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AEC RESEARCH AND DEVELOPMENT REPORT

ORNL-1730
Progress
4A

OPERATIONS DIVISION MONTHLY REPORT

FOR MONTH ENDING APRIL 30, 1954

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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ORNL-1730

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OPERATIONS DIVISION MONTHLY REPORT

for

Month Ending April 30, 1954

by

A. F. Rupp

DATE ISSUED

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CARBIDE AND CARBON CHEMICALS COMPANY
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OPERATIONS DIVISION MONTHLY REPORT

SUMMARY

The activities of the Operations Division for the month ending April 30, 1954 are summarized and indexed below:

1. The ORNL Graphite Reactor (3632 kw) and the LITR (3000 kw) operated satisfactorily. There were no slug ruptures this month (p 2).

2. The recently installed 900-hp fan motor at the Graphite Reactor is operating satisfactorily (p 2).

3. Changes were made in the LITR circulating-water ion-exchange equipment to reduce radiation damage of the anion-exchange resin (p 5).

4. The first series of test runs in the new iodine plant was completed; all equipment operated satisfactorily (p 7).

5. Preliminary design data were furnished to the Engineering Department to prepare the preliminary proposal for the Fission-Product Plant (p 8).

6. The detailed design of the multikilocurie loading cell was completed (p 9).

7. Studies indicated that recovery of Cs^{137} from cesium-copper ferrocyanide sludge is difficult (p 9).

8. The waste-storage pits again proved their value in receiving large quantities of contaminated chemicals for disposal (p 10).

9. Rala run 56 was not completed because of dissolver operating difficulties (p 11).

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REACTOR OPERATIONS

ORNL Graphite Reactor

No slug ruptures were found during April. Approximately seven months have now elapsed since the last rupture (October 12, 1953). Operating data are given in Table 1.

The design of the addition to the canal demineralizer addition has been completed and is being checked.

The underwater slug cutter is being repaired, and an air motor is being substituted for the electric motor, which formerly operated in a box pressurized with compressed air to keep out the water.

The 900-hp motor on the No. 2 fan began vibrating excessively and was replaced by the motor removed from this position in February. The job was started at shutdown on April 26 and completed at approximately 10:00 AM on April 27. The motor now installed was rebuilt by Allis-Chalmers in 1951 and was removed in February 1954 for repair of a part which had come loose. The motor is now operating satisfactorily, with very little vibration. Fan bearings on the No. 2 fan were inspected on April 5 and found to be in good condition.

Table 2 shows a comparison of the pressure drop across the exit air filters last month with that experienced this month and with clean filters.

Six uranium rods approximately $\frac{1}{4}$ in. in diameter and 12 in. long were irradiated for two weeks for ANL. The rods were canned in aluminum tubes with approximately $\frac{3}{32}$-in. walls and with four fins $\frac{1}{8}$ in. thick and approximately $\frac{5}{16}$ in. wide welded to each can. These cans were removed from the reactor by pushing them into a special receptacle suspended through the scanner holes and lowered gently to the mattress plate to avoid damage.

The usage of experimental facilities in the ORNL Graphite Reactor is shown in Table 3.

TABLE 1. REACTOR DATA

	ORNL GRAPHITE REACTOR			LITR		
	April 1954	March 1954	Year to Date	April 1954	March 1954	Year to Date
Total energy, Mwd	101.0	104.7	409.7	77.0	77.8	318.3
Average power/operating hr, kw	3632	3684	3678	3000	3000	2998
Average power/24-hr day, kw	3367	3376	3414	2566	2510	2652
Lost time, %	7.3	8.4	7.2	16.9	16.3	13.0
Excess reactivity	87 inhr	81 inhr		2.8%	3.3%	
Fuel pieces charged	80	119	373	3	1	7
Fuel pieces discharged	89	124	541	3	1	7
Research samples	78	95	329	5	6	19
Radioisotope samples	228	243	891	18	27	88

TABLE 2. PRESSURE-DROP DATA

	PRESSURE DROP (in. water gage)		
	Glass Wool	CWS No. 6	Total Across House
4-30-54	3.0	3.3	7.5
3-31-54	2.9	3.2	7.4
Clean filters	1.1	1.3	3.3

TABLE 3. 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, 2, north and south	4 × 4			Regulating rods
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, 6, north and south	4 × 4			Shim rods
7, 8, 9, vertical	4 × 4			Safety rods
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, 14, north and south	4 × 4	Operations	J. A. Cox	Target exposures for radioisotopes and research
15, north	4 × 4	Solid State (G.E.)	L. E. Stanford (G.E.)	Miscellaneous large-sample exposures
15, 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, north 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	Solid State (G.E.)		Ionization-chamber tests
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, 33	9 × 9			Contain chamber for high-power-level trip circuit
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

TABLE 3. (continued)

HOLE NUMBER AND ORIENTATION	DIMENSIONS (in.)	DIVISION ASSIGNED TO	PERSON IN CHARGE	TYPE OF EXPERIMENT OR USAGE
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, 47	6-in. dia			Used for viewing west end of graphite with periscope; vertical holes 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-cooled 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 liquid-nitrogen temperatures
52, south	4 × 4	Physics	L. D. Roberts	Low-temperature work
53, 54, 55	4 × 4	Solid State (G.E.)	L. E. Stanford (G.E.)	Half-holes 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		Empty
58, south	4 × 4	Chemistry	H. Levy	Neutron spectrometer
59	4 × 4	Unassigned		Half-hole; blocked by work at hole 17, south
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 and west animal tunnels				General exposures of large samples to low flux

TABLE 3. (continued)

HOLE NUMBER AND ORIENTATION	DIMENSIONS (in.)	DIVISION ASSIGNED TO	PERSON IN CHARGE	TYPE OF EXPERIMENT OR USAGE
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	Unassigned		Charging-face hole; empty
C, D	1.68-in. dia	Solid State	J. C. Pigg	Charging-face holes; insulation test
1069	1.5-in. dia	Unassigned		Charging hole containing an aluminum liner; used for general exposure of suitable samples
1768, 1867, 1968	1.75 in. square	Solid State	R. H. Kernohan	Charging holes 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-coated thermopiles for reactor instrumentation
Others				Seven uncharged peripheral holes contain $CaCO_3$ for radioisotope production; 409 uncharged peripheral holes remain unused

Low-Intensity Test Reactor

Operating data for the LITR are given in Table 1. The down time was high again in April largely because of shutdowns required by research personnel. Of the 16.9% lost time, 6.7% was due to research-required shutdowns, as shown in the following tabulation:

	April	March
Unscheduled shutdowns for operational reasons, hr	2.583	2.600
Regular operational shutdowns, hr	53.150	58.933
Special shutdowns for research, hr	48.317	59.899

The new resin column ordered from the Pennfield Company was reported to have been shipped on April 16 but has not been received. It has been established that the anion resin, IRA 410, suffers damage from radiation, and accordingly it has been decided to insert cation resin in the two columns now on hand (which hold about 3 cu ft each) and install them ahead of the mixed-bed column. Most of the radioactivity should then be removed by the small columns, which would prevent damage to the anion resin. It has not been possible to regenerate anion resin that has been used in a mixed-bed column where the cation resin accumulates large amounts of radioactivity, and the manufacturer agrees with our findings that the damage is due to radiation.

Work is proceeding on installation of the circulating fuel loops in holes HB-2 and HB-4. The pump shield and most of the auxiliary piping have been installed around HB-2. At HB-4 an overhead crane, some of the shielding around the outside of the hole, and an auxiliary generator have been installed.

The usage of experimental facilities in the LITR is indicated in Table 4.

RADIOISOTOPE PRODUCTION

Routine radioisotope production for April is reported in Tables 5 and 6. Special radioisotope preparations for the month are presented in Table

TABLE 4. 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	G. H. Jenks	Experiment being prepared
HB-5	6-in.-ID beam hole	Chemistry	C. H. Secoy	HRP fuel stability and corrosion tests (no tests during month)
HB-6	6-in.-ID beam hole	Chemistry	C. H. Secoy	HRP fuel stability and corrosion tests
HR-1, 2	Pneumatic tubes	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	C. H. Secoy	Uranium exposures by J. Halperin
C-46, 48	Hollow Be core pieces 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, 56	Mg trays 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, 4	Inclined low-flux holes	Unassigned		Empty

TABLE 5. PROCESSED RADIOISOTOPE PRODUCTION DURING APRIL

PRODUCT	SOURCE	AMOUNT (mc)	SPECIFIC ACTIVITY (mc/g)
Calcium-45	Hanford irradiation	1,387	62
Cerium-144	Scrup waste	668	5,000
Chromium-51	LITR irradiation	1,395	2,350
Iodine-131	Graphite Reactor metal	50,753	c.f.*
Iron-55, 59	Hanford irradiation, Fe^{55}	299.7	32
	Hanford irradiation, Fe^{59}	86.9	94
Manganese-54	86-in. cyclotron	3.5	c.f.
Mercury-203	Hanford irradiation	3,072	351
Phosphorus-32	Graphite Reactor irradiation	15,525	40,000
Strontium-89	Hanford metal	113	c.f.
Sodium-24	LITR irradiation	1,174	2,600
Sulfur-35	Hanford metal	15,270	c.f.

*No added carrier.

7. Some difficulty was experienced with four of the I^{131} runs during the month, as a result of the poor condition of the old iodine processing equipment, which is becoming progressively worse. The new I^{131} plant is expected to be in limited operation by June 15.

All remaining Co^{60} was transferred from the canal to underground storage, and the calibration of the gamma chamber for monitoring Co^{60} pieces was completed.

Thirty-five thousand pieces of cobalt metal of various shapes and sizes were nickel plated (using the phosphite reduction process) before irradiation in various reactors.

Radioisotope shipments are reported in Table 8.

RADIOISOTOPE DEVELOPMENT

Iodine-131 Plant Tests

Three test runs (6, 7, and 8) were made in the new iodine plant during the month. A 100-mc quantity of I^{131} tracer was added to each run, along with sufficient inactive iodine to make the total weight of iodine equivalent to that in a production run.

Run 6 was made with conditions adjusted to reduce the amount of nitrogen compounds carried over into the iodine product distillate. Hydrogen peroxide was added to the catch-tank solution before it was dropped to the still, rather than to the still as is normally done. No lowering in the amount of nitrates carried over was achieved.

Run 7 was made with no oxygen sparging in the catch tank during dissolving and distillation, followed by oxygen sparging in the catch tank after distillation was completed. The iodine was scrubbed out of the gas stream as efficiently as in previous runs, but the total of nitrate and nitrogen oxides in the catch tank after the first distillation was reduced by a factor of 2 over that in previous runs. However, no reduction in nitrates and nitrogen oxides in the product distillate was achieved.

In run 8, conditions of dissolving were changed to test the effect on completeness of iodine distillation from the dissolver. Three separate dissolving periods were run, followed each time by a distillation from the dissolver with nitrogen gas sparging. The yield of iodine from this test was less than that for previous tests.

The test runs were discontinued after run 8. During this series of test runs, the following points were proved: operability of equipment according to design expectations, the efficiency of the cold-water scrubber in removing more than 99% of the iodine from the gas stream, and the efficacy of the oxygen sparge in the catch tank in oxidizing nitrite compounds to nitrate compounds. As a result of knowledge gained from these runs, several improvements in operating technique can be made, namely, abandonment of the caustic-scrubber processing step, reduction of concentration of sodium hydroxide in both the caustic scrubber and the distillate receiver, and reduction of the amount of hydrogen peroxide added to the still solution.

TABLE 6. UNPROCESSED RADIOISOTOPE PRODUCTION DURING APRIL

PRODUCT	UNITS
Service irradiations	78
Antimony-125	1
Antimony-beryllium	1
Arsenic-76	2
Barium-131	1
Bromine-82	2
Chromium-51	1
Copper-64	4
Gold-198	50
Gold-199	2
Iodine-131	5
Lanthonum-140	2
Molybdenum-99	2
Osmium-191	1
Phosphorus-32	38
Potassium-42	16
Rubidium-86	5
Ruthenium-97	1
Selenium-75	1
Silver-111	2
Sodium-24	20
Sulfur-35	1
Yttrium-90	1
Total	237

Iodine-131 Equipment Installation

Fabrication of the frame for the analytical hood was completed, and installation is in progress. The product-discharge carrier track was installed in cell 1.

All glassware for the final purification cell has been made and installed. Installation of piping, instrumentation, and electrical services to this cell is in progress.

Fission-Product Plant

Preliminary equipment flowsheets were prepared for the use of the Cost Estimate Section of the Engineering Department in preparing a preliminary proposal for submission to the AEC.

TABLE 7. SPECIAL RADIOISOTOPE PREPARATIONS DURING APRIL

	NUMBER	TOTAL AMOUNT
Co^{60} sources	173	1981 curies
Sr^{90} sources	9	860 mc
H^3 ampoules	33	17.32 curies
He^3 ampoules	1	500 cc

TABLE 8. RADIOISOTOPE SHIPMENTS

	APRIL 1954	MARCH 1954	APRIL 1953	AUGUST 1946 THROUGH APRIL 1954
Separated material	882	933	815	44,293
Unseparated material	213	248	207	11,706
Total	1095	1181	1022	55,999
Nonproject	973	1071	910	
Project	106	96	89	
Foreign	16	14	23	
Total	1095	1181	1022	

Fission-Product Equipment, Building 3028

Preliminary design sketches and information have been transmitted by the Chemical Technology Division to the Engineering Department for incorporation into design drawings.

Shielded Krypton Gas Hood, Building 3033

Design drawings for the shielded krypton gas hood have been completed and transmitted to the Mechanical Department for fabrication.

Multikilocurie Loading Cell, Building 3029

Design drawings for the multikilocurie loading cell were completed. Specifications for the manipulators are being prepared by the Engineering Department. It is hoped that construction can be started within one month.

Cesium-137 Source

The 1540-curie Cs^{137} source recently made was given a visual inspection approximately 40 days after it was sealed in the stainless steel container. No evidence of swelling, corrosion, or other damage was found.

A type 316 stainless steel source container was fabricated to contain the 60-curie $Cs^{137}Cl$ test pellet. A threaded closure was provided so that the pellet could be removed and the container inspected periodically for corrosion.

A 20-μg sample of $Cs^{137}Cl$ was prepared for mass assay. The ORNL mass spectroscopy group will determine the isotopic ratios of Cs^{133}, Cs^{134}, Cs^{135}, and Cs^{137} so that the half-life of Cs^{137} may be calculated from the amount of activity present in a sample of known weight and composition.

Cesium-Copper Ferrocyanide Studies

Since Hanford may precipitate a large amount of Cs^{137} as a complex copper or nickel ferrocyanide, the use of this sludge as feed material for the fission-product plant is being considered. Experiments showed that this compound does not dissolve well in hot HNO_3, insoluble Prussian blue and Berlin green pigments being formed during the attack with HNO_3; only 50% of the Cs^{137} was recovered. The ferrocyanide compound can be dissolved with Versene and the cesium removed on clay or 3 *M* exchanger; however, this procedure would probably be too expensive. The ferrocyanide compound may also be dissolved by heating with concentrated H_2SO_4; the resulting solution is one from which 99% of the Cs^{137} can be recovered by the alum crystallization process. However, it now appears that the recovery of Cs^{137} from the ferrocyanide sludge will be much more difficult than was previously thought.

Ruthenium Chemistry

In a continuation of experiments on the behavior of ruthenium in several radioisotope separation processes, it was noted that ruthenium, in from 6 to 14 *N* HNO_3 solutions, does not extract well into either TBP or Varsol. Upon passing these same solutions through Dowex-1 anion exchanger, about 30% of the ruthenium was retained on the column. The extractability of ruthenium into TBP-Varsol from UNH solutions, before and after sparging with NO gas (to promote formation of ruthenium nitroso complexes), showed no detectable difference.

RADIOACTIVE-WASTE DISPOSAL

A total of 14.2 curies of beta activity was discharged to White Oak Creek from the settling basin and the retention pond (see Table 9). This discharge is 29% greater than that of last month and 40% of the average per month in 1953.

TABLE 9. ACTIVITY DISCHARGED TO WHITE OAK CREEK

DISCHARGED FROM	APRIL 1954		AVERAGE PER MONTH, YEAR TO DATE		AVERAGE PER MONTH, 1953	
	Gallons	Beta Curies	Gallons	Beta Curies	Gallons	Beta Curies
Settling basin	14,790,000	13.1	14,500,000	14.2	19,450,000	24.1
Retention pond	480,000	1.1	620,000	1.9	500,000	11.7
Total	15,270,000	14.2	15,120,000	16.1	19,950,000	35.8

The volume of hot wastes received this month was low. The waste evaporator was shut down intermittently to utilize the manpower on other work. Significant operating data for the waste evaporator are given in Table 10.

Continued maintenance was necessary on the hot off-gas turbines. The impeller of the electrically powered turbine became loosened for the second time in a week and was welded in place permanently. The turbine shaft seals of the steam-turbine-powered off-gas fan were replaced with new equipment.

Velometers were installed in the hot off-gas lines from each area served by the system. It is now possible to measure the total flow from any area at any time. Unfortunately, the Velometers are very fragile and have already begun to fail.

The glass-wool filters of both the hot off-gas system and the Building 3026 hood-and-cell ventilation systems were replaced.

The semiannual inspection and cleanup of the Cottrell precipitator and electrical power supply were performed. No repairs were necessary.

The trailer used to haul radioactive wastes was temporarily removed from service for emergency repairs after it received serious corrosive attack from acidic wastes. One new surplus trailer has been procured to replace the damaged one since it could not be put back into its original good condition; another surplus trailer was also obtained as a spare.

The corrosion samples taken from the waste monitoring tanks on February 10, 1954, were reinstalled on April 22, 1954.

The roof and road drains in the Radioisotope Area have been diverted from the process waste system to the storm sewers in order to reduce the volume of flow to the Process Waste Treatment Plant which is planned for the future.

A total of 29,160 gal of radioactive and inactive chemical wastes was transferred to chemical-waste-storage pit No. 2. Of this amount, only 400 gal, received from the decontamination of the homogeneous reactor, was radioactive; it contained 0.696 beta curies. The remaining volumes were 10,550 gal of $Al(NO_3)_2$ waste from Unit Operations, Building 4505; and 18,210 gal of NH_4NO_3 from metal recovery operations, Building 3505.

MISCELLANEOUS OPERATIONS

Water Demineralization

The demineralized-water plant gave some trouble because of leaking multiport valves in the No. 1 anion column. Repairs are being made, and separate valves will be installed to prevent such leakage in the future. Demineralized-water production was 263,280 gal in April, as compared with 392,460 gal in March. Table 11 shows a comparison of the number of regenerations and the average amounts of water passed through each unit during March and April.

Hydrogen Liquefaction

Nineteen liters of liquid hydrogen was produced in seven runs in April, in which a specially made cold trap, containing only silica gel to prevent conversion of the liquid hydrogen, was used. Approximately 14 of the 19 liters was collected in storage flasks and delivered to the Chemistry Division.

Upon recommendation from The Johns Hopkins University, a trial batch of Yellow Dot hydrogen is being obtained to determine whether this material will prevent freeze-ups in the apparatus.

A design for an improved hydrogen liquefier has

TABLE 10. WASTE-EVAPORATOR OPERATION

	SOLUTION FED TO EVAPORATOR (gal)	CONCENTRATE PRODUCED (gal)	VOLUME REDUCTION	BETA CURIES IN FEED	BETA CURIES IN CONDENSATE
April 1954	106,800	5,800	18.4:1	5,300	0.13
Average per month, year to date	148,900	9,600	15.5:1	11,500	0.33
Average per month, 1953	188,300	18,100	10.4:1	12,300	1.62

TABLE 11. AVERAGE AMOUNTS OF WATER PASSED THROUGH REGENERATION UNITS DURING MARCH AND APRIL

UNIT	NUMBER OF REGENERATIONS		AMOUNT OF WATER THROUGH EACH UNIT (gal)	
	April	March	April	March
No. 1 cation	3	5	63,000	50,440
No. 2 cation	4	4	51,225	71,125
No. 1 anion	6	6	19,550	31,292
No. 2 anion	6	7	32,383	34,971

been obtained from The Johns Hopkins University, and studies are under way to determine the feasibility of replacing the present liquefier with one of the suggested design.

Activation Analyses

A total of 158 requests for information concerning activation analyses has been received; 62 have developed into requests for analyses, 42 of which have been completed.

RALA

Repairs were completed, tests were made, and the equipment was reinstalled in time to start run 56 on April 26. The starting date was one week ahead of schedule as a result of unexpectedly early shipment of slugs from Hanford.

The run could not be completed and the building had to be vacated because of the escape of some dissolver gases from a rapid dissolving reaction which exceeded the capacity of the off-gas system. This occurred at the start of the HNO_3 addition for the fourth dissolving cycle. No attempt will be made to continue the run or to decontaminate the building until the radiation background decreases sufficiently through decay to allow a reasonable amount of working time.

The fourth dissolving, which resulted in the release of the dissolver gases, was the beginning of the second portion of the run. The dissolving of approximately 57 out of a total of 161 Hanford slugs had been completed in three batches 28 hr before the fourth one was started, and the product from these three batches was being processed through the resin cubicle in preparation for shipment at the time. The only reasonable explanation for the occurrence is that the uranium metal became heated by absorption of its radiation during the waiting period and thus produced a more vigorous reaction than usual when the 60% HNO_3 was added. The thermocouples of the equipment, which is more than 10 years old, were destroyed some time ago by corrosion, and repairs are not possible because of the high radiation background; therefore the temperature cannot be measured. The operating procedure was the same as that used for the past 10 years.

SF MATERIAL CONTROL

One enriched U-Al alloy fuel rod was shipped to Phillips Petroleum Company, Scoville, Idaho. The total shipped to date is 627 fuel rods and 59 control rods.

During the month 225.25 kg of 93% enriched uranium in the form of U-Al alloy billets was received from Y-12 for extrusion by the Metallurgy Division in connection with the fabrication of "J" slugs. This material, along with a 44.62 kg balance from the previous month (total weight, 269.87 kg), was returned to Y-12 upon completion of the extruding work.

Twelve kilograms of contained U^{235} was received from Y-12 in the form of metal ("broken buttons") for use by the Metallurgy Division in the fabrication of enriched U-Al alloy fuel rods for the MTR.

During the month two product batches of Hanford metallurgical waste containing a total of 1647 g of plutonium were shipped to Dow Chemical Company, Denver, Colorado. Nine additional batches, containing a total of 6.3 kg of plutonium, were on hand for shipment at the end of the month.

Two carload-lot shipments were received from Hanford during April. The first shipment consisted of 477 irradiated thorium slugs for the Thorex process, and the second shipment consisted of 162 irradiated uranium slugs for the Rala process and six irradiated "J" slugs for use in developing a process for recovering SRO enriched-uranium fuel.

Work was concluded on the rough drafts of Vol. I, Sec. 4, of the *SF Procedures Manual* for ORNL, dealing with measurement methods. This section is now in the process of being edited and is expected to be issued about June 1. Existing supplemental SF manuals are in the process of being modified. These are to be included in Vol. II of the *SF Procedures Manual* as rapidly as possible.

SF surveys consisted in visiting four persons possessing SF material. The material in their possession was checked and weighed when feasible. No apparent discrepancies were encountered. In addition, the records of three 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 April there were 36 receipts and 46 outgoing shipments, compared with 27 receipts and 40 shipments last month. Tables 12 and 13 are summaries of receipts and shipments for April.

TABLE 12. SF MATERIALS RECEIVED

FROM	MATERIAL	NUMBER OF SHIPMENTS	AMOUNT (g)
Argonne National Laboratory, ANL	Normal uranium	1	1,140.00
	Plutonium	1	33.00
Carbide and Carbon Chemicals Co., K-25, CCC	Depleted uranium	1	304,278.00
	Depleted uranium (net weight)	1	1,411,685.00
Carbide and Carbon Chemicals Co., Y-12, CYT	Enriched uranium	10	221,818.35
	Normal uranium	8	8,411.00
	Thorium	2	4,679.00
	U^{233}	1	0.22
	Plutonium	1	0.03
	Depleted uranium	3	7,613.00
General Electric Co., HGE	Thorium	1	789,074.87
	U^{233}		648.00
	Depleted uranium	1	582,709.00
	Plutonium		108.00
	Enriched uranium	1	199.73
North American Aviation, Inc., DNA	Normal uranium	1	57.00
Phillips Petroleum Co., MTI	Enriched uranium	2	0.27
	U^{236}		0.02
	Thorium		160.00
Sylvania Electric Products, Inc., SYL	Thorium	1	1,000.00
Total shipments received		36	

[redacted]

TABLE 13. SF MATERIALS SHIPPED

TO	MATERIAL	NUMBER OF SHIPMENTS	AMOUNT (g)
Argonne National Laboratory, ANL	Depleted uranium	1	1,140.00
Carbide and Carbon Chemicals Co., K-25, CCC	Depleted uranium	1	81.00
Carbide and Carbon Chemicals Co., Y-12, CYT	Depleted uranium	1	8,456.00
	Enriched uranium	25	252,447.36
	Normal uranium	1	884.00
	Thorium		850.00
	Plutonium	1	0.03
Dow Chemical Co., SFJ	Plutonium	2	1,647.08
E. I. du Pont de Nemours & Co., SDA	Depleted uranium	4	129,316.08
	Normal uranium	1	187.00
General Electric Co., AGT	Normal uranium	1	100.00
General Electric Co., SGE	Depleted uranium	1	2,484.48
North American Aviation, Inc., DNA	Normal uranium	2	210.00
Phillips Petroleum Co., CPI	Enriched uranium	1	283.10
	Normal uranium	1	2,152.78
	Depleted uranium	1	45,615.00
Phillips Petroleum Co., MTI	Enriched uranium	2	200.13
Total shipments		46	

[redacted]