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OPERATIONS DIVISION MONTHLY REPORT

for

Month Ending April 30, 1952

AEC RESEARCH AND DEVELOPMENT REPORT

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OPERATIONS DIVISION MONTHLY REPORT

for

Month Ending April 30, 1952

by

M. E. Ramsey

DATE ISSUED

JUN 30 1952

OAK RIDGE NATIONAL LABORATORY
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 April 30, 1952 are summarized and indexed in the following:

1. Lost pile-operating time was 14.9% compared with 11.6% for March and 12.2% for the year to date (p. 3).

2. One slug rupture occurred during April and was discharged without difficulty (p. 3).

3. Approximately 9000 aluminum-silicon bonded slugs have been charged into the central zone of the X-10 graphite pile (p. 3).

4. The LITR power level was raised from 1000 to 1500 kw. Operation at the higher level is satisfactory (p. 4).

5. LITR cooling water analyses indicate relatively low corrosion rates in the reactor water system (p. 4).

6. Low P^{32} yields during the month appear to have been caused by failure of the gold liner in the product evaporator (p. 6).

7. The alterations to Building 3515 and process development required for separations of larger amounts of fission products are progressing satisfactorily (p. 7).

8. Fission-product, source-fabrication work is in the design stage (p. 8).

9. A total of 19.4 curies of beta activity was discharged to White Oak Creek compared with 17.5 curies last month (p. 11).

10. Los Alamos reports organic impurities in the last RaLa shipment. Presence of these impurities is not too serious now but will be objectionable if the time required for transportation is reduced drastically (p. 12).

11. There were 939 radioisotope shipments compared with 1011 during the previous month (p. 13).

12. All outstanding requests for Fe^{59} low in Fe^{55} have been filled (p. 13).

PILE DEPARTMENT

OPERATING DATA

	April 1952	March 1952	Year to Date 1952
Graphite Pile			
Total accumulated kwhr	2,203,648	2,423,988	9,396,629
Average kw/operating hr	3596.52	3685.46	3685.05
Average kw/24-hr day	3060.62	3258.05	3235.75
Per cent lost time	14.90	11.60	12.19
Excess pile reactivity (inhr)	75	50	
Slugs discharged	9209	270	9882
Slugs charged	9201	266	9870
Product made (g)	80.42	88.47	342.94
Product discharged (g)	1841.33	24.54	1884.83
Low-Intensity Test Reactor			
Total accumulated kwhr	697,609	521,773	2,017,397
Average kw/operating hr	1091	930	886
Average kw/24-hr day	969	701	695
Per cent lost time	11.2	24.6	21.6
Position of No. 2 shim rod (in. out)	22.773	23.432	

PILE OPERATIONS

Graphite Pile

The increase in down time this month was a result of the extra work involved in discharging and recharging approximately 2000 slugs per week.

One slug rupture occurred during April and was discharged without difficulty. The data are as follows:

Number	99
Date	4/7/52
Channel	1266
Days in pile	96
Approx. temp.	210 °C
Remarks	In thermocouple row; detected with scanner

Approximately 9000 aluminum-silicon bonded slugs have been charged into the central zone of the pile. The temperatures registered by thermocouples on slugs in this zone have been higher than those shown previously by unbonded slugs in the same region. Even after increasing the maximum metal temperature to 260°C, it has been necessary to run at a somewhat lower power than formerly. During April 1951, for example, the average power per operating hour was 3746 kw compared with 3596 kw this month and 3685 kw for March 1952. It is believed that this increased temperature is partly due to better conduction of heat through the ends on which the thermocouples are fastened. It is planned to increase the maximum metal temperature to 275°C as soon as all the unbonded slugs are discharged from the central portion of the pile.

Bonded-slug production at Y-12 was continued during the month. Oven testing of 7920 slugs at

400°C for one week resulted in four ruptures and two blisters. All but one rupture and one blister were apparently a result of faulty aluminum in the end caps. Because of the shortage of uranium stock, the number of slugs that Y-12 will produce has been reduced from approximately 62,000 to 53,000, which will leave only about 13,000 extra slugs after complete recharging of the reactor.

On April 28, 280 slugs containing tantalum (2 lb each) were discharged from the outer channels. Samples of this material were monitored in air and found to have a specific activity of approximately three curies per pound. Another batch of 30 tantalum slugs containing 1 lb each was irradiated in hole A and channel 1964 for one month, after which it was pushed to the edge of the graphite where little irradiation was received; the batch was finally discharged on April 28. This material had a specific activity of approximately 30 curies per pound.

Excess reactivity was about 75 inhr at the end of the month. Considerable difficulty was experienced with hole 19, which developed leaks on three separate occasions. Water from this tube ran into the graphite and resulted in the loss of considerable reactivity. The first occurrence was with a tube that had been in the pile for approximately two and one-half years. The second and third tubes had faulty gasketing that failed soon after tube insertions.

Drawings are completed for the steel structure to be used on top of the pile as support for the new large shields planned for holes 10, 11, and 12.

The ANL experiment in hole 11 was terminated and equipment was removed this month, thus making the hole available to the ORNL Chemistry Division.

Two batches of liquid hydrogen were produced during the month. It is expected that this material will soon be required on a daily basis, which will make it necessary to keep a supply on hand.

A smaller, individual steam-reducing valve for the air-conditioning system is required to prevent steam losses during the day when steam is not being used. Under these conditions with no flow in the steam line, the static pressure builds up great enough to cause loss of steam through the pop-off valve. A separate reducing valve for the air conditioner will permit adequate steam pressure to be maintained on this unit and will eliminate steam losses.

Low-Intensity Test Reactor

The new water system at the LITR has operated very satisfactorily, although paint has continued to come off the lines installed in February. The paint has been readily caught and removed in a strainer installed for this purpose.

Approval was received on April 24 for operation at a power level of 1500 kw, and the power was immediately raised to this figure. No difficulty has been experienced at the higher power level, and shielding appears to be adequate.

It has been suspected that small amounts of fission products have been leaking from one of the fuel elements into the water. This was indicated by gamma-ray measurements of water samples taken from the sample tubes directly beneath the fuel elements. Slightly higher readings were obtained from this element compared with other elements, and when it was changed to another lattice position, the water from it continued to be more radioactive. Apparently only small amounts of fission products reached the cooling water, which indicates that the corrosion rate of the aluminum-uranium alloy is low. Other checks, such as beta counting of water samples a few hours after they are taken, show essentially no difference between this and other elements and also indicate that the corrosion rate is low.

The inlet water line to the reactor was placed underground as far as practical to shield that portion of the water system. The remainder of the inlet water line will be shielded with an inch of lead. A new calibration of the orifice in the inlet line shows a water flow of approximately 1500 gal/min at full pump load.

An analysis for corrosion products in the LITR cooling water gave the following results after the water had been circulated through the reactor for one week: Al, 0.21 ppm; Fe, 0.02 ppm; Be, 0.41

ppm; and Cu, 0.02 ppm. On the basis of approximately 10,000 gal of water contained in the system, the corrosion rate of beryllium and aluminum appears to be reasonably low and that of iron appears to be negligible. The latter is significant because the pump housing and impeller and a good share of the piping and reactor tanks are made of plain steel.

An annunciator system is now installed, to which any experiment may be connected to cause the reactor to be set back to 1% of full power or to be scrammed, depending upon the seriousness of the undesirable condition that is likely to develop.

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 that experienced when all filters were clean.

FAN HOUSE

The overhauled shaft pump was reinstalled on the No. 2 compressor.

RADIOISOTOPES

Stringers 13, 14, and 16 contained 389 cans of target material at the end of April as compared with 380 cans of target material in these stringers at the end of March.

Table 2 shows a comparison of the radioisotope and research samples charged into the pile during April with those handled in March.

WATER-DEMINERALIZATION BUILDING

Table 3 shows water treatment data for April compared with that of March.

TABLE 1

Pressure-Drop Data

Date	Pressure Drop (in. water gage)		
	Glass Wool	CWS No. 6	Total Across House
4/30/52	2.8	1.8	5.9
3/31/52	3.3	1.8	6.4
Clean filters	1.1	1.3	3.3

TABLE 2

Radioisotope and Research Samples

	April 1952		March 1952	
	Research	Radioisotopes	Research	Radioisotopes
Stringers 13, 14, and 16	8	142	9	252
Hole 22	66	1	39	6
All other holes	9	22	14	18
Total by groups	83	165	62	276
Total for month	248		338	

TABLE 3

Water Demineralized and Deaerated

	Gallons Produced		
	April 1952	March 1952	Year to Date 1952
Demineralized	405,000	508,200	1,858,550
Deaerated	56,940	60,000	190,940

CHEMICAL SEPARATIONS AND RADIOISOTOPE DEVELOPMENT DEPARTMENTS

RADIOISOTOPES

Iodine (I^{131} – 8 d)

Seventy-two ORNL slugs were processed and 53,612 mc of iodine was shipped.

Only one run gave trouble in processing this month. The crude product from the first two distillations contained a reddish-colored material that completely held up the iodine. This portion of the run had to be discarded, with a loss of about 60 to 75% of the I^{131}. The iodine in the caustic scrubber, however, was recovered.

Iodine Development Work

No further work was done on the new iodine plant this month. Permission has not been received to start construction.

Phosphorus (P^{32} – 14.3 d)

Thirteen 2500-g cans of irradiated sulfur were processed and 8493 mc of phosphorus was shipped.

The yields of all runs this month were lower than normal; the reason for this was unknown until the end of the month when the gold liner in the product evaporator was examined and found to be damaged. It is suspected that the damage was caused by repeated pressure-vacuum changes in this vessel, and some product may have been lost behind the leaking liner. Since no spare gold-lined evaporator was available, the entire evaporator assembly was replaced with one made of quartz. If this change proves to be practical, the gold-lined vessel will be permanently eliminated.

Phosphorus Development Work

Sufficient sulfur was purified by passing it through the magnesium oxide column to load all irradiation cans for regular P^{32} production. The first test cans should be ready for removal from the pile within about one month.

Carbon (C^{14} – 5740 y)

During the month, 1116.4 mc of C^{14} as $BaCO_3$ was produced. A special order of low specific activity $BaCO_3$, containing only 2 mc of C^{14} in 50 g of $BaCO_3$, was made up. A shipment of 10 mc of C^{14} as Na_2CO_3 solution was also made.

Fission Products

Building 3026 Processing. Operations were continued on the processing of old "W" slugs for Sr^{90} production. The following list gives a breakdown of the production runs during the month.

Sample	$Sr^{89,90}$ (mc)	Sr^{89} (%)
SS-44-AE-P-1	93.9	6.5
SS-44-AE-P-2	72.0	5.6
SS-44-AE-P-3	278.0	7.0
SS-44-AE-P-4	295.0	6.2
SS-44-AE-P-5	56.0	8.6
SS-44-AE-P-6	190.0	10.5
SS-44-AE-P-7	512.0	11.8
SS-44-AE-P-8	96.5	
SS-44-AE-P-9	107.0	6.4
SS-44-AE-P-10	43.0	7.0
SS-45-AE-P-1	262.0	10.8
SS-45-AE-P-2	78.0	11.0
SS-45-AE-P-3	554.0	11.5
SS-45-AE-P-4	280.0	12.0
SS-45-AE-P-5	391.0	
SS-45-AE-P-6	218.0	
Total	3536.4	

Precipitation Process (Building 3515). Twelve shop drawings were completed and transmitted to the Mechanical Department for fabrication of equipment. Five drawings remain to be completed on this project. They are listed as follows: product and sample carriers, product bottle capper, housing for filter for cell exhaust gases, and final revision of the flow sheet. The Instrument Department completed twelve drawings necessary for the fabrication and installation of manometer piping and solenoid valve-control circuits. The manometer installation on this job is unique in that all manometers are placed inside a cell and will be read by means of a periscope.

Process vessels are being installed in cell No. 2, and a lead floor has been completed in cell No. 1. The radiation level in cell No. 1 will still permit only 75 min of working time per day, but this will be substantially increased, since piping alterations will allow the crystallizer to be washed thoroughly.

Several purchased items have not yet been delivered. These are as follows: micrometallic filter vessel, delivery date May 8, 1952; Vycor process vessels, delivery date June 6, 1952; internal shielding glass for periscopes; and miscellaneous Swagelock fittings. Definite delivery dates for the last two items mentioned are not known.

Special processing of old "W" slugs by the Chemical Technology Division was completed, and the concentrated 1AW waste was stored in tank 19.

Chemical development work was continued to obtain data pertinent to the precipitation process. The corrosion of stainless steel during the reduction of iodate to iodine with oxalic acid in the presence of nitric acid solution was studied by boiling a solution of the expected concentration of these materials in a stainless steel vessel for 48 hours. The ratio of stainless steel surface exposed to solution volume was considerably greater than that expected in the actual process. After a period of 48 hr of continuous boiling under conditions to simulate those that will be experienced in actual practice, there was no visible evidence of corrosion of the stainless steel, and only insignificant traces of iron, chromium, and nickel were found in the solution. It was concluded that stainless steel could be used in the presence of these reactants in the proposed process.

The first flow sheet calls for removal of aluminum from the final cesium alum concentrate by selective separation on an ion-exchange column. In an effort to eliminate this ion-exchange step, methods of precipitating the aluminum are being investigated. A promising procedure developed by Willard and Tang [*J. Am. Chem. Soc.* **59**, 1190 (1937)] uses hydrolysis of urea to separate aluminum from a sulfate solution as a dense crystalline precipitate. Their results were checked in the laboratory on aluminum sulfate solutions in 1-liter batches; these results are given in Table 4.

It is concluded that this precipitation method can probably be used to separate aluminum in the final stage of the cesium process. Further checks are being made on the possible losses that may result from the interference of urea and sulfate and the carrying of cesium in the supernatant liquor.

TABLE 4

Results of Urea Precipitation of Aluminum

Aluminum (g/liter)	NH_4Cl (g/liter)	$(NH_4)_2SO_4$ (g/liter)	Urea (g/liter)	Boiling Time (hr)	Condition of Precipitate
3.78	0	30	30	3.5	Dense, crystalline
0.404	0	10	8	2.0	Dense, crystalline
0.108	10.0	0	8	2.0	Flocculent
0.108	10.0	0	0	0.3	Flocculent

Cs^{137} Source Assembly Station (Building 3013). Twenty-five drawings have been completed on the design of equipment, which represents approximately 35% of the total design work required.

Since the final source will be made of cesium sulfate, an extensive investigation of the properties of this compound is being made. Cs_2SO_4 can be deposited by evaporation from aqueous solution without any loss from decrepitation. Upon evaporation with excess sulfuric acid the hydrosulfate is formed, which, upon ignition, is converted to the pyrosulfate and then to the normal sulfate without any loss owing to decrepitation. A temperature of 900 to 1000°C maintained for 1 hr is required for this conversion. In order to convert $CsHSO_4$ to Cs_2SO_4 at a lower temperature, dry ammonium carbonate may be added to the cooled, glassy $CsHSO_4$. Upon heating this mixture to approximately 250°C, at which point the ammonium carbonate decomposes to NH_3, H_2O, and CO_2, the ammonia reacts with any excess, free sulfuric acid. The $(NH_4)_2SO_4$ formed is then driven off by heating at 600 to 700°C. The same thing can be accomplished by passing an ammonia-saturated air stream over the heated $CsHSO_4$. Aqueous solutions of ammonia or ammonium carbonate cannot be used for quantitative conversion.

As stated previously, $CsHSO_4$ melts to an oily liquid and is converted to the normal sulfate without decrepitation at 900°C. A test run was made in a Vycor beaker at 1100°C for 2 hours. Although the vessel was severely etched, no signs of failure were noted, and it was concluded that Vycor is suitable for this operation. A test sample of normal cesium sulfate prepared by the ammonium carbonate procedure described in the preceding paragraph was pelleted at 15,000 psi; the resultant density was 3.6 g/cc (the theoretical density of cesium sulfate is approximately 4.2 g/cc).

Purified Fission Products. During the month 53.4 mc of carrier-free praseodymium (Pr^{143} – 13.8 d) was separated.

Argonne-Type Cell (Building 3029)

Construction of the Argonne-type cell started on April 23. To date, concrete forms for the cubicle and the runway are about 30% complete.

Preparation of Europium Target Material

Two samples of europium concentrate were received for testing and evaluation. Work was started on the isolation of europium from a low-grade rare-earth mixture containing 0.5% of the element. The samarium and europium were isolated by sodium amalgam extraction. It is proposed to separate the europium by selectively reducing it to the divalent oxidation state with amalgamated zinc or an electrolytic method.

In the recovery of by-products, a 1.9-g sample of crude praseodymium oxide was converted to the chloride, adsorbed on a 2.2 by 25-cm column of Nalcite HCR cation-exchange resin and eluted with 0.1% citric acid solution adjusted to pH 6.1 with ammonium hydroxide. One-liter fractions were taken of the effluent, from which the praseodymium content was recovered.

Tritium

A micro gas-density balance was constructed and sealed into the tritium system and calibrated. The sensitivity is 5.8 μg/mm deflection. Since the volume of the bulb is 1.4 ml and the deflection can be read to 0.1 mm, the density can be determined to ± 0.4 μg/ml of gas, which will allow tritium to be assayed to $\pm 0.20\%$. It will now be possible to assay tritium in the system at any time by using this instrument. This is particularly important, since there is good evidence that degradation of the tritium occurs in the system by interchange of tritium with hydrogen in stopcock grease. To alleviate this condition, an all-metal tritium system is now in the final stages of construction. In the new system tritium will be stored in uranium metal.

Processed Radioisotopes

Table 5 is a list of radioisotope preparations that were made from pile-irradiated targets.

Cyclotron Radioisotopes

The following radioisotope product solutions were prepared from cyclotron targets.

1. Be^7, 52.9 d, 37.2 mc carrier-free (in isotonic solution),
2. Na^{22}, 2.6 y, 14.5 mc at 100 mc/g Na,
3. Co^{56}, 72 d, 0.315 mc carrier-free,
4. Co^{57}, 270 d, 0.90 mc carrier-free.

TABLE 5

Radioisotopes Produced from Pile-Irradiated Targets

Product	Amount (mc)	Specific Activity (mc/g)
Iron		
Batch 1		
Fe^{55}, 2.9 y	19.5	7.2
Fe^{59}, 46.3 d	11.9	4.4
Batch 2* (enriched Fe^{58})		
Fe^{59}, 46.3 d	34.4	1607
Batch 3* (enriched Fe^{58})		
Fe^{59}, 46.3 d	61.2	2300
Batch 4* (enriched Fe^{58})		
Fe^{59}, 46.3 d	34.6	1628
Scandium (Sc^{46} – 86 d)	2600	19.1 curies/g

*The Fe^{55} content of batches 2, 3, and 4 was less than 2%.

Special Preparations

Thirty-five sources were loaded with a total of 157.2 curies of Co^{60}.

A 75-mc Ce^{144} source was prepared in a customer's source holder.

Red-phosphorus–Bakelite rods were molded as follows: 3 rods, 1/2 in. in dia by 1 1/4 in. long; and 2 rods, 1/4 in. in dia by 1 in. long. These will be irradiated for special medical uses.

Miscellaneous Work

Two source containers were designed and fabricated for 45-mc Cs^{137} sources.

The vertical periscope in the FP cell in Building 3026 was repaired.

Corrosion tests on a piece of titanium tubing in 0.2 *N* HNO_3 and molten sulfur were begun.

A new set of specifications for optical-grade zinc bromide shielding solution was established by using information from Argonne and from this laboratory. A requisition was submitted for 1450 lb of the solution.

A small area of the concrete floor in Building 3033 was covered with a sample of Neoprene-bearing material for test purposes.

Plans were made for a new instrument room immediately east of the cold laboratory. .

In order to reduce the ever-present contamination on the floor of the decontamination building and the periodic replacement of the concrete floor, which is pitted by the acid solutions, one quarter of the floor is being covered with stainless steel plate salvaged from the burial ground. This work is about 95% complete.

RADIOACTIVE WASTE DISPOSAL

The slurrying of metal precipitate from tank W-7 to tank W-10 was continued until the middle of the month at which time the pump in W-7 failed. Inspection of the pump revealed a broken impeller, a worn shaft, and worn bearings. These parts will be replaced as soon as they are obtained from the vendor.

The shielding of the main transfer line of the tank farm with 1/2 in. of lead has been started. The radiation from this line during transfers caused high and unnecessary exposure of operating personnel in the general vicinity of the transfer line.

The repainting of the jet- and valve-pit covers is about 70% complete.

Work on the new chemical-waste storage pit has progressed until the project is about 97% complete.

The investigation to find the leak into tanks W-17 and W-18 revealed that the underground section of the cell ventilation duct from Building 3026-C, which drains into these two tanks, was leaking.

The telemetering system has been partly tied into the central recording instruments at the evaporator in Building 3506. This work is 75% complete.

The Cottrell precipitator power pack was shut down for 2 hr this month to clean the rectifying tubes that became coated with a carbonaceous material.

The automatic damper and steam turbine control system on the hot off-gas blowers is now completed. This enables the system to operate without complete loss of off-gas as soon as the power to the electric blower fails.

A new wet-bulb reservoir and wet-and-dry-bulb thermometers were installed downstream from the heater to determine the relative humidity of the off-gas.

The joints in the radioisotope area hood ventilation duct are being caulked and cemented to eliminate leakage of air and dirt into the system. Holes were formed in the ground that were visible from the surface when the dirt was drawn into the underground ductwork.

Waste Discharged to White Oak Creek

A total of 19.4 curies of beta activity was discharged from the settling basin and retention pond this month (see Table 6). This discharge is 11% greater than that of last month. The major contributors were the Building 3505 canal that was discharged, the Building 3001 canal that was purged as a result of slug ruptures, the decontamination of Building 3036, and the waste evaporator in Building 3506 that gave an unusual amount of operating difficulty during the month because of poor evaporator feed characteristics.

Chemical-Waste Evaporator (see Table 7)

The evaporator was shut down for 8 hr for the repair of a sheared pin in the discharge valve that leads from the evaporator to the concentrate storage tank W-6.

The waste evaporator produced very low decontamination factors in two runs despite the fact that no known foam-overs occurred. A check of all instrumentation revealed that everything was in order; no explanation for the poor results is known.

TABLE 6

Activity Discharged to White Oak Creek

Discharged From	April 1952		March 1952	
	Gallons	Beta Curies	Gallons	Beta Curies
Settling basin	22,136,000	19.33*	26,168,000	17.31
Retention pond	295,000	0.06	579,000	0.16
Total	22,431,000	19.39	26,747,000	17.47

*Less than 6.0 curies contributed by the evaporator.

TABLE 7

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
April 1952	219,000	20,100	10.9:1	10,506	5.09
March 1952	224,200	16,300	13.8:1	7,598	1.24

The water-spray nozzle was cleaned, and a leaking condensate return line was repaired during a regular shutdown to discharge a batch from the evaporator.

Waste-Tank Inventory

TABLE 8

Waste-Tank Inventory

Tanks	Capacity (gal)	Free Space (gal)	
		April	March
Hot-Pilot-Plant Storage			
W-3, 13, 14, 15	48,500	32,500	30,900
Chemical-Waste Storage			
W-5	170,000	68,500	45,200
Evaporator-Concentrate Storage			
W-6, 8	340,000	59,000	67,600
Metal-Waste Storage			
W-4, 7, 9, 10	543,000	283,500	316,000

RaLa (Ba^{140} – 12.5 d)

Pressure testing of the Tucson carrier, after the pouring of lead was completed, revealed that the fabricator had used mild-steel welding rod instead of the specified stainless steel on parts of one of the carriers. Also, the slug baskets for both carriers were welded with mild-steel rod. One of the Tucson carriers was shipped to Hanford to be tested and put into service. The other carrier will have to undergo repairs before shipment.

A discussion with a representative from Los Alamos revealed that the most recent shipment had definite indications of the presence of organic impurities. These impurities were removed at Los Alamos along with the decay impurities that are in the product after it has been in transit over a relatively long period of time.

The removal of both types of impurities results in an appreciable loss of product at Los Alamos. However, as long as the decay impurities must also be removed, the loss from organic material is not considered serious in itself. This will not be true if a speed-up in transportation – changing from truck to plane – now under discussion materializes. It may then be profitable to take necessary measures to eliminate organic impurities prior to shipment. This probably will involve extensive alterations to the equipment that are at present considered unjustifiable in view of the uncertainty of the entrie future of RaLa production, as well as no certainty of transportation by airplane instead of by truck.

RADIOISOTOPE CONTROL DEPARTMENT

There were 939 radioisotope shipments during April 1952 compared with 1011 during March 1952 and 867 during April 1951. All outstanding requests for Fe^{59} produced from enriched Fe^{58} have been filled and it is fairly certain there will be a continuing supply to satisfy future requests. Table 9 shows a breakdown according to separated, unseparated, project, nonproject, and foreign shipments.

TABLE 9

Radioisotope Shipments

	April 1952	March 1952	April 1951	August 1946 to April 1952, Inclusive
Separated material	731	788	679	25,483
Unseparated material	208	223	188	7,190
Total	939	1011	867	32,673
Nonproject	814	860	665	
Project	113	135	169	
Foreign	12	16	33	
Total	939	1011	867	

HANFORD IRRADIATIONS

The radioisotope samples listed in Table 10 were received from Hanford during the month.

TABLE 10

Radioisotopes Received from Hanford

Sample No.	Material	No. of Pieces	Date Discharged	Date Received
ORNL-145	Enriched Fe^{58}	1	April 1952	4/15/52
ORNL-144	Chromium metal	1	April 1952	4/15/52
ORNL-129	Calcium	1	April 1952	4/15/52
ORNL-88	Tin	1	April 1952	4/15/52
ORNL-146	Cobalt	2	3/28/52	4/18/52
ORNL-84	Silver	1	April 1952	4/18/52
ORNL-80	Mercury	1	3/16/52	4/18/52
ORNL-13	Beryllium nitride	64 64 64	3/17/52 3/15/52 3/16/52	4/18/52

CYCLOTRON RADIOISOTOPES

Table 11 is a list of the outstanding orders for cyclotron radioisotopes.

TABLE 11

Cyclotron Radioisotope Orders

Material	Amount (mc)	Status
Mn^{54}	11.2	Material has been requested
Co^{57}	1.5	Material in process
As^{73}	2.0	Material to be requested
Sr^{85}	5.0	Material has been requested

Table 12 is a list of the number of radioisotope bombardments received and requested during April.

Table 13 lists the number of the radioisotopes cyclotron-processed during April 1952 as divided into millicurie and service irradiation amounts.

TABLE 12

Bombardments Received and Requested

Material	Mass. Institute of Technology		University of California		University of Pittsburgh		Washington Universtiy	
	Bombard-ments	Beam Hours	Bombard-ments	Beam Hours	Bombard-ments	Beam Hours	Bombard-ments	Beam Hours
Bombardments Received								
Be^{7}			1	47.20	14	327.00		
Na^{22}	2	190.00			9	400.25	4	300.00
Mn^{52}					2	20.00		
Mn^{54}	1	50.00					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		
Sr^{85}	2	59.75			1	10.00		
Y^{88}	1	10.00						
I^{125}							2	60.00
Molybdenum metal					2	15.70	4	40.40
Sulfur					1	2.00		
Total received	8	419.75	11	457.00	45	963.80	22	974.40

TABLE 12 (continued)

Material	Mass. Institute of Technology		University of California		University of Pittsburgh		Washington University	
	Bombardments	Beam Hours	Bombardments	Beam Hours	Bombardments	Beam Hours	Bombardments	Beam Hours
Requested but not Received								
Be^{7}					1	15.00		
Ti^{46}			1	3.00				
Ti^{48}			1	3.00				
Mn^{54}			1	100.00				
Fe^{57}			1	3.00				
Ga^{67}					1	8.00		
As^{74}	1	5.00						
Sr^{85}	1	30.00						
Total hours outstanding (not received or requested)		1045.25		934.00		513.20		525.60

TABLE 13

Shipments of Cyclotron-Processed Radioisotopes

Material	No. Shipments April 1952	Total Millicuries and Service Irradiations			
		April 1952		To Date	
		mc	S.I.	mc	S.I.
Be^{7}	5	42		318.243	4
Na^{22}	6	6.1		73.404	
Mn^{52}				10.991	
Mn^{54}	3	3.8		7.52	
$Fe^{55,59}$				63.64	4
Co^{57}				3.1	
Zn^{65}				42	4
Ga^{67}	1		1		13
As^{73}	1	0.5		4.560	
Sr^{85}				6	
Sr^{90}					1
Mo^{95}					6

ACTIVATION ANALYSES

Work on activation analyses continued at a normal rate.

SF MATERIAL CONTROL

Two carload-lot shipments were received from Hanford during the month. The first shipment, which was received on April 18, consisted of 140 irradiated uranium slugs for the Purex process and 6 casks loaded with material for radioisotope separation. The second shipment was received on April 29, and consisted of 140 irradiated uranium slugs for the Purex process, 444 irradiated thorium slugs (6 in. long), and 20 irradiated thorium slugs (4 in. long) for the U^{233} program. One container was loaded with 268 thorium slugs, and a second container was loaded with 176 thorium slugs, 6 in. long; 20 thorium slugs, 4 in. long; and 140 uranium slugs, 4 in. long. The mixture of 4-in. uranium and thorium slugs (within the same container) caused considerable concern in segregating the material. The matter was discussed with G. F. Penn, USAEC, Hanford, and it was requested that Hanford refrain from loading thorium and uranium slugs of the same length in the same carrier.

An additional 13,296 silicon-bonded, aluminum-jacketed, normal uranium slugs were received from Y-12 during April. The slugs are to be used for testing, and subsequently they will be loaded into the X-10 graphite pile.

On April 11, 24,901 lb of Penbarnite grade, thorium nitrate was received from United Lead Company, Middlesex, New Jersey, for use in the U^{233} and Thorex programs. The material was contained in 131 drums, 20 of which were sent to the Chemical Technology Division and 111 were stored in the Building 1000 vault.

During the month 30 MTR fuel assemblies and four MTR control rods were shipped to Phillips Petroleum Company, National Reactor Testing Station, Scoville, Idaho. The total number shipped to date is 66 assemblies and eight control rods.

A total of 446.79 g of Purex process plutonium was shipped to Los Alamos during April. In addition, separation work on Hanford slugs designated as Sr^{90} material was started, and approximately 300 g of separated plutonium will be available for shipment to Los Alamos early in May.

In connection with the recommendations contained in SF Accountability Survey Report No. 35, it is noted that Nos. 6, 7, and 8 have been accomplished at the end of April. The research work associated with recommendation No. 1 is still in progress. Random selected core punchings have been dissolved and the results obtained have been sent to A. de la Garza, K-25 plant. Recommendations 2, 3, and 4 are still under study. New forms have been drafted and submitted for reproduction for use in connection with recommendation No. 5. It is expected that these forms will be ready for use early in June. Steps have been taken to revise *Standard Practice Procedure No.* 58, incorporating descriptive data relative to usage of the new forms.

SF surveys during the month consisted of visiting four persons possessing SF material. Material in their possession was inspected and weighed when it was feasible, and no apparent discrepancies were encountered. In addition, the records of three analytical laboratories were audited. Results of the audits disclosed that all records were in good order and that proper accounting had been made for all samples.

During the month there were 29 receipts and 30 outgoing shipments compared with 32 receipts and 22 outgoing shipments last month. Tables 14 and 15 show a summary of receipts and shipments for the month of April 1952.

TABLE 14

SF Materials Received

From	Material	Amount (g)
Argonne National Laboratory	Normal uranium carbide	120.00
Battelle Memorial Institute	Thorium crystal bar	975.00
Carbide and Carbon Chemicals Co., K-25 Area	Depleted uranium (waste solution)	524.00
	Normal uranium (UO_3 in H_2O)	258.00
	Plutonium	0.42
	Depleted uranium (waste solution)	1,658.00
	Plutonium in waste solution	0.005
Carbide and Carbon Chemicals Co., Y-12 Area	Enriched uranium (UF_4)	0.84
	Enriched uranium (U_3O_8)	83.80
	Enriched uranium (UF_4)	0.20
	Enriched uranium (UF_4)	0.20
	Normal uranium (UF_3)	1.60
	Normal uranium (slugs) net	2,308,000.00
	Normal uranium (slugs) net	1,557,792.00
	Normal uranium (UO_3)	4,225.00
	Normal uranium (slugs) net	2,308,000.00
	Thorium billets	170,970.00
	Normal uranium (slugs) net	1,556,442.00
	Normal uranium (UF_4)	0.80
	Normal uranium (slugs) net	2,536,820.00
	Normal uranium ($UO_3 \cdot H_2O$)	8,925.00
	Normal uranium (slugs) net	1,672,343.00
	U^{233}	0.002
	Normal uranium (slugs) net	4,034,030.00
General Electric Co. HGE	Depleted uranium (slugs)	248,930.00
	Plutonium in slugs	119.00
	Depleted uranium (slugs)	248,930.00
	Plutonium in slugs	122.00
	Irradiated thorium slugs	756,454.00
General Electric Co. AGT	Enriched uranium (irradiation rig)	0.23
United Lead Co.	Thorium nitrate	4,520,931.00

TABLE 15

SF Materials Shipped

To	Material	Amount (g)
Argonne National Laboratory	Depleted uranium (slugs)	20,988.00
	Plutonium in slugs	0.54
	Depleted uranium	20,988.00
	Plutonium in slugs	0.31
	Depleted uranium (sliced slugs)	1,096.00
	Plutonium in sliced slugs	0.03
	Normal uranium (slugs)	29,362.00
Brookhaven National Laboratory	Enriched uranium (foil)	9.50
Carbide and Carbon Chemicals Co., K-25 Area	Normal uranium (UO_3)	258.00
Carbide and Carbon Chemicals Co., Y-12 Area	Enriched uranium (solution)	0.11
	Enriched uranium solution	147.38
	Normal uranium (scrap)	93,019.25
	Normal uranium (UO_2SO_4)	8,192.00
	U^{233} $[UO_2(NO_3)_2]$	0.04
	Normal slugs	2,878,260.00
	U^{233} $[UO_2(NO_3)_2]$	0.11
	Enriched uranium (U_3O_8)	2.12
	Thorium metal	1,651.50
	Thorium nitrate	217.00
General Electric Co. SGE	Depleted uranium purex solvent	Negligible
	Plutonium nitrate solution	0.12
Los Alamos SFC	Plutonium in solution	145.18
	Plutonium in solution	301.61
National Lead Co.	Normal uranium solution	65,003.40
Phillips Petroleum Co.	Enriched uranium (MTR assemblies)	840.89
	Enriched uranium (MTR assemblies)	839.91
	Enriched uranium control rods	218.73
	Enriched uranium control rods	217.13
	Enriched uranium (MTR assemblies)	839.06
	Enriched uranium (MTR assemblies)	839.43
	Enriched uranium (MTR assemblies)	841.13
University of California	Normal uranium (sheets)	437,715.00
USAEC, New York Operations Office	Normal uranium (U_3O_8)	0.42