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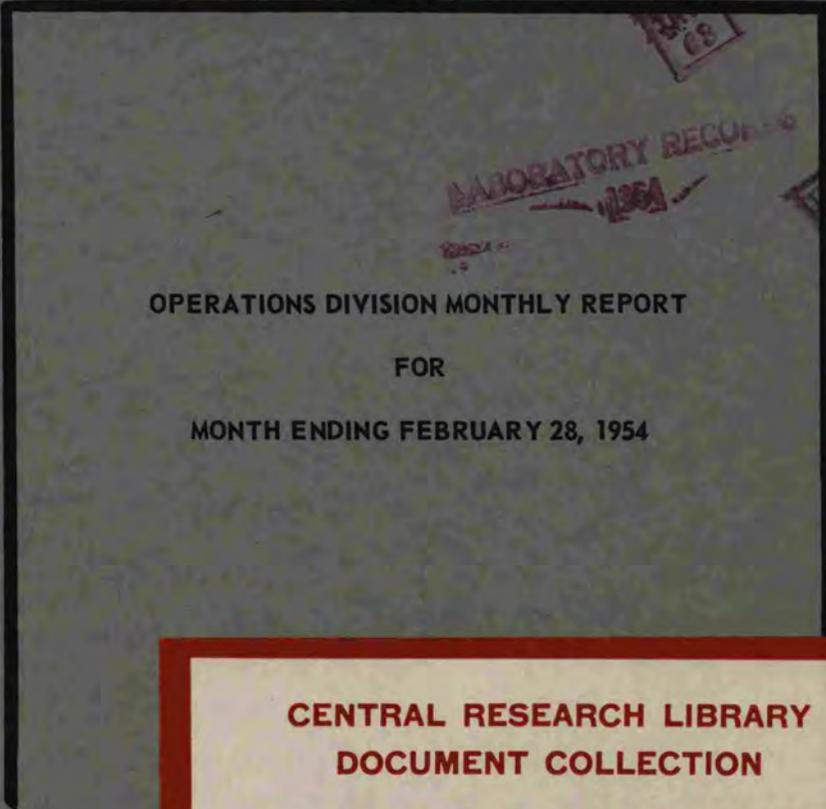
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OPERATIONS DIVISION MONTHLY REPORT

FOR

MONTH ENDING FEBRUARY 28, 1954

LABORATORY RECORDS
1954

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OPERATIONS DIVISION MONTHLY REPORT

for

Month Ending February 28, 1954

by

A. F. Rupp

DATE ISSUED

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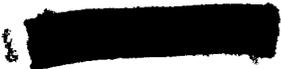
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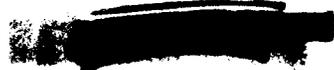
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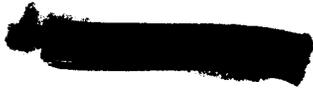
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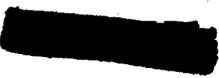


ERRATUM

Operations Division Annual Report for Year Ending December 31, 1953, ORNL-1680

p 13, column 2, line 23

for 1 curie of Ir^{192} = 1.82 r/hr read 1 curie of Ir^{192} = 0.55 r/hr

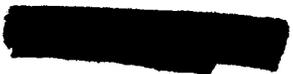


OPERATIONS DIVISION MONTHLY REPORT

SUMMARY

The activities of the Operations Division for the month ending February 28, 1954 are summarized and indexed below:

1. The Graphite Reactor and the LITR operated satisfactorily during the month. Two power failures increased the down time slightly (p.2).
2. A 900-hp motor was replaced on the Graphite Reactor No. 2 fan (p 2).
3. A 200-g fuel element was charged into the LITR (p 5).
4. Extraction equipment for P^{32} production was replaced (p 6).
5. Approval was received for construction of the multikilocurie loading cell (p 8).
6. The alum process of production for Cs^{137} from waste is also practical for waste decontamination (p 8).
7. There were 1048 shipments of radioisotopes, compared with 1030 in January (p 10).



OPERATIONS DIVISION MONTHLY REPORT

REACTOR OPERATIONS

ORNL Graphite Reactor

Several more holes in the Graphite Reactor became available recently, and by using them for radioisotope production, the time required for removing samples was considerably reduced. If these holes are needed for research work later, at least one could be given up at the expense of extra down time. Operating data are given in Table 1.

Monday morning shutdowns are now being held at 5:00 AM, one hour earlier than formerly.

No ruptures occurred during February. The power level was reduced from 3800 to 3700 kw because warmer weather caused the maximum metal temperature to rise to approximately 275°C during the warmer days.

The safety amplifiers are being revised so that an adjustment of only 20% in the trip point will be permitted. Also, the circuit will be such that amplifier failure will give a signal on the annunciator.

Design has begun on an improved water system so that water demineralized for the canal may be used for cooling experiments in the reactor and then returned to the canal. It is hoped that installation will begin by April 1.

Two orders for sliced uranium slugs were received from Argonne National Laboratory and North American Aviation, Incorporated. The slug cutter designed to cut radioactive slugs under water is

in need of repair, and there may be some delay in filling the orders.

It is planned to change the glass-wool filters in one cell of the exit-air filter house within the next three months. There was no increase in pressure drop across the filter house this month (7 in. water gage); the total pressure drop with clean filters was 3.3 in. of water.

The 900-hp motor on the No. 2 fan was replaced by a spare motor on February 17. This motor had been installed in November 1951 after having been rebuilt by Allis-Chalmers. For the last several weeks, sparks had sometimes come out of the airports when the motor was being started, and it was necessary to determine what repairs should be made. The spare motor that was installed had been removed from the No. 2 fan in November 1951, repaired at ORNL, and stored in the fan house. The installation was not completed until about 9:30 PM, February 17, because of difficulty in aligning the motor with the fan.

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

Low-Intensity Test Reactor

The rather high down time on the LITR of 8.7% was caused by increased research activity requiring frequent shutdowns. Approximately 40% of the down time was due to these shutdowns and to two power failures. Regular operational shutdowns accounted for only 5.3% down time. Operating data are given in Table 1.

TABLE 1. REACTOR DATA

	ORNL GRAPHITE REACTOR			LITR		
	February 1954	January 1954	Year to Date	February 1954	January 1954	Year to Date
Total energy, Mwd	94	110	204	76.4	86.8	163
Average power/operating hr, kw	3583	3800	3697	2992	2999	2996
Average power/24-hr day, kw	3352	3555	3458	2733	2804	2771
Lost time, %	6.44	6.45	6.45	8.70	6.48	7.50
Excess reactivity	71 inhr	103 inhr		3.3%	2.8%	
Fuel pieces charged	128	46	174	2	1	3
Fuel pieces discharged	184	144	328	2	1	3
Research samples	86	70	156	4	4	8
Radioisotope samples	235	185	420	19	24	43

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 and 2, north and south	4 x 4			Regulating rods
3, north and south	4 x 4	Operations	J. A. Cox	Sulfur exposure for radiophosphorus production
4, north and south	4 x 4	Operations	J. A. Cox	Miscellaneous exposures of special samples
5 and 6, north and south	4 x 4			Shim rods
7, 8, and 9, vertical	4 x 4			Safety rods
10, vertical	4 x 4	Solid State	J. H. Crawford	Low-temperature sample-exposure facility (no samples during month)
11, vertical	4 x 4	Operations and Chemical Technology	J. P. McBride	Boron shot safety tube and HRP fuel studies (no samples during month)
12, vertical	4 x 4	Operations	J. A. Cox	General exposures of samples in water-cooled facility
13 and 14, north and south	4 x 4	Operations	J. A. Cox	Target exposures for radioisotopes and research
15, north and south	4 x 4	Operations	J. A. Cox	Miscellaneous large-sample exposures
16, north and south	4 x 4	Operations	J. A. Cox	Target exposures for radioisotopes and research
17, north	4 x 4	Unassigned		Empty
17, south	4 x 4	Physics	E. O. Wollan	Neutron polarization
18, north and south	4 x 4	Operations	J. A. Cox	Miscellaneous large-sample exposures
19, north and south	4 x 4	Solid State	O. Sisman	Water-cooled exposure facility
20, north	4 x 4			Graphite temperature thermocouples
20, south	4 x 4	Solid State	J. C. Wilson	Creep of metals (no samples during month)
21, north and south	4 x 4	Operations	J. A. Cox	Sulfur exposure for radiophosphorus production
22, north	4 x 4	Solid State (G.E.)		Ionization-chamber tests
22, south	4 x 4	Operations	J. A. Cox	Two pneumatic tubes for general usage
30	9 x 9	Solid State (G.E.)	L. E. Stanford (G.E.)	Life tests of equipment in radiation (no tests during month)
31	9 x 9			Blocked by one end of air seal H beam across top of graphite
32 and 33	9 x 9			Contain chambers for high-power-level trip circuit
34	9 x 9			Contains chamber for No. 2 power-level galvanometer
35	9 x 9			Blocked by one end of air seal H beam across top of graphite

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TABLE 2. (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 and 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 the temperature of liquid nitrogen
53, 54, and 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 2. (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. Blizzard	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	Solid State	J. C. Pigg	Insulation test
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, 1867, and 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

A 200-g fuel element of the type being produced for the MTR was inserted on February 23. It has not yet been determined whether this fuel element will be preferable to the 168-g element formerly used.

The ion exchange column for purifying the cooling water has not yet been ordered because it was necessary to obtain new bids. The low bidder quoted on a unit somewhat larger than specified, and bids had to be solicited for a unit of the larger size. It is hoped that this unit will be obtained by April 1, since the present equipment requires very awkward and unsafe regeneration procedures.

A fuel-element container returned to the Brighton Copper Works for repair has not yet been received. Four shields for LITR pneumatic tube samples and a viewing shield with a lead-glass window are also on order. They are designed to reduce the exposure to radiation when samples are removed from the LITR.

No further data have been obtained on beam-hole liner temperatures; special apparatus is being made for this purpose. A graphite-beryllium collimator in HB-1 may be a source of trouble and will be removed as soon as possible so that it can be checked for possible growth.

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Work is proceeding on installation of circulating fuel loops in HB-2 and HB-4. A concrete pad, roll-up door, and hot drain have been installed in the west room for HB-2. In the east room, miscellaneous electrical and piping work was completed. A charcoal trap for collecting radioactive gases from the loop equipment was installed in a 12-ft hole in the floor.

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, 5, and 6.

The ^{131}I dissolver cell was partially decontaminated, and emergency repairs were made to the still drain valve extension handle which broke during a run. No operating time was lost.

The old transite P^{32} extraction hood which had been extremely difficult to decontaminate and maintain in the past was replaced with one made

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 and 6	6-in.-ID beam hole	Chemistry	C. H. Secoy	HRP fuel stability and corrosion tests
HR-1 and 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	C. H. Secoy	Contains Ca sample for A. H. Snell
C-46 and 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 and 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 and 4	Inclined low-flux hole	Unassigned		Empty

TABLE 4. PROCESSED RADIOISOTOPE PRODUCTION DURING FEBRUARY

PRODUCT	SOURCE	AMOUNT (mc)	SPECIFIC ACTIVITY (mc/g)
Calcium-45	LITR irradiation	0.01	c.f.*
Cerium-141	Hanford metal	223	c.f.
Cerium-144	Scrap waste	576	c.f.
Gross fission products	Hanford metal	1,400	
Iodine-131	Graphite Reactor metal	55,579	c.f.
Phosphorus-32	Graphite Reactor irradiation	13,193	40,000
Niobium-95	Hanford metal	50	c.f.
Sodium-22	University of Pittsburgh cyclotron	40	1,410
Sodium-24	LITR irradiation	1,339	3,096
Strontium-89	Hanford metal	1,005	c.f.
Strontium-90	Scrap waste	20,330	c.f.
Sulfur-35	Hanford irradiation	13,600	c.f.

*No carrier added.

TABLE 5. UNPROCESSED RADIOISOTOPE PRODUCTION DURING FEBRUARY

PRODUCT	UNITS
Service irradiations	58
Antimony-125	1
Bromine-82	8
Chlorine-36	1
Cobalt-60	1
Copper-64	3
Europium-152, 154	1
Gold-198	48
Gold-199	3
Hafnium-181	2
Iodine-131	4
Mercury-203	1
Molybdenum-99	1
Potassium-42	17
Rubidium-86	2
Samarium-153	2
Scandium-46	1
Silver-111	2
Sodium-24	23
Sulfur-35	4
Yttrium-90	1
Total	184

TABLE 6. SPECIAL RADIOISOTOPE PREPARATIONS DURING FEBRUARY

	NUMBER	TOTAL AMOUNT
Co ⁶⁰ sources	39	27.4 curies
Cs ¹³⁷ sources	1	60 mc
H ³ sources	17	5463 mc
H ³ -Zr targets	1	7470 mc
He ³ ampoules	2	20 cc

of stainless steel. The two extractors which were corroded by sulfuric acid generated in the process were also replaced with new ones made of Carpenter-20 stainless steel. It is expected that these changes will considerably reduce the radiation exposure to the operating and maintenance personnel.

RADIOISOTOPE DEVELOPMENT

New Iodine-131 Processing Unit, Building 3028

The volumetric calibration of I¹³¹ process vessels was completed, and equipment tests were made as follows: The chilled-water system was found to be leak-tight and of sufficient capacity. The specific-gravity instrument on the dissolvers was

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checked with different densities of NaOH solution. Reproduction of results on this instrument is not yet satisfactory. The rate of distillation from the dissolvers was found to agree with design calculations. Since extra capacity had been added over design capacity, the steam pressure was cut to 15 psi to obtain a slower rate. The off-gas pressure controller and the sampler performance are satisfactory. The sample return tube in dissolver A was partially dissolved during a 24-hr boiling HNO_3 test. A type 309 stainless steel pipe was installed in place of this tube. Leaks were repaired in the dissolver B condensate line and in the reflux-condenser water line. The interior of the dissolvers was examined with a periscope after the boiling HNO_3 test and was found to be in good condition. The catch tank was found to be satisfactory, with the exception of reproducibility of the specific-gravity measurement. The steam pressure was reduced on the coils to the still so as to provide the desired distillation rate. No excessive corrosion of the still was found in the boiling HNO_3 test. The rectifying column on the still performs satisfactorily with respect to flow rate and reflux. All jets performed satisfactorily. The entire system was cleaned out with trichloroethylene and steam.

Work has not been started on the analytical hood. The Engineering and Maintenance Division reports that it is impossible to schedule work on this item because of higher priority commitments.

Cesium-137 Source

Approximately 2000 curies of Cs^{137} crude product was purified during the month. Sulfate removal in the first two product cuts was incomplete. However, the sulfate content was considered to be low enough to proceed with the pelleting for the source. Two pellets of Cs^{137}Cl containing a total of 1500 curies will be pressed sometime during the first part of March.

During the run, the cubicle drain was changed to drain to the hot drain system rather than to the semihot drain system to avoid accidental discharge of very large amounts of activity to the waste pond.

Multikilocurie Loading Cell, Building 3029

Approval for the construction of the multikilocurie loading cell was received from the AEC. Purchase requisitions for the high-density viewing

glass and the pneumatic hoist are being prepared. A work order was written to cover the cost of engineering for this project. Arrangements were made for the detailed engineering to be done by the K-25 Engineering Department.

Krypton-85

Budget approval was received for the construction of a shielded hood for processing Kr^{85} , and a work order to cover the cost of engineering design and fabrication was written.

Removal of Cesium from Waste

The primary interest of the Radioisotope Group in separating Cs^{137} , Sr^{90} , etc. from wastes has been to obtain the relatively pure radioisotopes for special purposes such as teletherapy sources. It is apparent that reasonable decontamination of the wastes for disposal purposes and preparation of technical grade fission-product chemicals for large commercial sources would also be desirable if it could be accomplished by the same methods. One of the most important considerations in all waste decontamination processes, such as the ferrous sulfide method (Mound) and the copper ferrocyanide process (Hanford), is the removal of Cs^{137} . While the ORNL alum process is designed primarily for production of Cs^{137} , the decontamination factor per cycle is about 1000. Experiments have been made which indicate that the method is efficient over a wide range of solution conditions. Solutions up to 1 N HNO_3 and 2 M in Na_2SO_4 showed no significant decrease in cesium removal by the alum procedure. Since aluminum is one of the main elements necessary for alum formation, the method is particularly attractive for removing cesium from "25" and Redox process wastes. Successive crystallizations are easily made; therefore this method is an ideal chemical process in that a stream of product constantly enriched and augmented moves in one direction and another stream, progressively depleted in cesium, moves toward the waste collector. It appears that this process is quite well adapted to decontaminating relatively low-volume high-activity wastes, as well as producing pure Cs^{137} radiochemicals. Preliminary flowsheets are being made for the Multicurie Fission Product Plant in which this process is incorporated. The waste discharged from the plant will be low enough in Cs^{137} for discharge into the lagoon.

Some experiments were made with the Gaspar process (ferrocyanide) for precipitating cesium from dilute wastes, since the method may be especially adaptable for removing cesium from more dilute wastes. One disadvantage is the accumulation of large volumes of unstable copper or nickel ferrocyanide waste, rather than progressive enrichment of a compound from which cesium is easily recoverable.

Preliminary experiments with a new inorganic (and therefore perhaps radiation resistant) ion exchange medium manufactured by the Minnesota Mining Corporation for removal of cesium from water and dilute acid solutions were encouraging. This new medium may be useful in the final purification of Cs¹³⁷.

Carbon-14

No C¹⁴ production runs were made this month. Two beryllium nitride pellets submitted by the Brush Beryllium Company were analyzed for carbon content. According to the analyses, the carbon contents of the two pellets are 0.053% and 0.055%. The analyses by Brush on two similar pellets gave carbon contents of 0.041% and 0.038%. An analysis for iron showed 1500 ppm, as compared with 490 ppm reported by Brush. Although somewhat high, this iron content is acceptable. Instructions were sent to Brush to proceed with the manufacture of the main batch of pellets.

Strontium Source Preparation

A continuation of a previous literature search indicates that there are only two practical methods of preparing strontium metal in a manner suitable for use in source preparation. These methods are electrolysis from an organic medium and deposition from liquid-ammonia solution. The electrolytic method was reported in December.

The liquid-ammonia method requires the distillation of strontium from a mixture of SrO and Al, as described by Vanino.¹ A yield of 96% is claimed for this step. The strontium metal can be dissolved in liquid ammonia,² and the ammonia can then be removed by evaporation, as required, to deposit strontium metal.

Some experimental work was done on the electrolytic method. It is necessary to find a suitable

method for preparing anhydrous SrI₂, which is the salt used in preparing the electrolysis bath. One method is being tried in which SrI₂·6H₂O and NH₄I are dried under vacuum and the NH₄I is then distilled to leave SrI₂.

Rare-Earth Elution with Lactic Acid

Uranium and plutonium were removed from UNH solution, and the rare earths were carried down on Fe(OH)₃. The precipitate was dissolved, the solution was adjusted to near neutral pH, and the rare earths were sorbed on two 4-ft steam-heated ion exchange columns. The rare earths were eluted with 0.2 M citrate at pH 3.2 from one column and with 0.25 M lactate at pH 5.0 from the other column. The flow rates, temperature, and column volumes were kept the same in both cases.

The lactic acid removed the Y⁹¹ faster than the citrate solution did. Further elution on both columns did not remove Nd¹⁴⁷ or Pr¹⁴³, although the Pr¹⁴⁴ and Pm¹⁴⁷ were recognized by absorption curves. It was necessary to change the elutriant of both columns to 0.2 M citrate and pH 3.5 in order to elute Ce^{141,144} faster.

These results show that citrate elution is better than lactate elution for separation of the gross activities which contain Ce, Sr, and Ba.

Two peaks of Ce^{141,144} were removed during these runs which showed spreading of the band of activity originally sorbed on the column. This spread was probably caused by the relatively large amount of iron present in the starting solution.

Lactic acid may be useful for separation of the rare earths in the region of Y⁹¹ and Eu¹⁵⁵, as indicated by the quick removal of Y⁹¹.

There were no indications that lactate decomposes any more than the citrate under the conditions of the process: 95 to 100°C and high radiation fields. Final concentration from lactate solution was done by metathesis on a small ion exchange column in the same manner as that used with the citrate solution.

RADIOISOTOPE SALES

The price of Cs¹³⁷ has been reduced from \$2/mc for lots of 1 to 50 mc and \$0.50/mc for all lots over 50 mc to \$0.10/mc for lots up to 1 curie and \$0.025/mc for all lots over 1 curie. This reduction is now in effect.

Radioisotope shipments made during February 1954 are compared in Table 7 with those made

¹L. Vanino, *Handbunch de Preparation Chemie*, p. 460.

²Z. anorg. u. allgem. Chem. 114, 254 (1920).

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TABLE 7. RADIOISOTOPE SHIPMENTS

	FEBRUARY 1954	JANUARY 1954	FEBRUARY 1953	AUGUST 1946 THROUGH FEBRUARY 1954
Separated material	850	846	749	42,478
Unseparated material	198	184	181	11,245
Total	1048	1030	930	53,723
Nonproject	937	904	806	
Project	85	83	41	
Foreign	26	43	83	
Total	1048	1030	930	

during January 1954 and February 1953. A breakdown according to separated and unseparated material (including totals for August 1946 through February 1954) and for project, nonproject, and foreign shipments is also shown.

MISCELLANEOUS OPERATIONS

Water Demineralization

The regenerating pump on the No. 1 unit failed, and it was necessary to operate with the other unit for several days while the pump was being repaired. There were 11 regenerations of the anion units and 6 regenerations of the cation units.

The production of demineralized water was 318,660 gal, compared with 408,540 gal in January.

Liquid Hydrogen

Six liquid-hydrogen runs were made during February and approximately 14 liters was produced. The largest single run to date was made on February 11, when approximately 7 liters was produced. On February 24, the Joule-Thomson valve developed a bad leak and it was necessary to remove the liquefier for repairs. A second liquefier obtained from K-25 was installed on February 25, but a leak developed during installation and it was decided that it would be easier to repair the first liquefier; consequently, a new valve is being fabricated so that it may be put back into operation.

Activation Analyses

A total of 151 requests for information concerning

activation analyses has been received; 56 have developed into requests for analyses, 42 of which have been completed.

RADIOACTIVE-WASTE DISPOSAL

A total of 15.6 curies of beta activity was discharged to White Oak Creek from the settling basin and the retention pond (see Table 8); this discharge is 65% of that of last month. Approximately 5 curies, or one-third of the total, was the result of a minor spill from the cesium production equipment in Building 3029.

A total of 49,200 gal of concentrated chemical waste bearing 1173 curies of beta activity was transferred to chemical-waste storage pit No. 2. This brings the total transferred to date to 331,800 gal containing 10,104 curies.

Significant operating data for the waste evaporator are shown in Table 9.

The hot off-gas system was completely shut down for 2 hr as a result of an electric power failure which occurred at a time when the auxiliary steam turbine was also out of service because of a bearing failure. Fortunately, there was no occurrence of high air activity because the power outage took place early on a Monday morning before any radioactive processing operations were begun.

A second plant-wide power outage resulted in a 1-hr shutdown of the hot off-gas Cottrell precipitator and the chemical-waste evaporator. The auxiliary hot off-gas steam turbine performed satisfactorily at that time.

TABLE 8. ACTIVITY DISCHARGED TO WHITE OAK CREEK

DISCHARGED FROM	FEBRUARY 1954		AVERAGE PER MONTH YEAR TO DATE		AVERAGE PER MONTH 1953	
	Gallons	Beta Curies	Gallons	Beta Curies	Gallons	Beta Curies
Settling basin	11,359,000	14.1	14,124,000	17.2	19,446,000	24.01
Retention pond	424,000	1.5	670,000	2.5	501,000	11.7
Total	11,783,000	15.6	14,794,000	19.7	19,947,000	35.71

TABLE 9. WASTE-EVAPORATOR OPERATION

	SOLUTION FED TO EVAPORATOR (gal)	CONCENTRATE PRODUCED (gal)	VOLUME REDUCTION	BETA CURIES IN FEED	BETA CURIES IN CONDENSATE
February 1954	167,250	8,052	20.8:1	20,729	0.6
Average per month year to date	177,545	11,662	15.2:1	15,073	0.5
Average per month 1953	188,293	18,108	10.4:1	12,316	1.6

Construction of the waste transfer line from the tank farm to the chemical-waste storage pit has been completed by the contractor. The construction of the pumping station by the Laboratory forces continues and is scheduled to be completed in April, when the delivery of the pump is expected.

RALA

The decontamination of resin cubicle No. 200, which has been out of service because of a thermowell leak and thermocouple failure in the product-evaporator tank, was started and completed early in the month. This cubicle was removed from Building 3026 to the Decontamination Building where it is undergoing further decontamination and disassembly in preparation for repair. The product-evaporator tank will be replaced with one of a new design that is expected to give better control of the product-evaporation operation. The Teflon liners in the sampling valves will also be replaced because they were found to be deteriorated by radiation.

³E. J. Witkowski, *Investigation of RaLa Filtration Difficulties*, ORNL CF-54-2-142 (Feb. 23, 1954).

The investigation of the filtration difficulties, which resulted in the complete failure of run No. 54 last November, was completed. This work has been completely covered in a report by Witkowski.³

SF MATERIAL CONTROL

Thirty enriched U-Al alloy fuel rods were shipped to Phillips Petroleum Company, Scoville, Idaho, raising the total number shipped to date to 606 fuel rods and 59 control rods.

Three truckload-lot shipments were received from Brookhaven. The shipments consisted of 1735 irradiated uranium slugs for processing in the Metal Recovery Program.

Thirty-five additional persons applied for and received SF material under the research-issuance procedure, following full discussions and personal visits by SF Office personnel.

Sixty-four enriched U-Al alloy billets containing 26 kg of U²³⁵ were received from Y-12 for extrusion by the Metallurgy Division in connection with the fabrication of SRO fuel and Hanford "J" slugs. This work is expected to become a production type of activity during April 1954 and will likely be active for about one year. Extrusion of the 64

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billets was on an experimental basis preparatory to the forthcoming large-scale work.

The SF Accountability Office prepared and submitted for issuance a supplemental SF manual covering procedures to be employed in processing plutonium contained in ceramic crucibles which have been received from Hanford. In addition, a rough draft of a supplemental SF manual was prepared to cover the procedures to be employed in the OREX process. The supplement is expected to be issued next month.

Work was started on the preparation of a special report to the AEC relative to SF measurement and record-keeping cost. The required information consists of determining the cost of measuring quantities of each major type of SF material received, shipped, discarded, and on hand; the cost of SF material compared with the cost of measuring for SF accountability purposes and for process control or research and development purposes; and the cost of keeping records subdivided by process operations personnel and SF accountability per-

sonnel. This report is scheduled to be completed about March 15. It must be submitted for inclusion in a report which will be prepared by the four Carbide plants by March 24. The combined reports will be submitted to the AEC on April 1.

Other special work accomplished during the month was the preparation and submission of the ORNL beryllium requirements cost budget for FY 1955 and 1956 and the preparation and submission of ORNL special reactor materials requirements for the three-year period beginning July 1, 1954.

Considerable study has recently been devoted to the problem of storing fissionable material. The study was made because of need for the storage of plutonium from metal recovery operations, U^{233} from the Thorex process, U^{235} from the recovery of SRO fuel, U^{235} fuels for and from the HRE, ARE, and Fluoride Fuel Test Loop Programs, and U^{235} contained in U-Al alloy billets for the SRO slug extrusion program. If these programs materialize as now planned, it is estimated that as much as

TABLE 10. SF MATERIALS RECEIVED

FROM	MATERIAL	NUMBER OF SHIPMENTS	AMOUNT (g)
Brookhaven National Laboratory, BNL	Depleted uranium	3	2,024,000.00
	Plutonium		500.00
Carbide and Carbon Chemicals Co., K-25, CCC	Depleted uranium	1	3,728.00
Carbide and Carbon Chemicals Co., Y-12, CYT	Enriched uranium	5	27,360.82
	Depleted uranium	1	150,000.00
	Plutonium	5	0.09
	Thorium	1	0.03
Dow Chemical Co., SFJ	Normal uranium	7	9,442.00
	Plutonium	1	13.59
E. I. du Pont de Nemours & Co., SDA	Normal uranium	1	1,000.00
General Electric Co., AGT	Enriched uranium	3	2.12
	Normal uranium	1	100.00
General Electric Co., HGE	Normal uranium	1	6,985.00
Los Alamos Scientific Laboratory, SFC	Thorium	1	60.00
National Lead Co., NLO	Normal uranium	1	2,000.00
Phillips Petroleum Co., MTI	Enriched uranium	1	0.31

75 kg of fissionable material will be in storage at X-10 at any one time. Present facilities are inadequate, and plans are under way to secure a new vault building.

Four persons possessing SF material were visited; the material in their possession was checked and weighed when feasible and no apparent discrepancies were encountered. Also, 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 February there were 33 receipts and 32 outgoing shipments, compared with 19 receipts and 20 shipments last month. Tables 10 and 11 are summaries of receipts and shipments for February.

TABLE 11. SF MATERIALS SHIPPED

TO	MATERIAL	NUMBER OF SHIPMENTS	AMOUNT (g)
Carbide and Carbon Chemicals Co., K-25, CCC	Depleted uranium	2	368.00
Carbide and Carbon Chemicals Co., Y-12, CYT	Enriched uranium	6	9.88
	Thorium	3	795.80
	Normal uranium	3	22,833.45
	Plutonium	2	0.05
E. I. duPont de Nemours & Co., SDA	Normal uranium	2	2,481.00
	Depleted uranium	1	13.75
Eniwetok Field Office, SFG	Depleted uranium	1	5.41
	Plutonium		9.07
General Electric Co., AGT	Enriched uranium	1	0.53
General Electric Co., SGE	Enriched uranium	1	17.61
Naval Radiological Defense Laboratory, NHP	Normal uranium	2	0.50
Phillips Petroleum Co., CPI	Normal uranium	1	24,141.00
Phillips Petroleum Co., MTI	Enriched uranium	6	5,559.48
USAEC, New York Operations Office, COL	Normal uranium	1	0.36