

# Oak Ridge $^{224}\text{Ra}/^{212}\text{Pb}$ Generator Production

Roy Copping

$^{212}\text{Pb}$  User Meeting, July 30<sup>th</sup> 2020

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Name/Org: Kevin J. Hart Date: November 1, 2019  
Guidance (if applicable): DOE Isotope Program PM Office



U.S. DEPARTMENT OF  
**ENERGY**

 **Isotope Program**  
U.S. Department of Energy

# Agenda

11:00 – 11:10 AM **Roy Copping**, Oak Ridge National Laboratory (Moderator)  
Introduction – *“Oak Ridge Ra-224/Pb-212 generator production”*

11:10 – 11:20 AM **Mengshi Li**, Viewpoint / University of Iowa  
*“Preclinical evaluation of synergistic anti-tumor effect from combination of  $^{212}\text{Pb}$  alpha-radiation and immune checkpoint inhibitors”*

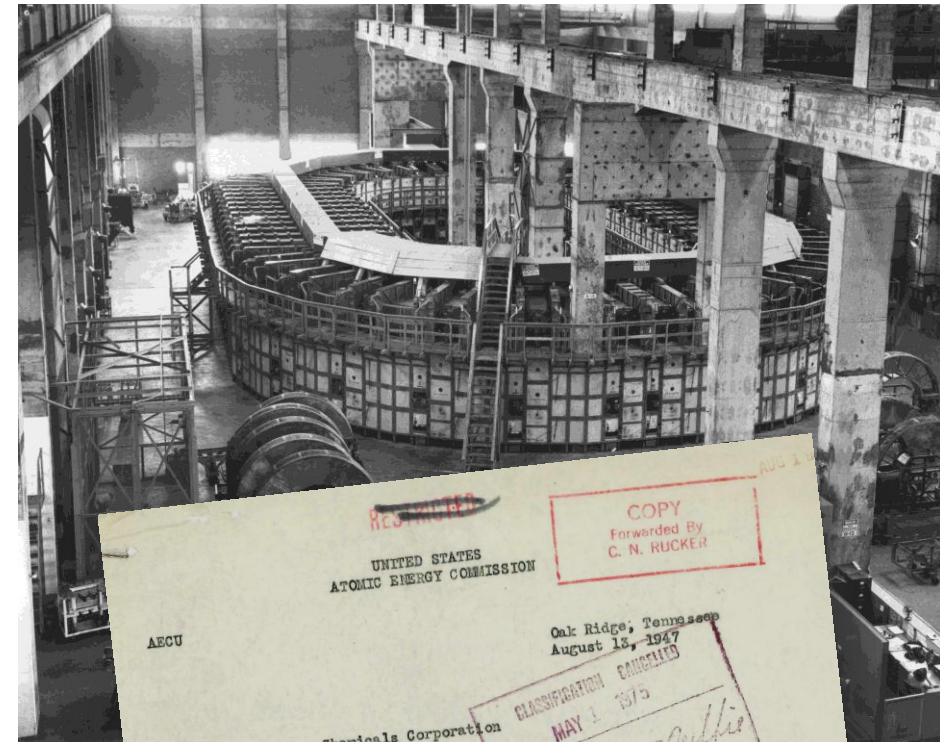
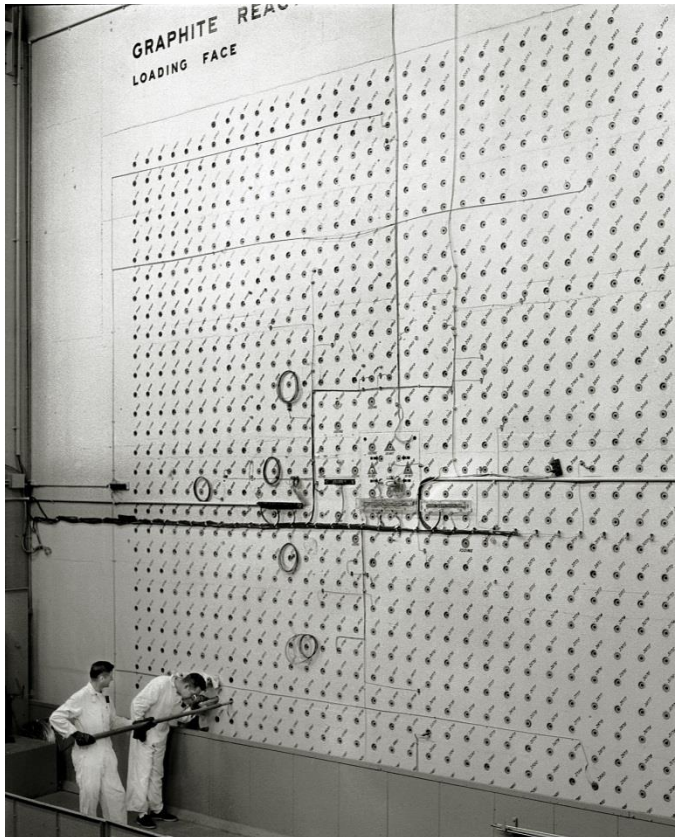
11:20 – 11:30 AM **Sangeeta Ray**, Johns Hopkins University  
*“Preclinical evaluation of  $^{212}\text{Pb}$ -based radiopharmaceutical therapy of prostate cancer”*

11:30 – 11:40 AM **Ebrahim Delpassand**, Chairman & CEO, RadioMedix Inc.  
*“ $^{212}\text{Pb}$ -AlphaMedix<sup>TM</sup> Targeted Alpha Therapy (TAT): A potential breakthrough in treatment of metastatic SSTR expressing NET”*

11:40 – 11:50 AM **Matt O'Hara**, Pacific Northwest National Laboratory  
*“Recent activities in  $^{212}\text{Pb}$  generator development at PNNL”*

11:50 – 12:30 PM Q&A Segment

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



RESTRICTED

COPY Forwarded By C. N. RUCKER

UNITED STATES ATOMIC ENERGY COMMISSION

AECU

Oak Ridge, Tennessee  
August 12, 1947

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"

CLASSIFICATION MAY 1 1975

DECLASSIFICATION OFFICE  
OF THE NATIONAL ARCHIVES  
WASHINGTON, D.C. 20540

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:

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



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

1947-2009



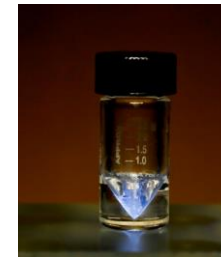
Large-scale mouse genetics project to study the effects of radiation on mammals  
Radiation Protection and Effects  
- Broad biological research program

1993



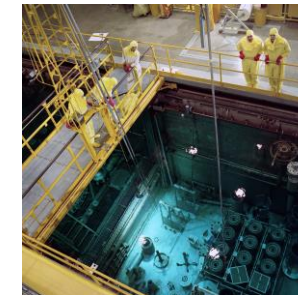
Cancer and Heart Disease Treatment

1997



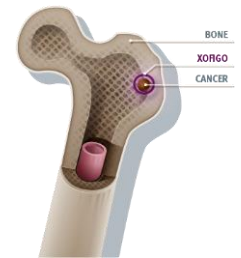
$^{225}\text{Ac}$  &  $^{225}\text{Ac}/^{213}\text{Bi}$  generator production

1998-2011



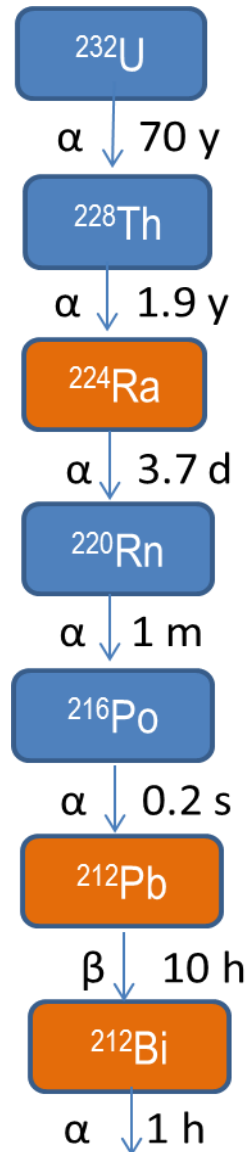
Office of Biological and Environmental Research: Low Dose Radiation Research

2017



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

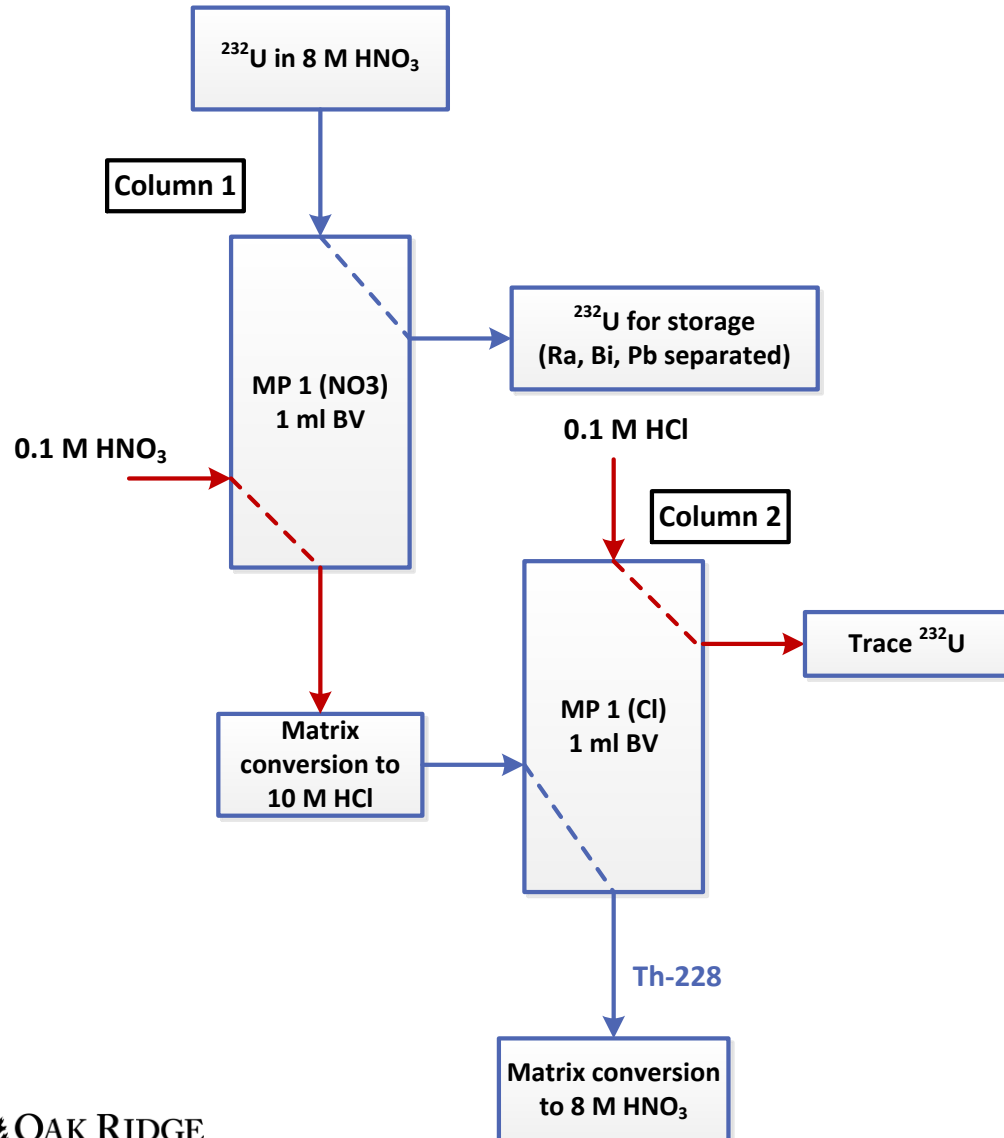
# $^{224}\text{Ra}/^{212}\text{Pb}$ Generator production



- Production established in 2014
- $^{224}\text{Ra}$  (3.6 d) separated from parent  $^{228}\text{Th}$  and loaded on cation resin
- “Generator” (<16 mCi) can be milked periodically for  $^{212}\text{Pb}$  ( $t_{1/2} = 10$  hrs) and  $^{212}\text{Bi}$  (1 hr) and used in TAT applications
- Shipments every three weeks
- $^{228}\text{Th}$  cow periodically supplemented from  $^{232}\text{U}$  parent

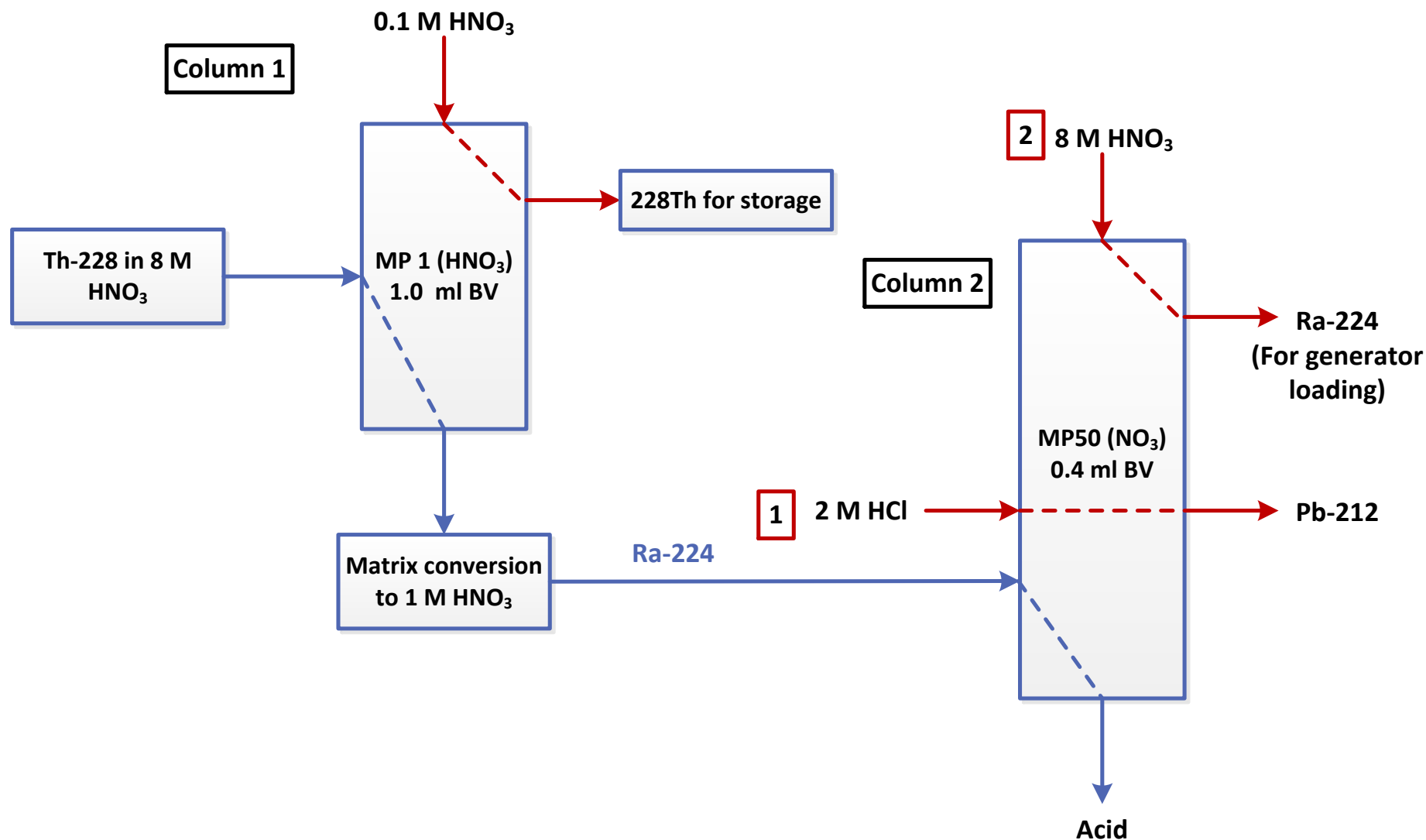
# Chemistry

- $^{228}\text{Th}$  parent recovered from  $^{232}\text{U}$  annually



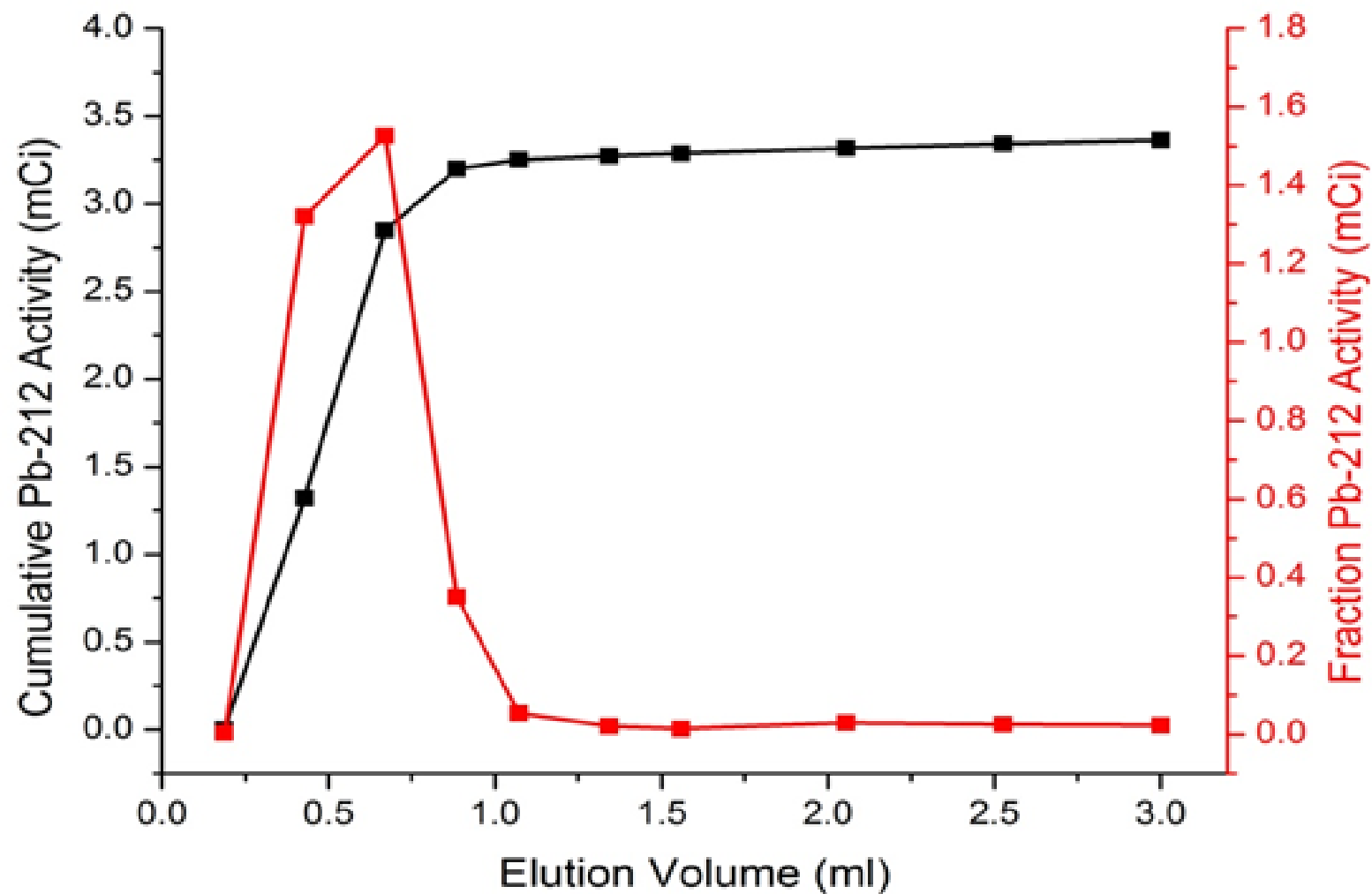
# Chemistry

- $^{228}\text{Th}$  separated and recycled during  $^{224}\text{Ra}$  separation for generator loading



# $^{212}\text{Pb}$ Elution Profile

- $^{212}\text{Pb}$  can be eluted from the generator in 2 M HCl





# $^{224}\text{Ra}/^{212}\text{Pb}$ Generator



# $^{224}\text{Ra}/^{212}\text{Pb}$ Generator Future Developments

- $^{228}\text{Th}$  available as a bi-product of Ac-227 production
- Expanded production envisaged in FY20/21
- Glovebox shield under construction to minimize worker dose and increase loading activity
- Can work with customer on schedule/activities