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RADIOISOTOPE PROGRAM PROGRESS REPORT FOR AUGUST 1973

J. H. Gillette

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ISOTOPES DEVELOPMENT CENTER

RADIOISOTOPE PROGRAM PROGRESS REPORT
FOR AUGUST 1973

J. H. Gillette

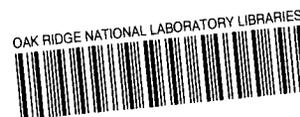
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Oak Ridge, Tennessee 37830
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RADIOISOTOPE PROGRAM PROGRESS REPORT
FOR AUGUST 1973

J. H. Gillette

RADIOISOTOPE PRODUCTION AND MATERIALS DEVELOPMENT

REACTOR-PRODUCED RADIOISOTOPES

Platinum-195m (*J. K. Poggenburg*)

Recent medical research has shown that some platinum compounds act as chemical therapeutic agents towards certain kinds of tumors. Platinum radioisotopes are needed for investigation of the therapeutic mechanism involved. Platinum-195m (4.0 d) has gamma emissions of 99 keV (11%) and 129 keV (2.8%) that make it suitable for whole-body scanning.

Two shipments of ^{195m}Pt containing ~ 15 mCi each were shipped to University of Southern California under our medical cooperative program. Future studies will include human volunteers, and for this the 95% enriched ^{194}Pt will be used instead of the 57% material now in use.

We have been producing a considerable amount of carrier-free ^{199}Au as a byproduct of ^{195m}Pt . Since the patient dose from this is about half that of ^{198}Au and the 158-keV gamma would be more superior for imaging than the 411-keV gamma of ^{198}Au , we have been supplying some of this to ORAU for study. Initially, the ^{199}Au was supplied in isotonic saline. The objective was to see if a microcolloid might form which would go predominantly to marrow. Since the activity also went to liver, kidney, spleen, and lung, it appears the activity was bound to protein and scavenged by macrophages. Effects of chelating agents will be explored.

Reactor Products Pilot Production (*R. E. Sizemore*)
(Production and Inventory Accounts)

<u>Processed Units</u>	
<u>Radioisotope</u>	<u>Amount (mCi)</u>
Calcium-47	20.47
Copper-67	28.2
Zinc-69	270.0

ACCELERATOR-PRODUCED ISOTOPES

Potassium-43 (*L. C. Brown and J. K. Poggenburg*)

Potassium-43 has been shown to be an excellent tool for studying blood perfusion in the heart and for diagnosing myocardial infarctions. Potassium-43 is currently produced in millicurie quantities in the HFIR by the $^{43}\text{Ca}(n,p)^{43}\text{K}$ reaction. The objective of this project is to investigate the large-scale photonuclear production of this radionuclide using the Oak Ridge Electron Linear Accelerator (ORELA). The ultimate goal is to develop the technology required to produce curie quantities of ^{43}K at costs that will allow its widespread clinical application as a primary agent for the early detection and diagnosis of heart disease.

We decided to repeat the ORELA marble slab experiment which last time was prematurely terminated when the spectrometer switching magnet failed. A thicker tantalum converter has been placed on the face, and also aluminum and polyethylene sheets have been included to monitor the photon fluxes >20 MeV and >40 MeV. The activity in the slabs had decayed, and the target was reassembled and delivered to ORELA. The irradiation should take place the first week of September.

Also scheduled for the same period is the 1-kW power level irradiation mentioned in last month's report.¹ The target consists of ten 1-in.-diam vacuum hot-pressed CaO discs and two of Sc₂O₃. These were stacked in an aluminum can with aluminum discs interspersed as thermal conductors, and the can was hydraulically swaged for thermal conduction. The target fabrication is complete and awaiting installation. A water jacket will supply cooling from a self-contained circulating system with a heat exchanger. This target will be placed in the main target room behind one of the available tantalum converters. A short irradiation is planned at this power level. This will also test the $^{45}\text{Sc}(\gamma,2p)^{43}\text{Sc}$ production path for its practical potential.

Two batches of reactor-produced ^{43}K were processed and four shipments totaling 13 mCi were made.

Cyclotron Products Pilot Production (*M. R. Skidmore*)
(Production and Inventory Accounts)

August 1973 ORNL 86-Inch Cyclotron runs for ORNL and non-ORNL programs are given in Table 1.

¹L. C. Brown and J. K. Poggenburg, "Potassium-43," in *Radioisotope Program Progress Report for July 1973*, ORNL-TM-4337, Oak Ridge National Laboratory, pp. 2-3.

Table 1. Cyclotron Irradiations and Runs for August 1973

Date	Customer	Product	Target	Total Time (hr:min)	Total Charges
<u>ORNL Programs</u>					
7-26-73	ORAU and Others	Gallium-67	Zinc-68	9:00	\$ 862
7-31-73	Isotopes Division	Bismuth-206	Lead-207	1:50	181
8-10-73	ORAU and Others	Gallium-67	Zinc-68	9:00	862
8-10-73	Isotopes Division	Thulium-167	Erbium-168	2:00	178
8-23-73	ORAU and Others	Gallium-67	Zinc-68	4:15	411
				26:05	\$2494
<u>Non-ORNL Programs</u>					
7-25-73	University of Massachusetts and Vanderbilt University	Iodine-126	Tellurium-126	2:15	\$ 334
8-22-73	New England Nuclear Corporation	Cobalt-57	Nickel-58	51:15	7314
				53:30	\$7648

FISSION PRODUCTS

Cesium-137 Pilot Production (*R. W. Schaich*)
(Production and Inventory Accounts)

1. Process Status

The ^{137}Cs process equipment is in standby condition.

2. Operational Summary

<u>Product Inventory</u>	<u>Amount (Ci)</u>
<u>Inventory Material</u>	
Cesium-137 chloride products	572,700
Sources in fabrication	0
Completed sources	<u>6,400</u>
<u>Total Inventory Material</u>	<u>579,100</u>
<u>Non-Inventory Material</u>	
Material returned or stored for customer	
Puerto Rico sources	8,760
Lockheed	29,050
AECL powder	86,360
Radiation sources	<u>37,450</u>
<u>Total Non-Inventory Material</u>	<u>161,620</u>
Total Inventory and Non-Inventory Material	740,720

Fabrication Summary

	<u>August 1973</u>		<u>CY 1973</u>		<u>FY 1974</u>	
	<u>No.</u>	<u>Ci</u>	<u>No.</u>	<u>Ci</u>	<u>No.</u>	<u>Ci</u>
Sources						
Fabricated	0	0	10	22,800	0	0
Shipped	0	0	10	22,800	0	0
Special Form Cans						
Fabricated	0	0	45	26,000	2	800
Shipped	2	800	42	23,900	2	800

3. Current Orders

Current orders for ^{137}Cs as sources or bulk powder are as follows:

<u>Customer</u>	<u>Amount (Ci)</u>	<u>Estimated Shipping Date</u>
J. L. Shepherd	7,614	September 1973
White Sands Missile Base	14,221	September 1973
3M Company	500	a
Technical Operations, Inc.	290	a

^aHolding for request for shipment.

Strontium-90 Pilot Production (*R. W. Schaich*)
(Production and Inventory Accounts)

1. Process Status

The ^{90}Sr heat source (45,700 Ci) for Messerschmitt-Bolkow-GmbH was completed and is awaiting boat booking for delivery in September 1973.

Further progress was made in decontaminating Cells 11, 12, and 14 at the Fission Products Development Laboratory. Activity was dislodged from upper horizontal surfaces of Cell 11 by high-pressure spraying with water. Lead-covered lines in Cell 11 were decontaminated with nitric acid. Readings in Cell 11 have been reduced from 10^6 R/hr to recent readings of 10^2 R/hr. Smear levels in Cell 11 have been reduced from 10^4 to 10 R/hr.

2. Operational Summary

<u>Product Inventory</u>		<u>Amount (Ci)</u>
<u>Inventory Material</u>		
Feed solution ($\pm 25\%$) ^a		690,800
⁹⁰ Sr titanate products ($\pm 10\%$) ^b		132,900
"AGN" liners		145,500
SNAP-7F sources		115,200
RCA source		62,400
⁹⁰ Sr silicate powder		30,500
Recovery material		25,400
Stock powder cans		<u>6,700</u>
Total		1,209,400
Less SNAP material purchase ^c		<u>277,400</u>
<u>Total Inventory Material</u>		<u>932,000</u>
<u>Non-Inventory Material</u>		
Quehanna Recovery Material		47,800
Weather Bureau Source		12,700
SNAP-7B		173,800
SNAP-7C		27,300
SNAP-7D		159,000
URIPS (Billed @ 221,000 Ci)		216,000
SNAP material purchase		<u>277,400</u>
<u>Total Non-Inventory Material</u>		<u>914,000</u>
Total Inventory and Non-Inventory Material		1,846,000

^aIncludes 200,000 Ci having power density sufficiently high for heat sources.

^bIncludes the Messerschmitt source (45,700 Ci).

^cStrontium-90 purchased under DRDT program and retained in solution form.

Fabrication Summary

	<u>August 1973</u>		<u>CY 1973</u>		<u>FY 1974</u>	
	<u>No.</u>	<u>Ci</u>	<u>No.</u>	<u>Ci</u>	<u>No.</u>	<u>Ci</u>
Sources						
Fabricated	1	45,700	1	45,700	1	45,700
Shipped	0	0	0	0	0	0
Special Form Cans						
Fabricated	0	0	71	1,700	0	0
Shipped	0	0	72	1,700	0	0

3. Current Orders

Current orders for ^{90}Sr as sources or bulk powder are as follows:

<u>Customer</u>	<u>Amount (Ci)</u>	<u>Estimated Shipping Date</u>
U. S. Navy	221,000	a
New England Nuclear Corporation	9	a
Messerschmitt-Bolkow GmbH	46,700	a

^aAll items are complete and awaiting receipt of further shipping instructions.

Short-Lived Fission Pilot Production
(Production and Inventory Accounts) (*R. W. Schleich*)

<u>Isotope</u>	<u>Number of Batches</u>	<u>Amount (Ci)</u>
Xenon-133	4	1400
Iodine-131	2	26

Promethium-147 Shipments and Current Orders

Donald W. Douglas Laboratories has ordered 100,000 Ci of ^{147}Pm to be shipped from Richland, Washington, in 50,000-Ci shipments in October and December 1973.

RADIOISOTOPE SALES

J. E. Ratledge

A request for quotation was received from Teledyne-Isotopes, Inc., for three ^{90}Sr sources (330 W each) using two of the existing AGN liners plus one new liner and for three ^{90}Sr sources (~330 W each) using three new liners. An order was received from Technical Operations, Inc., for ten ^{137}Cs sources containing a total of 290 curies. Also received was an order from General Electric Company, San Jose, California, for ~190 Ci of ^{133}Xe .

Shipments made during the month that may be of interest are listed below:

<u>Customer</u>	<u>Isotope</u>	<u>Amount</u>
<u>Large Quantities</u>		
Industrial Nucleonics Corporation	Krypton-85	125 Ci
General Electric Company, Illinois	Krypton-85	80 Ci
New England Nuclear Corporation	Tritium	8,000 Ci
Radium-Chemie, A. Zeller and Company	Tritium	10,000 Ci

<u>Customer</u>	<u>Isotope</u>	<u>Amount</u>
Saunders-Roe Developments, Ltd.	Tritium	2,000 Ci
3M Company	Promethium-147	5,452 Ci
3M Company	Cesium-137	800 Ci
United Aircraft Corporation	Gadolinium-153	5 Ci
Donald W. Douglas Laboratories	Promethium-147	50,000 Ci ^a

Withdrawn Items

University of Rochester	Iodine-131	350 mCi
Cleveland Metropolitan General Hospital	Iodine-131	50 mCi
University of Pittsburgh	Iodine-131	50 mCi
Mayo Clinic	Copper-67	20 mCi
University of Chicago	Copper-67	10 mCi

Items Used in Cooperative Programs

Vanderbilt University	Bismuth-206	10 mCi
Vanderbilt University	Gadolinium-153	2 Ci
Oak Ridge Associated Universities	Gallium-67	650 mCi
Oak Ridge Associated Universities	Gold-199	3 mCi
Oak Ridge Associated Universities	Thulium-167	0.36 mCi
University of Wisconsin	Gadolinium-153	1.7 Ci
University of Wisconsin	Cadmium-109	20 mCi
University of Southern California	Platinum-195m	30 mCi
Franklin McLean Research Institute	Gadolinium-153	500 mCi

Unusual Items

University of California, Berkeley	Tungsten-180 HFIR irradiation
Cleveland State University	Tellurium-122 HFIR irradiation

^aShipped from Richland, Washington.

The radioisotope sales proceeds and shipments for the first month of FY 1973 and FY 1974 are given in Table 2.

Table 2. Radioisotope Sales and Shipments

<u>Item</u>	<u>7-1-72 thru</u> <u>7-31-72</u>	<u>7-1-72 thru</u> <u>7-31-73</u>
Inventory items	\$18,650	\$20,206
Major products	4,340	6,465
Cyclotron irradiations	9,194	2,900
Radioisotope services	10,920	10,198
Miscellaneous processed material	6,604	2,306
Packing and shipping	<u>5,070</u>	<u>4,182</u>
Total	\$54,778	\$46,257
Number of Shipments	158	130

ADMINISTRATIVE

Visitors to the IDC and travel by IDC personnel are given in Tables 3 and 4, respectively.

Table 3. Visitors to IDC

Visitor	Affiliation	Subject Discussed
Masao Kato	Institute of Industrial Science University of Tokyo	Nuclear waste management
L. J. Tuberty R. B. Teeters	Mallinckrodt Chemical Works	Design of hot cells

Table 4. Travel by IDC Personnel

Traveler	Site Visited	Purpose of Visit
J. H. Gillette J. K. Poggenburg	Washington, D. C.	Program discussions with AEC-DBER
F. N. Case	New York, New York	Discussions with NOAA concerning experiments
L. C. Brown	Los Alamos, New Mexico	Attend meeting on Practical Applications of Accelerators

PUBLICATIONS

REPORTS

T. A. Butler, E. E. Ketchen, and J. R. DiStefano, *Curium Data Sheets*, ORNL-4910, Oak Ridge National Laboratory (August 1973).

J. H. Gillette, *Radioisotope Program Progress Report for July 1973*, ORNL-TM-4337, Oak Ridge National Laboratory.

J. H. Gillette, *Isotopes Program (5000) Progress Report for Quarter Ending June 30, 1973*, ORNL-TM-4338, Oak Ridge National Laboratory.

E. Lamb, *Isotopic Power Fuels Monthly Status Report for July 1973*, ORNL-TM-4339, Oak Ridge National Laboratory.

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