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ORNL-1586
Progress

ESEARCH AND DEVELOPMENT REPORT

OPERATIONS DIVISION MONTHLY REPORT

FOR

MONTH ENDING JUNE 30, 1953

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OAK RIDGE NATIONAL LABORATORY • U.S. ATOMIC ENERGY COMMISSION

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

for

Month Ending June 30, 1953

by

M. E. Ramsey

DATE ISSUED

JUL 27 1953

OAK RIDGE NATIONAL LABORATORY
Operated by
CARBIDE AND CARBON CHEMICALS COMPANY
A Division of Union Carbide and Carbon Corporation
Post Office Box P
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OPERATIONS DIVISION MONTHLY REPORT

SUMMARY

The activities of the Operations Division for the month ending June 30, 1953 are summarized and indexed below:

1. Lost graphite reactor operating time averaged 7.9%, compared with 7.1% for May (p. 3).
2. Four ruptured slugs were detected and discharged without difficulty (p. 3).
3. The LITR down time was 10.7%, compared with 9.2% for May (p. 3).
4. The LITR water-drop test in which two water sprays were used duplicated the 85°C maximum temperature encountered in an earlier test in which the same power level and only one spray were used (p. 3).
5. The mixed-bed resin column in the LITR water system has been replaced with a two-bed system (p. 4).
6. The slug dissolver used in the production of I^{131} was removed, was found to be leaking, and was replaced with a spare. Several poor I^{131} runs followed this replacement (p. 11).
7. Sulfur purification by the use of Al_2O_3 appears to be more satisfactory than purification with MgO (p. 11).
8. The hydrolytic-decomposition products of urea appear to complex barium and strontium sufficiently so that selective precipitation of iron may be made from Purex wastes (p. 11).
9. A total of 14.9 curies of beta activity was discharged to White Oak Creek, compared with 20.3 curies last month (p. 14).
10. RaLa run No. 52-A, which was processed to recover the high waste losses and the heel dissolving of run No. 52, gave a product of 3700 curies when estimated by radiation measurements. Analytical results of both runs are shown (p. 15).
11. The unsatisfactory process filter has been replaced, and several leaks in the equipment were detected and repaired (p. 17).
12. There were 1075 radioisotope shipments made this month, compared with 989 during May (p. 17).

REACTOR OPERATIONS DEPARTMENT

OPERATING DATA

	JUNE 1953	MAY 1953	YEAR TO DATE 1953
ORNL Graphite Reactor			
Reactor power			
Total accumulated (kwhr)	2,484,101	2,623,225	15,105,299
Average kw/operating hr	3745	3796.54	3798
Average kw/24-hr day	3450	3525.84	3477
Lost time (%)	7.87	7.13	8.44
Excess reactivity (inhr)	80	43	
Slugs discharged	159	85	606
Slugs charged	158	109	549
Product made (g)	89.84	95.74	550.47
Product discharged (g)	4.90	2.13	14.76
Low-Intensity Test Reactor			
Reactor power			
Total accumulated (kwhr)	944,566	1,013,578	5,465,893
Average kw/operating hr	1,469	1,500	1,456
Average kw/24-hr day	1,312	1,362	1,258
Lost time (%)	10.7	9.2	13.6
Position of No. 2 shim rod (in. out)	22.429*	24.750	

*Equivalent to approximately 2.2% excess reactivity.

REACTOR OPERATIONS

ORNL Graphite Reactor

There were four slug ruptures during the month, and all were of bonded slugs from lots that had tested nearly 100% beta transformed; pertinent data on the ruptures are shown in Table 1. No difficulty was encountered in removing the ruptured slugs from the reactor.

The excess reactivity of the reactor was approximately 80 inhr at the end of the month. The tantalum being irradiated for the Army Chemical Corps is scheduled to be discharged in August 1953, and its removal should give additional excess reactivity with which to handle the new liquid-nitrogen-cooled research facility to be inserted soon in hole 10.

The pneumatic-tube facility in channel 2079 is being adapted for general usage. However, there is some escape of radioactive gas at the hole during charging and discharging, and repairs are being made to stop the leaks.

The exit duct was inspected, and a number of straightener vanes were found to have been torn loose and were partly blocking the duct. The vanes were removed, and the resistance in this section of the duct has been decreased.

The hydrogen liquefier operated satisfactorily, and four successful runs were made which produced 6.5 liters of liquid hydrogen.

The usage of experimental facilities in the ORNL graphite reactor is shown in Table 2.

Low-Intensity Test Reactor

One spent fuel element was replaced with a new one on June 23.

A water-drop test was made on June 22 (after the reactor had operated for one week at 1500 kw) to test the cooling of the fuel elements following the loss of water from the reactor tank. The safety

TABLE 1. SLUG RUPTURES DURING JUNE

NUMBER	CHANNEL	DATE DISCOVERED	DAYS IN REACTOR	APPROXIMATE TEMPERATURE (°C)	POSITION*	REMARKS
114	2178	6/1/53	385	175	33	Bonded slug from batch 145 which tested 100% beta transformed
115	1272	6/15/53	399	95	19	Bonded slug, from batch 154, had thermocouple welded to one end; 75% of this batch was beta transformed
116	1270	6/22/53	420	200	18	Bonded slug from batch 138 which tested 100% beta transformed
117	1777	6/22/53	427	190	8	Bonded slug from batch 135 which tested 100% beta transformed

*Determined by counting from west end of row.

sprays were in operation, and the maximum temperature observed in thermocouples between the fuel plates was approximately 85°C. This test duplicates one made previously at the same power level, and it was made to check the effectiveness of the new spray nozzles, which were inserted on opposite sides of the tank and replaced the single nozzle previously used.

It has been found possible to insert corrosion samples in the lattice, and results obtained in this position will be compared with those obtained with no radiation.

No further shipments of spent fuel elements were made to the chemical processing plant at Arco because the container that was shipped on May 13 has not been returned.

The mixed-bed resin column at the LITR was replaced with a two-bed system; one bed contains cation resin and the other contains anion resin. Since the installation of this system on June 9, it has been noted that the specific resistance of the water has decreased from about 700,000 to 400,000 ohms/cc, largely because of the shorter effective length of the column. However, it is believed that there will be considerable advantage in the new arrangement because of the less frequent regeneration that should result.

The usage of experimental facilities in the LITR is indicated in Table 3.

FILTER HOUSE

Table 4 shows a comparison of the pressure drop across the exit air filters last month with the pressure drop this month and that experienced with clean filters.

FAN HOUSE

Failure of a connecting rod to one of the dampers resulted in the No. 3 fan being shut down for one day on June 9. It was necessary to fabricate a new rod to replace the damaged one.

RADIOISOTOPES

Stringers 13, 14, and 16 contained 231 cans of target material at the end of June, as compared with 289 cans of target material at the end of May.

Table 5 shows a comparison of the radioisotope and research samples charged into the ORNL graphite reactor during June with those handled in May.

WATER-DEMINERALIZATION PLANT

A comparison of the amount of water demineralized during June and May is given below:

	June 1953	May 1953
Water demineralized (gal)	372,500	379,020

TABLE 2. USAGE OF EXPERIMENTAL FACILITIES – ORNL GRAPHITE REACTOR

HOLE NUMBER AND ORIENTATION	DIMENSIONS (in.)	DIVISION ASSIGNED TO	PERSON IN CHARGE	TYPE OF EXPERIMENT OR USAGE
1, north and south	4 by 4			Regulating rod
2, north and south	4 by 4			Regulating rod
3, north and south	4 by 4	Operations	J. A. Cox	Sulfur exposure for radiophosphorus production
4, north and south	4 by 4	Operations	J. A. Cox	Miscellaneous exposures of special samples
5, north and south	4 by 4			Shim rod
6, north and south	4 by 4			Shim rod
7, vertical	4 by 4			Safety rod
8, vertical	4 by 4			Safety rod
9, vertical	4 by 4			Safety rod
10, vertical	4 by 4	Solid State	J. H. Crawford	Low-temperature sample-exposure facility (not yet installed)
11, vertical	4 by 4	Operations and Chemical Technology	J. P. McBride	Boron shot safety tube and HRP fuel studies (no samples during month)
12, vertical	4 by 4	Chemistry	H. F. McDuffie	HRP fuel studies and general exposures
13, north and south	4 by 4	Operations	J. A. Cox	Target exposures for radioisotopes and research
14, north and south	4 by 4	Operations	J. A. Cox	Target exposures for radioisotopes and research
15, north	4 by 4	Solid State (G.E.)	L. E. Stanford (G.E.)	Miscellaneous large-sample exposures
15, south	4 by 4	Solid State	J. C. Wilson	Creep of metals
16, north and south	4 by 4	Operations	J. A. Cox	Target exposures for radioisotopes and research
17, north	4 by 4	Unassigned		Empty
17, south	4 by 4	Physics	E. O. Wollan	Neutron polarization
18, north and south	4 by 4	Analytical Chemistry	G. W. Leddicotte	Empty
19, north and south	4 by 4	Solid State	O. Sisman	Water-cooled exposure facility
20, north	4 by 4			Graphite temperature thermocouples
20, south	4 by 4	Solid State	J. C. Wilson	Creep of metals
21, north and south	4 by 4	Operations	J. A. Cox	Sulfur exposure for radiophosphorus production
22, north	4 by 4	Unassigned		Empty

TABLE 2 (continued)

HOLE NUMBER AND ORIENTATION	DIMENSIONS (in.)	DIVISION ASSIGNED TO	PERSON IN CHARGE	TYPE OF EXPERIMENT OR USAGE
22, south	4 by 4	Operations	J. A. Cox	Two pneumatic tubes for general usage
30	9 by 9	Solid State (G.E.)	L. E. Stanford (G.E.)	Life tests of equipment in radiation (no tests during month)
31	9 by 9			Blocked by one end of air seal H beam across top of graphite
32	9 by 9			Contains chamber for high-power-level trip circuit
33	9 by 9			Contains chamber for high-power-level trip circuit
34	9 by 9			Contains chamber for No. 2 power-level galvanometer
35	9 by 9			Blocked by one end of air seal H beam across top of graphite
36	9 by 9			Contains chamber for high-power-level trip circuit
37	9 by 9	Training School	H. S. Pomerance	Contains chamber for reactor kinetics study
40	9 by 9			Contains chamber for No. 1 power-level galvanometer
41	6-in. dia			Rear wall suction pressure tap; hole into west plenum
42	6-in. dia			Unit pressure differential tap; hole into west plenum
43	6-in. dia			Unused (inaccessible); hole into west plenum
44	6-in. dia			Unused; hole into west plenum
45	6-in. dia			Gas discharged from Hole 22 pneumatic tubes; hole into west plenum
46	6-in. dia			Used for viewing west end of graphite with periscope; vertical hole into west plenum
47	6-in. dia			Used for viewing west end of graphite with periscope; vertical hole into west plenum

TABLE 2 (continued)

HOLE NUMBER AND ORIENTATION	DIMENSIONS (in.)	DIVISION ASSIGNED TO	PERSON IN CHARGE	TYPE OF EXPERIMENT OR USAGE
50, north	4 by 4	Solid State	J. H. Crawford	Empty
50, south	4 by 4	Physics	E. O. Wollan	Neutron spectrometer
51, north	4 by 4	Solid State	J. H. Crawford	Water-cooled U^{235} neutron converter
51, south	4 by 4	Physics	C. G. Shull	Neutron spectrometer
52, north	4 by 4	Solid State	J. H. Crawford	Facility for exposing samples at the temperature of liquid nitrogen
53	4 by 4	Solid State (G.E.)	L. E. Stanford (G.E.)	Half-hole for miscellaneous large-sample exposures
54	4 by 4	Solid State (G.E.)	L. E. Stanford (G.E.)	Half-hole for miscellaneous large-sample exposures
55	4 by 4	Solid State (G.E.)	L. E. Stanford (G.E.)	Half-hole for miscellaneous large-sample exposures
56, north	4 by 4	Physics	E. C. Campbell	Fast pneumatic tube
56, south	4 by 4	Physics	H. S. Pomerance	Oscillator for measuring neutron absorption cross sections
57, north	4 by 4	Training School	H. S. Pomerance	General purpose neutron collimator
57, south	4 by 4	Physics	S. Bernstein	Neutron polarization
58, north	4 by 4	Solid State	O. Sisman	Circulating loops for Na and NaK
58, south	4 by 4	Chemistry	H. Levy	Neutron spectrometer
59	4 by 4	Unassigned		Half-hole blocked by work at hole 17, south
60	4 by 4	Chemistry	H. F. McDuffie	Half-hole empty
61	4 by 4	Biology and Operations		Half-hole used for activation of phosphorus sources and general large-sample exposures
East animal tunnel				General exposures of large samples to low flux
West animal tunnel				General exposures of large samples to low flux
Thermal column		Physics		Used by several groups for low-level neutron flux work
Inclined animal tunnel in thermal column				Infrequent exposures of biological specimens

TABLE 2 (continued)

HOLE NUMBER AND ORIENTATION	DIMENSIONS (in.)	DIVISION ASSIGNED TO	PERSON IN CHARGE	TYPE OF EXPERIMENT OR USAGE
West core hole		Physics	E. P. Blizard	Lid tank for shielding studies
A	1.68-in. dia	Operations	E. E. Beauchamp	Charging-face hole containing 20 small cans of $CaCO_3$
B	1.68-in. dia	Unassigned		Charging-face hole – empty
C	1.68-in. dia	Unassigned		Charging-face hole – empty
D	1.68-in. dia	Unassigned		Charging-face hole – empty
1768	1.75 in. square	Solid State	R. H. Kernohan	Charging hole containing neutron converter donut; used for general exposures of samples to fast neutron flux
1867	1.75 in. square	Solid State	R. H. Kernohan	Charging hole containing neutron converter donut; used for general exposures of samples to fast neutron flux
1968	1.75 in. square	Solid State	R. H. Kernohan	Charging hole containing neutron converter donut; used for general exposures of samples to fast neutron flux
1069	1.5-in. dia	Unassigned		Charging hole containing an aluminum liner; used for general exposure of suitable samples
2079	1.5-in. dia	Transferred from Solid State to Operations during May 1953	J. A. Cox	Charging hole containing pneumatic tube; used for exposure of research and radioisotope samples
0857, 0880, 1484, 1853, 2857, 2880				Charging-face holes containing boron-coated thermopiles for reactor instrumentation
Others				Thirty-four uncharged peripheral holes contain tantalum slugs for the Army; seven uncharged peripheral holes contain $CaCO_3$ for radioisotope production; 375 uncharged peripheral holes remain unused

TABLE 3. USAGE OF EXPERIMENTAL FACILITIES – LITR

FACILITY NUMBER	TYPE OF FACILITY	DIVISION ASSIGNED TO	PERSON IN CHARGE	TYPE OF EXPERIMENT OR USAGE
HB-1	6-in.-ID beam hole	Physics	E. C. Smith	Chopper-type neutron velocity selector
HB-2	6-in.-ID beam hole	Solid State (G. E.)	D. S. Billington	General exposures of large samples and loops
HB-3	6-in.-ID beam hole	Solid State	J. C. Wilson	Creep of metals
HB-4	6-in.-ID beam hole	Chemistry	H. F. McDuffie	Empty
HB-5	6-in.-ID beam hole	Chemistry	H. F. McDuffie	HRP fuel stability and corrosion tests
HB-6	6-in.-ID beam hole	Transferred from Solid State to Chemistry in May 1953	H. F. McDuffie	Empty
HR-1	Pneumatic tube	Operations	J. A. Cox	General short exposures of research and radioisotope samples
HR-2	Pneumatic tube	Operations	J. A. Cox	General short exposures of research and radioisotope samples
C-28	Hollow fuel element in core	Solid State	T. H. Blewitt	Exposure of metal crystals to high, fast flux
C-38	Hollow fuel element in core	Solid State	J. B. Trice	Exposure of specimens for flux determination methods (no samples during month)
C-42	Hollow Be core piece with access tube from top plug	Solid State (G. E.)	L. E. Stanford (G. E.)	Exposure of miscellaneous small specimens; tube developed water leak and has been removed for repairs
C-44	Hollow Be core piece with access tube from top plug	Chemistry	H. F. McDuffie	Empty
C-46	Hollow Be core piece with access tube from top plug	Solid State	G. W. Keilholtz	Empty
C-48	Hollow Be core piece with access tube from top plug	Solid State	G. W. Keilholtz	Empty
C-53	Mg tray in core space	Operations	J. A. Cox	Exposures of research and radioisotope samples

TABLE 3 (continued)

FACILITY NUMBER	TYPE OF FACILITY	DIVISION ASSIGNED TO	PERSON IN CHARGE	TYPE OF EXPERIMENT OR USAGE
C-57	Mg tray in core space	Operations	J. A. Cox	Exposures of research and radioisotope samples
C-59	Be core piece with four vertical holes	Operations	J. A. Cox	Exposures of research and radioisotope samples
V-1	Inclined low-flux hole			Contains boron-coated thermopile for reactor instrumentation
V-2	Inclined low-flux hole	Analytical Chemistry	G. W. Leddicotte	Exposure facility for activation analyses
V-3	Inclined low-flux hole	Unassigned		Empty
V-4	Inclined low-flux hole	Unassigned		Empty

TABLE 4. PRESSURE-DROP DATA

DATE	PRESSURE DROP (in. water gage)		
	Glass Wool	CWS No. 6	Total Across House
6/30/53	2.4	2.7	6.4
5/31/53	2.4	2.7	6.3
Clean filters	1.1	1.3	3.3

TABLE 5. RADIOISOTOPE AND RESEARCH SAMPLES

	JUNE 1953		MAY 1953	
	Research	Radioisotopes	Research	Radioisotopes
Stringers 13, 14, 16	4	148	8	133
Hole 22	153	8	2	60
All other holes	3	18	2	35
Total by groups	160	174	12	228
Total for month	334		240	

CHEMICAL SEPARATIONS AND RADIOISOTOPE DEVELOPMENT DEPARTMENTS

RADIOISOTOPES

Iodine (I^{131} – 8 d)

Forty-eight ORNL slugs and one 8-in. Hanford slug were processed and 75,810 mc of I^{131} was shipped.

The I^{131} equipment was decontaminated for repairs immediately following the Hanford-slug run, and once again after only one run following the first decontamination.

The repairs that were accomplished after the first decontamination were as follows:

1. Two leaks in the product line to room 10 were repaired.
2. The dissolver was removed and cleaned; some Teflon gasket material found in it undoubtedly accounts for plugging of the jet line in previous runs. After the dissolver was reinstalled and tested, a leak was found between the inside of the dissolver and its jacket. The dissolver was then replaced with a spare, and the Teflon gasket was replaced with one of asbestos.
3. A leak in the top flange of the reflux condenser was reduced but could not be completely eliminated.
4. Several leaking valve-packing glands were tightened.
5. A leak in the still drain was welded; it is believed that this leak caused an appreciable loss of product in the past.

The second decontamination of the cell became necessary when the still drain valve could not be closed completely. The product from a six-slug run was almost completely lost before this difficulty was noticed.

Poor yields were experienced in the next four runs following the second decontamination. On the first run, a poor yield was anticipated and considered normal because it was preceded by a decontamination of the equipment. The yields from the other three runs, however, were abnormal. It was thought that the new asbestos gasket under the lid of the dissolver might be holding up the activity, but this is doubtful because the next two runs were satisfactory. Further developments may shed more light on the problem.

Iodine Development Work, Building 3028

The evaporator and the expansion chamber for the iodine development work were received this month; five pieces of equipment from a total of 21 have been received to date.

Incorrect welding rods were used in fabricating several vessels at the O. G. Kelley Company; these vessels will be remade by the vendor.

The dissolver that was recently removed from the old I^{131} plant because of leaks which developed along the welds was examined and the metal was analyzed. It was found that the vessel plate was niobium stabilized but that the welds were not – a result of using the wrong welding rods when this vessel was fabricated.

Phosphorus (P^{32} – 14.3 d)

Twenty-two 2500-g cans of bombarded sulfur were processed and 14,013 mc of P^{32} was shipped. All runs were satisfactory.

Sulfur Purification

Commercial sulfur was purified by passing the molten material through a column of activated Al_2O_3. Sulfur purification was accomplished previously by using MgO in a similar manner, but objectionable amounts of magnesium were found in the product. Extraction tests showed that most of the organic matter was removed by the Al_2O_3; changes in the amounts of inorganic impurities could not be detected by spectrographic analysis. It appears probable that commercial sulfur made from H_2S gas will be satisfactory without further purification. Sufficient quantities of this grade of sulfur are now on hand for test production runs.

Precipitation Process, Building 3515

Both precipitation-process cells have been decontaminated to a background of less than 30 mr/hr, and repair work can proceed as soon as a pipe fitter is available.

Developmental work on the precipitation process has been mainly concerned with the finding of economical methods, adaptable to routine operation, for removing the large amount of iron found in Purex waste. It was determined that urea and its hydrolytic decomposition products complex barium and strontium so that selective precipitation of hydrated iron oxide may be made below a pH of 7, even in the presence of small amounts of CO_3^{--} ion, with only about 10% loss of strontium and less than 1% loss of rare earths. By the use of this method, it may be possible to accumulate successive batches of alkaline and rare earths in precipitator No. 1 and to remove a major portion of the iron before proceeding with the group separations. This would result in a large increase in the production capacity of the present equipment.

Purification of Rare-Earth Fractions

Contamination with a relatively large amount of iron is also encountered in rare-earth fractions stored for further purification. Two iron-removal methods are being tested: (1) extraction of rare earths and iron into TBP from 10 *N* HNO_3, followed by selective stripping of the iron; and (2) precipitation of rare-earth oxalates, with iron remaining in the filtrate as the oxalate complex. Over-all recoveries are found to be lower from the TBP process (25 to 35%) than from the oxalate process (65 to 90%).

Preparation of Thulium Target Material

An ion-exchange separation of thulium from a 30% concentrate was completed, and the material will be pelleted and encapsulated for irradiation in the LITR. To date, no good source of supply of thulium has been found.

Processed Radioisotope Production

Table 6 is a list of radioisotope product solutions that were prepared during June.

Special Preparations

The following special preparations were made:

	Number	Total Amount
Co^{60} sources	104	63.06 curies
Cs^{137} sources	5	3.55 curies
Ba^{140} source	1	50.00 mc
Sr^{90} source	1	1.00 mc
H^3 ampoules	5	8.18 curies
95% He^3 ampoules	2	153.00 cc
4.45% He^3 ampoule	1	900.00 cc
Zr-H^3 targets	9	16.32 curies
A^{37} ampoule	1	20.00 mc

Miscellaneous Work

Practical measurements were made on the bremsstrahlung from a Sr^{90} solution in glass containers. Approximately 10 in. of concrete is required to shield 100 curies of Sr^{90} to a radiation level of 7 mr/hr.

A liner was designed of Boltaron, an unplasticized vinyl polymer, for use in the Sr^{90} purification cubicle. Laboratory tests have shown that this material has excellent chemical resistance and decontaminability and that it suffered no damage after a gamma radiation dose of 10^8 roentgens.

Installation of a Co^{60} monitoring station was completed; this equipment will allow individual pieces to be assayed without their removal from the remote manipulator cell.

A new, low melting point, silver solder (All-State No. 420) was used successfully with a soldering gun for remote control soldering of stainless steel capsules containing Co^{60}.

Drawings are being made for adapters that will permit cerium-barium high-density glass to be inserted in the remote manipulator cell in place of the present $ZnBr_2$ window. This change will make it possible to increase the amount of radioactivity that can be handled to about 600 curies of Co^{60}.

A storage garden containing seven large-diameter holes was designed for installation north of Building 3033 and will be used for the storage of irradiated Be_3N_2 slugs.

Samples of Tygon and Tygothene were given a gamma dose of 6×10^8 roentgens. Type S-22 Tygon and Tygothene A turned brown, lost flexibility, and became embrittled. Tygothene B was virtually destroyed and turned into a gray-green crumbling mass.

RADIOACTIVE-WASTE DISPOSAL

Seven pots, six drums, and five small, glass containers of waste were received from Argonne National Laboratory. The contents of three pots and one drum were jetted to chemical-waste tank W-5, and the contents of five drums, four pots, and five small, glass containers were jetted to metal-waste tank W-7.

There was 1500 gal of uranium-bearing liquid wastes received from K-25 and jetted to metal-waste tank W-7.

An investigation to locate the source of leakage of liquids into tank WC-2 revealed that water was not entering the tank from ground-water seepage.

TABLE 6. RADIOISOTOPES PRODUCED DURING JUNE

PRODUCT SOLUTION	SOURCE	AMOUNT (mc)	SPECIFIC ACTIVITY (mc/g)
Antimony (Sb^{125} – ~2.7 y)	Hanford reactors	102	Carrier-free
Barium (Ba^{140} – 12.8 d)	Fission products, ORNL graphite reactor	1,780	Carrier-free
Calcium (Ca^{45} – 152 d)	Hanford reactors	217	27.6
Beryllium (Be^{7} – 52.9 d)	86-in. cyclotron	241	Carrier-free
Carbon (C^{14} – 5720 y)	Hanford reactors	287	0.047
		236	0.050
Cerium (Ce^{141} – 28 d)	Fission products, ORNL graphite reactor	133	Carrier-free
Cesium (Cs^{134} – 2.3 y)	Hanford reactors	1,300	>15.3
		1,412	>17.2
Cesium (Cs^{137} – 37 y)	Fission products, ORNL graphite reactor	1,822	Carrier-free
Chlorine (Cl^{36} – 4.4×10^5 y)	Hanford reactors	0.925	0.282
		10.0	0.276
		3.28	0.280
		2.82	0.276
		5.76	0.274
		11.19	0.278
Chromium (Cr^{51} – 26.5 d)	LITR	1,560	1,640
Gross fission products	ORNL graphite reactor	371	Carrier-free
Enriched iron (Fe^{59} – 46.3 d)	LITR	31.65	1,730
Praseodymium (Pr^{143} – 13.8 d)	Fission products, ORNL graphite reactor	60	Carrier-free
Silver (Ag^{110} – 270 d)	Hanford reactors	720	1,330
Sodium (Na^{22} – 2.6 y)	Pittsburgh cyclotron	6.5	342
Strontium (Sr^{89} – 53 d)	Fission products, ORNL graphite reactor	65	Carrier-free
Strontium (Sr^{90} – 25 y)	Fission products, ORNL graphite reactor	2,920	Carrier-free
Ruthenium (Ru^{103} – 42 d)	Fission products, ORNL graphite reactor	238	<19,480
		55	<4,500
Sulfur (S^{35} – 87.1 d)	Hanford reactors	13,056	Carrier-free
Tantalum (Ta^{182} – 117 d)	Hanford reactors	384	4,270

It is now thought that the condensate, which collected in the off-gas manifold at the stack, ran back into WC-2 through its off-gas line. The valve in this line has been closed, and no increase in tank contents has been noticed since that time.

The electrical components which were connected to the W-16 automatic jet and which were located inside the W-16, W-17, and W-18 jet pit were bypassed as a result of a short circuit in the underground lines. This system is operating under a temporary bypass condition until permanent repairs can be made.

The corrosion-test coupons installed in the stainless steel monitoring tanks in December 1952 were removed for evaluation. The coupons inserted into tank WC-5, which services the chemical waste from Building 3508, were not recovered. The stainless steel cable securing these coupons failed because of corrosion, and the coupons were lost in the tank. The evaluation has not been completed, but the preliminary results show that no appreciable corrosion has occurred in the tanks tested.

Waste Discharged to White Oak Creek

A total of 14.94 curies of beta activity was discharged to White Oak Creek from the settling basin and the retention pond (see Table 7). This discharge was only 73% of that of last month and was the lowest monthly discharge since June 1952.

Chemical-Waste Evaporator

The chemical-waste evaporator was shut down for 40 hr this month. Twelve hours of down time resulted from a power outage caused by a transformer failure. It required the other 28 hr to decontaminate the evaporator in order to repair the leaking air-operated, automatic valve from the feed tank to the evaporator tank and to repair a leaking weld on a condensate-discharge line from a steam coil. Evaporator operation is shown in Table 8; waste-tank inventory is shown in Table 9.

TABLE 7. ACTIVITY DISCHARGED TO WHITE OAK CREEK

DISCHARGED FROM	JUNE 1953		MAY 1953	
	Gallons	Beta Curies	Gallons	Beta Curies
Settling basin	21,226,000	13.00*	20,733,000	15.80
Retention pond	423,000	1.94	502,000	4.53
Total	21,649,000	14.94	21,235,000	20.33

*1.14 curies contributed by the evaporator.

TABLE 8. 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 1953	199,133	16,229	12.27:1	9,571	1.14
May 1953	170,245	12,844	13.25:1	8,707	0.49

Waste-Tank Inventory

TABLE 9. WASTE-TANK INVENTORY

TANKS	CAPACITY (gal)	FREE SPACE (gal)	
		June 1953	May 1953
Hot-Pilot-Plant Storage			
W-3, 13, 14, 15	48,500	32,340	32,340
Chemical-Waste Storage			
W-5	170,000	74,000	72,000
Evaporator-Concentrate Storage			
W-6, 8	340,000	104,000	113,500
Metal-Waste Storage			
W-4, 7, 9, 10	543,000	242,000	237,000

RaLa (Ba^{140} – 12.5 d)

RaLa run No. 52-A, which was processed to recover the high waste losses and the heel dissolving of run No. 52 (reported last month), was completed and shipped on June 3 and had a product content of 3700 curies, as determined by radiation measurements. The product was very dark in color and appeared to be one of the darkest ever shipped. Again, there was a discrepancy in the readings of the two product-measuring instruments, but the value reported is considered to be valid.

The recovery run consisted of the high waste losses from the three metatheses, the extraction-tank and large-filter rinses, the $NaNO_3$ and NaOH regeneration elutions of the resin used in run No. 52, the product-evaporator rinse, and the slug-heel dissolving. No difficulties were encountered in the processing of this recovery run. The fuming HNO_3 waste loss was about 30% of the total product of the run; this was probably the result of an inefficient filter. The analytical results of runs Nos. 52 and 52-A follow:

Run No. 52

Slugs loaded, 71 (8-in.)
Slugs dissolved, 73.2 (by analysis)

	Curies	Per Cent
Product dissolved	34,784	100.00
Extraction-cell losses		
Extraction filtration	282	0.81
First metathesis waste	3,570	10.26
Second and third metatheses wastes	2,657	7.64
Extraction-tank and process-filter rinse (Versene)	272	0.78
Extraction-tank and process-filter rinse (HNO_3)	6,938	19.95
Cell A sump	164	0.47
Total extraction-cell losses	13,883	39.91

Resin-cubicle losses		
Feed-tank rinse	23	0.07
HCl effluent	1	0.00
Acetate-feed, Versene-feed, and NaOH effluents	32	0.09
Fuming HNO_3 waste	2,365	6.80
Sodium nitrate-regeneration waste	566	1.63
Product-evaporator-tank rinse	380	1.09
Total resin-cubicle losses	3,367	9.68
Total losses accounted for	17,250	49.59
Product (calculated at last separation time, 0630, on May 28, 1953)		
Based on analysis before transfer to shipping cone minus product-evaporator-tank rinse	13,872	39.88
Estimated by radiation measurements	7,000	20.12
Material balance (based on analyses)		89.47

Run No. 52-A, Recovery

	Curies	Per Cent
Starting material		
Unaccounted for loss from run No. 52	2,755	
Extraction-tank and process-filter rinse (HNO_3)	5,217	
Dissolver heels	1,400	
First metathesis waste	2,685	
Second and third metatheses wastes	1,998	
$NaNO_3$ regeneration	427	
Total estimated starting material	14,482	100.00
Extraction-cell losses		
Extraction filtration	170	1.18
Metatheses wastes	46	0.32
Extraction-tank and process-filter rinse	147	1.01
Combined resin-column elution	35	0.24
Total cell A losses	398	2.75
Resin-cubicle losses		
Feed-tank rinse	201	1.39
HCl elution	104	0.72
Fuming HNO_3 precipitation	1,715	11.84
Product-evaporator rinse	48	0.33
$NaNO_3$ regeneration	8	0.06
Total resin-cubicle losses	2,076	14.34
Total losses accounted for	2,474	17.09
Product (calculated at last separation time, 1300, on June 2, 1953)		
Based on analysis before transfer to shipping cone minus product-evaporator-tank rinse	3,606	24.90
Estimated by radiation measurements	3,700	25.55
Material balance (based on analyses and taking into account the evaporator rinse of 141 curies from run No. 52)		41.0

After the run shipment and the rinse of all cell vessels, the process-filter cubicle was decontaminated so that the large-area process filter which performed so inefficiently during run No. 52 could be removed. During the reinstallation and subsequent testing of the flat-plate-type filter, leaks were found in the inlet and outlet lines to the process filters, as well as by the gates and at the junction of the bodies and bonnets of three valves on the valve manifold. All these leaks were repaired and the repairs were tested.

Inspection was made of process-filter No. 1, which was also suspected to be leaking, and serious leakage was found around the packing gland of the inlet valve. This leakage was corrected, and the unit was tested and put back into service. It is believed that these leaks were the cause of the high losses which could not be accounted for in runs Nos. 52 and 52-A. The next run is scheduled to be started on July 1, 1953.

RADIOISOTOPE SALES DEPARTMENT

A supplement to the isotopes catalog was issued during the month. Briefly, this bulletin published price reductions for Tc^{99}, Be^{7}, Cr^{51}, and for large orders of I^{131}, P^{32}, and C^{14}. Also, ORNL offered polonium and polonium-beryllium sources for sale.

Radioisotope shipments made during June 1953 are compared in Table 10 with those made during May 1953 and June 1952. A breakdown according to separated and unseparated material (including totals for August 1946 through June 1953), and for project, nonproject, and foreign shipments is also shown.

HANFORD IRRADIATIONS

No samples were received from Hanford during the month of June.

CYCLOTRON RADIOISOTOPES

Two cyclotron targets were received this month – a 10-hr $As^{73,74}$ target and a 79.5-hr Mn^{54} target.

ACTIVATION ANALYSES

A total of 106 requests has been received for information concerning activation analyses; 39 have developed into requests for analyses, 28 of which have been completed.

TABLE 10. RADIOISOTOPE SHIPMENTS

	JUNE 1953	MAY 1953	JUNE 1952	AUGUST 1946 TO JUNE 1953, INCLUSIVE
Separated material	8[illegible]	809	754	35,964
Unseparated material	194	180	168	9,672
Total	1075	989	922	45,636
Nonproject	946	885	799	
Project	101	78	98	
Foreign	28	26	25	
Total	1075	989	922	

SF MATERIAL CONTROL

Three shipments consisting of 84 drums containing UNH solutions of depleted uranium were sent to Mallinckrodt Chemical Works, St. Louis, Missouri, during June. The total uranium content of the 84 drums was 6791 kg. These were the tenth, eleventh, and twelfth shipments of uranium recovered under the Metal Recovery Program and make a total of 25,709 kg shipped to date.

During June, 42 MTR fuel assemblies and 4 shim safety-control rods were shipped to Phillips Petroleum Company, Scoville, Idaho. This makes a total of 437 fuel assemblies and 52 control rods shipped to date.

Important quantities of fissionable material were received from Y-12 during June; namely, 11.05 kg of contained U^{235}, of which 1.05 kg was in the form of metal to be used in fabricating BSR fuel assemblies. The remaining 10.00 kg was in the form of metal to be used in fabricating MTR fuel assemblies.

During June, 1 liter of tritium of more than 90% purity was received from Los Alamos Scientific Laboratory for use by the Physics Division in a series of experiments in the Van de Graaff generator.

ORNL's polonium-source requirements for fiscal year 1954 were prepared and submitted to the AEC during June. In the past, the SF Accountability Office has handled the ordering of polonium sources. Effective July 1, 1953, the Radioisotope Sales Department will handle the procurement of such sources by issuing a purchase requisition. The cost of sources procured will be passed on to the recipient.

Work on the new SF accounting manual has been delayed somewhat because of an increase in current SF accountability work. However, a rough draft of the general section has been completed, and it is anticipated that it will be ready for publication by the time the manual binders are received.

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

During June, there were 31 receipts and 39 outgoing shipments, compared with 21 receipts and 30 shipments last month. Tables 11 and 12 are summaries of receipts and shipments for June.

TABLE 11. SF MATERIALS RECEIVED

FROM	MATERIAL	NUMBER OF SHIPMENTS	AMOUNT (g)
Argonne National Laboratory, ANL	Depleted uranium	4	37,492.40
	Plutonium		3.29
Battelle Memorial Institute, BMI	Normal uranium	1	1,740.00
Carbide and Carbon Chemicals Co., K-25, CCC	Depleted uranium	2	3,151.00
	Plutonium		0.01
Carbide and Carbon Chemicals Co., Y-12, CYT	Enriched uranium	5	11,073.04
	Depleted uranium	1	0.20
	Normal uranium	4	2,344.20
	Plutonium	1	Negligible
General Electric Co., AGT	Enriched uranium	2	0.67
Iowa State College, ISC	Normal uranium	2	417.10
Los Alamos Scientific Laboratory, SFC	Tritium	1	1.00 liter
North American Aviation, Inc., DNA	Normal uranium	3	60.00
Phillips Petroleum Co., MTI	Enriched uranium	4	84.50
USAEC, Nevada Proving Ground, SFN	Plutonium	1	18.08

TABLE 12. SF MATERIALS SHIPPED

TO	MATERIAL	NUMBER OF SHIPMENTS	AMOUNT (g)
Argonne National Laboratory, ANL	Normal uranium	1	11,660.00
	Thorium	1	390.80
Carbide and Carbon Chemicals Co., Y-12, CYT	Normal uranium	4	1,856.65
	Enriched uranium	9	299.45
	Depleted uranium	2	19.67
	Thorium	2	5,261.80
	Plutonium	1	Negligible
Mallinckrodt Chemical Works, MCW	Depleted uranium	3	6,790,500.00
Naval Radiological Defense Laboratory, NDL	Normal uranium	1	2.55
Phillips Petroleum Co., MTI	Enriched uranium	13	7,679.62
USAEC, New York Operations Office, COL	Normal uranium	1	0.42
USAEC, Oak Ridge Operations Office, CPA	U^{233}	1	Negligible