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AEC RESEARCH AND DEVELOPMENT REPORT

OPERATIONS DIVISION MONTHLY REPORT

FOR

MONTH ENDING OCTOBER 31, 1952

OAK RIDGE NATIONAL LABORATORY
OPERATED BY
CARBIDE AND CARBON CHEMICALS COMPANY
A DIVISION OF UNION CARBIDE AND CARBON CORPORATION
UCC
POST OFFICE BOX P
OAK RIDGE, TENNESSEE

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ORNL-1440

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OPERATIONS DIVISION MONTHLY REPORT

for

Month Ending October 31, 1952

by

M. E. Ramsey

DATE ISSUED

DEC 19 1952

OAK RIDGE NATIONAL LABORATORY
Operated by
CARBIDE AND CARBON CHEMICALS COMPANY
A Division of Union Carbide and Carbon Corporation
Post Office Box P
Oak Ridge, Tennessee

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OPERATIONS DIVISION MONTHLY REPORT

SUMMARY

The activities of the Operations Division for the month ending October 31, 1952 are summarized and indexed below:

1. Two ruptured slugs were located and discharged without difficulty (p. 3).

2. The Metallurgy Division is studying the growth of alpha- and beta-phase slugs resulting from cycling the slugs between 50 and 350°C (p. 3).

3. The LITR operated very satisfactorily during October with the down time being only 7.5% (p. 4).

4. A contract to build the structural portion of the I^{131} project was let to Johnson and Willard, of Knoxville (p. 6).

5. Purification of the sulfur to be bombarded in the ORNL graphite reactor for P^{32} production by use of MgO was discontinued because of some indication of Mg^{++} in the product (p. 6).

6. Work was continued on the preparation of evaporated zirconium films of 1.5 to 3.0 mg/cm^2 required for many of the tritium-zirconium targets (p. 7).

7. Methods of removal of the Am^{241} contamination from Pm^{147} are being studied (p. 7).

8. Europium oxide of satisfactory purity for use as target material has been prepared (p. 8).

9. A total of 34.0 curies of beta activity was discharged to White Oak Creek compared with 43.6 curies discharged last month (p. 10).

10. A leak has occurred in the RaLa equipment near the process filters, but the exact location has not been positively determined (p. 11).

11. There were 880 radioisotope shipments during October compared with 870 during the previous month (p. 12).

REACTOR OPERATIONS DEPARTMENT

OPERATING DATA

	OCTOBER 1952	SEPTEMBER 1952	YEAR TO DATE 1952
ORNL Graphite Reactor			
Reactor power			
Total accumulated (kwhr)	2,700,401	2,179,073	23,825,149
Average kw/operating hr	3953.55	3352.93	3643.92
Average kw/24-hr day	3629.57	3026.49	3254.80
Lost time (%)	8.19	9.74	10.68
Excess reactivity (inhr)	15	55	
Slugs discharged	106	4048	41,895
Slugs charged	106	4041	42,571
Product made (g)	98.55	79.53	869.53
Product discharged (g)	2.51	256.96	6241.50
Low-Intensity Test Reactor			
Reactor power			
Total accumulated (kwhr)	1,024,205	964,316	7,413,357
Average kw/operating hr	1,488	1,493	1,240
Average kw/24-hr day	1,377	1,339	1,013
Lost time (%)	7.5	10.3	18.3
Position of No. 2 shim rod (in. out)	26.909*	26.128	

*This corresponds to approximately 0.4% excess reactivity.

REACTOR OPERATIONS

ORNL Graphite Reactor

Two slug ruptures were found during October. Both were located by visual inspection, since the use of probes gave no indication of either rupture.

Rupture No. 104, which was discovered on October 13, occurred in channel 1372 after the slug had been in the reactor for 189 days at a temperature of about 250°C. Channel 1372 contained slugs from lot 118 that had been 87% beta transformed.

Rupture No. 105, which was also discovered on October 13, occurred in channel 1871 after the slug had been in the reactor for 195 days at a temperature of about 250°C. This channel contained alpha slugs from lot 110.

The ruptured slug in lot 118 had both ends pushed off, whereas the one in lot 110 had only one end pushed off. Both slugs had a number of blisters; the jackets were removed and are being examined to determine whether the blisters were caused by oxidation or diffusion. The slugs in general were not badly oxidized, and perhaps this explains the failure of the probes to indicate the ruptures. Based on limited experience, it has been observed that bonded slugs have not oxidized as rapidly after rupture as unbonded slugs.

The slugs being tested in the Metallurgy Division by cycling the temperature about 250 times between 50 and 350°C have increased in length. In one case, the jacket gives the appearance of failing, and further tests will be made to determine the point at which rupture will occur. Slugs in the alpha phase grow much faster than those in the beta phase. Attempts will be made to measure the slug rows in the central zones of the reactor to see whether it will be possible to detect growth and possibly anticipate ruptures. Since the beta-transformed slugs have not increased appreciably in length, it is expected that ruptures will be less likely to occur in channels containing these slugs.

Slugs that were discharged along with the ruptures in channels 1372 and 1871 were measured in the canal by members of the Metallurgy Division. The slugs from lot 110 that were not beta transformed appeared to have increased in average length about 0.030 in. compared with 0.012 in. for the beta-phase slugs from lot 118. Further checks are being made in order to collect more data so that the increase in length of irradiated and unirradiated slugs can be followed more closely.

The job of producing 53,000 bonded slugs by Y-12 has been completed.

The excessive reactivity of the reactor has generally been above 20 inhr during the month. If more experimental samples are inserted into the reactor, however, it may be necessary to discharge some of the 540 tantalum slugs now being irradiated for the Army Chemical Center. An agreement has been reached with this organization that all or part of the tantalum may be discharged if necessary. Since it is now planned to use the tantalum in August 1953, it will probably be necessary to discharge at least part of it when the weather becomes warmer next spring.

Six runs were made during the month to produce liquid hydrogen; no difficulty was encountered with the liquid-hydrogen equipment.

Low-Intensity Test Reactor

The LITR operated very satisfactorily during October. The down time has decreased to 7.5% and can usually be kept near this level except when additional time is required to install experimental apparatus. Once during the month, for example, a shutdown lasted approximately 20 hr, whereas the reactor could have been started up within about 10 hr except for the delay in installing experimental equipment.

The two shim-rod bearings were not delivered as scheduled; however, one of the spent shim rods was removed from the reactor tank in a shield adapted for this purpose and was successfully moved to the canal of the ORNL graphite reactor where the fuel section was sawed out. Approximately 14 spent fuel elements are now ready to be shipped to Arco for separation as soon as approval for the carrier design has been received. Several months will be required to fabricate the carrier after the design has been approved.

The air cooler is essentially complete except that the motors have not yet been connected.

The spray tank has been installed but some of the associated piping is not complete. Other jobs of higher priority prevent this work from being done very rapidly.

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 when all filters were clean.

FAN HOUSE

Because of the pitting observed recently on the bearings of the No. 2 fan, it has been customary to remove the bearing covers each week to see whether the pitting has reached a serious stage. Thermocouples have now been placed in holes drilled in the body of the bearing so that if any trouble develops it should be immediately indicated by a high bearing temperature. With this precaution it should be possible to eliminate the weekly examination.

TABLE 1. PRESSURE-DROP DATA

DATE	PRESSURE DROP (in. water gage)		
	Glass Wool	CWS No. 6	Total Across House
10/31/52	3.4	2.1	6.7
9/30/52	3.0	2.0	6.1
Clean filters	1.1	1.3	3.3

RADIOISOTOPES

Stringers 13, 14, and 16 contained 380 cans of target material at the end of October as compared with 366 cans of target material in these stringers at the end of September.

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

WATER-DEMINERALIZATION BUILDING

Table 3 shows water-treatment data for October as compared with that of September.

TABLE 2. RADIOISOTOPE AND RESEARCH SAMPLES

	OCTOBER 1952		SEPTEMBER 1952	
	Research	Radioisotopes	Research	Radioisotopes
Stringers 13, 14, and 16	24	143	19	147
Hole 22	69	1	51	2
All other holes	3	28	4	25
Total by groups	96	172	74	174
Total for month	268		248	

TABLE 3. WATER DEMINERALIZED AND DEGASIFIED

	WATER TREATED (gal)		
	October 1952	September 1952	Year to Date 1952
Demineralized	333,360	363,360	3,988,630
Degasified	0	0	323,120

CHEMICAL SEPARATIONS AND RADIOISOTOPE DEVELOPMENT DEPARTMENTS

RADIOISOTOPES

Iodine (I^{131} – 8 d)

Forty-four ORNL slugs and one 8-in. Hanford slug were processed; about 34,071 mc of iodine was shipped.

Some difficulty was experienced in processing one 8-slug run through the glassware. The off-gas line in the scrubber became plugged, thus necessitating the use of house vacuum; the line was not unplugged until after the run was out of the equipment.

A leak was found in the product-transfer line that leads from the concrete-processing cell to the glassware equipment cell in room 10. The leak, which is in the processing cell, cannot be repaired until decontamination is effected; therefore, special operating precautions will be taken to minimize losses caused by the leak.

Iodine Development Work

A contract to build the structural portion of the I^{131} project was let to Johnson and Willard, of Knoxville. Preliminary excavation and piping disconnections by the Laboratory have been completed. The contractor is scheduled to begin work on November 3.

All structural and piping drawings for work to be done by the contracting firm were completed and given to that firm.

All vessel drawings and specifications were completed and were given to the Purchasing Department for transmittal to vendors for bids.

Preliminary drawings and specifications for equipment and piping installation to be done by ORNL were completed and checked.

Final design for instrumentation has not been completed.

Phosphorus (P^{32} – 14.3 d)

Twenty-two 2500-g cans of bombarded sulfur were processed and 9075 mc of P^{32} was shipped. The equipment gave little difficulty this month.

Phosphorus Development Work

There is some evidence that sulfur (target material) purified by passage through a MgO column contains sufficient MgO or other magnesium compounds to cause Mg^{++} to carry through the extraction and purification process for $P^{32}O_4^{---}$. A modification in the chemistry of the process, which was designed to eliminate Mg^{++} without a major change in operating procedure, was tested.

Some preliminary experiments with $P^{32}O_4^{---}$ tracer indicated that a solution buffered with NH_4Cl in the rare-earth hydroxide-precipitation step would prevent the precipitation of $Mg(OH)_2$ without decreasing the carrying of $P^{32}O_4^{---}$ on $Nd(OH)_3$. (La^{+++} has been used for this precipitation.) A mixture of rare earths containing about 75% neodymium was used in place of lanthanum since $Nd(OH)_3$ forms at a lower pH than $La(OH)_3$. The conditions chosen for a test run in the P^{32} production equipment were as follows: A solution was prepared that contained 350 mg of Nd_2O_3 as chloride in 800 ml of $P^{32}O_4^{---}$ solution, 1 *M* in NH_4Cl and 0.1 *M* in NH_4OH. Five milligrams of Mg^{++} was added to the solution prior to the $Nd(OH)_3$ precipitation. Other than the conditions noted here, the run was made by the usual procedure.

The final product solution was contained in a volume of 300 ml. Two 5-ml samples were removed; one was placed in a pyrex tube, the other in a quartz tube. Each sample was neutralized to pH 7.5 to 8.0 with NaOH and was heated at 15 psi in an autoclave for 15 minutes. This procedure closely approximates preparatory sterilization steps used when P^{32} is administered intravenously. The samples were cooled and allowed to stand at room temperature. No precipitate was observed in the samples after 40 hours.

The test run appears to be successful; however, should further experimentation indicate a need, the pH of the solution may be lowered by appropriate adjustments of the NH_4Cl to NH_4OH ratio. Since the formation of a $MgNH_4PO_4$ precipitate requires a large excess of both NH_4^+ ion and PO_4^{---} ion, such precipitation is not considered likely because of the low PO_4^{---} concentration.

Carbon (C^{14} – 5740 y)

The production of C^{14} from the September run (analyzed last month) was 426 mc with an isotopic ratio of 9.08% and 471 mc with an isotopic ratio of 10.09%.

The results obtained with a Fe_2O_3 bed used to supplement the CuO bed for oxidation of organics and hydrogen in the C^{14} gas train were negative. The Fe_2O_3 bed will be used in the November C^{14} run and will be operated at a higher temperature to be sure that oxidation takes place.

Tritium (H^3 – 12.4 y)

Work was continued on the preparation of evaporated zirconium films of 1.5 to 3 mg/cm^2 required for many tritium-zirconium targets. This thickness is about 100 times that obtained by ordinary evaporation methods. Since a limited amount of zirconium can be placed on the tungsten filament at one time, it is necessary to recharge the filament, as the tungsten dissolves in the zirconium metal. The required film can now be obtained in ten loadings by use of a filament of a number of strands of thin tungsten wire. The small-diameter wire enables the zirconium to flow evenly over the filament. It has been found that successive evaporations can be made which will adhere to each other if argon is blown against the face of the target during the loading of the filament. By means of this procedure, filaments have withstood four loadings before burning out.

To improve the geometry and to reduce the loadings to a minimum, a new filament of woven tungsten wire about 2 cm wide and 5 cm long will be tested. Use of this type of filament, upon which a large quantity of zirconium can be placed without burning it out, could reduce the loadings to about three and also reduce the possibility of spoiling the film by oxidation.

Argon (A^{37} – 34.1 d)

The large charcoal column for the A^{37} system was completed. The total volume of gas in the current batch (A^{37} + helium + impurities) was reduced, but not enough to permit packaging. A large lithium-metal trap was introduced into the system and gases other than argon and helium were scavenged at 1000°C. The volume was reduced to about 1 liter. The gas will again be passed through the charcoal column to further reduce the amount of helium carrier gas, after which the A^{37} should be ready for assay and packaging.

Experiments on the Separation of Promethium and Americium

Work was continued on methods of separating Pm^{147} from Am^{241} contamination. In work up to this time, limited success has been achieved by multiple fractionations on the steam-heated ion-exchange column and by oxidation-reduction steps on the americium, with subsequent removal of the promethium by the use of LaF_3 as a carrier.

A note in the Chalk River report concerning difficulties in purifying plutonium separated by the Trigly process indicated a possibility that this solvent (Trigly) might extract americium. Preliminary experiments with Trigly (triglycol dichloride) for plutonium extraction indicate that this solvent easily extracts more than 90% of the plutonium from a 7 *N* HNO_3 solution. However, the results of the extraction of americium were not encouraging (about 10%); additional work will be required to obtain better data before any conclusions can be drawn.

The oxidation of americium to the plus-five valence state with periodic acid and co-precipitation with $Zr(IO_4)_4$ were tested. The promethium left in solution was carried on LaF_3. The results showed that 8.2% of the americium was carried on the $Zr(IO_4)_4$ with a loss of 3.6% of the promethium; 44% of the promethium and 21.8% of the americium were carried on the LaF_3; 24.4% of the promethium and 33% of the americium were left in the filtrates from both precipitation steps.

The method previously reported, which was the oxidation of americium in 40% K_2CO_3-NaOCl solution followed by $SrCO_3$ or $La_2(CO_3)_3$ precipitation to carry the promethium, is also being studied; this method has given the best decontamination so far. Other methods to be studied are extraction of promethium from 10 *N* HNO_3 with TBP, and ion-exchange column fractionation with 13 *N* HCl or HCl plus organic solvents.

It appears that the most promising use for Pm^{147}, a pure, 0.2-Mev beta emitter, is in phosphor activation. For this purpose, the presence of 490-y Am^{241}, which emits a 5.4-Mev alpha particle, may actually be beneficial.

Strontium Purification

Two test runs were made by using approximately 500 mc of Sr^{90} obtained from the ion-exchange process in Building 3026. The product contained an excessive amount of organic matter that had carried through from the ion-exchange operations. Attempts were made to burn out the organic material, but there is some indication that the high temperatures required may cause the Sr^{90} to fuse into the quartz. The effect of residual sulfate from the resin, which survives the burning operation, is not clear. Methods using wet chemicals (excluding perchloric acid) have been ineffective in destroying this organic residue.

Europium Activation

A 10-mg quantity of Eu_2O_3 was activated in the LITR for 7 days and 13 hours. The neutron flux was measured by a cobalt-alloy monitor and was found to be 1.15×10^{13} neutrons/sec·cm^2. The Eu_2O_3 was analyzed spectrographically and was found to contain Sm_2O_3 in the ratio of $Sm/Eu \times 100 = 7.5$. The activity of the oxide was measured in terms of milliroentgens per hour at 1 m over a period of 18 days. It was estimated from these data that about 0.02 curie of $Eu^{152,154}$ was present. A plot of radiation readings vs. time showed the presence of the 9.2-h Eu^{152} and 47-h Sm^{153} activities in addition to the $Eu^{152,154}$ activities of about 5.3 years. By using an effective activation cross section of 841 barns for natural europium, the 10-mg sample should have given a yield of 0.024 curie of the 5.3-y $Eu^{152,154}$ activities. It was concluded that moderate samarium contamination in Eu_2O_3 would have no significant effect on the production of $Eu^{152,154}$ sources. Therefore, the purification of Eu_2O_3 for activation need not proceed to the ultra-pure stage. This general problem is still active, particularly with regard to a source holder for Eu_2O_3 pellets.

Fission-Product Equipment

Precipitation Process, Building 3515. Runs are being made with cold chemicals to check the operation of the precipitation-process equipment. Needle valves were found to be unreliable and are being replaced with gate valves. An additional vacuum filtration vessel to serve precipitator No. 2 is being installed.

Source Assembly Station, Building 3013. Orders have been placed with vendors for the manipulating equipment to be installed in the source assembly cell.

Gaskets in the waste-holdup tank outside Building 3013 were replaced, and all flanges were found to be leak-proof by testing with water. Leaking valves in the jet steam lines were replaced.

Instruments, wires, and the conduit that will not be used in the source assembly station were removed.

Hot Chemistry Cell, Building 3029

Installation of scatter shielding and of a carrier lid hoist at the hot chemistry cell was completed.

The following tools were designed, fabricated, and installed: brackets for tools, two screwdrivers adapted for Argonne hands, a device for opening aluminum rabbits, one scissors-type snare tong, and one electromagnet and control box.

Underground Storage Facility

Installation of 40 stainless steel tubes in the underground storage facility was completed. It is planned to move much of the Co^{60} now stored in the canal to this facility. Shielding plugs, storage containers, and a carrier positioner are being fabricated.

Sulfur Purification Unit, Building 3032

Drawings for the sulfur purification project have been completed by the Engineering Department, and a preliminary cost estimate has been obtained. Fabrication of equipment has not been started.

Instrument Room, Building 3038

Preliminary sketches for a cost estimate of the instrument room are complete with the exception of the placement of the air-conditioning unit. The filter for the modification of this unit is expected to arrive by November 8.

Processed Radioisotope Production

Table 4 is a list of radioisotope product solutions that were prepared during October.

Special Preparations

Forty-three Co^{60} sources were loaded with a total of 250.4 curies.

TABLE 4. RADIOISOTOPES PRODUCED DURING OCTOBER

PRODUCT SOLUTION	SOURCE	AMOUNT (mc)	SPECIFIC ACTIVITY (mc/g)
Calcium (Ca^{45} – 180 d)	ORNL graphite reactor	97	0.386
	Hanford reactors	469	34.1
Chromium (Cr^{51} – 26 d)	Hanford reactors	1280	600
Iron ($Fe^{55,59}$ – 2.9 y, 46.3 d)	Hanford reactors		
Fe^{59}		46	8.7
Fe^{55}		64	12.2
Nickel (Ni^{63} – 85 y)	Hanford reactors	54.9	9.7
Thallium (Tl^{204} – 2.7 y)	Hanford reactors	5220	678
Sodium (Na^{22} – 2.6 y)	Cyclotron	3.98	249
Manganese (Mn^{54} – 310 d)	Cyclotron	20.6	Carrier-free
Zr^{95}-Nb^{95} (65 d, 35 d)	Fission products, ORNL graphite reactor		
Nb		131.9	Carrier-free
Zr		120	Carrier-free

Two Cs^{137} sources were prepared that contained a total of 750 mc.

Six calibrated 3-in. P^{32}-bakelite plaques were shipped, and 116 plaques were molded.

Miscellaneous Work

The master-slave manipulator crates and 14 empty $ZnBr_2$ carboys were returned to the Shipping Department.

The dry box for handling radium was moved from Building 3013 to the Building 3014 annex for use by the Chemistry Division.

The department inventory of tongs was revised, and the material in the store room and on the storage pad was inspected.

A bank of lights was made for the Building 3026 cell.

All the radioisotopes stored behind the barricade in the Packing and Shipping Building, 3038, have been moved into the new lead barricade, which, it is hoped, will reduce scattered radiation and lower the exposure to operating personnel.

RADIOACTIVE-WASTE DISPOSAL

A complete shutdown of the hot pilot plant, Building 3019, was made to determine the source of excessive wastes discharged into tanks W-1 and W-2. After several weeks of investigation, a control of the flow has been established although it is not certain whether all the sources have been located.

The transfer of uranium slurry from tank W-7 to W-10 by means of the existing pump has been discontinued because of the inefficiency of the pump. This process will be resumed when adequate equipment is made available to accomplish the work.

An integrating recording flowmeter and sampling pump were installed in manhole No. 3, which services the process-waste system from the ORNL graphite reactor fan house, Building 3003, the low-intensity test reactor, Building 3005, and the "hot" shops, Building 3006. The highest flow recorded to date has been 100 gal/hr and bears almost no activity.

The cooling water to the still condenser of Building 3026-D has been rerouted from the process system to the storm sewer to reduce the unnecessary load on the settling basin.

Approximately 900 gal of concentrated chemical waste from tank W-8, which contained 28.3 curies of beta activity, was moved to chemical-waste pit No. 2. The total transferred to this pit to date is 17,100 gal and bears 318 beta curies of activity.

The use of water spray as a foam breaker in the waste evaporator has been discontinued after several tests showed that doubtful benefit was derived from its use. Superheated steam, introduced through several nozzles, is being investigated for use as a foam breaker.

Waste Discharged to White Oak Creek

A total of 34.0 curies of beta activity was discharged to White Oak Creek from the settling basin and the retention pond (see Table 5). The discharge was very low until the last week of the month when activity was introduced into the process-waste system from the Decontamination Building, 3036.

Chemical-Waste Evaporator

The chemical-waste evaporator was operated at a high rate during October to reduce the excessive waste inventory.

The shearing of another pin occurred in one of the valves in the line from the evaporator to the concentrate storage tank; the pin will be replaced as soon as a shutdown and decontamination are possible. Evaporator operation is shown in Table 6; waste-tank inventory is shown in Table 7.

TABLE 5. ACTIVITY DISCHARGED TO WHITE OAK CREEK

DISCHARGED FROM	OCTOBER 1952		SEPTEMBER 1952	
	Gallons	Beta Curies	Gallons	Beta Curies
Settling basin	16,555,000	31.50*	19,997,200	42.74
Retention pond	304,000	2.52	312,000	0.84
Total	16,859,000	34.02	20,309,200	43.58

*Less than 1.73 curies contributed by the evaporator operation.

TABLE 6. 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
October 1952	201,485	12,317	16.4:1	7,507	1.73
September 1952	186,736	9,626	19.4:1	12,030	0.93

Waste-Tank Inventory

TABLE 7. WASTE-TANK INVENTORY

TANKS	CAPACITY (gal)	FREE SPACE (gal)	
		October 1952	September 1952
Hot-Pilot-Plant Storage			
W-3, 13, 14, 15	48,500	31,000	31,000
Chemical-Waste Storage			
W-5	170,000	90,800	27,500

TABLE 7. (continued)

TANKS	CAPACITY (gal)	FREE SPACE (gal)	
		October 1952	September 1952
Evaporator-Concentrate Storage			
W-6, 8	340,000	40,600	50,500
Metal-Waste Storage			
W-4, 7, 9, 10	543,000	219,000	229,000

RaLa (Ba^{140} – 12.5 d)

The analytical summary for run No. 57 (shipped on October 1), which was not available for last month's report, is included in the outline that follows. All results are corrected to the last separation time of 1550 on September 30.

Slugs loaded	107 Hanford 8-in. slugs
Slugs dissolved	106 Hanford 8-in. slugs (by analysis)

	Curies	Per Cent
Total product dissolved	40,297	100.00
Cell A losses	7,122	17.67
Resin-cubicle losses	1,386	3.44
Total losses accounted for	8,508	21.11
Estimated product shipped (based on ion-chamber readings)	18,500	45.91
Losses unaccounted for		32.98
Material balance	27,008	67.02

Los Alamos has reported that their direct radiation measurements indicated only 9000 curies to be present in the shipment; the reason for the discrepancy is unknown. There is no reason to believe that any product was left behind or lost in any of the waste systems, as was the case during run No. 50.

After the product was shipped, the process filters were unplugged by backwashing. Tests indicated that the equipment operated unsatisfactorily because it was physically plugged rather than because of leaks. Filtration tests were made on the flow from the extraction tank to the resin cubicle, as well as to the waste tanks. In both cases the performance was satisfactory under vacuum.

However, a more thorough check was later made of the filter system, and losses were found to occur when solutions were put through the filters under pressure. This leak in the system may be the cause of the high loss that was unaccounted for in run No. 51, as well as the smaller losses that were unaccounted for in previous runs. It may also explain at least part of the excessive filtration time required in the last two runs.

Decontamination of the process filter cubicle, in preparation for repairs, was conducted until all known methods failed to lower further the radiation levels. These levels are still so high that it is impossible to make a satisfactory visual inspection of all the piping. It is believed that contamination has seeped between the lead shielding and the stainless steel liner and that to reduce further the radiation it would be necessary to dismantle the entire lead shield.

The valve and filters that have been successfully removed were found to have gaskets in poor condition; therefore, if the piping is in good condition, the dismantling of the cubicle will not be necessary at this time. The gaskets will be replaced and the equipment will be assembled and tested before making any further attempts to reduce the radiation in the cubicle.

The rebuilding of the No. 300 resin-column cubicle is now under way. The delay in the procurement of new parts and materials is slowing down the work.

RADIOISOTOPE SALES DEPARTMENT

Radioisotope shipments made during October 1952 are compared with those made during September 1952 and October 1951 in Table 8. A breakdown according to separated and unseparated material (including totals for August 1946 through September 1952), and for project, nonproject, and foreign shipments is also shown.

HANFORD IRRADIATIONS

The radioisotope samples listed in Table 9 were received from Hanford during the month.

CYCLOTRON RADIOISOTOPES

Table 10 is a list of the orders now on hand for cyclotron radioisotopes.

Table 11 is a list of the number of radioisotope bombardments received and requested during October.

Table 12 shows the quantity of radioisotopes that were cyclotron-processed and the number of shipments of radioisotopes that were made during October. Also shown are totals to date as divided into millicurie and service-irradiation amounts.

TABLE 8. RADIOISOTOPE SHIPMENTS

	OCTOBER 1952	SEPTEMBER 1952	OCTOBER 1951	AUGUST 1946 TO OCTOBER 1952, INCLUSIVE
Separated material	715	703	685	29,698
Unseparated material	165	167	147	8,151
Total	880	870	832	37,849
Nonproject	769	767	710	
Project	93	88	117	
Foreign	18	15	5	
Total	880	870	832	

TABLE 9. RADIOISOTOPES RECEIVED FROM HANFORD ON OCTOBER 31

SAMPLE NUMBER	MATERIAL	NUMBER OF PIECES	DATE DISCHARGED
ORNL-156	Cadmium	1	October 1952
ORNL-139	Indium metal	1	October 1952
ORNL-158	Antimony	1	October 1952
ORNL-141	Sm^{154}	1	October 1952
ORNL-142	Sm^{150}	1	October 1952
ORNL-60	Potassium chloride	2	9/18/52
		1	8/13/52
ORNL-88	Tin	1	October 1952
ORNL-164	Hafnium oxide	1	October 1952
ORNL-144	Chromium metal	1	October 1952
ORNL-147	Iron oxide	1	October 1952
ORNL-165	Calcium carbonate	3	October 1952
ORNL-149	Mercuric oxide	1	9/18/52
ORNL-13	Beryllium nitride	64	October 1952

ACTIVATION ANALYSES

A total of 61 requests has been received for information concerning activation analyses. Twenty-one of these have developed into requests for analyses, eight of which have been completed.

TABLE 10. CYCLOTRON-RADIOISOTOPE ORDERS

MATERIAL	AMOUNT (mc)	SERVICE IRRADIATIONS	STATUS
Be^{7}	8.0		Material has been requested
Na^{22}	15.10		Material has been requested
Mg^{28}		1	Material has been requested
Ti^{44}		1	Material has been requested
Cr^{48}		1	Material has been requested
As^{73}	2.02		Material has been requested

TABLE 11. 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			10	500.25	4	300.00
Mn^{52}					2	20.00		
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	2	80.60	1	34.00
Zn^{65}	1	100.00	1	47.80				
Ga^{67}					11	77.75		
As^{73}			1	10.50	3	30.50		
As^{74}	1	5.00						
Sr^{85}	3	89.75			1	10.00		
Y^{88}	1	10.00						
I^{125}							2	60.00
Molybdenum metal			1	10.00	2	15.70	5	50.40
Potassium chloride	1	1.00						
Sulfur					1	2.00		
Total received	11	455.75	15	657.40	47	1078.80	23	984.40

TABLE 11 (continued)

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 Requested but not Received								
Na^{22}					1	200.00		
Ti^{44}			1	10.00				
Mg^{28}			1	10.00				
Cr^{48}			1	10.00				
$As^{73,74}$					1	10.00		
Total hours outstanding (not received or requested)		1044.25		812.60		211.20		515.60

TABLE 12. PRODUCTION AND SHIPMENTS OF CYCLOTRON-PROCESSED RADIOISOTOPES

MATERIAL	NUMBER OF SHIPMENTS OCTOBER 1952	TOTAL PRODUCT (mc)		NO. OF SERVICE IRRADIATIONS	
		October 1952	To Date	October 1952	To Date
Be^{7}			368.743		4
Be^{9}	4			4	4
Na^{22}	8	3.403	87.557		
Mn^{52}			10.991		
Mn^{53}	1			1	1
Mn^{54}			19.22		
$Fe^{55,59}$			63.64		4
Co^{57}			4.144		
Zn^{65}	1	0.5	42.5		4
Ga^{67}	8			8	36
As^{73}			4.760		
As^{74}					1
Sr^{85}			6.0		
Sr^{88}			25.0		
Sr^{90}					1
Mo^{95}					9
KCl					1

SF MATERIAL CONTROL

One carload-lot shipment of SF material was received from Hanford during October; this shipment consisted of 240 irradiated uranium slugs for the Purex process and three lead pots containing miscellaneous radioisotopes.

An additional 1623 silicon-bonded, aluminum-jacketed, normal uranium slugs were received from Y-12 during October for use in the ORNL graphite reactor.

During October 6.438 kg of 93%-enriched uranium was received for use in fabricating fuel elements for the Idaho materials-testing reactor. In addition, 5.36 kg of 93%-enriched uranium was received for use in fabricating Convair fuel assemblies.

Thirty MTR fuel assemblies and four control rods were shipped to Phillips Petroleum Company, Scoville, Idaho, which makes a total of 214 fuel assemblies and 35 control rods shipped to date.

On October 9, four samples of depleted uranium and plutonium contained in UNH solutions from the Scrup process were shipped to Chalk River, Canada, for check analyses in accordance with the agreement negotiated between the USAEC and the National Research Council of Canada relative to the purchase of Chalk River fuel rods.

The lack of decision regarding the disposition to be made of plutonium extracted from Chalk River fuel rods (Scrup process) and Hanford slugs (Purex process) has resulted in an increase of the quantity in storage to 750 g of plutonium, which is in 13 containers. Practically all the available space in vault No. 3008 has been utilized and storage of additional quantities will necessitate the use of the vault in Building 2068.

The fissionable-material requirements of ORNL and Y-12 for the calendar year 1953 were prepared and submitted during the month.

On October 6, personnel from the USAEC SF Accountability Office began an SF survey at the Laboratory which involved an audit of records, inquiries relative to the effectiveness of internal control, discussions with personnel possessing SF material as well as analytical chemistry personnel, and spot checks of internal-material balances. One major step was undertaken in connection with the verification of inventory balances on MTR fuel plates to test the accuracy of uranium content and to attempt to place limits of recognized uncertainty on finished plates and assemblies. In the procedure utilized, 20 plates and two cores were sent to Westinghouse Electric Company for gamma scan readings. One plate was selected as a standard and it will ultimately be dissolved for the determination of its uranium content. (Dissolution work is now in progress.) Results of the gamma scan readings indicate a possible variance from the standard of approximately $\pm 1.3\%$. If the data secured are satisfactory, it is planned to fabricate and install a scanning apparatus for use at the rolling mill.

SF surveys during the month consisted in visiting one person possessing SF material, and no apparent discrepancy was encountered. In addition, the records of three analytical laboratories were auditied; this disclosed that all records were in good order and that proper accounting had been made for all samples.

There were 28 receipts and 30 outgoing shipments of SF materials during October compared with 18 receipts and 45 shipments last month. Tables 13 and 14 are summaries of receipts and shipments for the month.

TABLE 13. SF MATERIALS RECEIVED

FROM	MATERIAL	NUMBER OF SHIPMENTS	AMOUNT (g)
Argonne National Laboratory	Depleted uranium	3	19,331.70
	Plutonium in depleted uranium		6.52
Brookhaven National Laboratory	Depleted uranium	1	17.83
	Plutonium in depleted uranium		0.01
California Research and Development Co.	Normal uranium (uranium-zirconium plates)	1	2,970.00
Carbide and Carbon Chemicals Co., K-25	Depleted uranium	1	1,145.00
	Plutonium in depleted uranium		0.001
	Normal uranium (U_3O_8)	2	0.35
Carbide and Carbon Chemicals Co., Y-12	Enriched uranium	5	11,084.87
	U^{233}	1	257.70
	Normal uranium	5	1,949,968.00
	Thorium	1	0.30
	U^{236}	1	0.38
General Electric Co. AGT	Enriched uranium	1	0.25
General Electric Co. HGE	Thorium	1	827,800.00
	Depleted uranium	1	497,860.00
	Plutonium in depleted uranium		285.00
Knolls Atomic Power Laboratory	Depleted uranium	1	1,167,000.00
Phillips Petroleum Co.	Enriched uranium	1	0.03
Westinghouse Electric Corporation	Enriched uranium	2	207.01

TABLE 14. SF MATERIALS SHIPPED

TO	MATERIAL	NUMBER OF SHIPMENTS	AMOUNT (g)
Argonne National Laboratory	Depleted uranium	1	20,988.00
	Plutonium in depleted uranium		0.30
	Normal uranium (zirconium-clad plates)	1	120.25
Carbide and Carbon Chemicals Co., Y-12	Depleted uranium	1	16.57
	Normal uranium	3	1,904,562.01
	Enriched uranium	7	39.87
	U^{233} in $UO_2(NO_3)_2$	3	645.54
	U^{236}	1	0.20
Mallinckrodt Chemical Works	Normal uranium	1	8,222.50
Phillips Petroleum Co.	Enriched uranium	9	6,417.82
USAEC, Chalk River, Canada	Depleted uranium	1	164.60
	Plutonium in depleted uranium		0.08
USAEC, New York Operations Office	Normal uranium	1	0.39
Westinghouse Electric Corporation	Enriched uranium	1	205.39