Lead-203/212 AGENDA

OCTOBER 4, 2022, 1 PM EDT

1:00 – 1:15 PM	**Dr. Andrew R. Burgoyne,** Oak Ridge National Laboratory
1:15 – 1:30 PM	**Mr. Matthew J. O'Hara,** Pacific Northwest National Laboratory
1:30 – 1:45 PM	**Dr. David Bauer,** Memorial Sloan Kettering Cancer Center
1:45 – 2:00 PM	**Dr. Izabela Tworowska,** RadioMedix
2:00 – 2:15 PM	**Dr. Dijie Liu,** Viewpoint Molecular Targeting
2:15 – 2:45 PM	Moderated Q&A Segment

OAK RIDGE National Laboratory

ORNL Ra-224/Pb-212 Generator Production

Dr Andrew R. Burgoyne

Lead-203/212 Users Group Meeting

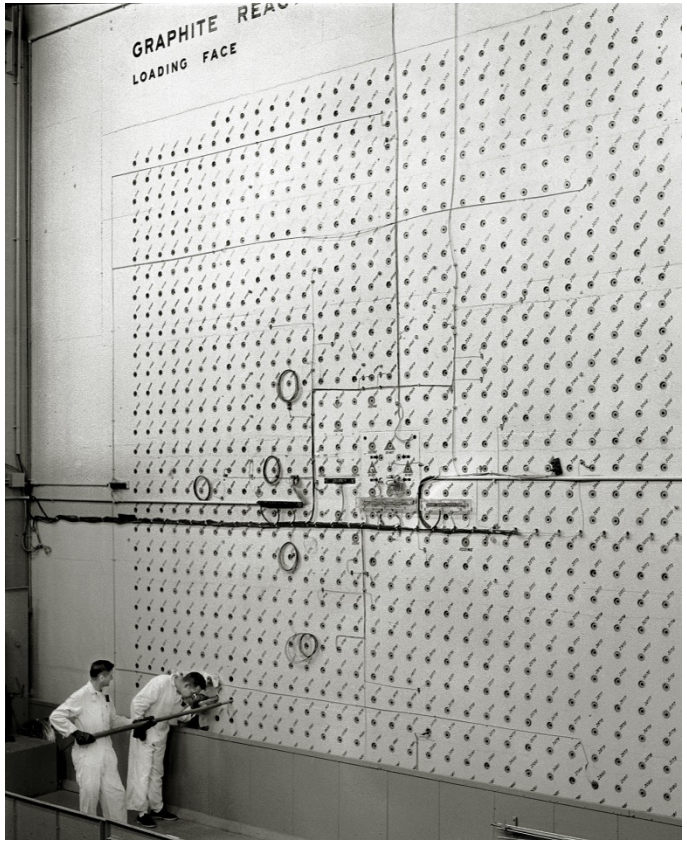
October 4th, 2022

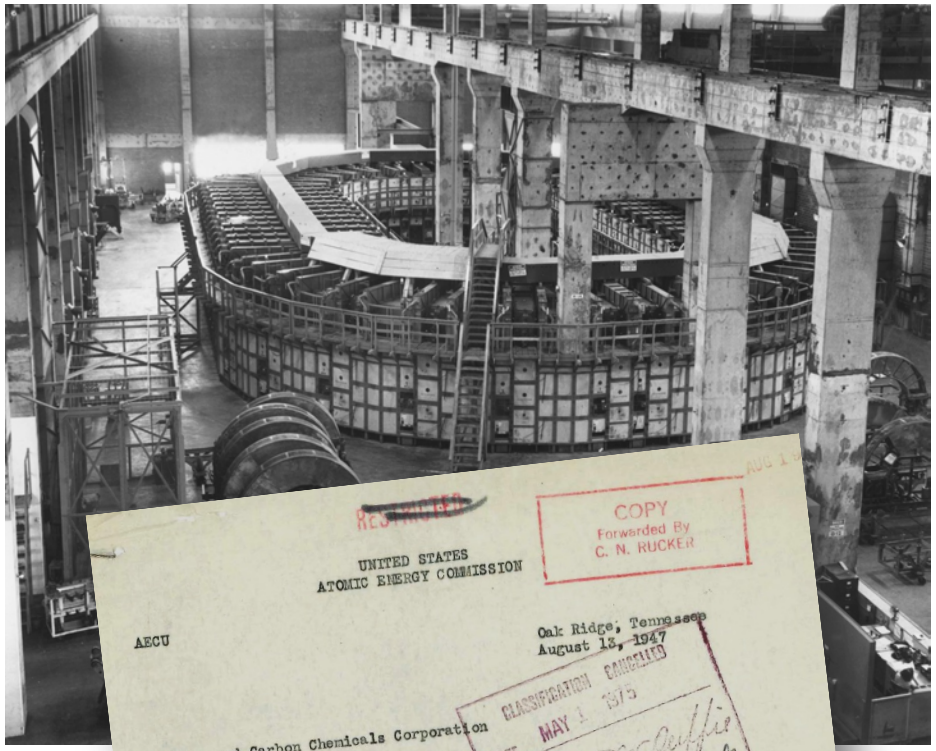
ORNL is managed by UT-Battelle, LLC for the US Department of Energy

U.S. DEPARTMENT OF ENERGY

Isotope Program
U.S. Department of Energy

Isotope production, enrichment and distribution began at Oak Ridge in 1946





COPY
Forwarded By
C. N. RUCKER

UNITED STATES
ATOMIC ENERGY COMMISSION

AECU

Oak Ridge, Tennessee
August 13, 1947

CLASSIFICATION CANCELLED
DATE MAY 1 1973

Carbide and Carbon Chemicals Corporation
Post Office Box P
Oak Ridge, Tennessee

Attention: Mr. C. E. Center

Gentlemen:

Subject: STABLE ISOTOPES FOR "OFF-PROJECT CUSTOMERS"

The Atomic Energy Commission is undertaking the formulation of a policy and program to make available and to distribute stable isotopes to qualified establishments beyond the limits of AEC projects and installations. The program will also include a survey of the potential market for stable isotopes.

As discussed with Mr. Rucker in a recent conference on this matter, an arrangement similar to that effected with Monsanto Chemical Company for the distribution of radio isotopes would be considered very desirable and effective. Accordingly, the following outlined plan is offered for your consideration and comments:

a. All requests for stable isotopes will be addressed to the Isotopes Branch, AEC. This branch will screen these requests and make determinations of approval or allocations between requesting agencies. Questions of availability, specifications, etc. will be coordinated between AEC and Carbide.

b. Approved requests will be transmitted by the Isotopes Branch through the Contracting Officer to Carbide, Y-12.

c. Upon receipt of an approved request, the properly authorized person in Carbide would then contact the requesting agency to consummate details to effect the shipment.

ORNL has a Rich History in Medical Radioisotopes

1946

1st ^{14}C shipment to Barnard Free Skin and Cancer Hospital, St. Louis.
1946-1963: 1000's of shipments of up to 60 different radioisotopes

1947-2009

Large-scale mouse genetics project to study the effects of radiation on mammals

1993

Cancer and Heart Disease Treatment

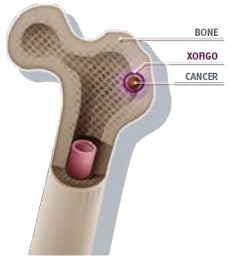
1997

^{225}Ac & ^{225}Ac /^{213}Bi generator production

1998-2011

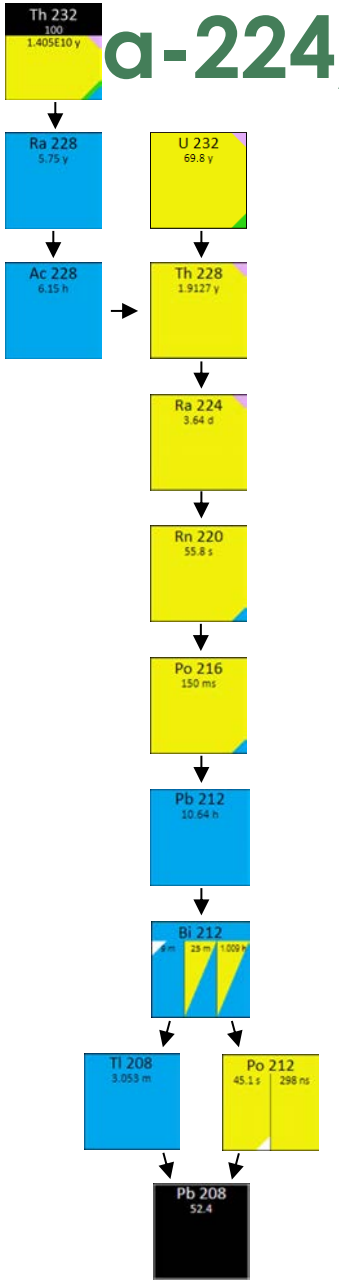
Office of Biological and Environmental Research: Low Dose Radiation Research

2017



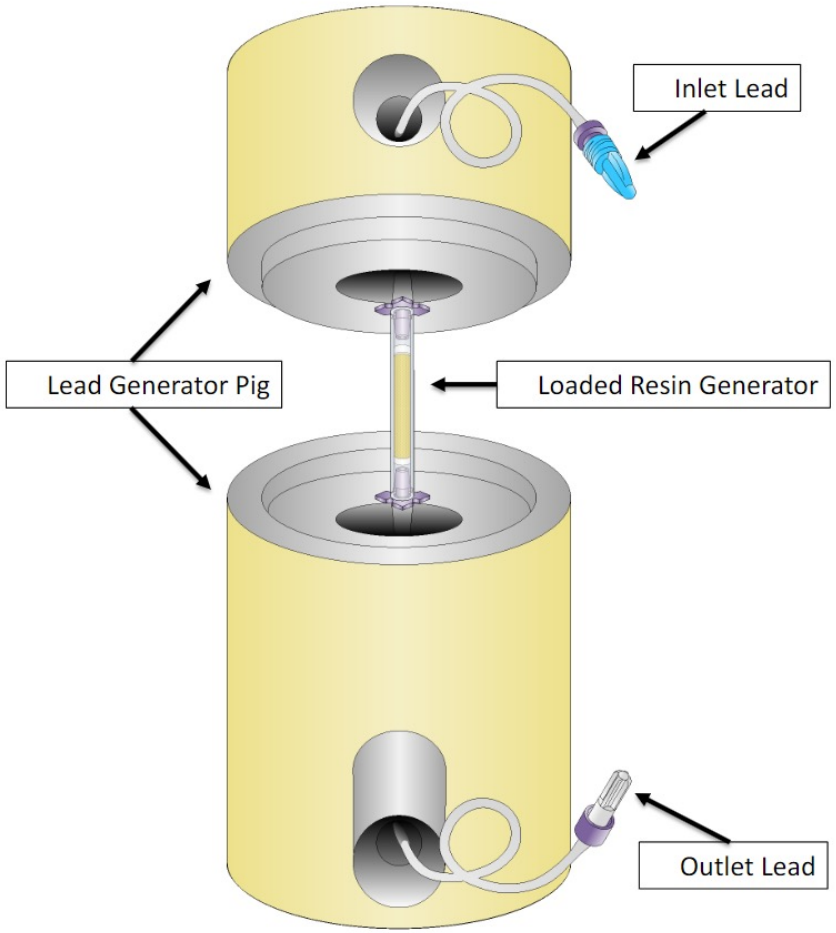
^{227}Ac/^{223}Ra treatment for prostate cancer patients

a-224/Pb-212 Generator production



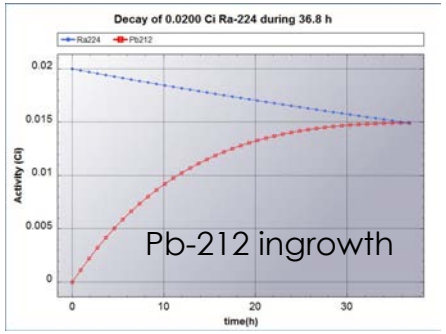
- Production established in 2014
- ^{224}Ra (3.6 d) separated from parent ^{228}Th and loaded on cation resin
- “Generator” (<20 mCi) can be milked periodically for ^{212}Pb ($t_{1/2}$ = 10.6 h) and ^{212}Bi($t_{1/2}$ = 1 hr) and used in TAT applications
- Stock of ^{228}Th available to support production

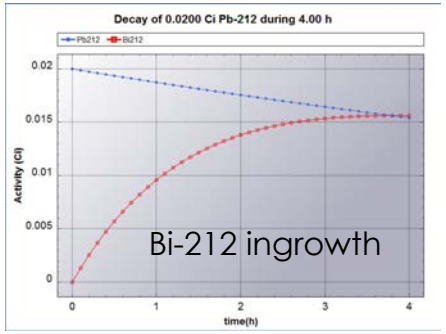
Ra-224/Pb-212 Generator production

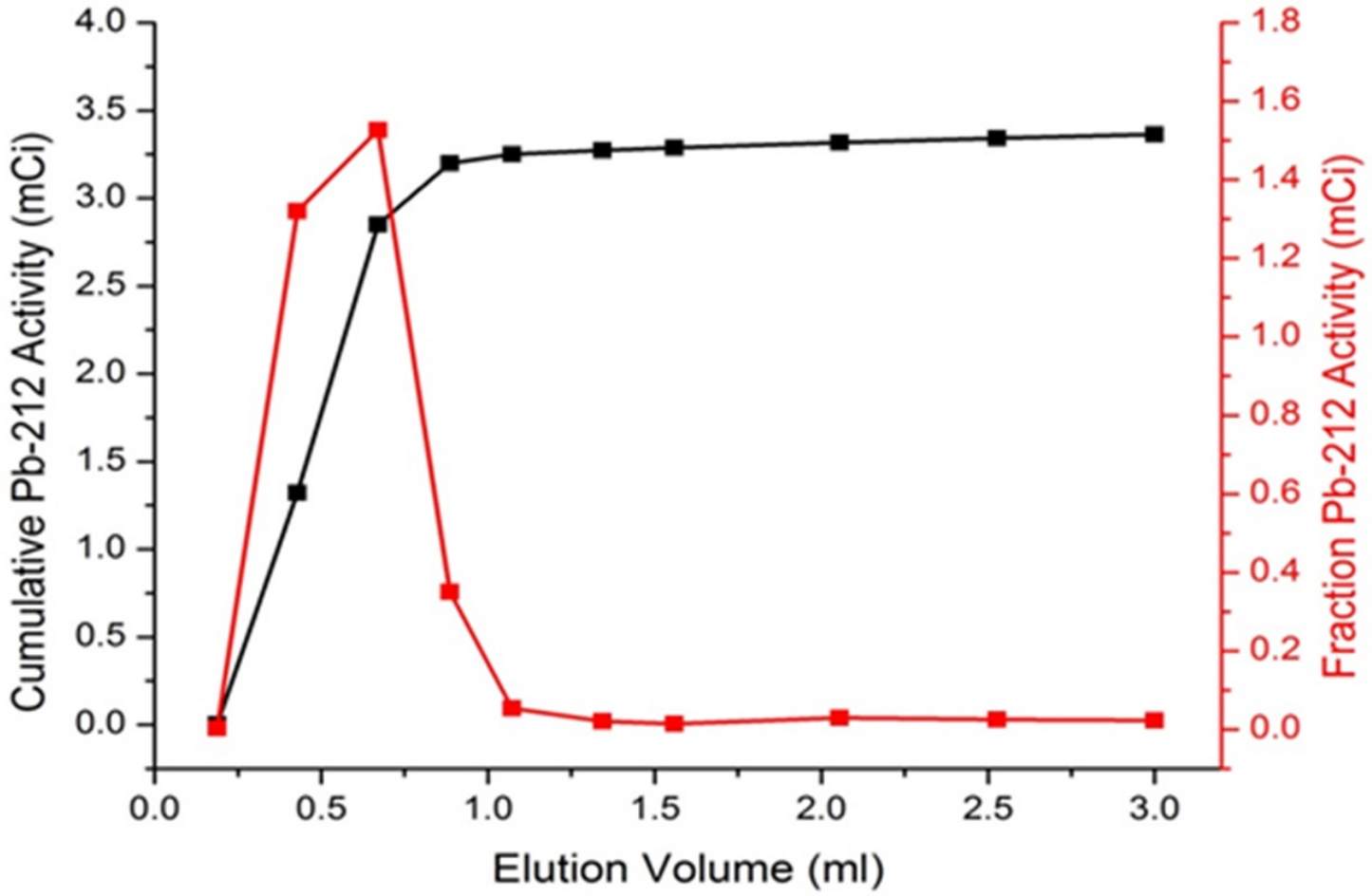


Pb-212 Elution Profile

- Pb-212 can be eluted from the generator in 2 M HCl
- Bi-212 can be eluted in 0.15 M HI or 0.15 M KI/0.1 M HCl

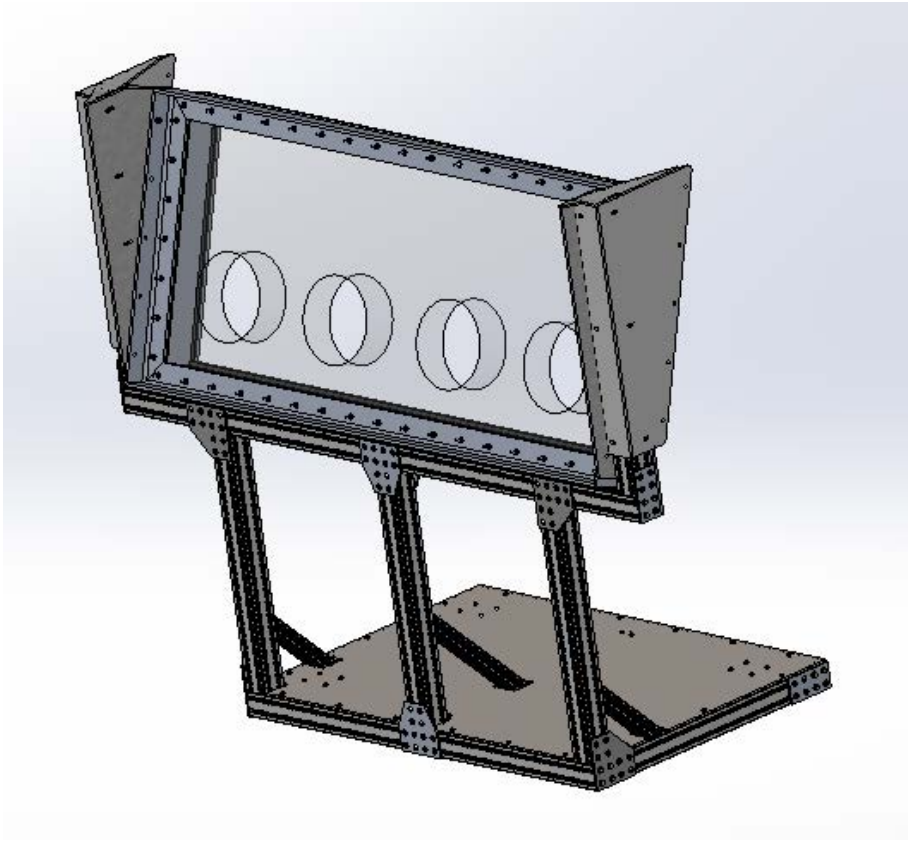






Future Increased Production

- Glovebox shield under construction to minimize worker dose and increase loading activity



Ordering and Availability

Isotope Program U.S. Department of Energy | NIDC NATIONAL ISOTOPE DEVELOPMENT CENTER MANAGED BY THE U.S. DEPARTMENT OF ENERGY ISOTOPE PROGRAM

Radium-224/Lead-212/Bismuth-212 Generator Product Information

Specifications

Radioisotope	Ra-224
Half-Life/Daughter	Radium-224: 3.6319 days to radon-220 Lead-212: 10.64 hours to bismuth-212
Decay	Decay Radiation Information (NNDC)
Chemical Form	Ra-224 absorbed on AG MP-50 resin
Radionuclidic Purity	>99.9% Ra-224; <0.01% Th-228
Production Route	Decay of thorium-228
Processing	Ion exchange separation
Primary Container	Generator is housed in a one inch lead pig with inlet/outlet holes

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Radium-224 Product Information

Specifications

Radioisotope	Ra-224
Half-Life/Daughter	3.6319 days to radon-220
Decay	Decay Radiation Information (NNDC)
Chemical Form	Radium chloride in 1 M HCl solution or solid radium nitrate
Radionuclidic Purity	>99.9% Ra-224; <0.1% Th-228
Production Route	Decay of thorium-228
Processing	Ion exchange separation
Primary Container	Glass V-vial
Availability	Routinely available (monthly)
Unit of Sale	Millicuries

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Thorium-228 Product Information

Specifications

Radioisotope	Th-228
Half-Life/Daughter	1.9116 years to radium-224
Decay	Decay Radiation Information (NNDC)
Chemical Form	Nitrate solid
Available Specific Activity	31.1 TBq/g (8.4×10^2 Ci/g), no carrier added
Radionuclidic Purity	>99%
Radioisotopic Purity	>99%
Production Route	Irradiation of radium-226
Processing	Ion exchange separation
Primary Container	Glass screw top bottle in nonreturnable container
Availability	Stock

Questions?