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OPERATIONS DIVISION MONTHLY REPORT

FOR MONTH ENDING JANUARY 31, 1954

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OPERATIONS DIVISION MONTHLY REPORT

for

Month Ending January 31, 1954

by

A. F. Rupp

DATE ISSUED

MAR 4 1954

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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 January 31, 1954 are summarized and indexed below:

1. The Graphite Reactor and the LITR operated satisfactorily during the month. The operating power of the Graphite Reactor was increased slightly – from 3700 to 3800 kw (p. 2).
2. The west room at the LITR is being remodeled to accommodate the liquid-fuel test loop (p. 2).
3. Temperature measurements were made in test holes at the LITR. The hole wall temperatures are below 100°C (p. 2).
4. There were 1030 radioisotope shipments in January 1954, compared with 896 in January 1953 (p. 8).
5. Experimental work on the purification of I^{131} by deposition on silver was discontinued temporarily; the present distillation method will be used in the new production unit (p. 8).
6. About 2100 curies of Cs^{137} has now been separated from tank-farm waste and is ready for fabrication into a large radiation source (p. 9).
7. Large Zr^{95}-Nb^{95} radiation sources may be made directly by adsorption on small amounts of silica gel (p. 9).
8. Rala run No. 55, finished during the month, was the most successful one to date (p. 11).

REACTOR OPERATIONS

ORNL Graphite Reactor

No slug ruptures occurred during January, although the operating power level was increased from 3700 to 3800 kw, which resulted in an increase of the maximum metal temperature from 245 to 260°C. Operating data are given in Table 1.

With the aid of a recorder recently installed for measuring the effluent from the canal and the canal demineralizer, it has been possible to materially reduce the amount of water going to the settling basin. The discharge is now usually between 150,000 and 200,000 gal/week. Also, the hot waste sent to the retention tanks W-1 and W-2 is being held to a minimum amount because it must be evaporated and stored. Generally, the amount of waste is kept to less than 1000 gallons.

Preliminary investigations are being made of a system which would permit the canal demineralizer effluent now being discharged to the settling basin to be used for cooling holes 19 and 51 and then to be returned to the demineralizers and recycled. This would increase the purity of the canal water, and it would no longer be necessary to operate the water-demineralization plant to supply cooling water for these holes; consequently, about 90% of the present load on the water-demineralization plant would be eliminated.

The operation of the fans was normal. The filter-house sump tank had to be emptied several times because of water seepage during recent heavy rains. The pressure drop across the filters increased 2.9% during the month.

The usage of experimental facilities in the ORNL Graphite Reactor is shown in Table 2.

Low-Intensity Test Reactor

The LITR operated normally during January. There was an unusually low amount of down time (6.5%) because of the new procedure of scheduling the removal of the top plug at two-week intervals instead of weekly. Four special shutdowns for experiments occurred in addition to the regular shutdowns.

The west room is being remodeled to accommodate the liquid-fuel loop scheduled to be tested in hole HB-4. Hot drains are being installed to the hole, and a concrete pad and door are being added on the west side of the west room.

Preliminary efforts to measure the wall temperature inside hole HB-2 gave results above 200°C. However, further tests have indicated that the wall temperature is below 100°C, and the high temperatures obtained previously were due to gamma heating in the thermocouple assembly. Equipment in the beam hole near the lattice which has no convenient path for heat to escape may go to 350°C or higher.

A low bid of $4830 was received on the mixed-bed ion-exchange apparatus to be used in the LITR cooling-water system, and this bid will be accepted.

TABLE 1. REACTOR DATA

	ORNL GRAPHITE REACTOR			LITR		
	January 1954	December 1953	Year to Date	January 1954	December 1953	Year to Date
Total energy, Mwd	110	108	110	87.0	84.5	87.0
Average power/operating hr, kw	3800	3711	3800	2999	2994	2999
Average power/24-hr day, kw	3555	3484	3555	2804	2719	2804
Lost time, %	6.45	5.97	6.45	6.48	9.2	6.48
Excess reactivity	103 inhr	150 inhr		2.8%	2.7%	
Fuel pieces charged	46	85	46	1	3	1
Fuel pieces discharged	144	131	144	1	3	1
Research samples	70	58	70	3		
Radioisotope samples	185	151	185	24		

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 × 4			Regulating rod
2, north and south	4 × 4			Regulating rod
3, north and south	4 × 4	Operations	J. A. Cox	Sulfur exposure for radiophosphorus production
4, north and south	4 × 4	Operations	J. A. Cox	Miscellaneous exposures of special samples
5, north and south	4 × 4			Shim rod
6, north and south	4 × 4			Shim rod
7, vertical	4 × 4			Safety rod
8, vertical	4 × 4			Safety rod
9, vertical	4 × 4			Safety rod
10, vertical	4 × 4	Solid State	J. H. Crawford	Low-temperature sample-exposure facility (no samples during month)
11, vertical	4 × 4	Operations and Chemical Technology	J. P. McBride	Boron shot safety tube and HRP fuel studies (no samples during month)
12, vertical	4 × 4	Operations	J. A. Cox	General exposures of samples in water-cooled facility
13, north and south	4 × 4	Operations	J. A. Cox	Target exposures for radioisotopes and research
14, north and south	4 × 4	Operations	J. A. Cox	Target exposures for radioisotopes and research
15, north and south	4 × 4	Operations	J. A. Cox	Miscellaneous large-sample exposures
16, north and south	4 × 4	Operations	J. A. Cox	Target exposures for radioisotopes and research
17, north	4 × 4	Unassigned		Empty
17, south	4 × 4	Physics	E. O. Wollan	Neutron polarization
18, narth and south	4 × 4	Operations	J. A. Cox	Miscellaneous large-sample exposures
19, north and south	4 × 4	Solid State	O. Sisman	Water-cooled exposure facility
20, north	4 × 4			Graphite temperature thermocouples
20, south	4 × 4	Solid State	J. C. Wilson	Creep of metals (no samples during month)
21, north and south	4 × 4	Operations	J. A. Cox	Sulfur exposure for radiophosphorus production
22, north	4 × 4	Unassigned		Empty
22, south	4 × 4	Operations	J. A. Cox	Two pneumatic tubes for general usage
30	9 × 9	Solid State (G.E.)	L. E. Stanford (G.E.)	Life tests of equipment in radiation (no tests during month)
31	9 × 9			Blocked by one end of air seal H beam across top of graphite
32	9 × 9			Contains chamber for high-power-level trip circuit
33	9 × 9			Contains chamber for high-power-level trip circuit

TABLE 2. (continued)

HOLE NUMBER AND ORIENTATION	DIMENSIONS (in.)	DIVISION ASSIGNED TO	PERSON IN CHARGE	TYPE OF EXPERIMENT OR USAGE
34	9 × 9			Contains chamber for No. 2 power-level galvanometer
35	9 × 9			Blocked by one end of air seal H beam across top of graphite
36	9 × 9			Contains chamber for high-power-level trip circuit
37	9 × 9			Test facility for ionization chambers
40	9 × 9			Contains chamber for No. 1 power-level galvanometer
41	6-in. dia			Rear wall suction-pressure tap; hole into discharge manifold
42	6-in. dia			Unit pressure differential tap; hole into discharge manifold
43	6-in. dia			Unused (inaccessible); hole into discharge manifold
44	6-in. dia			Unused; hole into discharge manifold
45	6-in. dia			Gas discharge from hole 22 pneumatic tubes; hole into discharge manifold
46	6-in. dia			Used for viewing west end of graphite with periscope; vertical hole into discharge manifold
47	6-in. dia			Used for viewing west end of graphite with periscope; vertical hole into discharge manifold
50, north	4 × 4	Solid State	J. H. Crawford	General sample-exposure facility
50, south	4 × 4	Physics	E. O. Wollan	Neutron spectrometer
51, north	4 × 4	Solid State	J. H. Crawford	Water-coaled U^{235} neutron converter
51, south	4 × 4	Physics	C. G. Shull	Neutron spectrometer
52, north	4 × 4	Solid State	J. H. Crawford	Facility for exposing samples at the temperature of liquid nitrogen
53	4 × 4	Solid State (G.E.)	L. E. Stanford (G.E.)	Half-hole for miscellaneous large-sample exposures
54	4 × 4	Solid State (G.E.)	L. E. Stanford (G.E.)	Half-hole for miscellaneous large-sample exposures
55	4 × 4	Solid State (G.E.)	L. E. Stanford (G.E.)	Half-hole for miscellaneous large-sample exposures
56, north	4 × 4	Physics	E. C. Campbell	Fast pneumatic tube
56, south	4 × 4	Physics	H. S. Pomerance	Oscillator for measuring neutron absorption cross sections
57, north	4 × 4	Training School	H. S. Pomerance	General purpose neutron collimator
57, south	4 × 4	Physics	S. Bernstein	Neutron polarization
58, north	4 × 4	Unassigned		Released by Solid State during January
58, sauth	4 × 4	Chemistry	H. Levy	Neutran spectrometer
59	4 × 4	Unassigned		Half-hole; blacked by work at hole 17, sauth

TABLE 2. (continued)

HOLE NUMBER AND ORIENTATION	DIMENSIONS (in.)	DIVISION ASSIGNED TO	PERSON IN CHARGE	TYPE OF EXPERIMENT OR USAGE
60	4 × 4	Solid State	J. C. Wilson	Half-hole for creep of metals (no samples during month)
61	4 × 4	Operations	J. A. Cox	Half-hole for miscellaneous large-sample exposures
East animal tunnel				Generol 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				Exposures of biological specimens
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	Solid State		Charging-face hole; coaxial cable exposure
C	1.68-in. dia	Unassigned		Charging-face hole
D	1.68-in. dia	Chemical Technology		Charging-face hole; uranium exposures
1069	1.5-in. dia	Unassigned		Charging hole containing an aluminum liner; used for general exposure of suitable samples
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
2079	1.5-in. dia	Operations	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-cooted thermopiles for reactor instrumentation
Others				Seven uncharged peripheral holes contain $CaCO_3$ for radioisotope production; 409 uncharged peripheral holes remoin 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. D. 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	G. H. Jenks	Experiment being prepared
HB-5	6-in.-ID beam hole	Chemistry	H. F. McDuffie	HRP fuel stability and corrosion tests
HB-6	6-in.-ID beam hole	Chemistry	H. F. McDuffie	HRP fuel stability and corrosion tests
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
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
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	ANP fuel tests (no tests during month)
C-48	Hollow Be core piece with access tube from top plug	Solid State	G. W. Keilholtz	ANP fuel tests (no tests during month)
C-49	Be core piece with four vertical holes	Operations	J. A. Cox	Exposures of research and radioisotope samples
C-53	Mg tray in core space	Operations	J. A. Cox	Exposures of research and radioisotope samples
C-56	Mg tray in core space	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

A new shielded container for moving spent fuel elements from the LITR to the Graphite Reactor canal was received from the Brighton Copper Works. The welding was not approved, and the container was returned to the vendor for repair.

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

RADIOISOTOPE PRODUCTION

Radioisotope production for the month is tabulated in Tables 4 and 5. Ten metallic Co^{60} sources containing a total of 431 curies were fabricated. Five sources having a total of 25 curies of Ir^{192} and 7 ampoules of tritium containing a total of 6.11 curies were shipped.

Special work was performed as follows: Co^{60} solution, which is to be used in the Chemistry Division for studies on the half life of Co^{60}, was prepared from metal that had been in the Graphite Reactor for five years; 41 microcuries of carrier-free Ba^{133} was separated from an ORNL 86-in. cyclotron target for the Physics Division.

RADIOISOTOPE SALES

Radioisotope shipments made during January 1954 are compared in Table 6 with those made during December 1953 and January 1953. A breakdown according to separated and unseparated material (including totals for August 1946 through January 1954) and for project, nonproject, and foreign shipments is also shown.

RADIOISOTOPE DEVELOPMENT

New Iodine-131 Processing Unit, Building 3028

The construction and installation of equipment as covered in the original I^{131} project work order is complete, with the exception of pipe insulation and painting. Equipment yet to be installed includes the shielded analytical hood, the glassware in the final processing cell, and the product-removal track.

Construction drawings for the shielded analytical hood and the cell 1 sampler were completed.

Volumetric calibration of vessels is in progress.

Purification of Iodine-131

Additional I^{131} plating experiments were made in which a column packed with 37 g of 1-mm-dia silver wire cut into 1-mm lengths was used. Three experiments were run in which a synthetic solution

TABLE 4. PROCESSED RADIOISOTOPE PRODUCTION DURING JANUARY

PRODUCT	SOURCE	AMOUNT (mc)	SPECIFIC ACTIVITY (mc/g)
Antimony-124	Hanford irradiation	1,922	911
Barium-140	Hanford metal	4,479	c.f.*
Chromium-51	LITR irradiation	4,298	4,550
Iodine-131	Graphite Reactor metal	44,808	c.f.
Iron-59	LITR irradiation of Fe^{58}	98	7,250
Iron-55,59	Hanford irradiation	179	32
Phosphorus-32	Graphite Reactor irradiation	13,801	25,000
Ruthenium-106	Scrup waste	710	15,000
Sodium-24	LITR P-tube	13,435	4,400
Strontium-90	Scrup waste	23,100	c.f.
Sulfur-35	Hanford irradiation	134	4,340
Yttrium-88	ORNL 86-in. cyclotron	11	c.f.
Yttrium-91	Hanford metal	172	c.f.

*No added carrier.

containing a weight of inactive iodine equivalent to 10 curies of I^{131} and tracer amounts of I^{131} was used. The average amount of iodine retained on the column for these three runs was 98%. The amount of iodine eluted by H_2S water solution for the first two runs was 98%, but for the third run only 89% of the total iodine on the column was eluted.

TABLE 5. UNPROCESSED RADIOISOTOPE PRODUCTION DURING JANUARY

PRODUCT	UNITS
Service irradiations	50
Antimony-122	1
Arsenic-76	1
Barium-131	2
Bromine-82	1
Copper-64	3
Europium-152,154	1
Gold-198	53
Gold-199	3
Iodine-131	4
Mercury-197	1
Mercury-203	1
Molybdenum-99	1
Osmium-191	2
Phosphorus-32	2
Potassium-42	22
Rubidium-86	4
Silver-111	1
Sodium-24	15
Yttrium-90	1
Total	169

A portion of the evaporator solution containing 1425 mc of I^{131} from the present iodine processing unit was adjusted to a pH of 3, diluted by a factor of 4, and run through the same silver-packed column used for the tracer experiments. Approximately 80% of the I^{131} in this solution was retained on the column. However, in this case, only 20% of the I^{131} on the column could be eluted with the H_2S water solution. Attempts to elute more I^{131} from the column by using different chemicals were unsuccessful. It was therefore decided to discontinue the iodine plating experiments temporarily and concentrate on perfecting the distillation process now used in the final purification cell. Equipment was set up to determine the efficiency of a Bruun, 11-plate, glass, bubble-cap column in the separation of I^{131} from HNO_3, HNO_2, and H_2O_2.

A test solution was prepared as follows: 3 *N* NaOH, 0.3 *N* $NaNO_3$, 0.2 *N* $NaNO_2$, 100 μg of I as KI, and 2 mc of I^{131} – 500 ml total volume. One molar $KMnO_4$ plus a 25-ml excess was added to oxidize the nitrite to nitrate (250 ml total). The solution was neutralized with 21 *N* H_2SO_4 plus 1 ml in excess. Saturated H_3PO_3 was added to reduce the excess $KMnO_4$ and iodate. Five-milliliter portions of 6% H_2O_2 were added to the boiling solution, and the iodine distillate was caught in 0.38 *N* NaOH. The product had the following analysis: NO_3^-, 12 ppm; NO_2^-, <5 ppm; H_2O_2, <0.1 ppm.

A similar experiment was run in which oxalic acid was used as the reducing agent in place of H_3PO_3. The solution was made 1 *N* in H_2SO_4, and H_2O_2 was added as before. This product analyzed: NO_3^-, <10 ppm; NO_2^-, <10 ppm; H_2O_2, <0.1 ppm.

TABLE 6. RADIOISOTOPE SHIPMENTS

	JANUARY 1954	DECEMBER 1953	JANUARY 1953	AUGUST 1946 THROUGH JANUARY 1954
Separated material	846	859	753	41,628
Unseparated material	184	169	143	11,047
Total	1030	1028	896	52,675
Nonproject	904	932	796	
Project	83	73	77	
Foreign	43	23	23	
Total	1030	1028	896	

It was concluded that the Bruun distilling column was very efficient in removing nitrate, nitrite, and H_2O_2 from the iodine distillate.

Cesium-137 Source

Preparations for making the 1500-curie Cs^{137} source are nearly complete.

The original 60-curie $Cs^{137}Cl$ test pellet described in the Operations report for December (ORNL-1668) was pressed at 38,000 psi. Tests were made to determine whether lower pressures could be used. Chlorides of Cs, Rb, and K in the ratio of 5 Cs to 2 Rb to 1 K were dissolved and evaporated to dryness. The homogeneous mixture was pressed at 10,000 psi, and the pellet thus formed was of good quality, strong, and easily handled. The density was approximately 3.0, which would be satisfactory for the source. It is proposed to press the pellets at 20,000 psi, which should result in a density between 3.0 and 3.4.

A decision was made to assemble the 1500-curie $Cs^{137}Cl$ source in the hot chemistry cell of Building 3029. The versatility of this cell will permit greater flexibility if difficulty is encountered during the pressing and soldering operations. The hydraulic press from Building 3013 will be used to make the pellets. Approximately 2100 curies of partially purified Cs^{137} is now ready for transfer from the fission-product separation unit. Final purification of the Cs^{137} in Building 3029 is expected to start February 8.

Multikilocurie Loading Cell, Building 3029

The construction request for the multikilocurie loading cell has not yet been approved by the AEC. Specifications for the shielding window glass, manipulators, and hoist have been written by the Engineering Department so that purchase requisitions may be sent out as soon as project approval is received.

Zirconium-95–Niobium-95 Sources

Efforts continued on methods of making intense Zr^{95}-Nb^{95} sources by direct adsorption on silica gel, thus avoiding further complicated processing. A source was prepared by adsorbing Zr^{95}-Nb^{95} on silica gel directly from UNH dissolver solution. Hanford metal which had been irradiated for 60 days and cooled for 10 days was used. The total volume of the silica gel in the column was 13 ml, and the flow rate through the column was maintained at 600 ml/hr (46 column volumes/hr). The amount of Zr^{95}-Nb^{95} adsorbed was determined approximately by comparison with the radiation from a known equilibrium mixture of Zr^{95}-Nb^{95}. By this method it was found that 38 curies of Zr^{95}-Nb^{95}, which represents a recovery of approximately 36% of the total Zr^{95} contained in the UNH solution, had been taken up on this small column.

Fission-Product Separation Methods

In a separation experiment, uranium and plutonium were extracted from Hanford UNH solution with TBP, and Fe^{+++} was added to the solution to make a concentration of approximately 1.2 g/liter. The solution was neutralized with NaOH and K_2CO_3 to precipitate the iron carrying the activities. The precipitate was washed and then dissolved in 0.1 *N* HNO_3, and approximately 64% of the gross fission-product activity was found in the 0.1 *N* HNO_3 solution. This solution was diluted, and the gross activities were adsorbed on a steam-heated ion-exchange column. Elution with 0.2 *M* citrate removed all the iron before any Y^{91} was removed and left a Y^{91} fraction that was quite pure. It is expected that the remaining activities will also be separated quite satisfactorily.

Another experiment, under exactly the same conditions, is being made on the other ion-exchange column, with the exception that the elution is being made with lactic acid at a pH of 5.0 instead of with citric acid.

Carbon-14

One run consisting of five Be_3N_2 slugs was made from which the gas was divided into the following portions: (1) CO_2 and HCN absorbed in a caustic scrubber, (2) material which condensed in a liquid-nitrogen cold trap, (3) methane adsorbed on a cold silica-gel column. A charcoal column was put in the gas train following the CuO furnace (oxidation step) and another caustic scrubber. It was noted that this column, operated at liquid-nitrogen temperature, collected activity which should not be a C^{14} fraction. An effort will be made to identify the gas and the radioactivity in a continuation of this experiment.

Deposition of Cesium-137 into Mercury Cathode

One attempt was made to plate cesium into mercury from a solution which was 0.2 *M* in $(NH_4)_2SO_4$ and which contained 40 mg of CsCl per

liter and Cs^{137} tracer. At a pH of 7.2 and a potential of 5 volts, the ammonia began to plate and formed a gelatinous mass that floated on top of the mercury. Practically no cesium was removed from the solution. Further experiments at a lower pH will be made.

Krypton-85

A total of 80 cc of fission-product krypton was produced this month. The purification was completed on a charcoal column at –79°C. The purity of the krypton was estimated by a molecular-weight determination. The average molecular weight was found to be 84.0; the calculated value, found by using known krypton fission-product yields and assuming no casual contamination, is 83.9. If the various fission-yield data on krypton are correct, 18.6% of the krypton is Kr^{85}, and the Kr^{85} in the krypton produced can be calculated to be 23.3 curies.

A standard sample of Kr^{85} will be assayed mass spectrographically for use as a primary standard in the calibration of an ion chamber.

RADIOACTIVE-WASTE DISPOSAL

A total of 23.75 curies of beta activity was discharged to White Oak Creek from the settling basin and the retention pond (see Table 7). This discharge is 66% of the monthly average for last year and 126% of that of last month. The increase over last month can be attributed to several causes:

1. recurrence of a leak in the chemical-waste line in the pit west of Building 3026 (this line is used for Rala wastes),
2. a spill caused by a broken piece of P^{32} production equipment in Building 3032,
3. jetting of contaminated water from the valve and jet pit at tanks W-19 and W-20, which are used for storage of wastes used in the Fission Products Separation Building, 3515,
4. overflowing of tanks W-19 and W-20 as a result of leaks into the tanks during heavy rains,
5. an increase in the retention-pond discharge volume as a result of heavy rains.

Construction has been started on the transfer line from the south tank farm to chemical-waste storage pit No. 2. Construction continued on the pump pit for the waste transfer line in the south tank farm.

A total of 12,600 gal of chemical-waste concentrate bearing 262 curies of beta activity was transferred to chemical-waste storage pit No. 2 this month. This brings the total transferred to date to 282,600 gal containing 8930 curies.

Significant operating data for the waste evaporator are shown in Table 8.

MISCELLANEOUS OPERATIONS

Water Demineralization

Demineralized water production was 408,540 gal, compared with 379,140 gal in December 1953.

It was necessary to replace about 4 ft^3 of IRA-410 resin in the No. 2 anion unit on January 28. Apparently the resin was lost some time ago as a result of backwashing the unit. It is planned to install screen strainers on the wash lines.

Liquid Hydrogen

Three liquid-hydrogen runs were made during January and approximately 6 liters was produced.

Activation Analysis

A total of 147 requests for information concerning activation analyses has been received; 53 have developed into requests for analyses, 42 of which have been completed.

TABLE 7. ACTIVITY DISCHARGED TO WHITE OAK CREEK

DISCHARGED FROM	JANUARY 1954		AVERAGE PER MONTH 1953	
	Gallons	Beta Curies	Gallons	Beta Curies
Settling basin	16,889,300	20.30	19,446,000	24.06
Retention pond	915,400	3.45	501,000	11.69
Total	17,804,700	23.75	19,947,000	35.75

TABLE 8. WASTE-EVAPORATOR OPERATION

	SOLUTION FED TO EVAPORATOR (gal)	CONCENTRATE PRODUCED (gal)	VOLUME REDUCTION	BETA CURIES TO EVAPORATOR	BETA CURIES TO SETTLING BASIN
January 1954	187,840	15,271	12.3:1	9,416	0.42
Average per month 1953	188,293	18,108	10.4:1	12,316	1.62

Decontamination

Experiments were run to determine a good procedure for cotton-glove decontamination. Of several decontamination agents tried, Versene and a detergent were found to be most satisfactory. It was also found that trying to remove contamination to below tolerance levels by washing gloves more than once was impractical because of excessive damage to the gloves; the most practical way of lowering the level after one washing is to permit the material to decay over a period of time. To eliminate cross-contamination of gloves during washing, it was found necessary to separate the gloves according to several levels of contamination before washing.

RALA

After the complete failure of Rala run No. 54 last November, as a result of filtration difficulties, a laboratory investigation was made to determine the possibility of eliminating similar troubles in the future by making some process changes. The tests are still in progress and a separate report will be issued to cover this work as soon as they are completed. One bit of useful information obtained thus far was that the filter aid, which was used in the filtration of UNH and which appeared to cause much of the difficulty in run No. 54, could be eliminated, at least part of the time, by improving the removal procedure for the slug coating and bonding. It was found that the concentration of the HNO_3 used to undercut the bonding material was too low to be effective and that the bonding material was instrumental in plugging up the UNH filters when no filter aid was used.

On the basis of information obtained from these tests, the procedure for removing the slug coats and bonding was revised. The changes included an increase in the concentration of the HNO_3 used for undercutting the bonding material from 6 to 20%, the addition of a 50% NaOH boiling and sparging step to suspend the undercut bonding and facilitate its removal from the dissolver, and the addition of extensive water washing to assure a clean dissolver prior to the uranium dissolution step.

To test the new procedure before its use in a production run, a four-batch 138-curie test run was made in which twelve 4-in. W, fifteen 8-in. W, and 130 X slugs were used. The procedure worked very satisfactorily; the UNH "crud" filtration was carried out successfully without using filter aid. The process filters used for filtration of the $Pb\text{-}BaSO_4$ and the carbonate metathesis slurries worked exceptionally well in contrast to the difficulties usually experienced in their use.

Following the test run, a production run (55 and 55A) was started on January 15. Two large shipments were made, one on January 19 and the other on January 27. The combined activity in the two shipments was approximately 65,000 curies according to the chemical analysis of the product prior to transfer to the shipping cone. There is evidence, however, that some product was lost during the evaporation in the shipping cone and that the combined shipment may be as low as 50,000 curies. Unfortunately, it was again impossible to accurately check the quantity of product by direct radiation measurements. The first product could not be measured because of instrument failure. The second product could only be estimated from radiation readings because of the excessive growth of lanthanum between the time the last separation was made and the time of actual transfer to the cone; the delay was a result of a late delivery of a cone and carrier because of truck breakdowns between Los Alamos and Oak Ridge.

Los Alamos has reported that preliminary measurements indicated the presence of 24,000 curies in

the first shipment and that the product contained some white foreign material which does not hold the product but which makes filtration operations difficult. They have not yet made any appraisals or measurements of the second shipment. Direct radiation measurements made at ORNL, although not accurate, indicated that the second shipment may have contained as low as 26,000 curies. Assuming that Los Alamos' preliminary low measurement of the first shipment was correct and that the low radiation reading made here was also correct, the two shipments combined contained at least 50,000 curies.

Los Alamos was well pleased with the results of this run in spite of the impurities in the product.

The removal procedure for slug coating and bonding and the UNH filtration procedure developed prior to this run were successfully used on all ten batches in this run; no filter aid was used. The filtrations through the process filters were undoubtedly the least troublesome ever encountered. The sulfate extraction-filtration losses and the metathesis filtration losses were as low as any experienced thus far.

Only two processing difficulties were experienced which resulted in high product losses. One was the

TABLE 9. ANALYTICAL SUMMARY OF RUNS 55 AND 55A

Slugs loaded, 197 eight-inch Hanford

Slugs dissolved, 182.7 (by analysis)[a]

	RUN NO. 55	RUN NO. 55A	TOTAL	PER CENT
Last separation time, Ba^{140} parent from La^{140} daughter	January 19, 8:00 AM (4 batches)	January 23, 10:00 PM (6 batches)		
Total curies dissolved	44,610	40,073	84,683	100.00
Extraction-cell losses				
Extraction losses	251	621	872	1.03
Metathesis losses	402	132	534	0.63
Extractor-tank and process-filter rinse		186	186	0.22
Total extraction-cell loss			1,592	1.88
Cubicle feed solutions (not included in calculations)				
Acetate feed	21,431	41,414		
Versene feed	13,474	4,680		
Total feed	34,905	46,094		
Resin-cubicle losses				
Feed-tank rinse		5	5	0.00
Combined acetate, NaOH, and Versene wastes	152	36	188	0.22
HCl effluent	11	61	72	0.09
Fuming HNO_3 waste	545[b]	8,152	8,152	9.63
$NaNO_3$ regeneration waste	49	130	179	0.21
Product-evaparator rinse	2,649[b]	2,930[c]	2,930	3.46
Total resin-cubicle loss			11,526	13.61
Product				
Product analysis (before transfer to shipping cone)	35,914	34,470	70,384	83.11
Product shipped (analyzed value – evaporator rinse)	33,265	31,540	64,805	76.53
Material balance				92.01

[a]The last batch of slugs was not dissolved; it was left in the dissolver for test purposes.

[b]These losses are not included in the total column since they were recovered in run No. 55A.

[c]Some precipitate was noted in this sample; the analytical results did not check well.

precipitation of the product as $BaSO_4$, after elution from the column, which necessitated additional fuming nitric treatments, and the other was a loss of product solution into the off-gas line during the transfer to and evaporation in the shipping cone. A sample of the scrubber waste indicated that approximately 5000 curies was lost during the transfer and evaporation operation. It is believed that similar losses may be avoided in the future by some changes in the operating procedures.

Although the run can be considered the most successful to date, one accident marred its operation. The building was grossly contaminated, and two operators were overexposed when radioactive materials backed up to the panel board through a steam jet line. In cleaning out the line by steaming, the contamination was blown out into the operating area when a small valve at the pressure gauge failed. It was necessary to shut down the operation once for 4 hr when the air was found to be generally contaminated over the Laboratory while meteorological conditions were unfavorable. The off-gas scrubbers are obviously inadequate for the quantity of material now being handled.

The analytical summary of both parts of the run is given in Table 9.

SF MATERIAL CONTROL

Three shipments consisting of 75 drums containing depleted uranium nitrate solution were made to Carbide and Carbon Chemicals Co., Y-12. The total uranium content of the drums was 6364 kg. These shipments, numbered 38 through 40, were of uranium recovered under the Metal Recovery Program and make a total of 91,787 kg shipped to date.

Fifteen enriched U-Al alloy fuel assemblies were shipped to Phillips Petroleum Company, Scoville, Idaho, during the month. This makes a total of 576 fuel assemblies and 59 control rods shipped to date.

Two carload-lot shipments were received from Hanford. One consisted of 370 boxes containing plutonium in the form of castings and reduction crucible fragments for processing in the Metal Recovery Program, and the other consisted of 198 irradiated uranium slugs for the Rala process.

Two truckload-lot shipments of 1188 irradiated uranium slugs were received from Brookhaven for processing in the Metal Recovery Program.

Twenty persons applied for and received SF material under the research-issuance procedure after the matter had been fully discussed and personal visits had been made by SF Office personnel. Approximately 30 additional persons are qualified for research issuances because of the small quantity of material they hold.

The metal-recovery plant is being modified so that plutonium contained in Hanford metallurgical waste can be processed. Recovery of depleted uranium was discontinued during January because of this modification; therefore the 5600 kg of sodium diuranate "crud" received from Harshaw Chemical Company which cannot economically be recovered at ORNL is being held pending a decision by AEC to ship it to Y-12.

The work backlog of the SF Office is as follows: completing and issuing the measurement-methods section of the SF procedures manual, issuing supplemental manuals for the ADP process and the Hanford metallurgical waste-recovery program, and compiling a special report for the AEC relative to measurements cost on SF materials.

Three persons possessing SF material were visited; the material in their possession was checked and weighed when feasible and no apparent discrepancies were encountered. In addition, the records of five analytical laboratories were audited, and the results disclosed that all records were in good order and that proper accounting had been made for all samples.

During January there were 19 receipts and 20 outgoing shipments, compared with 25 receipts and 23 shipments last month. Tables 10 and 11 are summaries of receipts and shipments for January.

[redacted]

TABLE 10. SF MATERIALS RECEIVED

FROM	MATERIAL	NUMBER OF SHIPMENTS	AMOUNT (g)
Brookhaven National Laboratory, BNL	Depleted uranium	2	1,386,000.00
	Plutonium		199.00
Carbide and Carbon Chemicals Co., K-25, CCC	Depleted uranium	2	37,370.00
Carbide and Carbon Chemicals Co., Y-12, CYT	Enriched uranium	1	5.84
	Normal uranium	2	2,479.00
	U^{233}	1	18.74
	Plutonium	1	Negligible
	Depleted uranium	1	4.23
	Thorium	1	591.00
General Electric Co., AGT	Normal uranium	2	30.00
General Electric Co., HGE	Depleted uranium	1	712,199.00
	Plutonium	2	69,743.36
General Electric Co., SGE	Normal uranium	1	14.00
Phillips Petroleum Co., MTI	Enriched uranium	2	0.50

TABLE 11. SF MATERIALS SHIPPED

TO	MATERIAL	NUMBER OF SHIPMENTS	AMOUNT (g)
Carbide and Carbon Chemicals Co., K-25, CCC	U^{236}	1	0.05
Carbide and Carbon Chemicals Co., Y-12, CYT	Plutonium	2	0.01
	Depleted uranium	3	6,363,815.00
	Enriched uranium	4	11.01
E. I. du Pont de Nemours & Co., SDA	Normal uranium	1	88.10
General Electric Co., AGT	Normal uranium	1	21.60
Iowa State College, ISC	Normal uranium	1	136.00
Naval Radiological Defense Laboratory, NHP	Normal uranium	1	0.26
Phillips Petroleum Co., MTI	Enriched uranium	4	2,525.42
University of Californio Radiation Laboratory, LAB	Enriched uranium	1	2.48
USAEC, New York Operations Office, COL	Normal uranium	1	0.36

[redacted]