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OPERATIONS DIVISION MONTHLY REPORT

for

Month Ending June 30, 1952

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OPERATIONS DIVISION MONTHLY REPORT

for

Month Ending June 30, 1952

by

M. E. Ramsey

DATE ISSUED

AUG 13 1952

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Operated by
CARBIDE AND CARBON CHEMICALS COMPANY
A Division of Union Carbide and Carbon Corporation
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OPERATIONS DIVISION MONTHLY REPORT

SUMMARY

The activities of the Operations Division for the month ending June 30, 1952 are summarized below:

1. Lost graphite pile operating time was 12.2% compared with 11.6% for May and 12.1% for the year to date (p. 3).

2. An aluminum–silicon bonded slug ruptured and was discharged without difficulty (p. 3).

3. Approximately 26,000 aluminum–silicon bonded slugs have been charged into the X-10 graphite pile (p. 3).

4. Excess pile reactivity was low during the month because of high outside temperatures and the large amount of target material in the reactor (p. 4).

5. The LITR down time was 9.9% compared with 16.6% during May and 18.8% for the year to date.(p. 3).

6. A tentative design has been made for a bypass demineralizer for the LITR circulating water (p. 4).

7. The I^{131} cell was decontaminated and several leaks in the equipment repaired (p. 6).

8. Installation of the precipitation process equipment for fission-product separation in Building 3515 is 98% completed. Testing of equipment will start early in July (p. 6).

9. The precipitation of aluminum by hydrolysis of urea will be used in the fission-product, cesium-alum crystallization process (p. 7).

10. Results of studies of tributyl phosphate extraction of rare earths are encouraging (p. 8).

11. A total of 14.4 curies of beta activity was discharged to White Oak Creek compared with 46.5 curies last month (p. 11).

12. A shipment of 27,800 curies of RaLa was made on June 6 (p. 12).

13. Removal of the sulfate ions present after the extraction step of the RaLa process continues to be a problem (p. 12).

14. There were 922 radioisotope shipments made compared with 869 during the previous month (p. 15).

PILE DEPARTMENT

OPERATING DATA

	JUNE 1952	MAY 1952	YEAR TO DATE 1952
Graphite Pile			
Total accumulated kwhr	2,277,511	2,474,896	14,149,036
Average kw/operating hr	3,601.19	3,761.06	3,684.26
Average kw/24-hr day	3,163.21	3,326.47	3,239.25
Per cent lost time	12.16	11.55	12.08
Excess pile reactivity (inhr)	120	20	
Slugs discharged	10,132	6,927	26,941
Slugs charged	10,249	6,969	27,088
Product made (g)	83.12	90.32	516.39
Product discharged (g)	1,654.38	1,304.22	4,799.93
Low-Intensity Test Reactor			
Total accumulated kwhr	973,419	822,359	3,813,175
Average kw/operating hr	1,500	1,326	1,075
Average kw/24-hr day	1,352	1,105	873
Per cent lost time	9.9	16.6	18.8
Position of No. 2 shim rod (in. out)	25.944	22.578	

PILE OPERATIONS

Graphite Pile

One slug rupture occurred during June. The data are as follows:

Number	100
Date	6/16/52
Channel	1661
Days in pile	63
Approx. temp.	225°C
Remarks	Discovered by visual inspection. No indication from probe.

This rupture was the first to occur in the aluminum-silicon bonded slugs and did not follow the normal course usually observed with unbonded slugs. The uranium was completely oxidized and the aluminum jacket was entirely empty. There was no apparent tendency for the oxides to clog the channel, which causes overheating and results in other ruptures in adjacent slugs. The cap was pushed off the jacket and it appeared that the rupture began on the side of the slug below the cap, although this could not be proved.

Because of the rupture, the maximum metal temperature will not be increased for some time beyond 275°C. This temperature will be maintained until it is reasonably certain that the rupture rate remains low and that failure of submarginal quality slugs, which passed the slug test, has occurred.

Approximately 26,000 bonded slugs have now been charged into the reactor, which leaves only 14,000 unbonded slugs yet to be discharged and replaced.

"Donut" slugs with aluminum-silicon bonded aluminum jackets are being fabricated at Y-12 and a few have been received. These are expected to

withstand a higher metal temperature than the present unbonded "donut" slugs.

On June 30, 280 slugs, each containing 2 lb of tantalum, were discharged from the peripheral channels around the metal loading. The slugs will be stored in lead shields provided by the Chemical Corps to which they will be shipped in October, along with 540 (each containing approximately 1 lb of tantalum) more slugs to be irradiated during July, August, and September.

Excess reactivity was quite low during the month. Hole 19 was repaired so that water could not leak into the graphite. Approximately 35 inhr were absorbed when the hole was filled with water, and substitution of some samples for the water did not reduce the absorption appreciably. The lack of pile reactivity occasionally made it necessary to run at a somewhat lower power level on hot days than would have been possible otherwise.

Excess reactivity increased from about 20 to 120 inhr after tantalum was discharged from 32 channels around the periphery of the reactor, followed by the loading of half these channels with new tantalum slugs, and after channels 1870, 2168, and 1868 were loaded with metal. It will be necessary to load about 16 additional channels with tantalum slugs on July 7, but excess reactivity should still be sufficient for full-power operation.

Five batches of liquid hydrogen were produced during June for a total of approximately 10 liters. The storage container has been received and, as soon as transfer vessels and lines are fabricated, it will be possible to store the hydrogen.

The wooden dam installed in the canal to segregate radioactive cobalt has continued to perform this function very well. Water in the clean portion of the canal is generally below 200 counts/min/ml; whereas in the cobalt section, it is often 10,000 to 40,000 immediately after the cobalt has been handled.

Low-Intensity Test Reactor

The LITR operated satisfactorily during the month. Several experiments inserted into the reactor core gave marked effects on reactivity. One experiment, conducted by General Electric Company personnel, consisted of beryllium piece, with a hole about 2 in. in diameter, installed in lattice position C-46. When this beryllium piece was filled with water, it was impossible to start the reactor. Apparently, this water-filled piece must have been equivalent to more than 1% excess reactivity.

Any absorber in the beryllium row next to the fuel has a strong effect on reactivity. Such experiments inserted in the fifth row, with a separation of 3 in. of beryllium from the fuel, appear to have much less effect. Consequently, all experiments that can be accommodated in the fifth row have now been located there. Those that must have a tube projecting out of the top plug, however, must be in the fourth row, since shim-rod holes in the upper grid assembly provide the only access to the lattice from above. All beam holes and two vertical holes through the top plug now have experiments in them.

A tentative design has been made on a bypass demineralizer for the circulating water. The bypass is intended to remove both anions and cations from the water, and to maintain the specific resistance at about 10^6 ohms and the pH at approximately 7, which should result in a possible reduction of corrosion rate and radioactivity in the water. This design should increase considerably the safety and convenience of working inside the reactor, since tools and the working area around the top plug become contaminated from the reactor water under present conditions.

Plans are being made for constructing a container to ship spent fuel elements to Arco. This container will probably be large enough to hold 7 fuel elements and only the center sections will be shipped. The end boxes will be sawed off prior to shipment.

The air cooler for the LITR water system has been received and its installation begun. After the installation is completed, the use of filtered water for LITR cooling will be practically eliminated.

It was necessary to add one new fuel element to the reactor during June largely because of experiments that were being installed in the core.

FILTER HOUSE

Table 1 is a comparison of the pressure drop across the exit air filters last month with the pressure drop this month and with that experienced when all filters are clean.

FAN HOUSE

Operation was normal throughout the month.

RADIOISOTOPES

Stringers 13, 14, and 16 contained 357 cans of target material at the end of June as compared with 385 cans of target material in these stringers at the end of May. Table 2 is a comparison of the radioisotope and research samples charged into the reactor during June with those handled in May.

WATER-DEMINERALIZATION BUILDING

Demineralized and degasified water in the water-demineralization building was produced without serious trouble during the month, although regeneration of the resin columns was required at rather frequent intervals. Replacement of the old resin with new is scheduled for August. Table 3 presents the data for May and June for comparison.

Table 1

PRESSURE-DROP DATA

DATE	PRESSURE DROP (in. water gage)		
	Glass Wool	CWS No. 6	Total Across House
6/30/52	3.0	2.1	6.31
5/31/52	3.9	2.0	6.2
Clean filters	1.1	1.3	3.3

Table 2

RADIOISOTOPE AND RESEARCH SAMPLES

	JUNE 1952		MAY 1952	
	Research	Radioisotopes	Research	Radioisotopes
Stringers 13, 14, and 16	11	153	7	145
Hole 22	55	1	50	6
All other holes	6	31	5	17
Total by groups	72	185	62	168
Total for month	257		230	

Table 3

WATER DEMINERALIZED AND DEAERATED

	GALLONS PRODUCED		
	JUNE 1952	MAY 1952	YEAR TO DATE 1952
Demineralized	356,220	363,138	2,577,908
Deaerated	35,940	31,020	257,900

CHEMICAL SEPARATIONS AND RADIOISOTOPE DEVELOPMENT DEPARTMENTS

RADIOISOTOPES

Iodine (I^{131} – 8 d)

Twenty-four ORNL I^{131} slugs and three Hanford slugs were processed and 42,250.15 mc was shipped. All runs this month had lower than normal yields. After the Hanford slugs were processed, enough product was made to fill orders for 2½ weeks. The iodine cell was decontaminated and the equipment tested for leaks. It was found that the top of the dissolver had numerous leaks around the gasket and that the tantalum liner in the dissolver had a hole in it. The liner was removed and a new gasket installed. These repairs are expected to improve future yields.

Phosphorus (P^{32} – 14.3 d)

Seventeen, 2500-g cans of irradiated sulfur were processed and 13.496.51 mc of P^{32} was shipped. All but two runs contained little or no precipitate at a pH of 7.

Tritium

The tritium-helium system has been completed, and packaging is in progress. The efficiency of the tritium purification is indicated by the actual yield of 5.3 ml of He^3 at NPT, whereas the calculated yield is 5.2 ml.

A microresistance heater for heating targets for absorption of tritium into zirconium was designed and submitted to the shops.

Fission Products

Precipitation Process, Building 3515. Installation of precipitation process equipment is 98% complete. Work by the Mechanical Department is scheduled to be completed by July 3. A schedule of equipment testing has been made. Tests will begin about July 7 and will continue for 1 to 2 weeks, depending on the number of defects found during the tests. Some Mechanical Department work will be necessary during this period.

The delivery date of the Vycor vessels has been changed to July 10. Equipment testing will not be delayed, since many tests can be made without these vessels.

Four micrometallic filters were ordered but have not been received. The substitute filter vessel to replace the defective micrometallic filter vessels was built and installed without the filters. The Purchasing Department is negotiating the return of the defective vessels.

The two pieces of periscope shielding glass returned to Penberthy Company for refinishing have not been received.

Preparation of an equipment-operating manual is in progress.

Estimated date that "cold" chemical runs can begin is July 21.

Source Assembly Station, Building 3013. Flanges were removed from existing sleeves in the top of the cell, and a layer of barytes concrete was poured to 2⅛ in. below the top of sleeves in the source assembly station. A 2-in. thickness of lead will be placed on top of the concrete.

The Engineering Department estimates that the drawings will be completed by July 15 and that all engineering will be completed by July 31.

Total drawings required	75
Drawings completed and approved	47
Drawings completed, not approved	23
Drawings to be made	5

Preparation Cell, Building 3030, Cubicle 2. Installation and testing of the equipment for the preparation cell has been completed. A "hot" run was made with satisfactory results. The operating manual was completed.

Precipitation of Aluminum by Hydrolysis of Urea. The physical characteristics of aluminum hydroxide precipitates formed by hydrolysis of urea in boiling solution were found to be satisfactory. Further tests were made on this same precipitation by using chemical conditions similar to those expected under actual plant conditions; radioactive cesium was added to determine the losses. Ninety-five per cent of the cesium was found in the filtrate even when no washing of the aluminum precipitate was done. Washing lowered the losses to a negligible value.

This method of separating aluminum in the cesium-alum crystallization process will be used because it has a number of advantages over the resin-column method of separation. The quantity that can be handled in moderate-sized equipment is about 30 g of aluminum in the precipitation process; whereas, a one-liter resin column can handle only about 10 grams. Control of the process is also much easier, since the precipitation by hydrolysis of urea is virtually self-controlling. It is expected that no serious difficulties will be encountered because of high radiation fields. Studies are continuing on methods of destroying the excess urea.

Composition of Fission Product Cerium. An analysis was made of cerium that had been previously separated in large quantity from fission product waste. The actual weight of cerium in the preparation was determined spectrophotometrically, and the specific activity was found to be 70.77 curies/g of cerium 1030 days after removal from the reactor. This corresponds to approximately 1.1 g/kilocurie at push time vs. the calculated quantity of 1.6 g/kilocurie of Ce^{144}. The calculated figure was obtained by including the weights of all known fission chains ending in inactive cerium as well as the weight of Ce^{144} itself. A spectrographic analysis of the material was as follows:

Al	Very faint trace
Ca	Moderate
Ce	Weak
Mg	Faint trace

This indicates that the product was extremely pure, since a spectrographic report of "moderate" for calcium carries little significance.

Strontium-90. Fission product operations in Building 3026 were changed over to short-lived materials, as reported last month, and no further Sr^{90} crude was separated. Sr^{90} purification equipment in Building 3031 was dismantled and new purification equipment is being installed in the heavily shielded cell in Buidling 3030 that previously held the Cs^{137} purification equipment.

Cerium (Ce^{144} – 275 d). Ce^{144} was produced in the amount of 454 mc, carrier-free.

Hot Chemistry Cell, Building 3029

Construction of forms and placement of imbedded piping were completed and concrete was poured in the hot chemistry cell. Installation of piping is in progress. The master-slave manipulator is now scheduled to arrive from the manufacturer by July 15.

Preparation of Europium Target Material

A mixed samarium-europium product was obtained from Lindsay Light and Chemical Company. It was stated that this material contained 1.007 g of Eu_2O_3 in a total of 5.25 g, the remainder being primarily Sm_2O_3. A spectrographic analysis of this oxide showed the following composition:

$$Sm_2O_3 = 75.71\%$$
$$Eu_2O_3 = 19.90\%$$

On the basis of this analysis, the 5.25 g contain 1.045 g of Eu_2O_3.

Rare-Earth Separation by Solvent Extraction

A rare-earth oxide fraction weighing 9.5 g was dissolved in 30 ml of 16 *N* HNO_3. A quantity of 100% tributyl phosphate (TBP) was equilibrated with 16 *N* HNO_3, and 50 ml of this preparation was put into each of four 125-ml separatory funnels. The 30 ml of rare-earth solution was poured into the first separatory funnel and agitated for 3 minutes. The two phases were allowed to separate for 1 min and the aqueous phase was transferred to the second separatory funnel. The process was repeated down through the fourth stage. Each 50-ml portion of TBP was washed with successive 50-ml quantities of 12 *N* HNO_3, 10 *N* HNO_3, 8 *N* HNO_3, and water.

The process is shown in the following diagram. All samples were recovered and converted to oxide. Sample 1-4 had a light buff color and sample 4-1 had a dark brown color. These two fractions should represent the theoretical maximum separation under the conditions employed.

Sample 1-4 was analyzed spectrographically, which showed it to be mostly ytterium with traces of ytterbium, cerium, and lanthanum. These results show a rapid separation of the elements with a minimum number of extractions. The Sm_2O_3 content of samples 3-1, 4-1, and raffinate could not be determined because of a high background absorption in the region of the Sm^{+++} ion absorption. Particular attention is directed to the series of samples 3-1, 3-2, and 3-3, which show an anomalous trend in the Sm_2O_3 concentration. It will be noted that the Nd_2O_3 and Pr_6O_{11} content follows the regular behavior in this series. No reasonable explanation can be given for this effect without further study.

Processed Radioisotopes

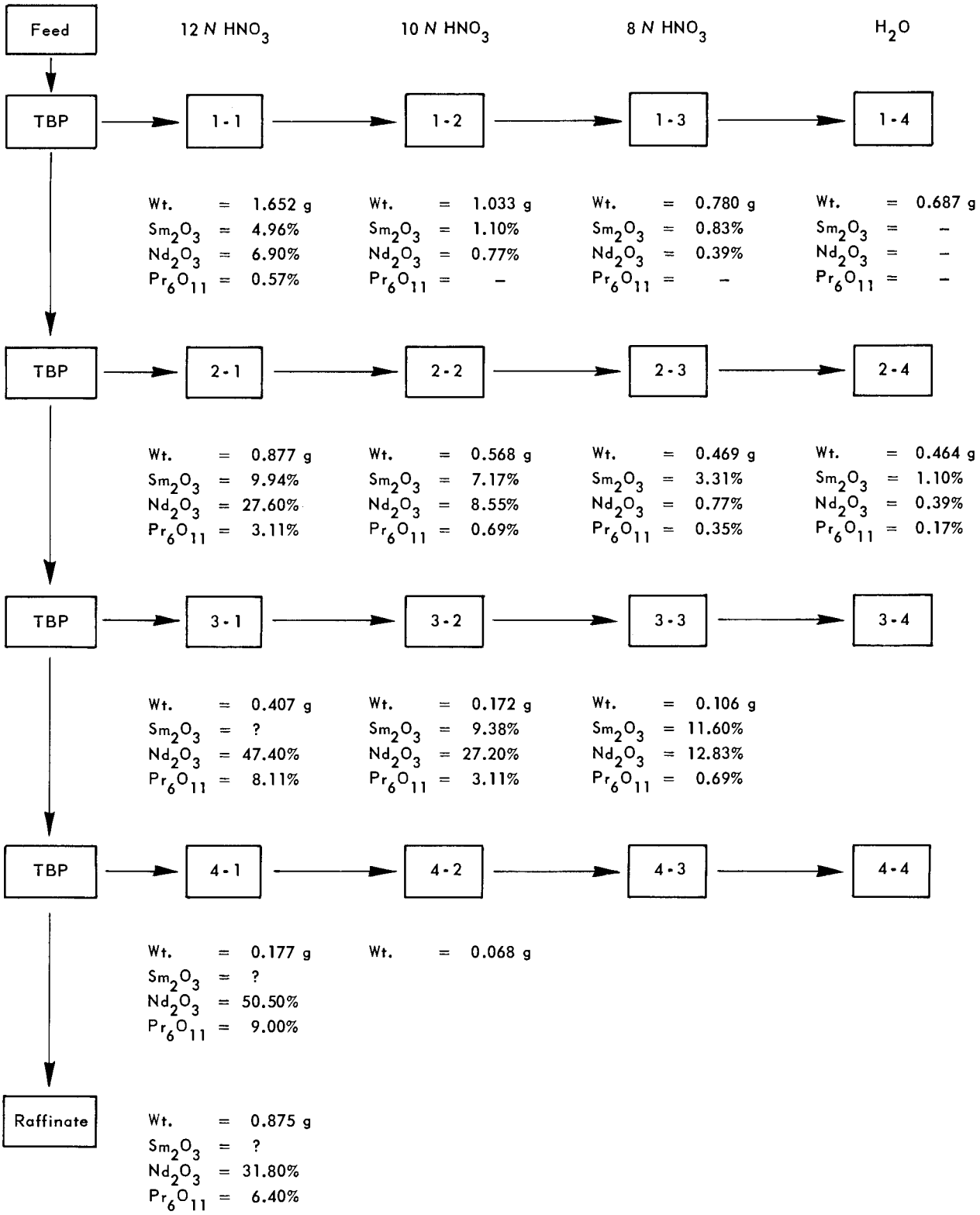
Table 4 is a list of radioisotope product solutions that were made from pile-irradiated targets.

Table 4

RADIOISOTOPES PRODUCED FROM PILE-IRRADIATED TARGETS

PRODUCT SOLUTION	AMOUNT (mc)	SPECIFIC ACTIVITY (mc/g)
Chromium (Cr^{51} – 26 d)	1680	1914
Iron ($Fe^{55,59}$ – 2.91 y, 46.3 d)		
Normal Iron – Fe^{59}	13.2	6.9
– Fe^{55}	21.8	11.3
Mercury (Hg^{203} – 43.5 d)	3420	830
Sulfur (S^{35} – 87.1 d)	2840, carrier-free	
Calcium (Ca^{45} – 180 d)	130	25

RARE-EARTH SEPARATION BY SOLVENT EXTRACTION



Cyclotron Radioisotopes

The following radioisotope product solution was prepared for cyclotron targets:

Sodium (Na^{22} – 2.6 y) 4.38 mc at 60 mc/g Na

Special Preparations

Forty-eight Co^{60} sources were loaded with a total of 168.8 curies.

Two Cs^{137} sources, 45 mc each, were prepared.

One $Eu^{152,154}$ source which had been irradiated in the LITR was encapsulated for ORINS. The strength of this source was not measured.

A total of 5.3 curies of tritium was prepared for shipment.

A 2-curie I^{131} source, as precipitated AgI, was prepared.

Miscellaneous Work

Ten instruments were returned to the instrument pool.

Four area tours and one orientation tour for new Engineering Department employees were conducted.

Experimental source containers using lead gaskets for sealing were made. They were found not to leak under 26-in. Hg vacuum.

Installation of a sampler in the I^{131} cell was made to replace worn-out sampling equipment.

Modification of tongs for the machine barricade and placement of mirror are in progress.

The corrosion test on titanium tubing in molten sulfur and HNO_3 was ended after two months exposure time. Results will be reported at a later date.

A 724-mc Ce^{144} source was made up in a thin glass tube, and studies are being made of the radiation output of this source suspended in air approximately 10 ft above the ground. An attempt will be made to correlate the radiation output with some of the decay schemes that have been recently reported for Ce^{144}.

Radiation damage studies are being made on various kinds of cements, including plastic cements and silicate cements, in the 5000-curie Co^{60} source belonging to the Chemical Technology Division. The purpose is to find a cement that is suitable for sealing threads on moderate-sized radiation sources.

A 4 by 4 ft stainless-steel tank that will be used to decontaminate carriers and other small equipment was set in the floor of the decontamination building this month. An overflow and a bottom drain were installed. Lumnite concrete topping was poured on the floor around the tank.

The installation of steel supports for the crane extension in the decontamination building was begun. When this work is finished, the crane capacity will be increased from 5 to 10 tons.

RADIOACTIVE WASTE DISPOSAL

The shielding of the tank farm transfer line was completed this month, thereby lowering the general radiation background appreciably.

The telemetering equipment for the tanks that are presently connected to the system has been completed.

The transfer of precipitated uranium from tank W-7 to W-10 was continued until the slurry pump failed early in the month. Repairs to the pump are being held up pending receipt of parts from the vendor.

The float that was usually stuck at tank W-17 was replaced with an entirely new assembly that operates more freely.

A large flow of water appeared in tanks W-1 and W-2 again and was traced back to a leaking water line in Building 3019.

The cooling water discharged from several distilled-water condensers and air-conditioning

units was diverted from the process waste system to the condensate drainage system, thereby lessening the load through the process waste system by 2000 gal/hour.

Approximately 12,000 gal of concentrated chemical waste that contained 187.0 beta curies were transferred from tank W-8 to lagoon No. 2 this month. The radiation levels are high, so the transfer operation is confined to two shifts per week.

The Cottrell precipitator was shut down for 36 hr this month because of a burned-out rectifier tube that has since been replaced.

Wastes Discharged to White Oak Creek

Much of the activity discharged to White Oak Creek this month (see Table 5) came from the high rate of operation at the evaporator to make space in tank W-5 for waste from the next RaLa run, as well as the purging of Buildings 3001 and 3505 canals.

About 126,000 gal of solution that contained 0.19 beta curie, was drained to White Oak Creek from the east pond to permit repair of the leaking outlet-valve.

Chemical-Waste Evaporator

The chemical-waste evaporator was shut down for 12½ hr this month to repair a leaking coil and a steam-reducing station and to replace a broken pin in the drain valve from the evaporator to tank W-6.

The automatic liquid-level control valve for the evaporator failed at the end of the month. This valve is being by-passed by a manually controlled valve and will be repaired as soon as it is practical. Operations and inventory are given in Tables 6 and 7.

Table 5

ACTIVITY DISCHARGED TO WHITE OAK CREEK

DISCHARGED FROM	JUNE 1952		MAY 1952	
	Gallons	Beta Curies	Gallons	Beta Curies
Settling basin	25,249,100	14.25*	25,453,000	46.43
Retention pond	362,600	0.10	300,000	0.07
Total	25,611,700	14.35	25,753,000	46.50

* Less than 4.87 curies contributed by normal evaporator operation.

Table 6

WASTE-EVAPORATOR OPERATION

MONTH	SOLUTION FED TO EVAPORATOR (gal)	CONCENTRATE TO W-6 (gal)	VOLUME REDUCTION	BETA CURIES TO EVAPORATOR	BETA CURIES TO SETTLING BASIN
June 1952	182,657	11,989	15.2:1	25,671	4.87
May 1952	208,000	17,200	12.1:1	11,161	0.33

Table 7

WASTE-TANK INVENTORY

TANKS	CAPACITY (gal)	FREE SPACE (gal)	
		June	May
Hot-Pilot-Plant Storage			
W-3, 13, 14, 15	48,500	31,600	32,175
Chemical-Waste Storage			
W-5	170,000	73,000	85,000
Evaporator-Concentrate Storage			
W-6, 8	340,000	59,000	52,000
Metal-Waste Storage			
W-4, 7, 9, 10	543,000	250,000	279,000

RaLa (Ba^{140} – 12.5 d)

RaLa run No. 47, begun on May 31, was processed to completion and shipped on June 6. The shipment contained 27,832 curies according to chemical analyses. The direct radiation readings indicated less product, but the readings were not considered valid in view of the lack of experience with radiation readings from such large quantities of product and the lack of accurate calibration of the radiation instruments.

The only serious operating difficulty encountered was during the product removal from the loading cubicle. The carrier was contaminated to 90 r/hr at 5 feet. During decontamination of the carrier, the operating area and personnel became contaminated.

Two plant power outages during the product evaporation operation did not affect the progress of the run because the recently installed automatic equipment that changes the off-gas system from an electric to a steam-operated blower functioned properly.

Two high losses were experienced in this run, a 6.56% loss in the dissolver heels and a 9.81% loss in a 0.4 M K_2CO_3 wash following the extraction washes. The K_2CO_3 wash was added to the run in an attempt to remove excess SO_4 ions which were believed responsible for incomplete metathesis in previous runs. It is interesting to note that the Versene feed contained only 21.9% of the product, compared with 63.5% during the last large-scale run. The removal of the excess SO_4 is believed to be responsible for this favorable change. The high loss in the carbonate wash may be eliminated by further alterations to the process.

The analytical summary of the run follows: (All values are corrected to eastern standard time, 1940, June 4, 1952.)

Slugs loaded	231 Hanford slugs
Slugs dissolved	251.8 (by analysis)

	Curies	Per Cent
Total curies dissolved	37,899	100.00
Cell A losses		
Dissolver heels	2,485	6.56
Extraction and washes	411	1.08
K_2CO_3	3,719	9.81
Metatheses and washes	394	1.04
Extraction tank and filter rinse	939	2.48
Total cell A loss	7,948	20.97
Resin cubicle losses		
Acetate feed effluent	0	0.00
NaOH elution	394	1.04
Versene feed effluent	2	0.00
Sodium versenate elution	3	0.01
HCl elution	4	0.01
Feed tank rinse	39	0.10
Fuming HNO_3 precipitation	822	2.17
Product tank rinse	1,023	2.70
Total resin cubicle losses	2,287	6.03
Product		
P. E.-1	29,522	77.90
P. E.-2	28,855	76.14
Total product shipped (radiochemical)	27,832	73.44
Material balance	38,067	100.44

Los Alamos, at first, reported the product to be highly satisfactory. On the last day of the month, however, they called to report great difficulty in their processing because of suspected impurities in the product. Run No. 48, which was already in progress at the time the call was received, will probably be modified in the purification steps in an attempt to further improve the product purity.

Resin-capacity and hold-up tests were run on the resin to determine the amount of damage, if any, that high radiation does to the resin. The results were inconclusive, since the data obtained in this run did not check with data obtained in previous runs.

Two dummy runs, each utilizing 65 unirradiated "X" slugs, were made for the purpose of developing a better method for removing the excess sulfate ions present after the extraction steps. In the first run, a 100-gal water wash was added to the five regular water washes following the extraction step. In the second run, the volume of K_2CO_3 used in the first metathesis was increased to 107 gal, or 10 times the normal volume. The results of the tests show that both methods will improve the process, but they were not conclusive enough to prove which would be most efficient. Also, it could not be determined from these two tests whether the removal of the sulfate ion would be efficient enough to permit the use of the fuming nitric metathesis and eliminate the Versene feed with its undesirable pH adjustment.

The addition of the large metathesis volume will be incorporated in the next full-scale run with no

other process changes. If it is effective, the amount of product in the Versene feed will be low enough to make the pH adjustment with relative ease.

Run No. 48 was started on June 28 with the loading of 214 four-inch Hanford slugs. At the end of the month, five dissolvings and extractions had been completed.

A box, shielded with ½ in. of lead, was built for use during product removal from the loading cubicle as a protection against radiation levels such as those that occurred in run No. 47. This box is of such size that a man can operate the crane controls from its interior while viewing the image of the depths of the loading cubicle reflected from a mirror mounted on the loading crane.

The second Tucson carrier was completed and shipped to Hanford. The first Tucson carrier was received with its first load of slugs for run No. 48. Slight difficulty was met in the first unloading, but it should disappear with familiarity of operation.

All health physics monitoring devices in Building 3026-D are now tied into the emergency electrical system so that they will operate even during an electrical power outage.

RADIOISOTOPE CONTROL DEPARTMENT

Table 8 shows a breakdown of radioisotope shipments according to separated, unseparated, project, nonproject, and foreign shipments.

HANFORD IRRADIATIONS

The radioisotope samples listed in Table 9 were received from Hanford during June.

CYCLOTRON RADIOISOTOPES

Table 10 is a list of the orders now on hand for cyclotron radioisotopes.

Table 11 lists the number of radioisotope bombardments received and requested during June.

Table 12 lists the number of radioisotopes cyclotron-processed during June.

Table 8

RADIOISOTOPE SHIPMENTS

	JUNE 1952	MAY 1952	JUNE 1951	AUGUST 1946 TO JUNE 1952, INCLUSIVE
Separated material	754	708	554	26,945
Unseparated material	168	161	123	7,519
Total	922	869	677	34,464
Nonproject	799	761	512	
Project	98	92	150	
Foreign	25	16	15	
Total	922	869	677	

Table 9

RADIOISOTOPES RECEIVED FROM HANFORD

SAMPLE NO.	MATERIAL	NO. OF PIECES	DATE DISCHARGED	DATE RECEIVED
ORNL-86	Thallium	2	June 1952	6/22/52
ORNL-87	Tungsten	1	June 1952	6/22/52
ORNL-156	Cadmium	1	May 1952	6/22/52
ORNL-146	Cobalt	2	May 1952	6/22/52

Table 10

CYCLOTRON RADIOISOTOPE ORDERS

MATERIAL	AMOUNT (mc)	STATUS
Mn^{54}	12.2	Material in process
As^{73}	2.0	Material in process
Sr^{85}	5.0	Material in process

Table 11

BOMBARDMENTS RECEIVED AND REQUESTED

MATERIAL	MASS. INSTITUTE OF TECHNOLOGY		UNIVERSITY OF CALIFORNIA		UNIVERSITY OF PITTSBURGH		WASHINGTON UNIVERSITY	
	Bombard-ments	Beam Hours	Bombard-ments	Beam Hours	Bombard-ments	Beam Hours	Bombard-ments	Beam Hours
Bombardments Received								
Be^{7}			1	47.20	15	342.00		
Na^{22}	2	190.00			9	400.25	4	300.00
Mn^{52}					2	20.00		
Mn^{54}	1	50.00	1	95.00			7	400.00
Fe^{54}			1	18.70				
Co^{57}	1	10.00					4	140.00
Fe^{59}			7	332.80	2	80.60	1	34.00
Zn^{65}	1	100.00	1	47.80				
Ga^{67}					11	77.75		
As^{73}			1	10.50	3	30.50		
As^{74}	1	5.00						
Sr^{85}	3	89.75			1	10.00		
Y^{88}	1	10.00						
I^{125}							2	60.00
Molybdenum metal					2	15.70	5	50.40
KCl	1	1.00						
Sulfur					1	2.00		
Total Received	11	455.75	12	552.00	46	978.80	23	984.40
Requested but not Received								
Mn^{53}			1	7.00				
Mg^{28}			1	10.00				
Cr^{48}			1	10.00				
Total hours outstanding (not received or requested)		1,044.25		921.00		521.20		515.60

Table12

SHIPMENTS OF CYCLOTRON-PROCESSED RADIOISOTOPES

MATERIAL	NO. SHIPMENTS JUNE 1952	TOTAL MILLICURIES AND SERVICE IRRADIATIONS			
		June 1952		To Date	
		mc	S.I.	mc	S.I.
Be^{7}	4	16.5		368.743	4
Na^{22}	4	3.1		80.804	
Mn^{52}				10.991	
Mn^{54}				7.52	
$Fe^{55,59}$				63.64	4
Co^{57}				4.144	
Zn^{65}				42	4
Ga^{67}	3		3		20
As^{73}				4.560	
Sr^{85}				6	
Sr^{90}					1
Mo^{95}					7

ACTIVATION ANALYSES

A system has been worked out for the accumulation of costs for all activation analyses.

SF MATERIAL CONTROL

Two carload-lot shipments were received from Hanford during the month. The first car, received June 22, contained 140 irradiated slugs for the Purex process pilot plant; the second car, received on June 28, contained 216 irradiated slugs for RaLa separation and 58 slugs for a "single-channel" experimental separation run.

An additional 5376 aluminum-silicon bonded, aluminum-jacketed, normal uranium slugs were received from Y-12 during June for use in reloading the X-10 graphite reactor.

On June 28, the following large quantities of fissionable element material were received from Y-12: 1684 g of 90 to 95% enriched uranium for use in fabricating CP-5 fuel elements for Argonne National Laboratory; and 6434.34 g of 90 to 95% enriched uranium for use in fabricating MTR fuel elements for Phillips Petroleum Company.

A large batch of separated U^{233} (393.69 g) was shipped during the month to Y-12 for use by A. D. Callihan in an experiment to determine the conditions for a sustained nuclear chain reaction in aqueous solutions of U^{233}. This increases the total amount shipped to date to 1320.45 g for use in the experiment.

Other significant shipments of fissionable material consisted of 132.01 g of Purex process plutonium, 328.26 g of Sr^{90} process plutonium, and 450.50 g of SCRUP plutonium which was sent to Los Alamos. In addition, 155.95 g of SCRUP plutonium was sent to Y-12.

During June, 36 MTR fuel assemblies and 8 MTR shim rods were shipped to Phillips Petroleum Company, Scoville, Idaho. The total number shipped to date is 114 assemblies and 18 shim rods.

In connection with recommendations contained in the USAEC SF Accountability Survey Report No. 35, it is noted that the status remains essentially the same as that stated in the May report; however, a rough draft of changes to Standard Practice Procedure No. 58 has been submitted for issuance, which should be about July 15.

At the request of the USAEC, a new procedure was issued for handling adjustments to the X-10 graphite reactor canal SF material balance. The

prime purposes of the procedure were to change the method of reporting U^{235} "burn-up" by fission from the category of "unaccounted for" to that of a removal captioned "burn-up by fission 3001 reactor" and to provide a means by which the total uranium consumed is adjusted without changing the average weight of slugs.

SF surveys during the month consisted of visiting two persons possessing SF material that was inspected and weighed when feasible; no apparent discrepancies were encountered. In addition, the records of three analytical laboratories were audited, disclosing that all records were in good order and that proper accounting had been made for all samples.

During June, there were 25 receipts and 49 outgoing shipments, compared with 19 receipts and 32 shipments last month. Tables 13 and 14 show a summary of receipts and shipments during the month.

Table 13

SF MATERIALS RECEIVED

FROM	MATERIAL	AMOUNT (g)
Argonne National Laboratory	Thorium (oxide)	185.72
Battelle Memorial Institute	Thorium (metal)	2,460.00
Brookhaven National Laboratory	Enriched uranium (metal)	0.986
Carbide and Carbon Chemicals Co., K-25 Area	Normal uranium (UF_6)	896.00
Carbide and Carbon Chemicals Co., Y-12 Area	Enriched uranium (U_3O_8)	0.01
	Normal uranium (UO_2)	1.50
	Depleted uranium (U_3O_8)	9.83
	Normal uranium (U/Zr)	431.00
	Normal uranium (oxide)	1,398.30
	Normal uranium (slugs) net	1,561,545.00
	Depleted uranium (metal)	29.02
	U^{236} (U_3O_8)	0.20
	Depleted uranium (U_3O_8)	10.00
	Normal uranium (slugs) net	2,369,431.00
	Normal uranium (UF_4)	29.10
	Normal uranium (slugs) net	2,537,568.00
	Normal uranium (slugs) net	8,567.00
	Depleted uranium (UO_2)	1,088.30
	U^{233} (alpha source)	Negligible
	Normal uranium (U/Zr)	475.4
	Enriched uranium (metal) MTR	6,000.03
	Enriched uranium (metal CP-5)	1,570.33
General Electric Co. AGT	Enriched uranium (UO_2)	0.14
	Normal uranium (U_3O_8)	39.40
General Electric Co. HGE	Depleted uranium (slugs)	103,128.00
	Plutonium (slugs)	14.00
	Depleted uranium (slugs)	384,064.00
	Plutonium (slugs)	100.00
	Depleted uranium (slugs)	248,930.00
	Plutonium (slugs)	147.00

Table 14

SF MATERIALS SHIPPED

TO	MATERIAL	AMOUNT (g)
American Cyanamid Co.	Normal uranium (sources)	2.47
California Research & Development	Normal uranium (Zr plates)	524.00
Carbide and Carbon Chemicals Co., K-25 Area	Depleted uranium (Purex)	838.70
Carbide and Carbon Chemicals Co., Y-12 Area	Normal uranium (UO_3)	7,293.00
	U^{233} $[UO_2(NO_3)_2]$	0.045
	U^{233} $[UO_2(NO_3)_2]$	393.69
	Enriched uranium (UO_2SO_4)	Unknown
	Enriched uranium (UO_2SO_4)	1.13
	Normal uranium (bars)	2,947.21
	Enriched uranium (MTR)	3.89
	Enriched uranium (MTR)	8.41
	Thorium (oxide)	185.72
	U^{233} $[UO_2(NO_3)_2]$	0.048
	Enriched uranium (alloys)	22.55
	Enriched uranium (alloys)	56.20
	Normal uranium (UO_3)	79.30
	Plutonium (SCRUP)	0.002
	Plutonium (SCRUP)	155.95
	Enriched uranium (MTR)	0.048
	Enriched uranium (MTR)	4.54
	Normal uranium (compounds)	94,096.62
	Normal uranium (turnings)	138,393.00
	Normal uranium (slugs)	32,795.28
General Electric Co., AGT	Normal uranium (UO_2)	11.79
	Enriched uranium (UO_2)	0.14
General Electric Co., HGE	Plutonium (Purex)	0.756
	Plutonium (Purex)	0.706
	Plutonium (Purex)	0.781
	Plutonium (Purex)	0.797
	Plutonium (Purex)	0.754
	Plutonium (Purex)	0.770
	Plutonium (Purex)	0.604
	Plutonium (Purex)	0.672
Los Alamos Scientific Laboratory	Plutonium (Sr^{90})	227.50
	Plutonium [illegible]	12.18
	Plutonium (SCRUP)	153.61
	Plutonium (Sr^{90})	109.76
	Plutonium (SCRUP)	296.89
	Plutonium (Purex)	132.01

[redacted]

TO	MATERIAL	AMOUNT (g)
Phillips Petroleum Co.	Enriched uranium (MTR)	435.00
	Enriched uranium (MTR)	839.00
	Enriched uranium (MTR)	839.00
	Enriched uranium (MTR)	840.00
	Enriched uranium (MTR)	842.00
	Enriched uranium (MTR)	843.00
	Enriched uranium (MTR)	840.00
	Enriched uranium (MTR)	435.00
University of California Radiation Laboratory	Normal uranium (sheet)	389,845.00
	Normal uranium (Zr plates)	189.00

[redacted]

[redacted]