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OPERATIONS DIVISION MONTHLY REPORT

FOR MONTH ENDING JULY 31, 1954

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OPERATIONS DIVISION MONTHLY REPORT

for

Month Ending July 31, 1954

by

A. F. Rupp

DATE ISSUED

AUG 9 1954

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CONTENTS

REACTOR OPERATIONS 1

ORNL Graphite Reactor 1

Low-Intensity Test Reactor 2

RADIOISOTOPE PRODUCTION AND SALES 2

RADIOISOTOPE DEVELOPMENT 7

Cs^{137} Sources 7

Inorganic-Exchanger (3-M) Experiments 7

Cesium Process Development 7

Multikilocurie Cell, Building 3029 8

Fission-Products Pilot Plant 9

I^{131} Plant, Building 3028 9

Shielded Transfer Vessel 9

RADIOACTIVE-WASTE DISPOSAL 9

MISCELLANEOUS OPERATIONS 10

Water Demineralization 10

Hydrogen Liquefaction 10

Activation Analyses 10

[redacted]

[redacted]

OPERATIONS DIVISION MONTHLY REPORT

REACTOR OPERATIONS

ORNL Graphite Reactor

Two slug ruptures were found on July 19; both were of bonded slugs, and the uranium was 100% beta transformed. Rupture No. 126 occurred in channel 1961 after the slug had been in the reactor for 826 days at a temperature of 238°C; rupture No. 127 occurred in channel 1263 after the slug had been in the reactor for 819 days at 153°C. One slug had both ends off, while the other had one end off and a longitudinal split in the jacket; rupture No. 127 also had a number of blisters. No explanation for these ruptures has been found. Measurements taken by the Metallurgy Division on the slugs that were discharged along with those that were ruptured show little or no increase in total length. Other rows containing transformed and partially transformed slugs will be measured again to determine whether the growth in these slugs has continued. Operating data for the ORNL Graphite Reactor and the LITR are given in Table 1.

The air motor on the underwater slug cutter failed because of inadequate bearings; consequently, the slug cutter is being changed so that an electric motor in a sealed box can be used.

Considerable progress has been made in installing improvements to the canal demineralizer. Most of the piping, pumps, filters, etc. are already installed. The sand filters will be emptied next and filled with anion resin.

The canal cleanup is proceeding at a slow but regular rate. The suction of the deep-pit pump has been attached to the discharge of the cleaner pump to increase the capacity; very good results have been obtained in the removal of silt. All the exposed cobalt metal that could be found in the canal has been removed. However, a number of small pieces are undoubtedly lying on the bottom of the canal, and they will be picked up with magnets after the silt has been removed. Most of the Co^{60} in the canal water is in solution rather than in the form of particles.

The armature of the spare 900-hp motor has been balanced at K-25 and will be assembled and tested in the motor here as soon as possible. No bids have been received yet for the new 900-hp motor.

A comparison of the pressure drop across the exit air filters last month with that experienced this month and with clean filters is shown in Table 2.

The paper filters in cell No. 4 were changed on July 6. The glass-wool filters in this cell will be changed as soon as possible, leaving both glass-wool and paper filters of cells Nos. 1 and 2 to be changed next.

One shutdown occurred because of high radiation at the core-hole monitron; this was caused by the

TABLE 1. REACTOR DATA

	ORNL GRAPHITE REACTOR			LITR		
	July 1954	June 1954	Year to Date	July 1954	June 1954	Year to Date
Total energy, Mwd	100	97.8	712.7	81.7	55.5	539.5
Average power/operating hr, kw	3477	3537	3621	2996	2998	2998
Average power/24-hr day, kw	3225	3259	3362	2635	1850	2545
Lost time, %	7.2	7.9	7.2	12.1	38.3	15.1
Excess reactivity	103 inhr	102 inhr		3.4%	4.2%	
Fuel pieces charged	51	118	614	2	2	13
Fuel pieces discharged	105	118	836	2	2	13
Research samples	95	88	569	12	11	60
Radioisotope samples	226	200	1523	24	23	150

[redacted]

TABLE 2. PRESSURE-DROP DATA

	PRESSURE DROP (in. water gage)		
	Glass Wool	CWS No. 6	Total Across House
7/31/54	2.0	1.7	4.9
6/30/54	1.9	2.2	5.6
Clean filters	1.1	1.3	3.3

lid tank being drained without having the inner tank filled. The incident is of interest since it is the first time there has been an occasion for this safety device to operate in the approximately six years it has been installed.

On July 12, fuses on the No. 2 fan blew while the fan was being started. They were replaced and were found to be among those which had been in the cubicle when it was struck by lightning in June; the fuses were probably damaged at that time.

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

Low-Intensity Test Reactor

Operation of the LITR was uneventful during July. Work has continued on the installation of the HRE fuel loop in facility HB-4, but several months of work still remain. A comparison of the June and July shutdowns is given below.

	July	June
Unscheduled shutdowns for operational reasons, hr	1.134	14.732
Regular operational shutdowns, hr	46.366	33.450
Special shutdowns for research, hr	42.235	227.600

A new pneumatic tube has been designed to replace the tube in facility HR-B. The new tube will be better since it is constructed of stainless steel rather than aluminum, is more accessible in case a sample becomes stuck, and has a thermocouple to indicate internal temperature. Minimum clearances of 100 mils are provided inside the liner, compared with 30 mils in the old tube.

A new regulating rod was installed on July 27 to replace the old one in which the cadmium had been considerably depleted. It was found that it was necessary to remove the lower section of the drive for the upper regulating rod in order to clean the threads in the coupling.

Measurements were made of the N^{16} content of the circulating water, and results will be reported later. A test was also made for U^{239} which should be present with the considerable amounts of Np^{239} already found; none was found, so additional tests are being made.

An analysis of the radioactive gases found in the air space above the water level in the seal tank indicated that only the normal fission-product gases were present.

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

RADIOISOTOPE PRODUCTION AND SALES

Data on the production of processed and unprocessed radioisotopes are given in Tables 5 and 6; special preparations data are given in Table 7.

Operations were normal and there were no unusual incidents during the month.

The first group of the Co^{60} wafers (2 cm × 1 mm) irradiated at Arco were monitored and found to average 154 curies per piece, a specific activity of 56 curies/g.

A newly developed machine for sealing LITR irradiation cans by remote control was used successfully to recan hot Ir^{192} pellets. By using this device better service can be offered to customers in reactivating Ir^{192} sources.

New prices were established for several items, as follows:

$Mn^{52,54}$ (cyclotron-produced)	\$175.00/mc (carrier-free)
Na^{22} (cyclotron-produced)	200.00/mc (carrier-free)
Na^{22} (cyclotron-produced)	50.00/mc (low specific activity)
$As^{73,74}$ (cyclotron-produced)	200.00/mc (carrier-free)

A summary of radioisotope shipments is given in Table 8.

TABLE 3. USAGE OF EXPERIMENTAL FACILITIES – ORNL GRAPHITE REACTOR

HOLE NUMBER AND ORIENTATION	DIMENSIONS (in.)	DIVISION ASSIGNED TO	PERSON IN CHARGE	TYPE OF EXPERIMENT OR USAGE
1, 2, north and south	4 × 4			Regulating rods
3, north and south	4 × 4	Operations	J. A. Cox	Sulfur exposure for radiophosphorus production
4, north ond south	4 × 4	Operations	J. A. Cox	Miscellaneous exposures of special samples
5, 6, north and south	4 × 4			Shim rods
7, 8, 9, vertical	4 × 4			Safety rods
10, vertical	4 × 4	Solid State	J. H. Crawford	Low-temperature sample-exposure facility (no samples during month)
11, vertical	4 × 4	Operations ond Chemical Technology	J. P. McBride	Boron shot safety tube and HRP fuel studies
12, vertical	4 × 4	Operations	J. A. Cox	General exposures of samples in water-cooled facility
13, 14, north and south	4 × 4	Operations	J. A. Cox	Target exposures for radioisotopes and research
15, north	4 × 4	Solid Stote (G.E.)	L. E. Stanford (G.E.)	Miscellaneous large-sample exposures
15, south	4 × 4	Operations	J. A. Cox	Miscellaneous large-sample exposures
16, north and south	4 × 4	Operations	J. A. Cox	Target exposures for radioisotopes and research
17, north	4 × 4	Unassigned		Empty
17, south	4 × 4	Physics	E. O. Wollan	Neutron polarization
18, north and south	4 × 4	Operations	J. A. Cox	Miscellaneous large-sample exposures
19, north and south	4 × 4	Solid State	O. Sisman	Water-cooled exposure facility
20, north	4 × 4			Graphite temperature thermocouples
20, south	4 × 4	Solid State	J. C. Wilson	Creep of metals (no samples during month)
21, north and south	4 × 4	Operations	J. A. Cox	Sulfur exposure for radiophosphorus production
22, north	4 × 4	Solid State (G.E.)		Ionizatian-chamber tests
22, south	4 × 4	Operations	J. A. Cox	Two pneumatic tubes for general usage
30	9 × 9	Solid State (G.E.)	L. E. Stanford (G.E.)	Life tests of equipment in radiation (no tests during month)
31	9 × 9			Blocked by one end of air seal H beam across top of graphite
32, 33	9 × 9			Contain chamber far high-power-level trip circuit
34	9 × 9			Contains chamber for No. 2 power-level galvanometer
35	9 × 9			Blocked by one end af air seal H beam acrass tap of graphite

TABLE 3. (continued)

HOLE NUMBER AND ORIENTATION	DIMENSIONS (in.)	DIVISION ASSIGNED TO	PERSON IN CHARGE	TYPE OF EXPERIMENT OR USAGE
36	9 × 9			Contains chamber for high-power-level trip circuit
37	9 × 9			Test facility for ionization chambers
40	9 × 9			Contains chamber for No. 1 power-level galvanometer
41	6-in. dia			Rear wall suction-pressure tap; hole into discharge monifold
42	6-in. dia			Unit pressure differential tap; hole into discharge manifold
43	6-in. dia			Unused (inaccessible); hole into discharge manifold
44	6-in. dia			Unused; hole into discharge manifold
45	6-in. dia			Gas discharge from hole 22 pneumatic tubes; hole into discharge manifold
46, 47	6-in. dia			Used for viewing west end of graphite with periscope; vertical holes into discharge manifold
50, north	4 × 4	Solid State	J. H. Crawford	General sample-exposure facility
50, south	4 × 4	Physics	E. O. Wollan	Neutron spectrometer
51, north	4 × 4	Solid State	J. H. Crawford	Water-cooled U^{235} neutron converter
51, south	4 × 4	Physics	C. G. Shull	Neutron spectrometer
52, north	4 × 4	Solid State	J. H. Crawford	Facility for exposing samples at liquid-nitrogen temperatures
52, south	4 × 4	Physics	L. D. Roberts	Low-temperature work
53, 54, 55	4 × 4	Solid State (G.E.)	L. E. Stanford (G.E.)	Half-holes for miscellaneous large-sample exposures
56, north	4 × 4	Physics	E. C. Campbell	Fast pneumatic tube
56, south	4 × 4	Physics	H. S. Pomerance	Oscillator for measuring neutron absorption cross sections
57, north	4 × 4	Training School	H. S. Pomerance	General-purpose neutron collimator
57, south	4 × 4	Physics	S. Bernstein	Neutron polarization
58, north	4 × 4	Unassigned		Empty
58, south	4 × 4	Chemistry	H. Levy	Neutron spectrometer
59	4 × 4	Unassigned		Half-hole; blocked by work at hole 17, south
60	4 × 4	Solid State	J. C. Wilson	Half-hole for creep of metals (no samples during month)
61	4 × 4	Operations	J. A. Cox	Half-hole for miscellaneous large-sample exposures
East and west animal tunnels				General exposures of large samples to low flux

TABLE 3. (continued)

HOLE NUMBER AND ORIENTATION	DIMENSIONS (in.)	DIVISION ASSIGNED TO	PERSON IN CHARGE	TYPE OF EXPERIMENT OR USAGE
Thermal column		Physics		Used by several groups for low-level neutron flux work
Inclined animal tunnel in thermal column				Exposures of biological specimens
West core hole		Physics		Lid tank for shielding studies
A	1.68-in. dia	Operations	E. E. Beauchamp	Charging-face hole containing 20 small cans of $CaCO_3$
B	1.68-in. dia	Unassigned		Charging-face hole; empty
C	1.68-in. dia	Solid State	J. C. Pigg	Charging-face hole; insulation test
D	1.68-in. dia	Solid State	C. E. Schilling	Charging-face hole; uranium samples
1069	1.5-in. dia	Unassigned		Charging hole containing an aluminum liner used for general exposure of suitable samples
1768, 1867, 1968	1.75-in. square	Solid State	R. H. Kernohan	Charging holes containing neutron converter donut; used for general exposures of samples to fast-neutron flux
2079	1.5-in. dia	Operations	J. A. Cox	Charging hole containing pneumatic tube; used for exposure of research and radioisotope samples
0857, 0880, 1484, 1853, 2857, 2880				Charging-face holes containing boron-coated thermopiles for reactor instrumentation
Others				Seven uncharged peripheral holes contain $CaCO_3$ for radioisotope production; 409 uncharged peripheral holes remain unused

TABLE 4. USAGE OF EXPERIMENTAL FACILITIES – LITR

FACILITY NUMBER	TYPE OF FACILITY	DIVISION ASSIGNED TO	PERSON IN CHARGE	TYPE OF EXPERIMENT OR USAGE
HB-1	6-in.-ID beam hole	Physics	E. C. Smith	Chopper-type neutron velocity selector
HB-2	6-in.-ID beam hole	Solid State (G.E.)	D. S. Billington	General exposures of large samples and loops*
HB-3	6-in.-ID beam hole	Solid State	J. C. Wilson	Creep of metals
HB-4	6-in.-ID beam hole	Chemistry	G. H. Jenks	Experiment being prepared
HB-5	6-in.-ID beam hole	Chemistry	C. H. Secoy	HRP fuel stability and corrosion tests (no tests during month)
HB-6	6-in.-ID beam hole	Chemistry	C. H. Secoy	HRP fuel stability and corrosion tests
HR-1, 2	Pneumatic tubes	Operations	J. A. Cox	General short exposures of research and radioisotope samples
C-28	Hollow fuel element in core	Solid State	T. H. Blewitt	Exposure of metal crystals to high, fast flux
C-38	Hollow fuel element in core	Solid State	J. B. Trice	Exposure of specimens far flux determination methods
C-42	Hollow Be core piece with access tube fram top plug	Solid State (G.E.)	L. E. Stanford (G.E.)	Exposure of miscellaneous small specimens
C-44	Hollow Be core piece with access tube from top plug	Chemistry	C. H. Secoy	Uranium exposures by J. Halperin
C-46, 48	Hollow Be core pieces with access tube from top plug	Solid State	G. W. Keilholtz	ANP fuel tests (no tests during month)
C-49	Be core piece with four vertical holes	Operations	J. A. Cox	Exposures of research and radioisotope samples
C-53, 56	Mg trays in core space	Operations	J. A. Cox	Exposures of research and radiaisatope samples
V-1	Inclined low-flux hole			Contains boron-coated thermopile for reactor instrumentation
V-2	Inclined law-flux hole	Analytical Chemistry	G. W. Leddicotte	Exposure facility for activation analyses
V-3, 4	Inclined low-flux holes	Unassigned		Empty

*No tests during manth.

TABLE 5. PROCESSED RADIOISOTOPE PRODUCTION DURING JULY

PRODUCT	SOURCE	AMOUNT (mc)	SPECIFIC ACTIVITY (mc/g)
Argon-37	LITR irradiation	1,850	No carrier added
Barium-133	Graphite Reactor irradiation	5.55	0.2
Beryllium-7	ORNL 86-in. cyclotron	344	No carrier added
Cerium-141	Graphite Reactor metal	230	No carrier added
Cesium-134	W irradiation	1,047	18,500
Iodine-131	Graphite Reactor metal	38,295	No carrier added
Iodine-131	W metal	60,315	No carrier added
Iron-55	LITR irradiation	25.3	20
Iron-59	LITR irradiation	37	4,900
Phosphorus-32	Graphite Reactor irradiation	22,519	40,000
Potassium-42	LITR irradiation	190	328
Ruthenium-103	Graphite Reactor metal	107	No carrier added
Sodium-24	LITR irradiation	1,012	2,328
Strontium-89	Graphite Reactor metal	119	No carrier added
Sulfur-35	W irradiation	3,510	No carrier added
Sulfur-35 (sulfide)	W irradiation	5,820	44,500

RADIOISOTOPE DEVELOPMENT

Cs^{137} Sources

Two Cs^{137} sources of 120 curies and 5 curies were pelleted and then encapsulated in the proposed, standard, cesium source containers. The preparation of the cesium chloride pellets was uneventful, and this operation can now be classified as routine. Measurements made on the two pellets are as follows:

	120-curie Pellet	5-curie Pellet
Height, cm	1.94	0.44
Diameter, cm	1.00	0.40
Weight, g	5.08	0.20
Density, g/cc	3.33	3.63
Specific activity, curies/g	23.6	25.0

Induction heating was used to silver braze the stainless steel capsules. This method was successful, but the operation was difficult to perform. Better methods, such as press-fitting of the inner capsule plug, are being sought.

Delivery of the 1540-curie Cs^{137} teletherapy source has not yet been requested by ORINS; the source was removed from storage, inspected, and leak-tested by the boiling-water method for the fourth time. No leaks were detected and the source appeared to be in good condition.

Inorganic-Exchanger (3-M) Experiments

Experiments on the use of 3-M exchanger to remove cesium from ammonium alum solutions were continued. It was found to be preferable to first precipitate the Al^{+++} as the hydroxide, then to filter and to pass the filtrate to a 3-M ion-exchange column. The takeup and later elution of the cesium were good, but the product CsCl contained an objectionable amount (4%) of insoluble material, believed to have come from the ion-exchange material. While this is not a serious limitation, further tests on the chemical stability of the 3-M exchanger are being made.

Cesium Process Development

Tests continued on the handling of iron and

copper ferrocyanide slurries used to carry cesium. A 0.04 M $K_2CuFe(CN)_6$ slurry was made up in a 50-gal stainless steel drum. After settling for three weeks, the slurry volume was still 50% of the total. No difficulty was experienced in jetting this slurry with a ½-in. steam jet, even though the slurry was not agitated prior to jetting. The flow rate obtained was 3.5 gpm through the ½-in. jet. It was concluded that such slurries can be easily handled by jetting in the fission-product plant.

TABLE 6. UNPROCESSED RADIOISOTOPE PRODUCTION DURING JULY

PRODUCT	UNITS
Service irradiations	58
Arsenic-76	1
Barium-131	2
Bismuth-210	1
Bromine-82	2
Calcium-45	2
Cerium-141	1
Copper-64	4
Gold-198	40
Gold-199	3
Hafnium-181	1
Indium-114	1
Iodine-131	4
Iridium-192	5
Mercury-197	1
Mercury-203	3
Molybdenum-99	3
Phosphorus-32	5
Potassium-42	15
Rubidium-86	9
Silver-111	2
Sodium-24	29
Total	192

Multikilocurie Cell, Building 3029

Bids for the construction of the multikilocurie loading cell were opened on July 22, and the low bid was 54% higher than the ORNL estimate for this portion of the project. The contractor stated that a high bid from a subcontractor for the fabrication of stainless steel parts was the primary cause of the difference between the ORNL estimate and his bid. Accordingly, the contractor was

TABLE 7. SPECIAL RADIOISOTOPE PREPARATIONS DURING JULY

	NUMBER	TOTAL AMOUNT (curies)
Co^{60} sources	367	861
Ir^{192} sources	6	93
Cs^{137} sources	11	135
Ce^{144} source	1	0.2
H^3 ampoules	5	4.29
Kr^{85} ampoules	8	1.8
H^3 target	1	0.552

TABLE 8. RADIOISOTOPE SHIPMENTS

	JULY 1954	JUNE 1954	JULY 1953	AUGUST 1946 THROUGH JULY 1954
Separated material	796	953	759	46,888
Unseparated material	185	244	189	12,342
Total	981	1,197	948	59,230
Nonproject	858	1,081	832	
Project	96	91	96	
Foreign	27	25	20	
Total	981	1,197	948	

requested to submit a new bid for the job, exclusive of stainless steel fabrication. Prefabrication of the stainless steel liner and piping will be done by ORNL.

Site preparation by ORNL is 100% complete.

Fission-Products Pilot Plant

The preliminary proposal for the fission-products pilot plant has been completed and was transmitted to the AEC on August 3, 1954. A report containing the proposed chemical processes to be used in the pilot plant and the semiworks data from which the proposed processes were evolved was compiled and forwarded to the AEC to serve as background information for those reviewing the proposal.

I^{131} Plant, Building 3028

Several chemical and tracer runs were made in the finishing equipment to check equipment operation and the effect of varying the chemical condition of the medium from which I_2 is distilled. A procedure was tried in which elemental iodine was reduced to I^- with sulfite, then oxidized to I^0 with H_2O_2, and then distilled; however, this procedure was found to give poorer yields of I^{131} than the method currently used. Apparently, severe oxidation and reduction procedures are necessary to alter various unusual forms of iodine which occur at extreme dilution.

Shielded Transfer Vessel

Construction drawings of the shielded transfer vessel are complete except for the details of the liquid-level device. The liquid level in the vessel will be measured by weighing the entire vessel. The sensing element will be a Taylor load cell connected to a standard 12-in. Taylor indicating dial.

Completion of construction drawings is scheduled for August 6. Approval of the design of this carrier for use in freight shipments was received from the Bureau of Explosives.

RADIOACTIVE-WASTE DISPOSAL

A total of 18.0 curies of beta activity was discharged to White Oak Creek from the settling basin and the retention pond (see Table 9); this discharge is 73% of that of last month and 50% of the average per month of 1953.

Radioactive wastes containing 4666 curies (133,800 gal) were pumped from tank W-8 to chemical-waste storage pit No. 2. In addition, 4127 gal of highly concentrated inactive $Al(NO_3)_3$ and NH_4NO_3 waste was transferred to the pit from Unit Operations, Building 4505, and the metal recovery operations, Building 3505. The total of all wastes discharged to waste storage pit No. 2 to date is 628,633 gal containing 16,263 curies.

The flow of waste water which formerly went to the settling basin from Buildings 2000, 2001, 2005, and 3017 is now being diverted to the storm-sewer system by means of a newly installed diversion box. This flow is still being metered and can be sampled at any time if questions arise concerning its contamination; previous experience has been that this stream usually is nonradioactive. The diversion of this water from the settling basin reduced the daily throughput about 75,000 gal.

The flanges on all lines to the hot off-gas system at the stack area 3039 and on the Cottrell precipitator were tested for leaks; none was found.

The ventilation fan which services the Radioisotope Area was shut down for 2 hr this month to allow the installation of additional duct work for the expansion of Building 3029.

TABLE 9. ACTIVITY DISCHARGED TO WHITE OAK CREEK

DISCHARGED FROM	JULY 1954		AVERAGE PER MONTH, YEAR TO DATE		AVERAGE PER MONTH, 1953	
	Gallons	Beta Curies	Gallons	Beta Curies	Gallons	Beta Curies
Settling basin	12,180,000	16.0	14,190,000	17.0	19,450,000	24.1
Retention pond	340,000	2.0	520,000	1.8	500,000	11.7
Total	12,520,000	18.0	14,710,000	18.8	19,950,000	35.8

The trailer tank used to haul wastes to the chemical-waste pit was discarded because of leaks which could not be repaired. Surplus trailer tanks recently acquired are being repaired, and their designs are being revised for plant use; one of these trailers should be available next month. Meanwhile, all wastes scheduled for pit disposal are being pumped to the chemical-waste pit.

MISCELLANEOUS OPERATIONS

Water Demineralization

Demineralized-water production was 314,580 gal in July, compared with 330,780 gal in June. Table 10 shows the number of regenerations and the average amount of water through each unit during June and July.

The manufacturer of the defective resin in the No. 1 cation column was contacted several months ago but has not replied to inquiries about the reason for the failure.

Hydrogen Liquefaction

Twenty-seven liters of liquid hydrogen was produced in 11 runs. The hydrogen cylinders now being obtained from Stores are sometimes low in pressure, and attempts are being made to improve the supply. The fabrication of the new hydrogen liquefier was delayed for lack of some special metal tubing now on order.

Activation Analyses

A total of 178 requests for information concerning activation analyses has been received; 71 have developed into requests for analyses, 56 of which have been completed.

TABLE 10. AVERAGE AMOUNTS OF WATER PASSED THROUGH REGENERATION UNITS DURING JUNE AND JULY

UNIT	NUMBER OF REGENERATIONS		AMOUNT OF WATER THROUGH EACH UNIT (gal)	
	July	June	July	June
No. 1 cation	3	2	66,567	40,400
No. 2 cation	2	4	67,000	70,375
No. 1 anion	5	6	33,640	23,317
No. 2 anion	6	7	24,683	30,729