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OPERATIONS DIVISION

REPORT FOR JANUARY 1955

By

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BY AUTHORITY OF: E. J. Murphy 6-10-58
BY: P. C. Hansen 8-10-58

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

[redacted]

[redacted]

TABLE 1

GRAPHITE REACTOR OPERATIONS

Period 1-1-55 to 1-31-55

	This Month	Last Month	Year to Date
Total energy, Mwd	100.5	101.2	100.5
* Average power, kw	3498	3500	3498
Time operating, %	92.7	93.2	92.7
Excess reactivity, inhr	72	65	
Slugs charged	50	61	50
Slugs discharged	74	61	74
** Input air temperature (av), °F	34		
** Exit air temperature (av), °F	138		
Exit air filters, Δp, in. H_2O	4.3		
⁄ Canal water radioactivity, counts/min/ml	2600		
Total facilities assigned, %	91		
Facilities in use for research, %	53		
Facilities in use for radioisotopes, %	27		
Research samples	98	130	98
Radioisotope samples	247	144	247

* Per operating hour.
** Temperatures for 1-31-55; more complete will be used in later reports.
⁄ Taken at canal bend.

Graphite Reactor

There were no slug ruptures in January. The automatic controller worked well, but No. 5 shim rod failed to scram once because of faulty solenoid valves in the hydraulic system.

Operations were normal for the cooling system. Delivery of the new lightning arrestors for the fan motor controls is expected next month. The spare motor will arrive by March 1.

The canal water demineralizer is working at a capacity of 50,000 gal per regeneration cycle. Because of rinsing difficulties, the effluent is not of good enough quality to recycle to water-cooled reactor tubes. The canal room walls and walkway were painted to reduce tracking of contamination in the main building; good results were noted thus far.

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MARTIN MARIETTA ENERGY SYSTEMS LIBRARIES

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TABLE 2

LITR OPERATIONS

Period 1-1-55 to 1-31-55

	This Month	Last Month	Year to Date
Total energy, Mwd	64.0	57.0	64.0
* Average power, kw	2968	2965	2968
Time operating, %	69.6	62.0	69.6
Excess reactivity, %	2.8	4.0	
Unscheduled shutdowns, hr	0.933	2.634	0.933
Regular shutdowns, hr	54.250	12.000	72.250
Research shutdowns, hr	171.184	268.133	153.184
≠ Inlet water temperature (av), °F	92		
≠ Outlet water temperature (av), °F	109		
≠ Cooling water reactivity, counts/min/ml	65,000		
≠ Cooling water resistivity, ohms	450,000		
Fuel pieces charged	0	1	0
Fuel pieces discharged	0	1	0
Total facilities assigned, %	100		
Facilities in use for research, %	61		
Facilities in use for radioisotopes, %	28		
Research samples	19	15	19
Radioisotope samples	37	43	37

* Per operating hour.
≠ Data taken only on 1-31-55; future averages will be obtained from more complete data.

Low-Intensity Test Reactor

The amount of downtime continues high because of research work now in progress at HB-4, 5, and 6.

Operations were normal. The drive mechanism for the fission chamber was rebuilt and installed; the new installation is quite compact.

Radioisotope Production and Sales

Radioisotope Shipments are shown below.

	January 1955	December 1954	January 1954	Since August 1946
Processed Material	889	806	846	51,833
Irradiation Units	219	170	184	13,590
Total	1108	976	1030	65,423
Domestic	1015	895	904	
Foreign	82	66	83	
AEC Projects	11	15	43	
Total	1108	976	1030	

Detailed radioisotope production and sales data are given in Tables 3 and 4.

Installation of the new iodine slug dissolver to replace the original one which was metallurgically unsound at the welds was completed.

Cobalt-60 teletherapy source loading continued in the old manipulator cell; construction of the new one is far behind schedule--only about 85% complete. It may be done by the end of March.

The smaller type 600 RHM teletherapy source is becoming more popular; one X-ray distributor says he will sell 3 or 4 per month for the rest of the year. Fifteen more "clover-leaf"-type source holders were ordered for this purpose.

Effort is being made to increase Co^{60} production in the MTR; 1.5 kg of additional cobalt was sent to Phillips in January.

The first steps have been taken to irradiate cobalt at Savannah to supply the large amount of Co^{60} needed in the future.

Plans are being made for a C^{14}-organics surplus sale, to dispose of miscellaneous labelled compounds, since commercial laboratories now supply most C^{14}-labelled compounds. The General Office Division is assisting us in this sale.

Processing was resumed on short half-life fission products and most unfilled orders will be taken care of by February 28.

Iron-59 made from enriched Fe^{58} targets is in short supply because of the very uncertain LITR operating schedule (research requirements).

The new edition of the Radioisotope Catalog is still being held in abeyance until the AEC publishes the new licensing procedure.

Radioisotope data on customers, shipments, amounts and kinds of radioactivity sold will be placed on the IBM system beginning July 1, 1955.

The radioisotope specifications manual was revised and is now in the rough draft stage.

U. S. Information Service personnel made a number of tape recordings around the Isotope Area during the month.

Cesium-137 production was stepped up since the small south tank farm works started operating January 2; 300 curies of Cs^{137} was separated from 870 gal of waste.

Radioisotope Development

Construction is in progress on the 250-gal shielded transfer vessel; it should be ready for use by May 1. Design work was started on a submerged jet and above-ground auxiliary tank system to transfer waste from Arco tanks into the shipping vessel.

About 500 mg of technetium-99 was removed from Purex-type waste by the TPA process. Because decontamination from other F.P.'s was lower than expected, the TPA-Tc precipitation step will be tried farther on in the fission product removal scheme, after most of the other F.P.'s have been removed.

Strontium-90 and rare earths were recovered in >90% yield, using the proposed F3P process on a semi-works scale (70 gal waste). The process chemistry of this section of the process is now considered well-established.

A new underground storage facility for Co^{60} is in the design stage and will be installed by June 30. It consists of 8-ft long vertical stainless steel tubes buried in fine crushed rock. The cans containing Co^{60}, within the tubes, will be handled magnetically and transferred in a bottom-opening heavy lead container.

Fission Product Pilot Plant

Criteria for the architect-engineer are complete; bids will be asked on February 15, and a selection should be made by March 1.

The characteristics required for the 20-ton bridge crane were decided upon: maximum 15 ft/min vertical speed, 60-65 ft/min on the trolley, 100-105 ft/min on the bridge with a five-speed control for each motor; electrical braking will be used.

Sampling of alum crystals is important for process control. A sampler was developed which draws ~500 ml of slurry through at a minimum speed of 2.5 ft/sec, to prevent settling of the crystals. The sampling error is ± 1%.

Crystal bed level in the remote crystallizers is another important control. A vertical dip "bubbler" tube was developed, which simultaneously measures liquid level depth and indicates the crystal bed level by showing a "pressure-pip" as it encounters the bed of crystals. The pressure data are recorded on a rapidly-moving chart.

Centrifugation studies were continued, particularly with $Al(OH)_3$-type precipitates. All precipitates encountered in the F3P process have been found to centrifuge well, but improvements in methods of feeding fluids to the centrifuge are being sought, since the steam jetting now used results in wide variation in the feed rate.

Corrosion studies were made on 347, 316, and 317 stainless alloys in dilute HNO_3-$NaNO_3$-oxalic acid solutions at 40° C, the chemical conditions during the F3P process rare earth oxalate precipitation. No significant attack was noted after 216 hours; the test is being continued.

TABLE 3.
RADIOISOTOPE PRODUCTION AND SALES

Period 1-1-55 to 1-31-55

Symbols: I = irradiated unit; P = processed material; HSA = high specific activity; LSA = low specific activity; CF = carrier-free; E = enriched torget; X = ORNL Graphite Reactor; FP = fission product

C-86 = 86" Cyclotron; W = Hanford; L = LITR; M = Arco; S = Scrup

Product	Type	Source	* Specific Activity	This Month		Year to Date	
				Produced	Sold	Produced	Sold
Antimony-122	I						
Antimony-124	I				1		1
Antimony-124	P-HSA				20		20
Antimony-125	I						
Antimony-125	P-CF				0.5		0.5
Argon-37	P-CF				7		7
Arsenic-73,74	P-CF						
Arsenic-76	I				3		3
Arsenic-77	I						
Barium-131	I						
Barium-131	P-HSA				3		3
Barium-140	P-CF						
Beryllium-7	P-CF				6		6
Bismuth-210	I						
Bromine-82	I				2		2
Cadmium-115	I						
Cadmium-115*m*	I						
Cadmium-115	P-HSA						
Calcium-45	I						
Calcium-45	P-LSA				33		33
Calcium-45	P-HSA				57		57
Calcium-45	P-E				4		4
Calcium-45	P-CF				0.008		0.008
Carbon-14	P				424.7		424.7
Cerium-141	I						
Cerium-141	P-CF						
Cerium-144	P-CF				16		16
Cesium-134	I						
Cesium-134	P-HSA	W	21,962	3,094	50	3,094	50
Cesium-137	P-CF				2,067		2,067
Chlorine-36	I				3		3
Chlorine-36	P				0.7517		0.7517
Chromium-51	I						
Chromium-51	P-HSA	L	2,809	2,301	764	2,301	764
Cobalt-57	P-CF				1		1
Cobalt-58	P-CF						
Cobalt-60	I				1		1
Cobalt-60	P-HSA				40		40
Copper-64	I				3		3
Europium-152,154	I						
F. P. (gross)	P						
Gallium-72	I						

* Specific activity is in mc/gram.
Amounts produced and sold are in mc for processed material and in units for irradiated material.

TABLE 3 (continued)
RADIOISOTOPE PRODUCTION AND SALES

Product	Type	Source	Specific Activity	This Month		Year to Date	
				Produced	Sold	Produced	Sold
Gold-198	I				74		74
Gold-199	I						
Hafnium-181	I						
H^3 (tritium)	P-CF				43,608		43,608
Indium-114	I						
Indium-114	P-HSA						
Iodine-129	P						
Iodine-131	I				5		5
Iodine-131	P-CF	X	CF	61,884	46,687		46,687
Iridium-192	P-HSA				3		3
Iridium-194	I						
Iron-55,59	I						
Iron-55,59	P-HSA				11		11
Iron-55	P-E				11		11
Iron-59	P-E	L	2,520	57	20.95		20.95
Krypton-85	P-CF						
Lanthanum-140	I						
Manganese-54	P-CF	C-86	CF	2	1.7		1.7
Mercury-197	I						
Mercury-203	I				2		2
Mercury-203	P-HSA	W	1,286	8,680	116		116
Molybdenum-99	I				2		2
Neodymium-147	P-CF						
Nickel-63	I						
Nickel-63	P-HSA				12		12
Niobium-95	P-CF				16		16
Osmium-191	I						
Palladium-109	I						
Phosphorus-32	I				1		1
Phosphorus-32	P-HSA	X	40,000	14,659	15,769		15,769
Phosphorus-32	P-CF	X	CF	41	37		37
Potassium-42	I				23		23
Potassium-42	P-HSA						
Praseodymium-142	I						
Praseodymium-143	P-CF						
Promethium-147	I						
Promethium-147	P-CF				60		60
Rhenium-186	I						
Rubidium-86	I				4		4
Ruthenium-97	I						
Ruthenium-103	P-CF						
Ruthenium-106	P-CF				42		42
Samarium-153	I						
Scandium-46	I						
Scandium-46	P-HSA				15		15
Selenium-75	I						
Selenium-75	P-HSA				70		70

TABLE 3 (continued)
RADIOISOTOPE PRODUCTION AND SALES

Product	Type	Source	Specific Activity	This Month		Year to Date	
				Produced	Sold	Produced	Sold
Silver-110	I						
Silver-110	P-HSA				83		83
Silver-111	I				1		1
Silver-111	P-CF						
Sodium-22	P-HSA				1.7		1.7
Sodium-22	P-CF				8.6		8.6
Sodium-24	I				27		27
Sodium-24	P-HSA	L	2,218	966	93	966	93
Strontium-85	P-CF						
Strontium-89	I				1		1
Strontium-89	P-CF						
Strontium-90	P-CF				10,216		10,216
Sulfur-35	I						
Sulfur-35	P-CF (SO_4^{--})				803		803
Sulfur-35	P-HSA (sulfide)				21		21
Sulfur-35	P-HSA (element)				1		1
Tantalum-182	I						
Tantalum-182	P-HSA	W	416	75	22	75	22
Technetium-99	I						
Technetium-99	P						
Thallium-204	I						
Thallium-204	P-HSA				20		20
Tin-113	P-HSA				1		1
Tungsten-185	I						
Tungsten-185	P-HSA	L	718	540		540	
Tungsten-187	I						
Yttrium-90	I				1		1
Yttrium-91	P-CF						
Zinc-65	I						
Zinc-65	P-HSA				221		221
Zinc-65	P-CF						
Zirconium-95	I						
Zirconium-95	P-CF						
TOTALS: Processed Material, mc				92,299	121,461	6,976	121,461
Irradiated Material, units					154		154

TABLE 4
RADIOISOTOPE PRODUCTION AND SALES – SOURCES AND MISCELLANEOUS PRODUCTS

Period 1-1-55 to 1-31-55

Symbols: VHSA = very high specific activity* CF = carrier-free
HSA = high specific activity T = teletherapy
MSA = medium specific activity R = radiography
LSA = low specific activity IR = irradiator

Product	Type	Number of Sources	Use	Size of Sources		Sales	
				Minimum	Maximum	Month	Year
Antimony-beryllium	Neutron						
Cesium-137	CF		T				
Cesium-137	CF		R				
Cesium-137	CF		IR				
Cobalt-60	VHSA		T				
Cobalt-60	HSA	1	T	1546 c	1546 c	1546 c	1546 c
Cobalt-60	MSA		T				
Cobalt-60	HSA		R				
Cobalt-60	MSA		R				
Cobalt-60	LSA	18	R	1 c	4.5 c	50.5 c	50.5 c
Cobalt-60	HSA	1	IR	413 c	413 c	413 c	413 c
Cobalt-60	MSA		IR				
Cobalt-60	LSA	16	IR	2 mc	2500 c	2572 c	2572 c
Iridium-192	HSA	9	R	6 c	19 c	85 c	85 c
Iridium-192	MSA		R				
Iron-55	HSA	3		4 mc	4 mc	12 mc	12 mc
Phosphorus-32	Plaques, 1 in.		IR				
Phosphorus-32	Plaques, 3 in.		IR				
Strontium-90	CF	9	IR	1 c	1 c	9 c	9 c
Tritium-zirconium	Evaporated target	2		120 mc	480 mc	600 mc	600 mc
Tritium-zirconium	Fused target	7		707 mc	4.8 c	21.5 c	21.5 c
Helium-3	Ampoules	1		200 cc	200 cc	200 cc	200 cc
Tritium	Ampoules	14		100 mc	1000 mc	**	
Deuterium	Fused target	1		3.4 cc	3.4 cc		
Argon-37	Ampoules	2		2 mc	5 mc	**	

* Ranges of specific activity used for Co^{60}: VHSA - > 40 c/g
HSA - 25-40 c/g
MSA - 10-25 c/g
LSA - Up to 10 c/g.

** See Table 3.

TABLE 5
WASTE DISPOSAL – WATER DEMINERALIZATION – HYDROGEN-LIQUEFACTION SHIFT OPERATIONAL SERVICES – EQUIPMENT DECONTAMINATION-ACTIVATION ANALYSIS – SF ACCOUNTING

Period 1-1-55 to 1-31-55

	This Month	Last Month	Year to Date	Total Last Year
Water through settling basin, gal	17,100,000	14,250,000	17,100,000	158,200,000
Activity through settling basin, curies	10.1	58.7	10.1	237.3
Water through retention pond, gal	590,000	780,000	590,000	6,090,000
Activity through retention pond, curies	1.0	0.7	1.0	17.2
Waste to lagoons, gal	195,300	116,400	195,300	997,000
Activity to lagoons, curies	1,053	196	1,053	7,224
Total activity in lagoons 2 and 3, curies	16,947	15,893	16,947	15,893
Demineralized water produced, gal	487,000	435,140	487,000	4,416,250
Liquid hydrogen produced, liters	None	None	None	135
Shift services for research division, man-hours	347		347	
Equipment decontamination services, man-hours	180		180	
Activation analyses completed	4	2	4	31
SF and special material receipts, number of lots	24	33	24	338
SF and special material shipped, number of lots	40	43	40	480
Number of research issuances	1	0	1	62
Materials requests issued	9	26	9	196
SF and special materials reports issued	7	8	7	95
Internal audits and surveys	8	10	8	97

Chemical waste storage pit No. 3 was put into operation; 140,000 gal of waste was transferred to it.

A bearing failure, requiring emergency repairs, occurred on the electrically-driven hot off-gas blower. It was the first breakdown since the Alemite oil mist lubrication system was installed seven months ago and was caused by plugging of the oil line inside the oil reservoir by a gasket which was improperly installed at the factory.

The annual inspection was performed on all fan and steam turbine bearings located in the stack area. The oil was drained from all bearings and turbine chests, the systems flushed and clean oil added. Belts, oil rings and oil seals were replaced and clearances were reduced on the Radioisotope Area exhaust fan. One bearing on the steam turbine driving the 60,000 CFM exhaust fan had to be scraped because of crystallization from overheating. Two bearings on the 60,000 CFM electrically-driven fan, used to ventilate Building 3026, had to be scraped because they had begun to seize.

The water demineralization equipment has been giving better service since HNO_3 is being used to regenerate the No. 2 unit, instead of sulfuric acid. The cation column of the No. 1 unit was opened and all of the IR 112 resin removed; it was replaced with 55 cubic feet of IR 120 supplied by the manufacturer, free of charge, to replace IR 112 lost due to particle fracture. Approximately one-half the resin in the No. 1 cation column was found to be missing.

The new hydrogen liquefier being built in the research shops was found to have a leak from the low pressure hydrogen line into the low pressure nitrogen line. Because the leak amounts to only about 30 cc/year, it is believed that the liquefier can be used.