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OPERATIONS DIVISION

MONTHLY REPORT

FOR MONTH ENDING

AUGUST 31, 1951

M. E. Ramsey

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OPERATIONS DIVISION
MONTHLY REPORT
for
Month Ending August 31, 1951

by
M. E. Ramsey

DATE ISSUED JAN 15 1952

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CARBIDE AND CARBON CHEMICALS COMPANY
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SUMMARY

1. Lost-pile operating time averaged 6.7%, compared to 10.3% in July and 9.8% for the year to date (Page 2).

2. One ruptured slug was detected and discharged during the month (Page 2).

3. Approximately 20% of the Al-Si bonded slugs are failing the five-day local test (Page 2).

4. The canal demineralizer has proved very effective in removing radioactivity from the canal water (Page 2).

5. Repairs have been completed on the Low Intensity Testing Reactor, and it is ready for operation (Page 3).

6. The distillation and scrubbing of iodine were investigated in connection with the proposed iodine plant (Page 5).

7. A leak occurred in the rare-earth evaporator, causing the Chalk River waste separation equipment to be shut down most of the month (Page 8).

8. The problem of removal of the fluoride ion from demineralized water was studied during the month (Page 10).

9. Approximately 41,000 gal of radioactive waste were transferred to the chemical waste storage pit (Page 12).

10. The activity discharged to White Oak Creek was 17.9 curies, compared to 8.9 curies during July 1951. The increase was largely due to the leak in the Chalk River waste separation equipment and to the effluent from the Graphite Pile canal (Page 13).

11. RaLa Run No. 45 was started on August 12, 1951, and 8,722 curies of product were shipped on August 16, 1951 (Page 14).

12. Since the operation of the equipment was not very satisfactory during the RaLa run and failed during a subsequent test run, one of the cubicles is being rebuilt, incorporating appreciable changes (Page 14).

13. There were 759 radioisotope shipments, compared to 809 shipments during the previous month (Page 18).

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PILE DEPARTMENT

OPERATING DATA

	AUGUST 1951	JULY 1951	YEAR TO DATE 1951
Total accumulated kwh	2,628,061	2,439,677	19,931,929
Average kw/operating hour	3784.47	3655.77	3789.15
Average kw/24-hour day	3532.34	3279.14	3417.68
Per cent lost time	6.7	10.3	9.8
Excess pile reactivity	130 in hr	135 in hr	
Slugs discharged	73	154	2924
Slugs charged	73	263	3028
Product made (gm)	95.91	89.04	727.44
Product discharged (gm)	8.41	9.06	361.84

PILE OPERATIONS

Graphite Pile - The average pile power per operating hour for the month was 3784.5 kw, compared with 3655.8 kw for July 1951.

The pile-down time was 6.7%, compared with 10.3% in July 1951, and 9.8% for the year to date. The decrease was due mainly to a reduced number of special research shutdowns.

One ruptured slug was detected on August 20, 1951. The last rupture occurred on April 22, 1951. The data are as follows:

RUPTURE NO.	CHANNEL NO.	DAYS IN PILE	APPROXIMATE TEMPERATURE
88	2161	1957	190°C

Approximately 10,000 Al-Si bonded slugs have been received from Y-12. About 4000 of these have been tested for one week in ovens at a temperature of 400°C. Some lots developed a high percentage of blisters (raised areas on the surface of the slug), while others showed less than 10% rejects. The over-all rate of failures has been about 20%. It is believed that this is caused by an irregular rate of growth of an U-Al compound. The latest lots produced at Y-12 are being tested to determine if any improvement in blistering has occurred. Efforts are being made to determine positively the cause of blistering.

The canal demineralizer has proved very effective in removing radioactivity from the canal water. The sand filters used to remove particles before the water enters the resin columns have apparently removed most of the suspended matter, since the activity is no longer reduced in the effluent from the sand filters. However, the effluent from the resin columns is reduced in activity from

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500-2000 beta counts/min/ml at 10% geometry to 0-5 beta counts/min/ml.

Because of the large amount of minerals in the canal water, the effluent from the resin columns is quite acid (*p*H about 3.5). To remedy this, it is proposed to use as feed water the demineralized water from several pile experiments. This will be used as makeup, and eventually the amount of dissolved matter in the canal water should be reduced.

Lead shields will be built around each resin column, since large amounts of radioactivity are removed by the columns.

The three new safety rods being built to replace the four now in the pile will be completed soon. Special cables ordered for the new safety rods have been delayed, however.

Approximately 400 slugs will be irradiated during September for the Army Chemical Corps.

When the present pile loading is discharged, slugs having 10 to 50 gm of plutonium/ton will be kept separate, in accordance with a recent AEC request.

Low Intensity Training Reactor - After completion of the training program for a group of Phillips Petroleum Company employees, several weeks were spent in testing instruments for the MTR. Following this, the reactor was shut down for extensive maintenance work on instruments and for painting the inside of the reactor tanks. *A* tank was completely painted and *B* tank was painted as low as possible.

After the maintenance was completed, a series of experiments were added to the lattice. After each change, the shim rods were withdrawn until the reactor was critical and the effect of each lattice change observed. In preparing the reactor for experimental work, the beam holes were carefully cleaned and measured.

Addition of the extra shielding has been completed and the exhaust air system is nearing completion.

A withdrawal mechanism has been prepared for the fission chamber which eliminates the necessity of adjusting the chamber manually.

FILTER HOUSE

Table 1 compares the pressure drop in inches of water, gage, across the exit air filters last month with that of this month, and that experienced when all filters were clean.

TABLE 1

DATE	GLASS WOOL (in. wg)	CWS NO. 6 (in. wg)	TOTAL ACROSS HOUSE
8-31-51	3.0	1.4	5.7
7-31-51	2.9	1.4	5.5
Clean Filters	1.1	1.0	3.3

FAN HOUSE

The operation of the fans was normal throughout the month. Both fan bearings were inspected. A small metal particle which had scored the inboard bearing of the No. 3 fan was removed.

RADIOISOTOPES

Table 2 is a comparison of the radioisotopes and research samples charged into the pile during August 1951 with those handled in July 1951.

At the end of August, there were 395 cans of target material in stringers 13, 14, and 16, compared to 371 cans of target material in these stringers at the end of July 1951.

WATER DEMINERALIZATION BUILDING

The operation of the building was normal, with 467,820 gal of water being demineralized, of which 53,510 gal was also deaerated (Table 3).

TABLE 2

	AUGUST 1951		JULY 1951	
	RESEARCH	RADIOISOTOPES	RESEARCH	RADIOISOTOPES
Stringers 13, 14, and 16	17	146	17	114
Hole 22	69	1	59	7
All other holes	7	19	7	30
Total by groups	93	166	83	151
Total for month	259		234	

TABLE 3

PRODUCED (Gallons)	AUGUST 1951	JULY 1951	YEAR TO DATE
Demineralized	467,820	688,200	4,892,210
Deaerated	53,510	109,380	404,670

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CHEMICAL SEPARATIONS AND RADIOISOTOPE DEVELOPMENT DEPARTMENTS

RADIOISOTOPES

Iodine (I^{131} - 8d) - Twenty-five ORNL slugs and two Hanford slugs were processed in six runs; 36,576 mc was shipped.

The scrubber solutions in three of the runs were processed separately to prevent a repetition of the high product losses described in last month's report. In the remainder of the runs, the distillates from the scrubber solutions were processed with those of the main portion of the runs. The high losses were prevented by adding extra caustic to the crude distillates of the scrubber portion of the runs.

During the shutdown after the Hanford slug runs, the glassware cubicle was decontaminated and overhauled. The ring balance on the dissolver in the cell was also overhauled.

Iodine development work - After several weeks' delay, the Engineering Department resumed work on piping and equipment layout drawings.

Several discussions concerning instrumentation for this process were held with the Instrument Department. That department will prepare specifications and necessary drawings for submission to the Foxboro Instrument Company, which will then furnish detailed designs and recommendations for all instrumentation involving their equipment.

Approval for construction has not been received. After the few remaining design problems are completed, work on the project will be halted.

The distillation and scrubbing of iodine was investigated in laboratory scale equipment with tracer I^{131}.

Air sparging - In this run, four cold water scrubbers and two caustic scrubbers were used past the catch tank. The I^{131} was distilled at 100°C, using KNO_2 and HNO_3 to oxidize the I^- to I_2 and also to form oxides of nitrogen within the solution. Sparging was done with air plus steam at 0.5 cu ft/hr. The dissolver contained 0.01 mg of inactive I^-.

Per cent I^{131} remaining in dissolver	28.6
Per cent distilled I^{131} in water scrubbers	79.4
Per cent distilled I^{131} in caustic scrubbers	20.6

Oxygen sparging - The conditions given above were duplicated, with the exception that O_2 was used in place of air for sparging.

Per cent I^{131} remaining in dissolver	21.52
Per cent distilled I^{131} in water scrubbers	89.00
Per cent distilled I^{131} in caustic scrubbers	11.00

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Carbon dioxide sparging - Conditions were the same as above except that CO_2 was used for sparging.

Per cent I^{131} remaining in dissolver	24.7
Per cent distilled I^{131} in water scrubbers	87.3
Per cent distilled I^{131} in caustic scrubbers	12.7

Oxygen sparging, HNO_3 in scrubbers - In this run, 70% HNO_3 was substituted for water in the four scrubbers; otherwise the conditions were the same as those for oxygen sparging alone.

Per cent I^{131} remaining in dissolver	58.98
Per cent distilled I^{131} in HNO_3 scrubbers	81.35
Per cent distilled I^{131} in caustic scrubbers	18.65

70% HNO_3 in dissolver - In this run, the I^{131} was added to the 70% HNO_3 in the dissolver and sparged with a mixture of air, steam, and NO_2. No I^{131} activity was removed from the dissolver during the course of the run. Preliminary tests indicated that I^- had been oxidized to IO_3^-.

Modified apparatus: bubble cap tower - The iodine apparatus was modified to include a two-plate bubble cap tower in place of the four water scrubbers. One caustic scrubber was used. A run was made similar to No. 1 with stainless steel being added to the dissolver. Water was used in the bubble cap tower.

Per cent I^{131} remaining in dissolver	24.8
Per cent distilled I^{131} in bubble cap tower water	95.9
Per cent distilled I^{131} in caustic scrubber	4.1

Phosphorus (P^{32} - 14.3d) - Eight 2500-gm cans of irradiated sulfur were processed and 8771 mc shipped. The equipment operated satisfactorily this month.

Carbon (C^{14} - 5740y) - Seven hundred and eighty-one mc of C^{14} as $BaCO_3$ was produced during the month. Ten slugs were also run under special conditions to collect possible He gases for the Chemistry Division. The analysis of the C^{14} from these slugs has not been completed.

Iron (Fe^{59} - 47d) - A 50-gm sample of X-10-irradiated $K_4Fe(CN)_6$ was processed for Szilard-Chalmers Fe^{59}, with the following analysis:

Total Fe	0.13 mg/ml
Concentration Fe^{55}	2.09×10^{-5} mc/ml
Concentration Fe^{59}	0.0024 mc/ml
Specific activity	0.0018 mc/mg

The Szilard-Chalmers reaction on ferrocyanide does not appear practical for radioisotope production, which is in agreement with opinions previously held on the subject.

Iron (Fe^{55} - 4y) - An Fe^{55} product was made from enriched Fe^{54} with the following analysis:

Total volume	75 ml
Concentration Fe^{55}	0.71 mc/ml
Concentration Fe^{59}	<0.0007 mc/ml
Concentration Co^{60}	4.6×10^{-6} mc/ml

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Specific activity	538 mc/gm
Fe	1.32 mg/ml
Acidity	0.076 *N* acid
Total Fe^{55}	53.2 mc

Iron (Fe^{59} - 47d) (Cyclotron) - Two ferric chloride solutions were prepared from deuteron-bombarded cobalt. Most of the iron separated was not radioactive.

Indium (In^{114} - 50d) - Indium chloride solution was prepared with the following analysis:

Total volume	100 ml
Concentration	1.61 mc/ml
Total indium	7.0 mg/ml
Specific activity	230 mc/gm
Normality	0.22 *N* acid
Heavy metals	<10 ppm
Total solids	18.2 mg/ml
NVM	6.5 mg/ml
Radiochemical purity	>99%

Fission Products - Most of the work this month has been devoted to developing operational techniques to reduce the time of production, and to produce the necessary fission product fractions. Washing column 2 with 0.25 *M* $(NH_4)_2SO_4$ was omitted and the products were removed directly from the 100-ml columns instead of from the 10-ml columns. Satisfactory results have been obtained as far as the recovery of Zr-Nb and mixed fission products (70 to 80% recovery) is concerned. Sufficient Sr^{89-90} was separated to obtain a pure strontium product (after repurification in Building 3030). Approximately 20 curies of rare earths was obtained practically free from alpha contamination (30 alpha counts/min/ml).

Ruthenium Purification Process - Equipment for purification of Ru has been installed in cubicle 6 of Building 3030. The unit was thoroughly tested and three inactive Ru runs were made. Final adjustments are being made, and the first tracer run is scheduled for next week. The old Ru equipment on the third floor of Building 3026 was dismantled.

Ruthenium (Ru^{103} - 42d) - The Ru^{103} process has not produced the expected amounts of ruthenium. A thorough investigation of the process is now in progress.

All of the work this month has been with dissolved Hanford slugs. By using larger amounts of fission products, the processing has been simplified.

Two liters of the Hanford UNH were diluted to 10 liters with distilled water and added to column 2. The effluent was boiled to dryness and taken up in two fractions, 250 ml of 1.0 *N* HNO_3 and 6.0 *N* HNO_3.

Results are shown in Table 4.

Strontium (Sr^{90} - 25y) - None was produced. The purification of the three-curie batch that must be reworked for lead removal will be started this week. Solubility curves for $Pb(NO_3)_2$, $Ce(NO_3)_3$, $Zr(NO_3)_4$ and $Sr(NO_3)_2$ in various strengths of nitric acid are being made.

Sulfur (S^{35} - 87.1d) - Carrier-free sulfur 35 as sulfuric acid was prepared with the following analysis:

Total S^{35}	9800 mc
Concentration	78.4 mc/ml
Acidity	0.052 *N* (HCl)
Total solids	0.5 mg/ml
NVM	0.5 mg/ml

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TABLE 4

	VOLUME	GROSS BETA	RUTHENIUM
SS-30-Ru^{103}-P	250 ml 1.0 *N* HNO_3	3.32 mc/ml	0.099 mc/ml
SS-30-Ru^{103}-P-1	240 ml 6.0 *N* HNO_3	1.22 mc/ml	0.037 mc/ml

Tritium (H^3 - 12.5y) - The zirconium-tritium targets being prepared were not completed this month because of difficulty with the palladium valve. A new valve has been made to purify the tritium so that it can be absorbed on Zr. One button containing 200 mc was completed.

An addition to the tritium system has been sketched and submitted to the Glass Shop. This addition will permit the evaporation of the Zr on to the tungsten base in place and thus avoid oxidation of the Zr by eliminating exposure to the air.

Zinc (Zn^{65} - 250d) (Cyclotron) - Zinc chloride solution was prepared with the following analysis:

Total volume	100 ml
Concentration	1.46 mc/ml
Total solids	0.0
NVM	0.0
Normality	0.17 *N* acid
Heavy metals	5 ppm
Zn	0.04 mg/ml
Specific activity	36,500 mc/gm
Purity	>99%

Zinc Bromide - Considerable time was spent on experimental work with the 80% zinc bromide solution used in viewing windows. We are particularly interested in learning how to prevent or reduce discoloration of $ZnBr_2$ solutions used in windows exposed to high radiation fields and how to clarify solutions already discolored. Several large batches of solution were purified for the Chemical Separations Department. A small surplus S.S. Alsop filter was ordered from Y-12 surplus for future work.

A 500-curie colbalt source will be used to test effects of gamma radiation on $ZnBr_2$. Hydroxylamine hydrochloride has been suggested by Argonne to reduce free bromine released by the oxidation effects of radiation. Several sequestering agents will also be tested.

Zirconium-Niobium (Zr^{95}-Nb^{95} - 65d-35d) - Ten liters of Hanford UNH were added to the 100-ml silica gel column (3.0 column volumes/hr). The column was washed with 10 liters of 0.5 *N* HNO_3 in an effort to remove the last traces of Pu. The product was removed with 5% oxalic acid.

Results are shown in Table 5.

There was about 31 curies with alpha count of 400/ml. Note that the Nb^{95} is about 20% of the total activity.

Chalk River Waste Separation - A leak from the inner tank of the rare-earth evaporator to the jacket

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TABLE 5

	VOLUME	ZIRCONIUM	NIOBIUM	ALPHA
SS-30-Nb-Zr-P	200 ml	119 mc/ml	30 mc/ml	62,000 counts/min/ml

was discovered on August 6. Radioactive material leaking into the condensate line was carried to the concrete drain pipe leading to White Oak Creek. A leaking joint in the concrete pipe about 100 ft south of Building 3515 resulted in spreading contamination to a ditch and surrounding area. The following corrective steps were made:

a. The contaminated earth in and near the ditch was removed.

b. Cell floor and pan drains were diverted to W-12 hot-waste storage tank.

c. A four-inch vitreous pipe for semi-hot waste drainage to the settling basin is being installed. The gallery floor drain, process-vessel condensate lines, and condensers will be connected to this semi-hot pipe.

d. The stainless-steel—rare-earth evaporator was replaced by an electrically heated glass unit.

e. The stainless-steel strontium fuming-vessel was removed and a by-pass line was installed.

f. The concrete gallery floor, also contaminated as a result of the afore-mentioned incident, is being decontaminated by chipping. The entire floor will be painted before operation is resumed.

Progress on these jobs has been very slow, and it is not expected that operation of the plant will be resumed before September 17.

Canal Water Decontamination - Several test runs were made to determine operating characteristics, using different methods of regeneration. Each resin column on nitric acid regeneration cycle decontaminated approximately 150,000 gal of water before break-through occurred. On the sodium hydroxide regeneration cycle, each column decontaminated only 72,000 gal before break-through. For this reason, and because the operation is simple, nitric acid regeneration will be used exclusively.

One run, using nitric acid regeneration, was made, recirculating purified water to the head of the canal. The primary purpose was to determine the effects of the low *p*H effluent. After two days of such operation, the canal water *p*H factor dropped from about 7 to 4 and activity of the water increased by a factor of 3. Consequently, it was decided to divert the effluent (about 20 gal/min) to semi-hot drain and to feed the canal with demineralized cooling water from the pile.

Complete decontamination of resin, using nitric acid regeneration, was not possible. Therefore, during the next month, it is planned to decontaminate the resin with citric acid and to shield the units with lead.

Gas Analysis - A^{37} has been admitted to the analytical system.

Efforts to count the A^{37} have been unsuccessful, although the tube behaves exactly as expected with the counting gas only. The characteristics of these tubes have been investigated thoroughly by the Instrument Department.

The failure of the tube is probably due to a small quantity of water in the A^{37}. The gas will be dried with P_2O_5 and counted again.

Removal of Fluoride Ion from Water - The addition of NaF to the Oak Ridge water supply is anticipated. Since fluoride ion may be objectionable in cooling water for the LITR, a brief investigation of removal methods was made. Several methods were tried as follows:

1. By anion exchange resin now used in the demineralizer unit.

A batch equilibrium experiment was performed with Permutite anion exchange resin. The F^- solution was shaken with the resin for a period of one hour and then allowed to stand about 16 hr before sampling. The analyses showed:

Initial F^-	Final F^-
3.8 ppm	2.1 ppm
15.2 ppm	7.1 ppm

A column of the resin, 18 × 2.2 cm, was prepared. Ten liters of 3.8 ppm F^- was passed through the resin bed at a linear flow rate of about 11.0 cm/min. The second and tenth liters of effluent were analyzed.

Second liter	1.1 ppm F^-
Tenth liter	2.6 ppm F^-

These results are in agreement with similar studies reported in the literature.

Aluminum ion was added to F^- solution in an attempt to form AlF_6^{3-} before passing the solution through the anion exchange column. An analysis of the effluent showed:

Initial solution	3.8 ppm each of Al^{3+} and F^-
Second liter	2.5 ppm F^-
Tenth liter	2.9 ppm F^-

2. Aluminum metal plus anion exchange resin.

A column of aluminum powder supported on glass wool was prepared to pre-treat the F^- solution before passing it through the resin column. The F^- solution initially contained 4 ppm F^-. The results showed:

Second liter	0.25 ppm

The aluminum powder gassed very strongly and required constant attention, which prevented the obtaining of data for the tenth liter of effluent. Aluminum turnings will be used to reduce the gassing.

3. $Ca_3(PO_4)_2$ column.

A column of $Ca_3(PO_4)_2$ lumps was prepared and a 4 ppm F^- solution passed through at the ~11 cm/min flow rate. The analysis showed:

Second liter 0.33 ppm F^-.

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Apparently one of several methods can be devised to treat the LITR water at low cost if fluoride should prove to be a problem.

Source Preparations - Co^{60} sources were loaded in special holders, as follows:

National Bureau of Standards	7 sources: one, 4 mc; two, 8 mc; one, 15 mc; one, 30 mc; one, 100 mc; one, 50 mc
Office of Civil Defense	3 sources: one, 50 mc; one, 4-5 mc; one, ½ to 1 mc
Atomic Energy Commission	1 source, 1.5 curies
Griffin Wheel Company	1 source, 500 mc
General Electric Company	1 source, 500 mc
Gulf Research	1 source, 1 curie
New York University	4 sources, 100-125 mc each
Sloane Physics Laboratory	1 source, 5 curies
Tracerlab, Inc.	20 sources, 500 mc each
Health Division	22 sources, 500 mc each
Froehling and Robertson	1 source, 500 mc
Los Alamos Scientific Laboratory	1 source, 50 curies
Pennsylvania Steel Castings Company	1 source, 1 curie
X-Ray Engineering Company	6 sources, 1 to 1.2 curies each

Packaging

Three milliliters of He^3 was packaged and shipped to Columbia University.

Services

Twenty millicuries of carrier-free P^{32} in a nitrate solution was prepared for the Brookhaven National Laboratory.

Forty-eight glass samples were irradiated for Pittsburgh Plate Glass Company; six samples each were given seven doses of gamma radiation as follows: 25, 50, 100, 200, 400, 600, and 1000 r.

Miscellaneous

The floor of Building 3030 was painted.

The C^{14} tongs were modified and several new fingers were designed for use with Sr^{90} plaques.

Transfer of materials to the new concrete storage platform was completed.

A new storage garden and bottom-discharge carrier shield were designed.

The master-slave cell for Building 3029 was discussed and basic design criteria were established. Final

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design work on this project will be started in the near future.

A low-cost bottle tong for use in the 20-ft hot barricades is nearing completion.

The partition in Room 204, Building 3037, was completed and the new room is in use.

A display showing typical elements of a remote-control operation was built for the symposium now in progress in Oak Ridge.

General - The off-gas system was shutdown for 4 hr to accomplish the following changes:

1. The glass-wool filters were changed, the new filters being packed double to insure maximum efficiency during the RaLa run.

2. A slide valve was installed in the manifold at the Building 3001 line-connection.

3. A humidity and temperature recorder was installed in the system at the exit of the heater for monitoring purposes during the RaLa run.

4. The position of the slide valves at the hot off-gas blowers were changed in preparation for the installation of automatic equipment for changing from the regular blower to the emergency blower in the event of a sudden breakdown.

The emergency off-gas turbine is again in operating condition. The old bearing was repoured; the new bearing has not yet been received.

TANK FARM

General - The transfer of radioactive metal waste supernate from W-10 to the chemical waste storage pit was begun on August 1, 1951, and discontinued on August 7, 1951, after a total of 26,400 gal, bearing 22.88 curies of beta activity, 134 kg of uranium, and 28.15 mg of plutonium was transferred. The transfer from this tank was discontinued because of the high uranium content. Further precipitation by the addition of 850 gal of 50%-caustic was made.

While the precipitate in tank W-10 was allowed to settle, a total of 15,000 gal of evaporator concentrate was transferred from W-8 to the storage pit. This transfer was started on August 7 and completed on August 10. The material carried 192.4 curies of beta activity, 15.5 kg of depleted uranium, and 8.48 mg of plutonium.

The entire transfer operation was successfully carried out. Two portable 500-gal tanks with the Dempster Dumpster truck were used. The operation presented no undue amount of radiation hazard.

The pipe trench, which was dug at the southeast corner of the south tank farm, became highly contaminated when a weld in a process tank jacket failed in Building 3515; the water from the jacket was piped to the storm sewer located in this area. This area has been cleaned up by removing the contaminated soil.

Wastes discharged to White Oak Creek - A total of 17.45 curies of beta activity was discharged from

[redacted]

[redacted]

the settling basin this month, which is an increase over the discharge of last month. Several times during the month large discharges of activities were noted which were traced to the ruthenium operations located on the third floor of Building 3026D and from Building 3001 canal.

Approximately 460 mc were discharged from the retention pond. The activity slowly declined following the high discharge last month as a result of Building 3515 operations. One high rise occurred during the month, which was attributed to a small discharge from the W-9 jet pit.

TABLE 6

Activity Discharged to White Oak Creek

DISCHARGED FROM	AUGUST 1951 GALLONS	AUGUST 1951 BETA CURIES	JULY 1951 GALLONS	JULY 1951 BETA CURIES
Settling basin	28,600,000	17.45*	28,805,000	7.85
Retention pond	363,000	0.46	430,000	1.05
Total		17.91		8.90

*Less than 2.8 curies contributed by evaporator.

Chemical Waste Evaporator

TABLE 7

Waste Evaporator Operation

GALLONS FED TO EVAPORATOR	GALLONS OF CONCENTRATE TO W-6	VOLUME REDUCTION	BETA CURIES TO EVAPORATOR	BETA CURIES TO SETTLING BASIN
August - 204,500	12,000	16:1	6,619*	2.79*
July - 256,700	20,480	11.5:1	3,841	0.37

*The results of one run are omitted; samples were misplaced.

[redacted]

[redacted]

Waste Tank Inventory

TABLE 8

TANKS	GALLONS CAPACITY	AUGUST FREE SPACE	JULY FREE SPACE
HOT PILOT PLANT STORAGE			
W-3, 13, 14, 15	48,500	8,600	7,130
CHEMICAL WASTE STORAGE			
W-5	170,000	49,000	75,000
EVAPORATOR CONCENTRATE STORAGE			
W-6, W-8	340,000	101,000	97,500
METAL WASTE STORAGE			
W-4, 7, 9, 10	543,000	180,000	160,000

RaLa (Ba^{140} - 12.5d) - Run No. 45 was started on August 12, 1951, after cubicle No. 200 was reassembled and put in operating condition. The flowmeter could not be satisfactorily adjusted to be of any assistance during the run.

A total of 150 4-in. Hanford slugs was loaded and dissolved in four batches. It became evident after dissolving the third batch that more than an adequate amount of product was available. Therefore, only the first two and one-half batches were used for the run; the remaining dissolver solution was held as a standby in case of chemical or mechanical failure.

No difficulty was encountered in the Cell A operations with the exception of a radiation shine of 42 r/hr through the blow tank addition line. During the transfer to the resin cubicle, a backup of activity into the Moore transmission system occurred, which resulted in a radiation background of 26 r/hr.

The *p*H adjustment of the feed took an unusually long time (5½ hr) and would not follow the prescribed curve. About midway through the passage of feed through the column, another check of the *p*H showed that it was again above the prescribed 6.1 to 6.5 limits. The *p*H was again adjusted to the desired level only after it was overshot in both directions several times.

On the basis of this evidence, it is now believed that *p*H of the feed

[redacted]

solution is not stable when the solution is subject to extremely high radiation, which appears to be the weakest point in the new process. It resulted in a loss of much operating time, and undoubtedly accounted for the high loss (6889 curies) in the feed tank rinse as it is surmised that the product precipitated when the *p*H dropped below 6.1 during adjustment. It is also believed that the relatively high loss of 659 curies (3.3%) in the feed effluent was caused by the *p*H rising above the 6.5 limit during the running of the feed through the column.

The run went through the remainder of the equipment without any difficulty, and L.S.T. was reached at 1400 on August 16, 1951. It was shipped as a nitrate at 0930 on August 17 and contained 8722 curies. The product was white and was distributed well in the tip of the cone.

In an attempt to keep the product carrier-free of contamination, it was not put into the loading cubicle until necessary to remove the product cone. In spite of this precaution, the carrier was found to be contaminated up to 10 r/hr, necessitating decontamination before shipment.

Following shipment of the run, an additional 650 curies were stripped off the column with HNO_3 to prove that the volume of HNO_3 elutrient, as called for by the present flowsheet, is inadequate to remove the maximum amount of product.

The column was titrated before and after the run, which indicated that approximately 20% of the resin capacity for cations was lost due to radiation damage.

Upon completion of the aforementioned test, it was found that P.V. 230, a plastic throttling valve, refused to open. As a result of this valve failure, it again became necessary to decontaminate the resin cubicle.

The following is an analytical summary of the entire run:

Slugs loaded - 150 4-in. HEW

Slugs dissolved - 147.2 (by analysis)

	CURIES	PER CENT
Total product dissolved	28,408	100.0
Cell A Losses		
Extraction	143	0.5
Metathesis	427	1.5
A-9 rinse	427	1.5
1/2 Batch C*	3,544	12.5
Batch D*	3,913	13.8
Total Cell A losses	8,454	29.8

	CURIES	PER CENT
No. 200 Resin Cubicle Losses		
Feed effluent	659	2.3
Sodium versenate	218	0.8
HCl elution	396	1.4
Feed tank rinse	6,889	24.2
Fuming nitric	1,570	5.5
Product evaporator rinse	157	0.6
Column holdup (stripped with HNO_3)	650	2.3
Column holdup (stripped during titration)	20	0.1
Total resin cubicle losses	10,559	37.2
Total losses accounted for	19,013	67.0
Product shipped (radiochemical)	8,722	30.7
Material balance		97.7

*One half of Batch C and all of Batch D were not added to the run.

The analytical summary of the resin column process follows:

	CURIES	PER CENT
Product in feed solution	19,994	100.0
Losses		
Feed effluent	659	3.3
Sodium versenate	218	1.1
HCl elution	396	2.0
Feed tank rinse	6,889	34.4
Fuming nitric	1,570	7.8
Product evaporator rinse	157	0.8
Column holdup (stripped with HNO_3)	650	3.3
Column holdup (stripped during titration)	20	0.1
Total losses	10,559	52.8
Product shipped	8,722	43.6
Material balance		96.4

A research run consisting of some wastes, plus one-half of Batch C dissolving and all of Batch D dissolving, was started to test some of the RaLa chemistry. However, it had to be abandoned due to the valve failure.

Instead of repairing the existing equipment, it is now planned to decontaminate and completely rebuild it. The major changes planned at present are:

a. All plastic valves will be eliminated; stainless steel valves will be used where necessary.

b. A stainless steel column will be installed in place of the glass column.

c. The induction flowmeter will be eliminated, and the flow rate will be measured by liquid level changes in the feed tank.

d. The deaerator will be eliminated. Air on the column will go back to the feed tank via a larger feed line.

e. A larger feed tank will replace the present tank.

f. The instrument piping within the cubicle will be made larger to permit more accurate manometer readings.

g. The new feed throttling valve will be placed at the bottom of the column to prevent air from entering the column in the event the valve should leak through the packing.

By the afore-mentioned changes, it is hoped that the pressure feed system now used can be replaced by a gravity feed system.

At the month's end, the cubicle reading up to 100 r/hr was moved to burial ground No. 3 for further decontamination and disassembly.

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RADIOISOTOPE CONTROL DEPARTMENT

GENERAL

During August 1951 there were 759 radioisotope shipments, compared with 809 during July 1951 and 689 during August 1950.

Table 9 gives the breakdown according to separated and unseparated material, as follows:

TABLE 9

	AUGUST 1951	JULY 1951	AUGUST 1950	AUGUST 1946 TO AUGUST 1951, INCLUSIVE
Separated Material 706-D Area	616	678	521	19,923
Unseparated Material 100 Area	143	131	168	5,922
Total	759	809	689	25,845

Table 10 is a breakdown of shipments according to nonproject, project, and foreign shipments, as follows:

TABLE 10

	AUGUST 1951	JULY 1951	AUGUST 1950
Nonproject	633	664	528
Project	114	132	148
Foreign	12	13	13
Total	759	809	689

HANFORD IRRADIATIONS

The following radioisotope samples were received from Hanford during August 1951 (Table 11):

TABLE 11

SAMPLE NO.	MATERIAL	DATE DISCHARGED	DATE RECEIVED
ORNL-60	KCl (2 pcs)	August 1951	8-30-51
ORNL-129	Calcium (2 pcs)	August 1951	8-30-51

CYCLOTRON RADIOISOTOPES

Following is a list of the outstanding orders for cyclotron radioisotopes now on hand:

MATERIAL	AMOUNT	STATUS
Na 22	9.2 mc	Material has been requested
Mn 54	7.0 mc	Material in process
Co 57	5.1 mc	Material in process
Fe 59	71.75 mc	Material has been requested

TABLE 12

Bombardments Received

	MIT		U. OF CALIF.		U. OF PITTSBURGH		WASHINGTON U.	
	BOMBARD-MENTS	BEAM HOURS	BOMBARD-MENTS	BEAM HOURS	BOMBARD-MENTS	BEAM HOURS	BOMBARD-MENTS	BEAM HOURS
Be 7			1	47.2	9	285.00		
Na 22	2	190.00			5	201.75	4	300.00
Mn 52					2	20.00		
Mn 54	1	50.00					4	200.00
Co 57	1	10.00					3	100.00
Fe 59			7	332.8	1	40.00	1	34.00
Zn 65	1	100.00	1	47.80				
Sr 85	2	59.75			1	10.00		

TABLE 12 (continued)

	MIT		U. OF CALIF.		U. OF PITTSBURGH		WASHINGTON U.	
	BOMBARD-MENTS	BEAM HOURS	BOMBARD-MENTS	BEAM HOURS	BOMBARD-MENTS	BEAM HOURS	BOMBARD-MENTS	BEAM HOURS
As 73					1	10.00		
I 125							2	60.00
Molybdenum Metal					1	13.00	3	30.00
Sulfur					1	2.00		
Ga 67					1	4.00		
Total Received	7	409.75	9	427.80	22	585.75	17	724.00
	Requested but not Received							
Ga 67					1	20.00		
Na 22					1	10.00		
Fe 59					1	40.00		
Molybdenum					1	10.00		
Total Hours Outstanding (Not received or requested)		1,090.25		1,072.20		834.25		776.00

TABLE 13

Shipments of Cyclotron-Processed Radioisotopes

MATERIAL	NO. SHIPMENTS AUGUST 1951	NO. MILLICURIES AUGUST 1951	NO. MILLICURIES TO DATE
Be 7	-	-	237.293
Na 22	1	.1mc	49.763
Mn 52	-	-	9.991
Co 57	-	-	3.
Fe 59	-	-	2.1 mc and 2 units
Zn 65	2	3.0 mc	35 mc and 3 units
Mn 54	-	-	2.72
Fe 55-59	-	-	61.
As 73	-	-	.650
Sr 85	-	-	6.

ACTIVATION ANALYSES

The status of the activation analyses work remains the same as shown in the July report.

SF MATERIAL CONTROL

During August, 48 *J* slugs containing 1,980.38 gm of 90 to 95% enriched uranium were received from Y-12 for encasement in six aluminum tubes. Following the encasement, the tubes were shipped to Chalk River, Canada, for insertion in the C.R. pile. The work was for the Westinghouse Atomic Power Division.

An additional 11,904 Al-Si bonded slugs was received from Y-12 for testing and subsequent loading into the Building 3001 pile.

On August 11, 1951, an express car was received from Hanford. The contents of the car consisted of the following: three huge containers carrying 84 slugs for the Purex process, four Phoenix containers loaded with 152 slugs for the RaLa process, and one cask loaded with three thorium slugs.

In response to an urgent request by the AEC, the following amounts of thorium metal were shipped from the Laboratory during August: 422.76 kg of thorium metal turnings was shipped to Iowa State College for reprocessing; 601.96 kg of thorium metal billets was shipped to the US AEC, Tonawanda Suboffice, Buffalo, New York. According to AEC, this material will be used in a high priority program.

The first shipment of decontaminated depleted uranium recovered by the Purex process method was effected during the month. This shipment amounted to 1,245.18 kg of uranium in the form of UNH solution and was sent to Mallinckrodt Chemical Works, St. Louis, Missouri.

SF surveys during the month consisted of visiting five persons possessing SF material. Material in their possession was inspected and weighed where feasible. No apparent discrepancies were encountered.

Records of three analytical laboratories were audited disclosing that all records were in good order and proper accounting had been made for samples.

During the month there were 23 receipts and 28 outgoing shipments, compared with 38 receipts and 24 shipments last month.

On August 20, 1951, the second carload-lot shipment of Chalk River fuel rods was received. The shipment consisted of three containers loaded with 300 12-in. sections of fuel rods. This raises the total number of pieces received to date to 500.

An answer to the AEC, ORO, SF Accountability Report was prepared and submitted in August.

Tables 14 and 15 summarize the receipts and shipments of SF materials for the month of August 1951.

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TABLE 14

Receipts

FROM	MATERIAL	AMOUNT (gm)
A. D. Mackay	Thorium (dioxide)	99.65
Battelle Memorial Institute (BMI)	Thorium (crystal bar)	700.00
Battelle Memorial Institute (BMI)	Normal uranium (metal)	130.00
C&CCC, Y-12 Area	Enriched uranium (U-Al slugs)	1,848.23
C&CCC, Y-12 Area	Enriched uranium (UF_4)	2.00
C&CCC, Y-12 Area	Enriched uranium (UF_4)	2.50
C&CCC, Y-12 Area	Normal uranium (UNH)	133,784.70
C&CCC, Y-12 Area	Normal uranium (UF_4)	9.68
C&CCC, Y-12 Area	Normal uranium (UNH)	232,640.90
C&CCC, Y-12 Area	Normal uranium (slugs)	3,933,950.00 (net)
C&CCC, Y-12 Area	Normal uranium (slugs)	3,926,650.00 (net)
C&CCC, Y-12 Area	Normal uranium (UF_4)	27.40
C&CCC, Y-12 Area	Normal uranium (UNH)	93,839.10
C&CCC, Y-12 Area	Normal uranium (UNH)	.34
C&CCC, Y-12 Area	Normal uranium (slugs)	4,159,550.00 (net)
C&CCC, Y-12 Area	Normal uranium (slugs)	2,311,350.00 (net)
General Electric Co. (AGT)	Enriched uranium (U_3O_8)	.38
General Electric Co. (AGT)	Normal uranium (UO_2)	.20
General Electric Co. (AGT)	Enriched uranium (compound)	.38
General Electric Co. (HGE)	Depleted uranium (slugs)	149,358.00
General Electric Co. (HGE)	Pu (in slugs)	66.00
General Electric Co. (HGE	Depleted uranium (slugs)	270,268.00
General Electric Co. (HGE)	Pu (in slugs)	50.00
General Electric Co. (HGE)	Thorium (slugs)	3,265.85
Iowa State College (ISC)	Thorium (billets)	184,750.00
Iowa State College (ISC)	Thorium (billets)	83,910.00

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TABLE 15

Shipments

TO	MATERIAL	AMOUNT (gm)
AEC, Tonawanda Suboffice (TOA	Thorium Metal (billets)	601,957.00
Argonne National Laboratory (ANL)	1 AW Solution (Purex Process)	Neg.
Battelle Memorial Institute (BMI)	Thorium metal	10,595.40
Battelle Memorial Institute (BMI)	Thorium metal (tubing)	17,305.00
Brookhaven National Laboratory (BNL)	Normal uranium (slugs)	2,333.00
C&CCC, K-25 Area	Depleted uranium (UNH)	3,292.80
C&CCC, K-25 Area	Pu (Nitrate Solution)	.0003
C&CCC, Y-12 Area	Normal uranium (UNH)	50,100.00
C&CCC, Y-12 Area	Depleted uranium (UNH)	1,646.50
C&CCC, Y-12 Area	Enriched uranium (U-Al alloy)	3.08
C&CCC, Y-12 Area	Normal Uranium (UNH)	232,640.90
C&CCC, Y-12 Area	Enriched uranium (UNH)	1.51
C&CCC, Y-12 Area	Normal uranium (bars)	1,000.00
C&CCC, Y-12 Area	Normal uranium (UO_2)	340.30
C&CCC, Y-12 Area	Normal uranium (slugs)	4,664.00
C&CCC, Y-12 Area	Plutonium (nitrate)	.02
C&CCC, Y-12 Area	Enriched uranium (dissolvers soln.)	.08
C&CCC, Y-12 Area	Normal uranium (slugs)	56,292.00
C&CCC, Y-12 Area	Enriched uranium (solution)	.01
C&CCC, Y-12 Area	Enriched uranium (U-Al alloy)	1,848.23
Chalk River (EVG)	Enriched uranium (U_3O_8)	.38
General Electric Co. (AGT)	Enriched uranium (U_3O_8)	.38
General Electric Co. (AGT)	Normal uranium (UO_2)	17.11
General Electric Co. (AGT)	Thorium metal (turnings)	422,759.48
Iowa State College (ISC)	Depleted uranium (UNH)	1,245,179.00
Mallinckrodt Chem. Works (MCW)		

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