " "	U_3O_8	6.20 gm.
" " "	1 Piece Normal Uranium	1,166.00 gm.
Fairchild Engine and Airplane Corporation	Be_2C Rods	2.64 gm.
" "	Uranyl Nitrate	69,868.70 gm.
General Electric Co.	Slugs (Normal)	131.00 gm.
" " "	Uranium Metal Waste Solution	22,220.00 gm.
		38.00 mg. Pu
" " "	Hanford Slugs (Normal)	235.20 gm.

VIII. SF Material Control: - (Continued)

12.

SHIPMENTS

Argonne National Laboratory	First Cycle Redox Uranium Product Solution (Normal)	79.00 gm.
" " "	First Cycle Redox Solution	5.00 ml.
C&CCC, Y-12 Area	1 Unjacketed Clinton Size Slug	1,166.00 gm.
Fairchild Engine and Airplane Corporation	Natural Uranium-Impure Uranium Foil and Chunk	718.20 gm.
Tracerlab, Incorporated	5 ml. Nitric Acid Solution (U-233)	44.40 mg.
" "	3 ml. Nitric Acid Solution (Pu)	10.00 mg.