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OPERATIONS DIVISION MONTHLY REPORT

FOR

MONTH ENDING MARCH 31, 1953

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OPERATIONS DIVISION MONTHLY REPORT

for

Month Ending March 31, 1953

by
M. E. Ramsey

DATE ISSUED

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OPERATIONS DIVISION MONTHLY REPORT

SUMMARY

The activities of the Operations Division for the month ending March 31, 1953 are summarized and indexed below:

1. Lost graphite reactor operating time averaged 8.8%, compared with 8.1% for February (p. 3).
2. A ruptured slug was detected and discharged without difficulty (p. 3).
3. The LITR down time was 13.4%, compared with 16.8% last month. The relatively high down time this month was due to the continuation of a series of water-drop tests started in February (p. 4).
4. A tube leak caused by wear from a turbulator developed in the fluid cooler. The manufacturer of the cooler has recommended the removal of all turbulators, and the recommendation has been followed (p. 4).
5. The source of the 3 to 4 ppm of chloride in the LITR circulating water is being investigated (p. 4).
6. The reason for the low I^{131} yields during the month has not been determined (p. 6).
7. Approximately 500 curies of Cs^{137} that is to be used in the preparation of a kilocurie source is in the various stages of processing (p. 6).
8. Bismuth-207 was separated from a lead target that had been bombarded with protons in the 86-in. cyclotron. The isotope is of interest primarily because of the 50-year half life of Bi^{207} and the 0.8-sec half life of the daughter, Pb^{207m} (p. 6).
9. New methods are being used for the separation of I^{125} from antimony cyclotron targets and the separation of Na^{22} from magnesium cyclotron targets (p. 6).
10. Efforts are being made to prepare a Pm^{147} glass which can be fused into a thin film on platinum for beta sources. The small amounts of promethium glass which were made were found to be unaffected by hot water or 6 *N* HNO_3 (p. 7).
11. A visual method for the estimation of the thickness of zirconium deposits for use in $Zr\text{-}H^3$ targets is being evaluated (p. 7).
12. After several weeks of search, the source of the excessive amount of radioactivity in the water collected in the retention pond has been found to be from valve group No. 1 (p. 8).
13. A total of 88.1 curies of beta activity was discharged to White Oak Creek, compared with 34.2 curies last month (p. 9).
14. The RaLa charging heads and product carrier have been satisfactorily realigned (p. 11).
15. The next RaLa run has been postponed by Los Alamos until May 1953 (p. 11).
16. There were 1115 radioisotope shipments this month, compared with 930 during February (p. 12).

REACTOR OPERATIONS DEPARTMENT

OPERATING DATA

	MARCH 1953	FEBRUARY 1953	YEAR TO DATE 1953
ORNL Graphite Reactor			
Reactor power			
Total accumulated (kwhr)	2,536,931	2,429,538	7,653,518
Average kw/operating hr	3741.42	3936.07	3869.29
Average kw/24-hr day	3409.85	3615.38	3543.30
Lost time (%)	8.86	8.15	8.43
Excess reactivity (inhr)	10	15	
Slugs discharged	106	65	266
Slugs charged	106	63	210
Product made (g)	92.59	88.67	279.33
Product discharged (g)	2.42	1.40	5.48
Low-Intensity Test Reactor			
Reactor power			
Total accumulated (kwhr)	956,717	711,035	2,539,055
Average kw/operating hr	1,484	1,272	1,420
Average kw/24-hr day	1,286	1,058	1,175
Lost time (%)	13.4	16.8	17.2
Position of No. 2 shim rod (in. out)	25.250*	25.022	

*This corresponds to approximately 0.9% excess reactivity.

REACTOR OPERATIONS

ORNL Graphite Reactor

A slug rupture (No. 111) was discovered on March 30 in channel 2071 after the slug had been in the reactor for 363 days at a temperature of about 265°C. This bonded slug was from lot 114, which is only about 25% beta transformed. The ruptured slug was the fourteenth from the west end of the row and was not indicated by the probes. The slug jacket was split lengthwise of the slug, but the uranium was not badly oxidized.

Reactivity was adequate until March 17, when water leaked into the inlet air duct. The cooling air carried sufficient water into the reactor to cause a shortage of reactivity which necessitated a power reduction.

Eighty-three tantalum slugs from the lot of 540 being irradiated for the Army Chemical Corps were discharged and shipped on March 9. Sixty-three of these slugs were opened at Dugway Proving Ground to determine whether a large percentage had leaked and whether the balance would be usable for the intended experiments. The 63 slugs were found to be dry, and the Chemical Corps now wishes to leave the remaining slugs in the reactor until August 1, 1953.

A heavy load of research irradiations, together with other scheduled irradiations, may create a shortage of reactivity; therefore either more uranium will have to be charged, or all or part of the tantalum will have to be discharged from the reactor before August.

The hole 10 shielding is almost complete, and when the Dewar vessel located in this hole is filled with liquid nitrogen, the nitrogen will probably absorb about 40 inhours.

The tractor on the overhead building crane was changed from the west to the east side of the hoist. This permits better access to the west face of the pile, particularly to the lid tank.

Information regarding operating procedures in use with hydrogen liquefaction at Los Alamos and at the Arthur D. Little Co. has been received and will be compared with practices here to determine whether any improvements can be made. Construction of the small building for liquid-hydrogen production is almost complete, and installation of equipment will be started soon.

Low-Intensity Test Reactor

The LITR operated well during the month; most of the down time of 13.4% was due to water-drop tests performed on March 2 and 9.

The spray tank operated very satisfactorily. On March 9, the water was dropped from the reactor tank during operation at 1500 kw, and the heating in the fuel elements was followed by means of thermocouples. The water that sprayed over the lattice kept the temperature to a maximum of approximately 85°C, and the spray lasted for 2½ hr, almost exactly the same time observed in previous experiments. It is planned to replace the present nozzle with two smaller nozzles that supply about 3 gpm each and which will be less likely to be struck by the top plug.

The bypass demineralizer operated from February 20 until March 27, a period of five weeks, as compared with the first unit which lasted only about four weeks. A regenerated resin column was installed on March 27.

Corrosion samples of beryllium have been added to those of steel and aluminum already in the reactor, and long-term specimens in each group are now scheduled for periods of 6 and 12 months.

The fluid cooler gave further trouble on March 9 in that a leak was observed in one of the tubes. An investigation showed that the turbulator in the tube had worked its way forward into the water stream and had worn on the tube wall until a hole had formed, which caused the leak. Further investigation showed that 9 of the 12 tubes in front of the ells to the outlet manifold had completely lost their turbulators, which were found in the strainer as a tangled mat totaling several cubic feet. The manufacturer of the cooler, The Trane Co., has recommended the removal of all the turbulators, and the recommendation has been followed. The pressure drop across the cooler is now about 14 psig, compared with a drop of approximately 40 psig at 900 gpm with the use of turbulators. Cooling capacity appears to have dropped very little. A ΔT of 26°F between outlet water and air temperatures has been observed at 900 gpm with both cooling fans running at full speed and the propeller blades set at a 16-deg pitch. Under similar conditions with the use of turbulators, the ΔT was 24°F.

Some silt was found to be depositing in the fluid-cooler tubes, and a qualitative analysis showed that the silt was mainly corrosive products of iron and aluminum, with some beryllium present. The silt did not appear to be forming a scale, and it was not felt that it would be difficult to remove or that it would interfere too much with cooling capacity. If necessary, however, the tubes could be cleaned by running a brush through each individual tube and then by flushing with water.

Further analyses of the activity found in the LITR circulating water indicate that about 58% of the total is due to Np^{239}, and that Na^{24} and Mn^{56} account for approximately 27 and 3%, respectively. Only small amounts of fission products were found; however, the silt and resin will be examined to determine whether they contain many of the fission products.

The 3 to 4 ppm of chloride found in the demineralized water used in the LITR is not due to the demineralizers which produce the water, since tests of these demineralizers show a maximum of 0.3 ppm, and in most stages of the operating cycle the chloride content is much below this. Further tests are being made to determine whether decomposition of the paint or some other component is releasing chlorides into the LITR water.

FILTER HOUSE

Table 1 shows a comparison of the pressure drop across the exit air filters last month with the pressure drop this month and that experienced with clean filters. It is planned to begin the changing of the glass wool filters on April 6.

FAN HOUSE

Both fans functioned normally throughout the month. The bearings on the No. 2 fan were rolled out and inspected and found to be in good condition.

RADIOISOTOPES

Stringers 13, 14, and 16 contained 330 cans of target material at the end of March, as compared with 411 cans of target material at the end of February.

Table 2 shows a comparison of the radioisotope and research samples charged into the ORNL graphite reactor during March with those handled in February.

WATER-DEMINERALIZATION PLANT

The following list shows the water-treatment data for March, as compared with those of February:

	March 1953	February 1953
Water demineralized (gal)	337,140	323,080

TABLE 1. PRESSURE-DROP DATA

DATE	PRESSURE DROP (in. water gage)		
	Glass Wool	CWS No. 6	Total Across House
3/31/53	3.7	2.6	7.6
2/28/53	3.7	2.5	7.4
Clean filters	1.1	1.3	3.3

TABLE 2. RADIOISOTOPE AND RESEARCH SAMPLES

	MARCH 1953		FEBRUARY 1953	
	Research	Radioisotopes	Research	Radioisotopes
Stringers 13, 14, and 16	9	210	25	210
Hole 22	43	4	44	8
All other holes	4	38	5	22
Total by groups	56	252	74	240
Total for month	308		314	

CHEMICAL SEPARATIONS AND RADIOISOTOPE DEVELOPMENT DEPARTMENTS

RADIOISOTOPES

Iodine (I^{131} – 8 d)

Eighty ORNL slugs were processed and 49,972 mc of I^{131} was shipped.

Several runs with lower than usual yields were made this month. The cause for these poor yields is not known, but it is believed that the basic difficulty occurs in the sparging step. There are some indications that all the iodine is not coming out of the UNH solution.

Iodine Development Work, Building 3028

The structural portion of the I^{131} plant was completed by Johnson and Willard. Delivery of vessels from vendors has been further delayed, and most of the equipment is not expected to arrive before May 1. Orders for instruments have been placed.

Phosphorus (P^{32} – 14.3 d)

Twenty-two 2500-g cans of irradiated sulfur were processed and 12,998 mc of P^{32} was shipped.

With the exception of one run, which had a high heavy-metal content and slight coloration, all runs were satisfactory this month. The unsatisfactory run was reprocessed several times before it met specifications; approximately one-half the product was lost.

Precipitation Process, Building 3515

Operations continued on the production of curie amounts of Cs^{137} that are being accumulated for the fabrication of a kilocurie source. It is estimated that approximately 500 curies is in various stages of processing at the present time. Most of the source material (Redox waste) has been removed from tank 14, but a large amount of solid material was found to be deposited on the bottom of the tank, and efforts are being made to dissolve this material and to clean the tank.

A revised top has been designed and is being fabricated for precipitator No. 2. The major changes are the addition of openings for an air-driven agitator, tantalum dip tubes, and a heating coil. It is expected that decontamination of the cell will be completed during May and that repairs to the equipment will be made after that time.

Source Assembly Station, Building 3013

All source assembly equipment and instruments have been installed and tested except for the calorimeter, which has not yet been delivered by the vendor. Tests were conducted on the evaporation steps by the use of inactive cesium sulfate, and it was found that an additional evaporator will be required to handle the initial stages of the evaporation, during which a great deal of foaming occurs as a result of the decomposition of organic matter and ammonium salts. The final evaporator and dryer was tested with potassium sulfate (used as a stand-in for cesium sulfate), and the dried salts were compressed into the source under a pressure of 5000 psi. The operation proceeded satisfactorily.

Bismuth (Bi^{207} – 50 y) from the 86-in. Cyclotron

Bismuth-207 was separated from a lead target which had been bombarded with protons in the 86-in. cyclotron. A combination of methods was used: (1) separation of bismuth as a radiocolloid from the alkaline solution of lead as sodium plumbate; and (2) absorption of anionic bismuth on Dowex-1 anion-exchange resin, removal of traces of lead with 0.5 *N* HCl, followed by elution of bismuth in 8 *M* HNO_3.

Bismuth-207 is of interest because it has a 50-year half life and a daughter, Pb^{207m}, with a half life of 0.8 second. The material separated from this target was returned to E. C. Campbell of the Physics Division, who is studying bismuth and lead isotopes. After further yield data are obtained on this production process, Bi^{207} will probably be offered in the radioisotope distribution program.

Iodine (I^{125} – 56 d)

An antimony target irradiated with alpha particles in the University of California cyclotron was processed to separate I^{125}. The procedure used was simultaneous dissolution of the antimony metal in 5 *N* HNO_3 and distillation of the iodine. Standard procedures have previously called for the complexing of the antimony with tartrate, but this was found to be unnecessary, since tellurium metal will momentarily dissolve in nitric acid and then precipitate as the hydrated oxide and release

the iodine during the process. Purification of the iodine product was accomplished by the same procedure as that used for I^{131}; namely, oxidation to the iodate in permanganate and sulfuric acid solution, followed by reduction to elemental iodine with phosphorous acid, and distillation of the iodine into an alkaline solution.

Sodium (Na^{22} – 2.6 y)

A new method for separating Na^{22} from magnesium cyclotron targets, without added carrier, was developed. The target was dissolved in acetic acid, and the concentration of the solution was adjusted to 30% in ethyl alcohol. The sodium was separated in radiocolloidal form (or an extremely minute precipitate) as sodium magnesium uranyl acetate by passing it through an ultrafine glass disk. It was necessary to allow the solution to stand for three days at a temperature of 10°C before the filtration was performed. The over-all recovery was extremely high – greater than 99.9%. The uranium and acetate ions were removed by ion exchange on Dowex-50 resin, and the product, sodium, was finally stripped from the column with 0.4 *M* HCl. The total solids in the product were less than 0.0 mg/ml; the probable concentration of sodium was less than 3 ppm, and the concentration of uranium was less than 0.000026 mg/ml.

Promethium (Pm^{147} – 2.7 y) Sources

Experimental work was started on methods of preparing Pm^{147} beta sources. Because of the extremely low energy of the promethium beta particle, it is important to have a minimum of solid material incorporated in the source. Efforts are being made to prepare a promethium glass which can be fused into a thin film on platinum. The principal difficulty encountered thus far is the extremely high melting point (approximately 1500°C) of the promethium glass. It is probable that insufficient SiO_2 has been combined with the promethium oxide, and it may be necessary to add silicates with lower melting points to achieve the desired results, although self-absorption of the beta particles would be increased because of the added weight. The small amounts of promethium glass which were made were found to be unaffected by hot water or 6 *N* HNO_3.

Tritium (H^3 – 12.5 y)

Thirteen ampoules that contained a total of 3150 mc of H^3 were prepared and assayed, and four Zr-H^3 targets that contained a total of 14.6 curies of tritium were prepared. The backlog of orders for Zr-H^3 targets, particularly those for thick targets, is being reduced.

Work continued on the development of thin Zr-H^3 targets. A method of estimating the thickness of these very thin deposits is being tried as follows: A small piece of glass is placed in the evaporation chamber at the same time that a tungsten target is being coated. The bright filament is observed through the glass, and the point at which light can no longer be perceived through the zirconium metal layer is noted. Since the thickness of the layer is known, the thickness of deposits on targets at various distances from the filament can be calculated.

Several types of furnaces were tried for heating the zirconium targets during H^3 absorption. Only quartz and pyrex were found to have a sufficiently low H^3 absorption to be used for fabrication of the furnace chamber; metals, including stainless steels, absorb far too much H^3 at 400°C.

Helium (He^3 – Stable)

Three ampoules of 90% He^3 (26 cc) and three ampoules of 3.5% He^3 (1100 cc) were packaged.

Equipment, made of copper throughout, is now being installed for routine production of ultrapure He^3 (valuable in nuclear-measurement devices). A copper bellows pump, filled with oil and used in place of the usual glass Toepler automatic pump (which operates filled with mercury), was designed and fabricated for use in the all-metal system.

Processed Radioisotope Production

Table 3 is a list of radioisotope product solutions that were prepared during March.

Special Preparations

Seventy-four Co^{60} sources were loaded with a total of 357 curies. A source containing 80 curies of Au^{198} was prepared for the National Bureau of Standards. Sixteen units of KH_2PO_4 were processed for the U.S. Department of Agriculture; this is a continuation of the work reported last month.

Miscellaneous Work

A carrier was designed for shipping specially loaded multicurie Co^{60} sources. The carrier is designed so that individual tubular sources containing Co^{60} may be lowered through the bottom of the carrier into an underground, or underwater

TABLE 3. RADIOISOTOPES PRODUCED DURING MARCH

PRODUCT SOLUTION	SOURCE	AMOUNT (mc)	SPECIFIC ACTIVITY (mc/g)
Calcium (Ca^{45} – 152 d)	Hanford reactors (from enriched Ca^{44})	124	2480
	ORNL graphite reactor	181	1.36
	Hanford reactors	724	24.8
	ORNL graphite reactor	198	1.56
Chromium (Cr^{51} – 26.5 d)	Hanford reactors	687 1,194	780 1410
Cobalt (Co^{58} – 72 d)	Hanford reactors	30.5	Carrier-free
Indium (In^{114} – 50 d)	Hanford reactors	115.5 179	132 190.6
Iron (Fe^{59} – 46.3 d)	Hanford reactors (from enriched Fe^{58})	29.25	1718
Mercury (Hg^{203} – 43.5 d)	Hanford reactors	6,045 691	682 66
Nickel (Ni^{63} – 85 y)	Hanford reactors	11.62	12.5
Mixed fission products	Scrup	1,098	
Niobium (Nb^{95} – 35 d)	Fission products, ORNL graphite reactor	316	Carrier-free
Strontium (Sr^{90} – 25 y)	Fission products, Hanford reactors	13,800	Carrier-free
Cobalt ($Co^{57,58}$ – 290 d, 72 d)	Y-12 cyclotron	0.828	Carrier-free
Iodine (I^{125} – 56 d)	University of California cyclotron	0.229	Carrier-free
Sodium (Na^{22} – 2.6 y)	University of Pittsburgh cyclotron	13.9	1390

source holder, without exposure to the operator. The assembled sources will be used by purchasers for conducting radiation studies in which very intense gamma fields are required.

A wide-range scintillation gamma meter, capable of measuring radiation fields up to 1000 r/hr, was obtained for use in studying gamma radiation output of large sources of Co^{60}, Cs^{137}, Ce^{144}, etc. Since the radiation studies will be made in open air, 10 ft above the ground (to minimize scatter), the instrument is designed so that it may be read remotely.

RADIOACTIVE-WASTE DISPOSAL

After many weeks of extensive excavation in the north tank farm in search of the source of activity discharged into the retention pond, a serious leak was discovered in valve group No. 1 which appeared to have contributed the bulk of the activity. Highly contaminated earth was found as far as 13 ft below the surface when holes were drilled around this valve group. Water that was added to these holes flowed underground toward tanks W-3 and W-4, where the earth was found to be highly contaminated at a depth of 20 feet. The activity

at this point was proved, by a series of tests, to be seeping into the retention pond system through loose joints in the pipe.

The pit for valve group No. 1 was excavated, and highly contaminated earth was found on three sides. Decontamination of the box to a level which permitted visual examination from a distance disclosed that a section of the pit at floor level had been completely deteriorated by leaking acid solutions.

In agreement with the pilot-plant supervisors, since the waste lines of the Hot Pilot Plant were involved, it was decided to revise the piping and to replace the existing valve pit and its many valves with two simple diversion boxes lined with stainless steel which will be leak-tight and easily decontaminated. This work cannot be started, however, until decontamination of the cells in Building 3019 is completed, which will be at least another month; there is, temporarily, no need for these waste lines.

A total of 21,600 gal of chemical-waste concentrate bearing 615.28 curies of beta activity was discharged to the chemical-waste storage pit No. 2 from tank W-8. The total transferred to date from the concentrate tank to the pit is 76,800 gal containing 1981 curies. Additional wastes, consisting of 600 gal bearing approximately 15 g of U^{235} and 16 curies of beta activity from the Homogeneous Reactor Building and 6500 gal bearing approximately 6.13 curies of beta activity from the washings of the pit excavation at valve group No. 1 in the north tank farm, were also transferred to the same waste pit.

Seventeen pots and eight drums of waste were received from Argonne National Laboratory. The contents of four drums and four pots were sent to chemical-waste tank W-5, and the contents of thirteen pots and four drums were sent to metal-waste tank W-7.

Holes were drilled at the radioactive-gas stack pad to determine the reason for a severe vibration felt at this point. It was found that there was as much as 2 in. of void between the concrete pad and the earth fill. Concrete was poured into this void, and the vibration was almost entirely eliminated.

The east bearing on the stand-by, hot off-gas blower failed and was replaced; the reason for the failure is not known. Also, the graphite seals on the small steam turbine were replaced.

When the north shaft bearing of the blower serving Buildings 4501 and 4505 became overheated, it was removed and scraped, and the fan shaft was polished; the bearing is now performing satisfactorily.

The semiannual inspection of the Radioisotope Area hood-ventilation duct was made; no defects were encountered and no repairs were necessary.

The telemetering cable to tank WC-1 failed and was replaced with more adequately insulated outdoor cable.

The Cottrell precipitator was shut down for 5 hr for cleaning of the relay contacts and rectifying tubes.

The overspeed controlling-point of the steam-turbine governors and the speeds of all fans and blowers were checked and regulated.

The manhole 150 flowmeter recorder, the integrator, and the sampling station serving the west wing of Building 3550 were put into service on March 30.

Waste Discharged to White Oak Creek

A total of 88.1 curies of beta activity was discharged to White Oak Creek from the settling basin and the retention pond (see Table 4). This discharge is 2.5 times that of last month, with the retention pond contributing 64.5% of the total. The increase in the retention-pond activity was caused by rain water that washed out the activity in the soil from the excavations previously described in this report.

The rise in the activity discharged from the settling basin was the result of difficulty in waste-evaporator operation, the pumping of some contaminated water from the excavation pit at valve group No. 1, and a source which, to date, has not been located despite the sampling at many extra sampling points in the tank farm. The sampling has been discontinued inasmuch as the activity has decreased.

Chemical-Waste Evaporator

The chemical-waste evaporator operation was more difficult this month because of two reasons: the pH of feed solutions was fluctuating from acid to alkaline very rapidly, and the feeds contained soap and detergents which exaggerated the foaming tendencies of the evaporator. Both troubles are the result of intensive decontamination efforts at the Hot Pilot Plant.

The valve stem in the line between the evaporator tank and the tank W-6 drain valve was sheared. This repair will be made as soon as the evaporator can be conveniently decontaminated.

The internal treatment of the waste-evaporator tank coils with a 5% by volume solution of Versene T was completed. The remedial effect of this treatment is not definitely known, inasmuch as the worn and nonoperating steam traps on the outlets of the coils were changed during this treatment period. The evaporation rate has returned to normal levels.

Evaporator operation is shown in Table 5; waste-tank inventory is shown in Table 6.

TABLE 4. ACTIVITY DISCHARGED TO WHITE OAK CREEK

DISCHARGED FROM	MARCH 1953		FEBRUARY 1953	
	Gallons	Beta Curies	Gallons	Beta Curies
Settling basin	20,296,000	31.19*	18,303,500	11.50
Retention pond	742,000	56.87	820,200	22.67
Total	21,038,000	88.06	19,123,700	34.17

*0.85 curie contributed by the evaporator.

TABLE 5. WASTE-EVAPORATOR OPERATION

MONTH	SOLUTION FED TO EVAPORATOR (gal)	CONCENTRATE TO W-6 (gal)	VOLUME REDUCTION	BETA CURIES TO EVAPORATOR	BETA CURIES TO SETTLING BASIN
March 1953	226,824	20,768	10.91:1	2114	0.851*
February 1953	187,618	16,273	11.5:1	1514	0.028

*Does not include the result of one run; the sample was lost before analysis.

Waste-Tank Inventory

TABLE 6. WASTE-TANK INVENTORY

TANKS	CAPACITY (gal)	FREE SPACE (gal)	
		March 1953	February 1953
Hot-Pilot-Plant Storage			
W-3, 13, 14, 15	48,500	30,870	31,020
Chemical-Waste Storage			
W-5	170,000	91,000	70,400
Evaporator-Concentrate Storage			
W-6, 8	340,000	83,000	87,400
Metal-Waste Storage			
W-4, 7, 9, 10	543,000	208,500	204,000

RaLa (Ba^{140} – 12.5 d)

The charging heads of the product cones were satisfactorily realigned without the insertion of the flexible bellows, at one time considered necessary, in the inlet and outlet air lines. A slight revision was made by the addition of a yoke on the side of the charging head which positions the heads at three points and thus prevents movement in any direction. This revision, coupled with the complete alignment of the product carrier, cone manipulator, and charging heads to the closest tolerances in all directions, satisfactorily completed the work on product evaporation and removal equipment. Heating tests have demonstrated that the head does not shift its position and that the manipulator works as freely as it did in the original installation.

Transfer tests from the product evaporator tank to the product cone again demonstrated that a complete product transfer without loss can be made by a utilization of the prescribed jet pressure and jetting time.

A recheck of the product-drying tests made last month reaffirmed the findings that a differential of 4 ± 1 in. H_2O, as registered on the air-flow manometer, provides the best product distribution, a minimum loss of product, and a minimum of drying time.

The air heater burned out during the product-drying tests and was replaced with an available spare unit.

Much more equipment has been removed from cell B this month; for example, all instruments from the cell B panel boards have been sent to the Instrument Salvage Pool, and very little piping remains to be removed from inside the cell. Work is progressing more slowly on the removal of piping outside the cell; this piping is being decontaminated and salvaged for plant use wherever possible.

The next RaLa run has been postponed by Los Alamos until some time in May 1953.

RADIOISOTOPE SALES DEPARTMENT

Bureau of Explosives permits have now been obtained for the use of containers to be utilized in shipping polonium and polonium-neutron sources. Permit No. 56 was issued to cover the spherical paraffin-filled container for polonium-beryllium sources, and permit No. 57 was issued to cover the plywood boxes for polonium shipments.

Approximately 3500 of the new radioisotope catalogs have been distributed, and numerous requests for catalogs are still being received.

As of April 1, 1953, all government agencies are being required to order radioisotopes on AEC Form 375. Use of this form eliminates past difficulties with the conditions and terms applying to government purchase orders.

Radioisotope shipments made during March 1953 are compared in Table 7 with those made during February 1953 and during March 1952. A breakdown according to separated and unseparated material (including totals for August 1946 through March 1953), and for project, nonproject, and foreign shipments is also shown.

HANFORD IRRADIATIONS

Table 8 is a list of the radioisotope samples that were received from Hanford during the month.

CYCLOTRON RADIOISOTOPES

Table 9 is a list of the orders now on hand for cyclotron radioisotopes.

TABLE 7. RADIOISOTOPE SHIPMENTS

	MARCH 1953	FEBRUARY 1953	MARCH 1952	AUGUST 1946 TO MARCH 1953, INCLUSIVE
Separated material	840	749	788	33,459
Unseparated material	275	181	223	9,091
Total	1115	930	1011	42,550
Nonproject	1022	806	860	
Project	72	41	135	
Foreign	21	83	16	
Total	1115	930	1011	

TABLE 8. RADIOISOTOPES RECEIVED FROM HANFORD ON MARCH 16

SAMPLE NUMBER	MATERIAL	NUMBER OF PIECES	DATE DISCHARGED
ORNL-157	Calcium carbonate	2	2/17/53
ORNL-148	Potassium chloride	2	2/17/53
ORNL-129	Calcium carbonate	1	2/17/53
ORNL-149	Mercury	1	2/17/53

TABLE 9. CYCLOTRON-RADIOISOTOPE ORDERS

MATERIAL	AMOUNT (mc)	SERVICE IRRADIATIONS	STATUS
Na^{22}	8.5		Material in process
Si^{32}		1	Material has been requested
Ti^{44}		1	Material has been requested
I^{125}	0.1		Order to be cancelled

TABLE 10. BOMBARDMENTS RECEIVED AND REQUESTED

MATERIAL	MASS. INSTITUTE OF TECHNOLOGY		UNIVERSITY OF CALIFORNIA		UNIVERSITY OF PITTSBURGH		WASHINGTON UNIVERSITY	
	Bombard-ments	Beam Hours	Bombard-ments	Beam Hours	Bombard-ments	Beam Hours	Bombard-ments	Beam Hours
Bombardments Received								
Be^{7}			1	47.20	15	342.00		
Na^{22}	2	190.00			19	957.85	4	300.00
Mg^{28}			2	19.80				
Mn^{52}					2	20.00		
V^{53}							1	6.00
Mn^{53}			1	8.00				
Mn^{54}	1	50.00	2	182.40			7	400.00
Fe^{54}			1	18.70				
Co^{57}	1	10.00					4	140.00
Fe^{59}			7	332.80	1	40.60	1	34.00
Zn^{65}	1	100.00	1	47.80				
Ga^{67}					10	69.75		
As^{73}			1	10.50	4	40.50		
As^{74}	1	5.00						
Sr^{85}	3	89.75			1	10.00		
Y^{88}	1	10.00						
I^{125}							2	60.00
Sb^{125}			1	75.90				
Iridium							1	8.00
Molybdenum metal			1	12.50	2	15.70	5	50.00
Potassium chloride	1	1.00						
Sulfur					1	2.00		
Total received	11	455.75	18	755.60	55	1498.40	25	998.00
Bombardments Requested but not Received								
Si^{32}			1	10.00				
Ti^{44}			1	10.00				
Total hours outstanding (not received or requested)		1044.25		724.40		701.60		502.00

Table 10 shows a list of the number of radioisotope bombardments received and requested through March 1953.

Table 11 lists the quantity of radioisotopes that was cyclotron-processed and the number of shipments of radioisotopes made during March. Also shown are totals to date as divided into millicurie and service-irradiation amounts.

ACTIVATION ANALYSES

A total of 102 requests has been received for information concerning activation analyses. Thirty-three of these have developed into requests for analyses, 22 of which have been completed.

TABLE 11. SHIPMENTS OF CYCLOTRON-PROCESSED RADIOISOTOPES

MATERIAL	NUMBER OF SHIPMENTS MARCH 1953	TOTAL PRODUCT (mc)		NUMBER OF SERVICE IRRADIATIONS	
		March 1953	To Date	March 1953	To Date
Bi^{207}					1
Be^{7}	2	3	415.743		5
Be^{9}	4			4	23
Na^{22}			122.807		
Mg^{28}	1			1	2
$Mn^{52,54}$	2	2	4.8		
Mn^{52}			10.991		
Mn^{53}					1
Mn^{54}			23.22		
$Fe^{55,59}$			63.64		4
Co^{57}	3	3	7.144		
Zn^{65}			43.5		4
Ga^{67}	2			2	52
As^{73}			6.780		
As^{74}					1
Sr^{85}			6		
Sr^{88}			25		
Sr^{90}					1
Mo^{95}					9
Pm^{146}					1
KCl					1
Iridium foil					1
In^{111}	1			1	1
Li^{7}	1			1	1
V^{53}	1			1	1

SF MATERIAL CONTROL

Thirty drums containing UNH solutions of depleted uranium were shipped to Mallinckrodt Chemical Works, St. Louis, Missouri, on March 30. The total uranium content of the 30 drums amounted to 2425 kg, and this was the third shipment of uranium recovered under the Metal Recovery Program, with 5109 kg having been shipped to date.

A total of 550.52 g of plutonium was shipped to Los Alamos Scientific Laboratory on March 17. The shipment consisted of 176.35 g of plutonium recovery residues and 374.17 g of Purex process plutonium.

During March, 28 MTR fuel assemblies were shipped to Phillips Petroleum Co., Scoville, Idaho. This makes the total number shipped to date 330 fuel assemblies and 46 control rods.

Other important shipments of fissionable material consisted of the following: 160 enriched uranium-aluminum alloy plates containing 1389 g of U^{235} to North American Aviation, Inc., Downey, California, and 6 enriched uranium-zirconium alloy plates containing 54.58 g of U^{235} to California Research and Development Co., Livermore, California.

An important quantity of fissionable material was received from Y-12 during March, namely, 26.82 kg of contained U^{235}. Of this amount, 4.44 kg was in the form of uranyl sulfate and will be used as fuel for the HRE. The remaining 22.38 kg was in the form of metal and will be used to fabricate MTR fuel elements.

The official AEC *SF Accountability Survey Report No. 42* was received on March 13. A rough draft of this report was reviewed with AEC personnel on February 6, and several errors in fact were found which were corrected in the official release. The survey report contained six current recommendations for supplementing the ORNL SF accountability system, and a brief discussion of these recommendations is given below.

The first recommendation deals with revision and expansion of the present *SF Accounting Manual*. This is considered to be a major job requiring several months to complete; however, the work has been tentatively scheduled for completion in June or July 1953.

The second recommendation deals with slight changes in the method of journalizing transactions, and also the institution of a new procedure wherein copies of adjustment journal entries are to be furnished to the AEC. The initial part of this recommendation has been accomplished; the latter part is still under consideration.

The third recommendation was very minor and has been accomplished.

The fourth recommendation concerns the establishment of a testing, repairing, and calibrating program on all equipment used to measure SF materials and the establishment of a quality-control program to affix permissible limits of error in gross measurements of SF material. The first provision of the recommendation was set up on a two-week cycle, but the first cycle was not completed until the middle of March because additional personnel had to be trained; the latter cycle was started on February 9.

The fifth recommendation pertains to the retention on file of all shipping and receiving documents for audit purposes. All such documents are presently retained except those classified "Top Secret," which are returned to the authenticator after verification of material content and entry in records of accounts. Arrangements have been made to discontinue the practice of classifying the receiving documents as "Top Secret" (shipping forms originated by ORNL have not been classified TS), which is felt to be in line with the AEC *Guide for Classification of SF Shipping Forms*, dated May 25, 1950, from C. L. Wilson, General Manager. This guide specifically deals with transfers of production material on a routine and recurrent basis. It is true that large quantities of material are received at various times; however, they are not routinely scheduled, although such receipts do occur sporadically. Accordingly, on future occasions when documents are classified TS, it is planned to return them to the originator for downgrading the classification and thereby make all documents available for audit.

The sixth recommendation requests that ORNL consider the application of the gamma-scan method of determining U^{235} to the finished MTR fuel plates as a means of establishing a measured, monthly inventory and as a confirmatory analysis of uranium. This recommendation is under study. Thus far, the results obtained on 20 plates which were taken to Westinghouse for gamma scanning have been evaluated statistically. No absolute opinion could be formed from the data; however, the results were somewhat encouraging. The statistician suggested that further scanning tests

be made over a longer period of time. In addition, it has been requested that Westinghouse send drawings of their gamma-scan device to ORNL for review by ORNL Instrument Department personnel.

SF storage facilities for unirradiated material have been improved considerably. During the month, new cadmium-lined, storage bins were installed in the east vault of Building 3008. These bins were designed to give an "always safe" geometric arrangement of stored fissionable material of a specified maximum weight per package of material. Sufficient shelving space is now available to safely store the normal amounts of material received and shipped by ORNL. The west vault of Building 3008 is being used to store normal uranium, depleted uranium, and small supplies of special material. Silicon-bonded slugs are stored in a barricade in the Building 3001 extension. All thorium is now stored in Building 3052.

Two special reports were prepared and submitted by the ORNL SF Office during March; they were as follows: ORNL's estimated special reactor material requirements for the next three years, and ORNL's projected beryllium requirements for the next five years.

SF surveys during the month consisted in visiting 12 persons possessing SF material. The material in their possession was inspected and weighed where feasible, and no apparent discrepancies were encountered. In addition, the records of four analytical laboratories were audited; this disclosed that all records were in good order and that proper accounting had been made for all samples.

There were 38 receipts and 46 outgoing shipments of SF material during March, compared with 19 receipts and 38 outgoing shipments during February. Tables 12 and 13 are summaries of receipts and shipments for March.

TABLE 12. SF MATERIALS RECEIVED

FROM	MATERIAL	NUMBER OF SHIPMENTS	AMOUNT (g)
Argonne National Laboratory, ANL	Normal uranium	1	580.00
	Depleted uranium	2	27,094.50
	Plutonium	1	14.91
Battelle Memorial Institute, BMI	Thorium	1	2,630.00
Carbide and Carbon Chemicals Co., K-25, CCC	Depleted uranium	1	6,674.00
	Normal uranium	1	0.03
	Enriched uranium	1	0.03
Carbide and Carbon Chemicals Co., Y-12, CYT	U^{233}	6	714.34
	Enriched uranium	6	26,820.21
	Plutonium	4	0.04
	Thorium	1	0.09
	Depleted uranium	1	0.85
	Normal uranium	7	5,777.40
Mallinckrodt Chemical Works, MCW	Normal uranium	1	226,000.00
Naval Radiological Defense Laboratory, NDL	Normal uranium	1	5.10
North American Aviation, Inc., DNA	Normal uranium	1	1.00
Phillips Petroleum Co., MTI	Enriched uranium	2	0.09

TABLE 13. SF MATERIALS SHIPPED

TO	MATERIAL	NUMBER OF SHIPMENTS	AMOUNT (g)
American Cyanamid Co., CPI	Normal uranium	1	3,615.95
California Research and Development Co., CRD	Normal uranium	1	11,400.00
	U^{233}	1	2.26
	Enriched uranium	1	54.58
Carbide and Carbon Chemicals Co., Y-12, CYT	Enriched uranium	8	48.45
	U^{233}	9	1,172.75
	Depleted uranium	1	22.00
	Normal uranium	3	1,749.68
	Plutonium	2	0.03
E. I. du Pont de Nemours & Co., SDA	Normal uranium	1	900,155.00
General Electric Co., SGE	U^{233}	1	0.02
Los Alamos Scientific Laboratory, SFC	Plutonium	2	550.52
Mallinckrodt Chemical Works, MCW	Normal uranium	1	111,341.00
	Depleted uranium	1	2,425,275.00
North American Aviation, Inc., DNA	Enriched uranium	2	1,389.21
	Normal uranium	1	1.00
Oak Ridge Institute of Nuclear Studies, ORN	Normal uranium	1	114.75
Phillips Petroleum Co., MTI	Enriched uranium	7	4,708.76
USAEC, Oak Ridge Operations Office, CPA	U^{233}	1	Negligible
Westinghouse Electric Corp., WEM	Normal uranium	1	2,475.00