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LABORATORY RECORDS
1954

OPERATIONS DIVISION

MONTHLY REPORT
FOR MONTH ENDING APRIL 30, 1950

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OPERATIONS DIVISION

MONTHLY REPORT

for

Month Ending April 30, 1950

by

L. B. Emlet

DATE ISSUED

MAY 19 1950

OAK RIDGE NATIONAL LABORATORY
operated by
CARBIDE AND CARBON CHEMICALS DIVISION
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SUMMARY ORNL-699

1. Lost pile operating time averaged 10.1% for the month, compared to 7.5% for March, 1950. (Page 5.)
2. One ruptured slug was detected and removed without difficulty. (Page 5.)
3. All cell ventilation air, as well as vessel off-gases, were directed to the 900 Area stack. (Page 8.)
4. Work is continuing on the design of new I^{131}-fission product production equipment. Initial corrosion tests on titanium metal indicate that it may be satisfactory as a construction material for the tank required. Most stainless steels corrode sufficiently to cause difficulty when the dissolver solutions are processed through an ion exchange column to isolate fission products. (Pages 8, 9, and 10.)
5. Installation of new phosphorus extraction equipment in Building 906 is approximately 90% completed. (Pages 11 and 12.)
6. An attempt will be made to fractionate the dissolver gases from Be_3N_2 slugs to produce C^{14} methane. (Pages 12, 13, and 14.)
7. Storage of Zr^{95}-Nb^{95}, complexed with oxalic acid, results in slow precipitation on the glass walls of the bottle. (Page 15.)
8. Fe^{59} with 1.7% Fe^{55} was produced from the Hanford irradiation of enriched Fe^{58}. (Page 16.)
9. The activity discharged to White Oak Creek totaled 11.07 beta curies for the month, as compared to 8.19 curies for March, 1950. Approximately 2.4 curies of activity were discharged from the evaporator during April, 1950. This increase is due to the re-concentration of highly active concentrate. (Pages 20 and 21.)

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SUMMARY - (Continued) ORNL-699

10. RaLa Run #41 was completed on April 13, 1950. A "skyshine" measurement indicated 4,800 curies present. This is the largest batch produced to date. Los Alamos reported the material to be exceptionally pure. (Page 23.)

11. Approval for the installation of the new ion exchange RaLa process has been received. This process will reduce radiation hazards and give increased efficiencies. (Page 24.)

12. There were 635 shipments of radioisotopes during the month, compared to 662 in March, 1950. (Page 25.)

[redacted]

A. PILE DEPARTMENT

I. Operating Data:

	APRIL 1950	MARCH 1950	YEAR-TO-DATE 1950
Total Accumulated KWH	2,236,791	2,487,173	9,329,835
Average KW/operating hour	3457.18	3612.62	3552.60
Average KW/24-hour day	3106.65	3342.97	3239.53
Percent Lost Time	10.1	7.5	8.8
Approx. Excess Pile Reactivity	90-100 inhours	120-130 inhours	
Slugs Charged	133	126	741
Slugs Discharged	172	126	733
Product Made (grams)	81.63	90.77	340.50
Product Discharged (grams)	14.93	9.52	54.62

II. Pile Operations:

The pile was down 10.1% compared to 7.5% for the previous month, and 8.8% for the year-to-date. The increase in pile-down time was due principally to location and discharge of a ruptured slug and a water leak in the Hole 11 fuel evaluation experiment.

A ruptured slug indicated its presence on the probe on April 26, 1950. It was located by visual scanning and discharged without difficulty. The slug was exposed as follows:

Rupture No.	Metal Channel No.	Date of Discharge	Days in Pile	Approximate Maximum Metal Temperature in Channel
71	1575	4-26-50	2003	190°C.

During an attempt to flush out the water circulation system used in connection with the fuel evaluation experiment in Hole 11, a water leak developed at an improperly assembled flange and several liters of water spilled into the outer liner of the hole. The water was removed on the routine April 24th shutdown, prolonging the pile-down time somewhat.

The major items of permanentization work remaining to be completed in the Pile Area are replacement of the pile control wiring, rebuilding of the inlet filter house, replacement of the wood structure now housing the fan motors and controls with a concrete block structure,

II. Pile Operations: - (Continued)

and replacement of the pile-cooling fans. The replacement of the wood structure at the Fan House has progressed slowly during the month. The other items have not been started yet. The combination change house and storage room, including the central air-conditioning unit, were accepted from Construction by the Laboratory during the month.

The excess pile reactivity was ninety to one hundred inhours at the end of the month. The approximately thirty-inhour decrease from last month was due to warmer weather, charging of four Invar samples for irradiation damage studies, and a small loss due to the solids resulting from the water spill in Hole 11.

III. Filter House:

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

	GLASS WOOL FILTERS		CWS #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	--
3-31-50	3.5	218	2.8	180	7.4	124
4-30-50	3.7	6	2.9	3	7.8	5

Due to the current magnitude of the pressure loss across the Filter House, another cell of glass wool filters will be changed during the coming month. At the completion of the scheduled changes, three-fourths of the initial installation of glass wool media will have been changed since the Filter House was put in operation on November 14, 1948. The two layers of FG #50 are now being replaced by a layer of FG #25 and a layer of FG #50 which should give even longer filter media life.

III. Filter House: - (Continued)

Filter House operation has been normal throughout the month.

IV. Fan House:

Fan House operation has been normal throughout the month.

V. Radioisotopes:

The following is a comparison of the radioisotope and research samples charged into the pile during April, 1950, with those handled in March, 1950:

	MARCH, 1950		APRIL, 1950	
	Research	Radioisotopes	Research	Radioisotopes
Stringers 13, 14, and 16	48	159	43	191
Hole 22 (Pneumatic Tube)	49	8	40	2
All Other Holes	10	17	9	20
TOTAL BY GROUPS	107	184	92	213
TOTAL FOR MONTH	291		305	

At the end of April, 1950, there were 413 cans of target material in Stringers 13, 14, and 16, compared to 419 cans of target material in these stringers at the end of March, 1950.

VI. Water Demineralization Building:

The operation of the building was normal throughout the month with 617,100 gallons of water being demineralized of which 52,660 gallons were also deaerated.

Produced: (gallons)	APRIL, 1950	MARCH, 1950	YEAR-TO-DATE, 1950
Demineralized	617,100	621,800	2,344,300
Deaerated	52,660	42,000	141,460

B. CHEMICAL SEPARATIONS AND RADIOISOTOPE DEVELOPMENT DEPARTMENTS

I. Radioisotopes:

1. General

Construction personnel completed the installation of the hot off-gas lines from Buildings 706-C and D to the 900 Area stack, the hot off-gas filter, and the standby steam turbine and blower. The remainder of the 900 Area stack pad was also poured.

ORNL personnel completed the tie-in of all hot off-gas lines from 706-C and 706-D to this new system, and the system was put into operation during the latter part of the month. Indications are that the pressure drop and capacity in the system are adequate to meet presently anticipated requirements. In a 48-hour test run, the standby turbine and hot off-gas blower operated satisfactorily.

The 706-C and D ventilation filters (both the glass wool and the C.W.S. paper) were replaced when the pressure drop across the filter box reached 6.7" w.g.. This is an increase of 2.5" w.g. over new filters which average about 4.2" w.g. pressure drop. The replaced filter units were found to be coated with what appeared to be concrete dust, possibly coming from the construction work in the cells of 706-C.

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

Eighteen ORNL slugs were processed and 23,228 millicuries shipped. Product for shipments made during the first two weeks of this month was supplied by the Hanford slugs processed during the latter part of last month.

During the first part of the month, repair and testing of the equipment in the 706-C cell were completed. In addition to

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

the repairs noted last month, leaks were repaired in fifteen pipe welds, four valve packing glands, and the top flange of one transfer line. It was also necessary to replace three tantalum to stainless steel pipe connectors. As noted in last month's report, the equipment appears to be slowly deteriorating in view of the steady increase in the maintenance work required.

On April 10 and 11, 1950, some air activity was noted during the dissolving and sparging operations. It appears that this could only have been caused by a leak in the off-gas system, although the best possible check of the line failed to reveal any leaks; however, this check was not conclusive because of the complicated layout of the line. On April 24, 1950, the off-gas lines were tied into the system to the new stack. This new off-gas cell ventilation system should substantially reduce the incidents of high air activity.

Iodine Development Work

A general external layout for the 910 Building I^{131} plant was planned and discussed with members of the Engineering Department. A preliminary cost estimate is being prepared on the new iodine and fission products facilities.

Letters of inquiry regarding availability, cost, and fabrication of titanium were sent to various companies.

Corrosion tests on titanium and various stainless steels were continued and indicate that titanium is by far the best material of those tested for use alternately in boiling 70% HNO_3 and boiling 7.5% NaOH solution. Weight loss of Ti after Test #1 in HNO_3 was 6.9 mdd*, and after Test #2 was 1.4 mdd. This may

* mdd = $mg/dm^2/day$

2. Iodine Development Work - (Continued)

indicate that the thin surface film formed in boiling HNO_3 inhibits further corrosion.

After HNO_3 Test #2 on Ti, the sample was partially immersed in a 7.5% NaOH solution at room temperature for twenty hours. A very slight difference in the coloration in the portion bathed by NaOH solution was noted. The temperature was then raised to 92°C. for two hours. A change in thickness of the film (refractive color change) was noted where the sample was bathed with NaOH. No weight loss was observed after boiling the Ti for twenty-six hours in 7.5% NaOH. A third test of the same sample in boiling 70% HNO_3 produced a weight loss of only 0.7 mdd.

Of the stainless steels tested, type 309 is the best for use in boiling 70% HNO_3. Complete results of the corrosion tests are tabulated below:

Material Tested	Test No.	Corrosive Medium	Amount of Corrosion
347 S.S.	1	Boiling 70% HNO_3	110 mdd*
347 S.S.	2	" " "	104 mdd
C-20 S.S.	1	" " "	89 mdd
C-20 S.S.	2	" " "	86 mdd
Titanium	1	" " "	6.9 mdd
Titanium	2	" " "	1.4 mdd
309 S.S.	1	" " "	28.2 mdd
309 S. S.	2	" " "	26.4 mdd
317 E.L.C. - S.S.	1	" " "	127.3 mdd
317 E.L.C. - S.S.	2	" " "	91.5 mdd
L-605	1	" " "	318 mdd
318 S.S.	1	" " "	99.4 mdd
Titanium	1	Boiling 7.5% NaOH	No wt. loss after 26 hrs.
Titanium	3	Boiling 70% HNO_3	0.7 mdd

* mdd = $mg/dm^2/day$

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

Twenty 2,000-gram cans of irradiated sulfur were processed and 7,860.5 millicuries were shipped. All products were within specifications. Lower yields are a result of breakage of the primary evaporator and higher than usual waste losses in the purification step.

Phosphorus Development Work

Installation work on the new extraction equipment in Building 906 is 90% completed and the testing program has been started. The 2" diamater hydraulic cylinder used for tilting the extractor was found to be too small and will be replaced with a 4" cylinder. Heating tests showed that the main body temperature tended to run too high while the temperature of the ends of the unit were marginal. By introducing another steam inlet line, it is now possible to control the temperatures of the jacket and coil sections separately. Steam pressure in the coils was boosted to 100 psi, while that in the jacket was reduced to 40 psi. All internal temperatures were measured by thermocouples and found to be sufficiently high.

The remote-control valve clutches were modified and a Brown recorder was mounted to record temperatures from this unit and another extraction unit which will be built for stand-by after thorough operating tests have been made on unit #1.

Preliminary designs have been made for an electronic control device which will permit only correct rates of heating and cooling of the glass-lined equipment. The purpose of this device is to prevent injury to the equipment by an operating error.

3. Phosphorus Development Work - (Continued)

Work on the purification equipment has progressed quite well. Delivery of some stainless tubing fittings is expected within twenty-five days.

The new-type sulfur irradiation can was pressure tested at 10 psi, then filled with one pound of sulfur and inserted into the highest temperature zone of the pile channel reserved for sulfur. This test should reveal whether or not the sulfur melts while in the pile.

The gold-lined finishing evaporator was tested for corrosion by evaporating 400 ml of 0.1 HCl to 10 ml. Spectrographic tests indicated no gold in the solution and a Purple of Cassins test indicated << 1 ppm of gold. During these tests it was quite emphatically demonstrated that one of the largest sources of impurities in our final product is the reagent grade chemicals (such as HCl) which we use.

Approximately eighty millicuries of carrier-free P^{32} were produced for several special orders.

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

No runs were made.

The following is a listing of the C^{14} available in the unprocessed Be_3N_2 and $Ca(NO_3)_2$ slugs:

No. of $Ca(NO_3)_2$ Slugs in Pile	2,535
No. of $Ca(NO_3)_2$ Slugs in Canal	451
Total C^{14} Content in $Ca(NO_3)_2$ (Estimated)	3,517.7 mc
No. of Be_3N_2 Slugs on Hand	851
Total C^{14} Content in Be_3N_2 (Estimated)	38,295 mc
Total C^{14} Available (Estimated)	41,812.7 mc

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

An inventory of approximately 186 millicuries of C^{14} in the form of $BaCO_3$ is on hand.

Carbon Development Work

No further work is being done on the construction of Be_3N_2-C^{14} equipment for Building 905 because of the urgency of other high priority work.

A sample, stated to contain 3.3 mc of $C^{14}O_2$ of 40% isotopic abundance, was converted to $BaC^{14}O_3$. The sample, contained in a glass tube equipped with a break seal, was sealed onto the conversion apparatus and pressure, volume, and temperature measurements made which indicated that there was enough gas to produce 21.8 mg of $BaCO_3$ rather than the 25.6 mg equivalent claimed by the producer of the sample. After conversion, 15 mg of $BaCO_3$ were collected. The low yield is incompatible with test run results. Ninety-nine percent of the activity was accounted for, and tested runs made prior to this one gave 100% yield. It is concluded that the original sample did not contain the stated quantity of $C^{14}O_2$.

The following is a brief statement of the status and general plan of C^{14} production research:

a. Collect in flasks all the gases that come from dissolving one beryllium nitride slug.

b. Pass this gas slowly through a micro low-temperature fractionation column to separate the components according to their boiling points as much as possible.

c. Pass the largest portion of the above gases (which will be methane) and hydrogen through a glow discharge tube to convert

4. Carbon Development Work - (Continued)

c. to acetylene, which will be a good starting material for the synthesis of many organic compounds.

d. Produce some pure (carbon-free) beryllium nitride for production of very high specific activity C^{14}.

Equipment for part one is about ready for use. Arrangement has been made to by-pass the gas through a CuO furnace and scrubbers to produce some $BaCO_3$ if needed before the large equipment is ready. For part two, the micro column is ready to mount; the Topler pump and traps are finished. The equipment can be assembled as soon as a magnatic valve being fabricated is ready. No work has been started on parts three and four.

5. Sulfur (S^{35} - 87.1d)

Five cans of KCl irradiated in the X-pile were processed to yield 2,380 mc of S^{35}. The bulk of this material was then used to produce BaS^{35}. The analysis is incomplete.

One Hanford-irradiated unit of KCl was processed to produce carrier-free $H_2S^{35}O_4$. Part of this material will be converted to elemental sulfur (S^{35}).

6. Fission Products

SS-21 was completed and the product fractions stored for final purification. There was some delay in starting SS-22 (young slugs) because of a decision to replace the IR-120 resin in column #2 with IR-100 resin. This run should get underway in about one week.

6. Fission Products - (Continued)

a. Zirconium-Niobium (Zr^{95}-Nb^{95}, 65d, 35d)

About 1,900 mc of Nb^{95} were separated from Zr^{95} and purified for shipment. All wastes were stored as a future source of Nb.

An oxalic acid rinse of the product storage bottle yielded 800 mc of pure Zr-Nb for shipment. Apparently storage of Zr-Nb, even complexed in oxalic acid, results in slow precipitation on the glass. A periodic re-check of activity is therefore necessary with stored Zr and Nb.

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

Approximately three curies of Y^{91} are in process of final purification from Pm^{147}.

c. Promethium (Pm^{147} - 3.7y)

Several rare earth fractions containing Pm^{147} were reworked on a long column to separate it from traces of Ce^{144}. One pure Pm^{147} fraction was freed from alpha contamination by TTA extraction. Indications are that very little Pm^{147} is lost during the extraction. Approximately thirteen millicuries of pure Pm^{147} were prepared for shipment.

d. Strontium (Sr^{89} - 53d)

Approximately 800 mc of Sr^{89} were prepared this month.

7. Tritium (H^3 - 12.1y)

Installation of tritium equipment is 80% completed. The equipment should be ready for testing and calibration by May 15, 1950.

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

A high vacuum system for the extraction of A^{37} from irradiated calcium, assaying and packaging has been designed and is now being installed in the second gas hood of Building 907.

9. Cesium (Cs^{137} - 33y)

During the month a special order was received for twenty curies of cesium. Facilities are being designed for construction at W-3 in the North Tank Farm, the old ruthenium site in the South Tank Farm, and in Building 908. These facilities should be completed so that operations may start early in June, 1950.

10. CR Waste Project

Experimental work on the chemistry of this process has been completed. Design work has been started and will be integrated with the design of the South Tank Farm facilities for cesium production.

11. Iron (Fe^{59} - 46.3d)

A Hanford-irradiated sample of enriched Fe^{58} was processed. Analysis:

Total Fe^{59}	-	40 mc
Concentration	-	0.577 mc/ml
Specific Activity, Fe^{59}	-	1500 mc/gram Fe
Percent Fe^{55}	-	< 1.7%

This is the best sample of Fe^{59} (low in Fe^{55}) yet obtained; the specific activity is also exceptionally high.

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

Chlorine 36 was produced from Hanford NaCl. Analysis as follows:

Total Cl^{36}	-	0.86 mc
Concentration	-	0.0086 mc/ml
Specific Activity	-	0.23 mc/gram Cl
Total Solids	-	0.0 mg/ml
Acidity	-	1.03 N

13. Cobalt (Co^{60} - 5.3y)

A Hanford cobalt pellet of high specific activity was put into solution as the nitrate for dispensing. It was necessary to make a separation from gold, since this pellet was gold-plated. Analysis is incomplete.

14. Cadmium (Cd^{115} - 42d)

A Hanford sample was put into solution as the nitrate for dispensing. Analysis incomplete.

15. Terbium (Tb^{160} - 72d)

A Hanford sample of Tb was put into solution as the nitrate for dispensing. Analysis incomplete.

16. Cyclotron Targets

a. Sodium (Na^{22} -3y) [Mg^{24} d - α - Na^{22}]

A target is now being processed for Na^{22}. A new technique for removing Mg from solution without introducing unfavorable cations is being investigated. This consists of precipitation of the Mg as $Mg(OH)_2$ with $Ba(OH)_2$, followed by removal of Ba^{++} from the supernate as $BaCO_3$. The solution is then boiled to expell excess CO_2. This leaves the solution virtually cation-free, thus making very favorable conditions for absorption of the Na^{22} on an ion-exchange column.

b. Iodine (I^{125} - 56d) [Te^{124} - d-n -I^{125}]

A tellurium target was received from Washington University and is being processed for I^{125}. The first test target processed here (ten beam hours) contained practically no I^{125}.

16. Cyclotron Targets - (Continued)

c. Cobalt (Co^{57} - 270d) [Fe^{56}, d-n Co^{57}]

The Co^{57} from the test target, processed some time ago, is still in for analysis. The second Co^{57} target is approximately 90% through processing. The ion-exchange procedure for separation of Co and Ni appears to be satisfactory.

d. Iron (Fe^{59} - 46.3d) [Co^{59}, d-2p - Fe^{59}]

A target has been received from California which is now being processed. Re-analysis on the test target product is not complete.

e. Zinc (Zn^{65} - 250d) [Cu^{65}, d-2n - Zn^{65}]

A zinc target (copper) has been received but no work was done on it this month.

17. Miscellaneous Work

a. Hanford Irradiations

Five samples of Fe^{58}, five samples of Ca^{44}, and nine cans of Co wafers were prepared for irradiation at Hanford.

b. Ruthenium Sources

The ORINS needle was plated with Ru and covered with silver. One plaque was plated (2 mc), but could not pass smear tests so will have to be done over.

c. Cobalt Sources

Two, 500-mc cobalt sources were sealed in holders furnished by customers.

d. Fe^{55} Source

A 24-mc Fe^{55} x-ray source was prepared according to specifications. The Fe was not plated as indicated last month since early results (reported then) later proved [redacted]

17. Miscellaneous Work - (Continued)

d. Fe^{55} Source

unsatisfactory because of poor adherence. The source was deposited on a fritted disc as hydroxide, burned to Fe_2O_3, and covered with a very thin film of aluminum. The source has been shipped.

e. Strontium Sources

Five Sr^{90} sources, ranging from 1 mc to 20 mc were prepared.

f. Ce^{144} Source

Work is in progress on a special Ce^{144} source deposited on a gold holder furnished by a customer.

g. P^{32} Plaques

K-25 is continuing their investigation of the low thermal stability of the plastic used.

h. KBr for Decontamination School

Twenty-eight grams of irradiated KBr were dissolved and furnished to the Health Physics Division.

i. Removing Hg from Gold

Our stock of gold to be used for irradiation in the X-pile to produce Hg^{198} was baked for several days at 800°C. to remove ordinary Hg.

j. Drying Special Sources

Various methods of drying radioactive sources in completely closed glass chambers under vacuum or by passing very dry air through are being tried. High rates of evaporation below the boiling point have been achieved. This method will be helpful in preventing the spread of contamination. [redacted]

II. Tank Farm and Burial Ground:

1. General

a. The project to install three underground stainless steel tanks for the CR process is essentially completed and the excavation has been back-filled. A one-inch line from tank W-15 to the old ruthenium equipment located in the South Tank Farm has also been partially laid.

After two batches of the CR wastes were sent to tank W-15, it became evident that the radiation levels around the valve pits would be too high for safe operation when future wastes which are expected to be more active were sent through this system. To eliminate this hazard, the transfer lines in these pits are now being shielded with lead.

b. Work has begun on the installation of Vee-notched weir on the outlet from the Retention Pond. More accurate results of the Retention Pond discharge should be available when this work is completed.

c. The inlet weirs to the Settling Basin were cleaned out.

2. Wastes Discharged to the White Oak Creek

Approximately 10.90 curies of beta activity were discharged from the Settling Basin this month.

ACTIVITY DISCHARGED TO WHITE OAK CREEK

	MARCH, 1950		APRIL, 1950	
Discharged From	Gallons	Beta Curies	Gallons	Beta Curies
Settling Basin	23,125,000	7.87*	17,819,000	10.90*
Retention Pond	452,199	.32	357,760	.17
TOTAL		8.19*		11.07*
* Contributed by Evaporator		.94		2.36

[redacted]

3. Chemical Waste Evaporator

The evaporator was operated at a reduced rate during most of the month because of a very high concentration of activity in the waste discharged from Building 706-D and because 38,000 gallons of evaporator concentrate from tank W-8 were transferred to W-5 for further concentration. The processing of the concentrate resulted in frequent foam-overs until optimum operating conditions were established for this particular waste. These foam-overs increased the quantity of activity discharged to the Settling Basin.

During the month the equipment was shut down and the following work was done:

a. A sheared pin in a valve from the evaporator to W-6 was replaced twice.

b. Four valves in the water lines to the condensers were replaced.

c. The sampling equipment was modified so that the air from the jet could not blow the sample bottle off the sampler.

WASTE EVAPORATOR OPERATION

Gallons Fed to Evaporator	Gallons of Concentrate to W-6	Volume Reduction	Beta Curies To Evaporator	Beta Curies To Settling Basin
APRIL - 159,158	28,205	4.6:1	2,031.92	2.36
MARCH - 229,245	25,247	8.1:1	1,034.10	.94

4. Waste Tank Inventory

HOT PILOT PLANT STORAGE

Tanks	Gallons Capacity	Gallons In	Gallons Out	Discharged to	Free Space
W3,13,14,15	48,500	550	-0-	---	11,048

4. Waste Tank Inventory - (Continued)

Tanks	Gallons Capacity	Gallons In	Gallons Out	Discharged To	Free Space
		CHEMICAL WASTE STORAGE			
W-5	170,000	157,958	159,158	Evaporator	68,400
		EVAPORATOR CONCENTRATE STORAGE			
W-6, 8	340,000	28,200	38,400	Evaporator	117,600
		METAL WASTE STORAGE			
W4,7,9,10	543,000	7,184	-0-	--	134,664

5. Special Wastes

a. Three Dayton shipments were buried.

b. Twelve drums and eight pots of uranium-plutonium waste were received from Chicago.

c. A total of 341,355.85 grams of uranium were transferred to the Metal Waste System this month. Of this, the Chemical Technology Division transferred 311,033.2 grams; Chemical Separations, 30,316 grams; and the Chemistry Division, 6.65 grams.

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

Following the replacement of a new glass reactor in cell III of the cubicles and of a frozen drain valve in the separator of the off-gas line, RaLa Run #41 was started on April 9, 1950, as scheduled. Seventy-six Hanford, four-inch slugs were loaded to the dissolver. These were dissolved and extracted in two batches. Operations were normal and the losses were lower than usual.

The glassware processing time was relatively short. L.S.T. was reached at 0515 on April 13, 1950, and the product was shipped at 1600 on the same day. It contained 4,800 curies, as determined by a nine-hour skyshine measurement of 42.5 R/hour. This was the largest run ever produced and according to Los Alamos, the purest.

An evacuation-level air contamination occurred at the time of the 6 P product sampling. It is believed that this was caused by leakage out of the A-16 blowers. The blowers have since been disconnected from the system and both off-gas lines are now tied into the new blowers at the 900 Area stack. It is hoped that these changes will reduce similar air activity in the future. The new blowers appear to furnish more than adequate vacuum to both the A-16 and the A-4 systems.

The analytical summary of the run follows:

Slugs Loaded: 76 Hanford Slugs
Slugs Dissolved: 71.4 Hanford Slugs (by analysis)

	CURIES	PERCENT
Total Curies Dissolved	6,456	100.00
Cell A Losses	1,404	21.8
Cell B Losses	349	5.4
Losses Accounted For	1,753	27.2
Material Balance through B-6	---	91.2
Product Shipped (Skyshine)	4,800	74.3
Material Balance through Skyshine	---	101.5

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

Following shipment of the run, decontamination of the glassware cubicles was begun. New glassware, tygon lines, and Hastelloy valves will be placed in the cubicles before the next run is made. The cubicle equipment replacement work is at present 15% completed.

Work has been started on the demolition of the former 706-DA Building which housed the cell ventilation fan and the vessel off-gas blowers. All electrical wiring, fuse boxes, and relays have been disconnected from the electrical panel board in 706-D Building to the former 706-DA Building control board.

The Construction Request (CR-110 for $287,400) submitted several weeks ago to the Atomic Energy Commission for the modification of Cell A equipment and the installation of the ion exchange method of RaLa production has been approved. The process development and design work being handled by the Chemical Technology Division are being expedited so that the initial phases of the construction program can be started by the end of May, 1950. After completion of Run #42, Cell A will be decontaminated (about June 19, 1950) so that line changes and tank installations can be started. The first run through the ion exchange columns is tentatively scheduled for November, 1950, although it is expected that at least two runs will have to be made during September and October by the present process.

The installation of this improved process is expected to materially reduce the hazards of the present isolation methods. Improved yields and product quality, and potentially greater production capacities are also expected with this new process.

C. RADIOISOTOPE CONTROL DEPARTMENT

I. General:

During April, 1950, there were 635 radioisotope shipments, compared with 662 during March and 548 during February. In April, 1949, there were 461.

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

	APRIL 1949	MARCH 1950	APRIL 1950	August, 1946, to April, 1950, Inc.
Separated Material 706-D Area	357	476	467	10,630
Unseparated Material 100 Area	104	186	168	3,200
	461	662	635	13,830

The following table indicates the breakdown between non-project, project, and foreign orders for April, 1949, and March and April, 1950:

	APRIL 1949	MARCH 1950	APRIL 1950
Non-Project	354	525	504
Project	64	120	118
Foreign	43	17	13

II. Hanford Irradiations:

The following radioisotope samples were discharged from Hanford, as scheduled:

1 Can Iron
8 Cans Sulfur
1 Can Antimony
1 Can Thulium and Terbium

Of these, the iron was received April 25, 1950.

Efforts are still being made to have samples discharged from Hanford and shipped immediately by motor freight or rail express to avoid delay. However, most of the samples we have received have been held at Hanford until an escorted shipment was sent. This has caused delays of several weeks in some cases. [redacted]

II. Hanford Irradiations: - (Continued)

The costs transferred from Hanford for irradiations performed during December, 1949, and January, 1950, totaled $12,715.55. Of this, only $2,498.42 was due to radioisotope irradiations. Most of the balance (over $9,000.00) was due to work in obtaining sludge samples for the Chemical Technology Division. The amount charged for radioisotope irradiations has decreased markedly due to elimination of pile charges which were formerly made on ORNL irradiations. The Hanford report of March 31, 1950, indicated that ninety-one inhours were devoted to radioisotope irradiations. ORNL was allocated only one hundred inhours for this purpose.

III. Strontium Beta Sources:

A number of Strontium 90 beta sources have been prepared for radioisotope customers for use in thickness gauges and other applications. Since an industrial radiochemical concern is now making similar sources, the Atomic Energy Commission has suggested that ORNL refrain from making these sources unless specifically approved by the AEC Isotopes Division.

IV. Special Preparations:

The amount of special work has been increasing and consists mainly of specially prepared Cobalt 60 sources. An order was received from Mexico recently for sixty cobalt needles pointed at one end and with eyes at the other. These needles are to be gold-plated with sufficient gold to absorb most of the cobalt beta rays. Among the other special sources being prepared are two plated Ruthenium 106 sources, a special 300-mc Ce^{144} source depositied on a gold holder, an Fe^{55} source plated on a metal holder, and a Na^{22} source deposited in a plastic film.

V. Phosphorus in Fertilizers:

The P^{32}-irradiated units, consisting of KH_2PO_4, irradiated for one month in the pile, have been sold in large numbers to the Department of Agriculture for investigating phosphorus uptake from different fertilizers. Recently, a representative of the Department of Agriculture visited the Laboratory and described some trouble being encountered in using these units. Instead of all the phosphorus being in the form of ortho-phosphate, it was found that a considerable portion was in a reduced form, such as phosphite. In those fertilizers in which the phosphorus was oxidized during preparation, this was of small concern. However, in fertilizers where oxidation did not take place in preparation, it is now necessary to carry out a preliminary oxidation step tp be sure that the phosphorus is all in the ortho-phosphate form. In the future it is desired to study a number of natural phosphate rocks and any chemical processing would alter the properties of this material. The Department of Agriculture desires to irradiate these phosphate rocks and study the uptake of the phosphorus in plants. Several samples are now being irradiated at different neutron fluxes and at different temperatures to determine whether the method of irradiation has any effect on the oxidation state.

VI. Tritium:

A supply of tritium in ampoules ranging in size from ten millicuries to approximately ten curies each has been received from Argonne National Laboratory and will be used in filling routine orders until the packaging equipment is ready.

VII. Cyclotron Targets:

Last month the four institutions preparing cyclotron targets were asked to confirm arrangements made by the Atomic Energy Commission specifying the amount of irradiation time which had to be completed before June 30, 1950, on ORNL purchase orders. Only two replies have been received to date. No schedule of additional irradiations has been given to the institutions which desired more irradiation time (Washington University and the University of California), since the Atomic Energy Commission has made no decision as to what material should be obtained. These two institutions are expecting to receive 145 and 200 beam hours, respectively, before the end of the fiscal year.

Following is a list of the outstanding orders for cyclotron-produced radioisotopes now on hand:

		Status
Be^{7} - 20 mc.		All of the targets for these materials are being processed.
Na^{22} - 1.64 mc.		
Fe^{59} - 3.0 mc.		
Zn^{65} - 1.0 mc.		
I^{125} - .50 mc.		
As^{73} - 11 mc.		Target being bombarded.

VII. Cyclotron Isotopes: - (Continued)

BOMBARDMENTS RECEIVED

	M. I. T.		U. of CALIF.		U. of PITTSBURGH		WASHINGTON U.	
	Bombard-ments	Beam Hours	Bombard-ments	Beam Hours	Bombard-ments	Beam Hours	Bombard-ments	Beam Hours
Be^{7}					5	170.00		
Na^{22}	1	109.75			5	201.75	4	300.00
Mn^{52}					1	10.00		
Mn^{54}							1	50.00
Co^{57}							2	50.00
Fe^{59}			3	184.50				
Zn^{65}	1	100.00						
I^{125}							2	60.00
Molybdenum metal strips to produce Tc^{96}							1	10.00
TOTAL RECEIVED	2	209.75	3	184.50	11	381.75	10	460.00

REQUESTED BUT NOT RECEIVED

Mn^{52}					1	10.00		
Zn^{65}			1	40.00				
As^{73}					1	10.00		
TOTAL HOURS OUTSTANDING (Not received or requested)		540.25		525.50		348.25		280.00

SHIPMENTS OF CYCLOTRON-PROCESSED ISOTOPES TO DATE

Isotope	Amount	Shipments to Date	Shipments in April '50
Be^{7}	59.873 mc.	15	3
Na^{22}	12.570 mc.	18	4
Mn^{52}	.001 mc.	1	1

VIII. Activation Analyses:

A description of the types of analyses which can best be performed by this method and the limits of the analysis will be published in a technical journal soon. The following is a list of the different activation analyses underway at the present time:

1. Vinylite Resins submitted by Carbide and Carbon Chemicals Division, UCC, November 25, 1949. One set of these samples was submitted for analysis of cadmium and other trace metals and one set for iron and other trace metals.

   Present Status: Analysis is in progress. The cadmium series of resins show trace amounts of cadmium and copper.

2. Stainless Steel, Ni-Cr-Mo-W-Alloy, and Ferrous Material submitted by Carbide and Carbon Chemicals Division, UCC, Niagara Falls, New York, February 13, 1950.

   Present Status: This analysis is in progress.

3. Magnesium Metal Alloys submitted by the Dow Chemical Company, December 22, 1949, for analysis for trace elements.

   Present Status: A long bombardment has been made. Calcium has been definitely identified from this, while other long-lived activities appear to be absent. A short bombardment is now being made to check the presence of such elements as Si, Na, K, etc.

[redacted]

IX. Carbon 14:

Carbon 14 standards supplied by the Bureau of Standards and analyzed by gas counting indicate that the C^{14} now being sold by ORNL is actually 1 to 12% higher than specified; i.e., analyses are about 6% low. This indicates that the precision of the present method is not as good as previously believed. Further work is being done to check this.

Logan B. Emlet, Director
Operations Division

wp

[redacted]

X. S-F Material Control:

1. Accountability for all SF material located in the ORNL section of Y-12 was transferred to the Y-12 Accountability Representative during the month. This entailed material charged to the Biology and Reactor Technology Divisions, which consisted wholly of normal uranium.

   The decision to effect the transfer resulted from several conferences held between X-10 and Y-12 personnel. Within these conferences, it was concluded that geographical location should influence responsibility of SF control.

2. On April 8, 1950, the fifth and final shipment of Chalk River fuel rods was received. The number of pieces amounted to fifty-three, thus raising the total number received in the five shipments to 261.

   The Hanford car was also received on the above date. This shipment consisted of seventy-six slugs for the RaLa process.

3. In connection with fabrication of CP-3 fuel rods for Argonne National Laboratory, the SF Office received 6.4 kgs. of enriched uranium, 93.2% U-235, from Y-12. This material was forwarded to the Metallurgy Division for further fabrication.

4. Ten highly enriched U/Al alloy slugs were received from Hanford. These slugs will be encased in a specially designed aluminum tube and forwarded to Chalk River for irradiation.

5. Approximately eleven tons of normal uranium bars were received from Simonds Saw and Steel Co. These bars are to be fabricated into Clinton-sized slugs for charging into the pile.

X. S-F Material Control: - (Continued)

5. The manner in which the material was packed for shipment caused considerable difficulty in handling and storage. These bars were bound ten to a bundle. Each bundle weighed approximately 500 pounds. They were unboxed and exposed to air which apparently caused the outer surface to form a skin of oxide. The oxide was easily disengaged from the bars, and these fragments caused high alpha contamination to the courier truck. To prevent spreading of this contamination as well as to maintain the normal radiation precautions, the material was taken to the burial ground area where it was wrapped in paper, sealed with a cocoon, and boxed.

6. On April 13, 1950, a procedure was established to reduce SF losses arising from cutting, extruding, melting, and grinding operations in the Metallurgy Division. Breifly, the procedure is as follows: Scrap from crucible scrapping, spatter, slag, extrusions, and the dust collecting system will be collected once each month and turned in to the SF Office for recovery. A water-quenching jig will be installed on the extrusion press to reduce losses due to oxidation.

XI. S-F Material Control: - (Continued)

7. Following is a summary of shipments and receipts of SF materials for the month of April, 1950:

SHIPMENTS

To	Material	Content	
Argonne National Lab.	Thorium and Uranium (normal)	Negligible	
" " "	Irradiated X Slugs (depleted)	13,992.00	gm.
		.16	gm. Pu
" " "	Normal Uranium	6.00	gm.
" " "	Normal Uranium	10.00	gm.
" " "	Irradiated X Slugs (depleted)	13,992.00	gm.
		.19	gm. Pu
Batelle Memorial Inst.	Thorium Metal	110.30	gm.
Brookhaven National Lab.	U_3O_8 (irradiated)	3.40	gm.
" " "	Irradiated Thorium Oxcarbonate Slugs	1,054.40	gm.
C&CCC, K-25 Area	Depleted Uranium and Plutonium	41,928.75	gm.
		Nil	gm. Pu
C&CCC, Y-12 Area	Normal Uranium	7,248.00	gm.
" " "	Normal Uranium	1,738.26	gm.
" " "	U/Al Ingot (normal)	56.20	gm.
" " "	Normal Uranium	58,915.21	gm.
" " "	U-233	0.3640	gm.
" " "	U-233	0.50	gm.
" " "	Enriched Uranium	27.99	gm.
" " "	U-233	0.215	gm.
" " "	Enriched Uranium	132.19	gm.
General Electric Co.	Normal Uranium/Alloy Rods	1,048.50	gm.
" " Schenectady	Redox Waste Soltuion (depleted)	Nil	
New Brunswick Lab.	Thorium	0.6035	gm.

[redacted]

XI. S-F Material Control: - (Continued)

7. Shipments and receipts for April, 1950.

RECEIPTS

Argonne National Lab.	Stainless Steel Clad Uranium Needles (normal)	6.0	gm.
" " "	Irradiated X Slugs (depleted)	13,992.00	gm.
		.13	gm. Pu
" " "	Waste Solutions (depleted)	27,290.00	gm.
		.60	gm. Pu
" " "	U_3O_8 (normal)	3.4	gm.
" " "	Zr/Uranium-235 Plated (enriched)	12.7223	gm.
" " "	Depleted Uranium and Plutonium	35,090.00	gm.
		.47	gm. Pu
" " "	Depleted Uranium and Plutonium	130,713.00	gm.
		.26	gm. Pu
Chalk River	Slugs (depleted)	192,322.16	gm.
		127.00	gm. Pu
C&CCC, K-25 Area	Uranium Buttons (normal)	19.00	gm.
C&CCC, Y-12 Area	UO_3 (enriched)	5.27	gm.
" " "	Uranium Slugs (normal)	3,590.00	gm.
" " "	UNH (normal)	332,815.35	gm.
General Electric Co.	Irradiated Slugs (depleted)	135,133.54	gm.
		26.04	gm. Pu
" " "	Thorium Metal Slugs	41,163.29	gm.
Simonds Saw and Steel Co.	Uranium Rods (normal)	10,661,179.36	gm.
Tracerlab, Incorporated	U_3O_8 (normal)	0.4551	gm.
" "	U_3O_8 (normal)	0.4113	gm.
" "	U_3O_8 (normal)	3.8725	gm.

[redacted]