



Introduction to the DOE Isotope Program and Mission

DOE Office of Science's Office Hours
March 11, 2024

Dr. Ethan Balkin

Office of Science for Isotope R&D and Production
U.S. Department of Energy

Statement of Commitment



The DOE Office of Science (SC) microsite on Diversity, Equity & Inclusion is now posted on the SC website.

The entirety of the statement can be found at:


<https://science.osti.gov/sc-2/research-and-conduct-policies/diversity-equity-and-inclusion/>

“The DOE Office of Science (SC) is fully committed to fostering safe, diverse, equitable, and inclusive work, research, and funding environments that value mutual respect and personal integrity. Effective stewardship and promotion of diverse and inclusive workplaces that value and celebrate a diversity of people, ideas, cultures, and educational backgrounds is foundational to delivering on the SC mission. The scientific community engaged in SC-sponsored activities is expected to be respectful, ethical, and professional.

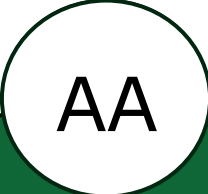
The DOE SC does not tolerate discrimination or harassment of any kind, including sexual or non-sexual harassment, bullying, intimidation, violence, threats of violence, retaliation, or other disruptive behavior in the federal workplace, including DOE field site offices, or at national laboratories, scientific user facilities, academic institutions, other institutions that we fund, or other locations where activities that we support are carried out...”

The Faces of DOE IP

 Vacant Admin Assistant	 Andrea Conrad Financial Management Specialist Budget Formulation	 Jehanne Gillo Director	 Deanna Ammons Financial Management Specialist Budget Execution	Bill Newton Subcontract Support	Leonard Mausner Subcontract Support
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Ethan Balkin
Radioisotope Production R&D



AA
Ade Ademiluyi
Alternative Isotope Production



Kenneth Brooks
Isotope Program Operations (NIDC)




Arne Freyberger
Isotope Accelerator Facilities



April Gillens
Stable Isotopes



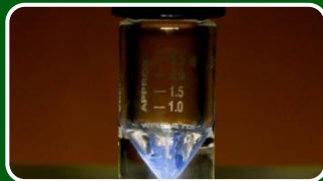
Khanne Jackson
Isotope Program Initiatives



Jon Neuhoff
Isotope Reactor Facilities



Julie Ezold
Technical Advisor



Produce and/or distribute radioactive and stable isotopes that are in short supply; includes by-products, surplus materials and related isotope services



Maintain the infrastructure required to produce and supply priority isotope products and related service



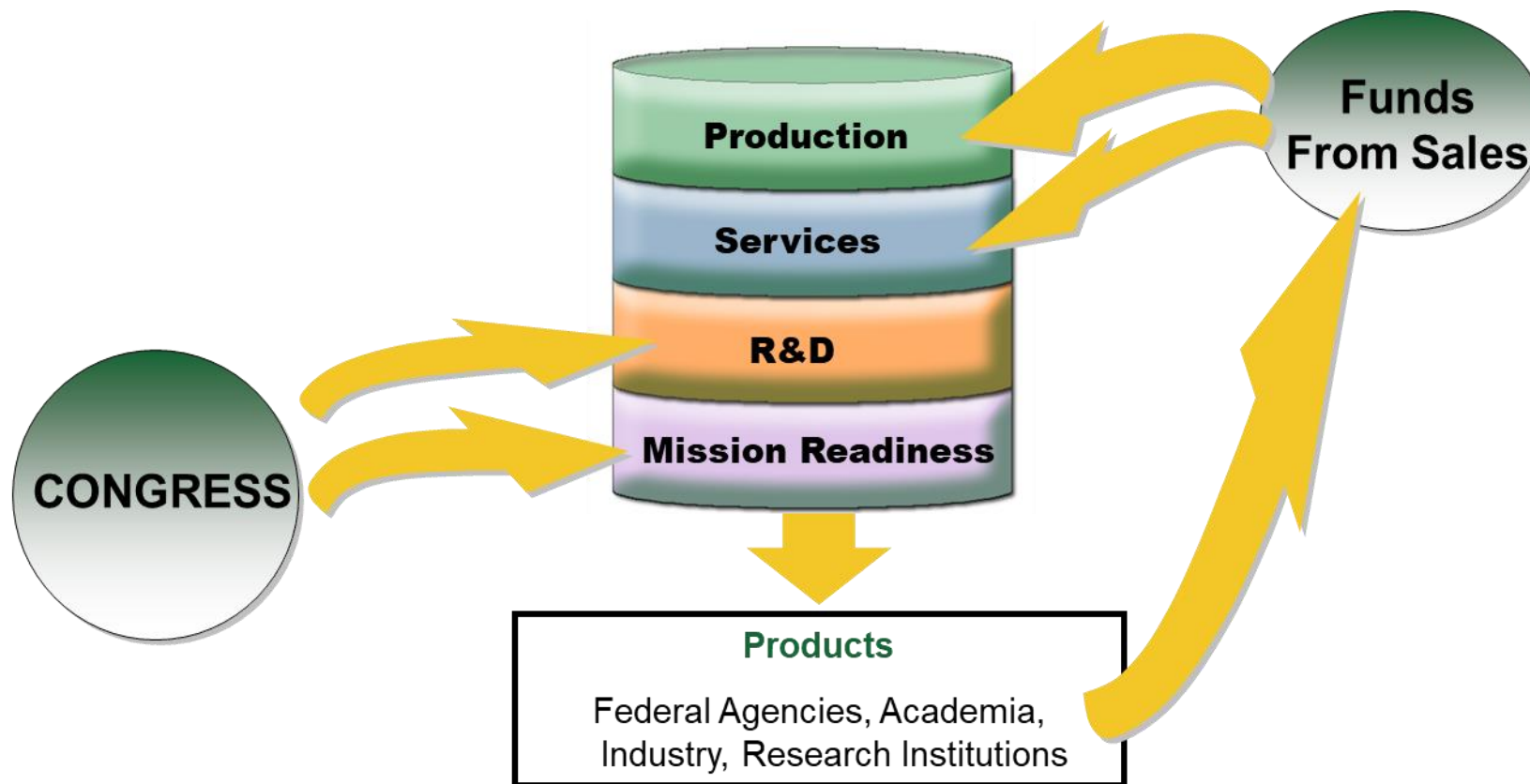
Conduct R&D on new and improved isotope production and processing techniques which can make available priority isotopes for research and application. Develop workforce.



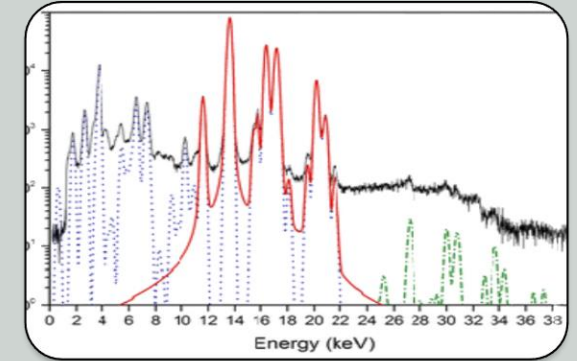
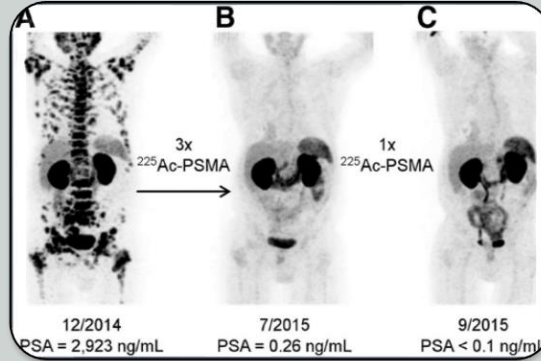
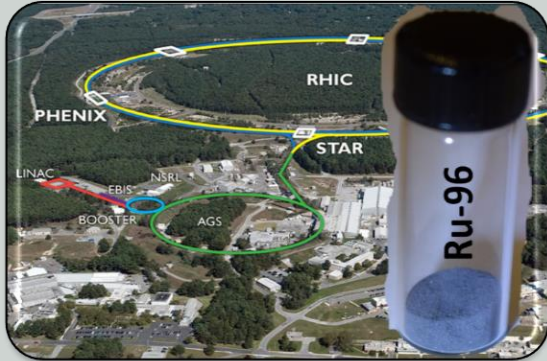
Ensure robust domestic supply chains. Reduce U.S. dependency on foreign supply to ensure National Preparedness.

Government Role

- Research program enables advances and workforce development
- Coordinated isotope production capacity mitigates shortages
- Ability to nurture markets, provide high risk, or boutique isotopes
- Leverage world-class capabilities at national laboratories
- “Non-profit”, “No-compete”, research and government stature enables unique perspective
- Equal opportunity to access, technology



Applications of Isotopes



Basic Research

- Physics
 - Super Heavy Elements
 - Nuclear Physics
- Environment
- Materials
- Agriculture
- Analytical Chemistry
- Geosciences

Medicine

- Therapies
- Imaging/Diagnostics
- Research
- Dental

Industry

- Standards
- Inspections
- Testing
- Sources
- Nuclear Data
- Forensics

National Security

- Communication
- Detection
- Nuclear Data
- Global Positioning
- Sources

Deciding What to Produce?



The DOE IP does not compete with domestic private industry.

Policies and Procedures for Transfer of Commercial Radioisotope Production and Distribution to Private Industry (“Policy Notice”), 30 Fed. Reg. 3247 (March 9, 1965)

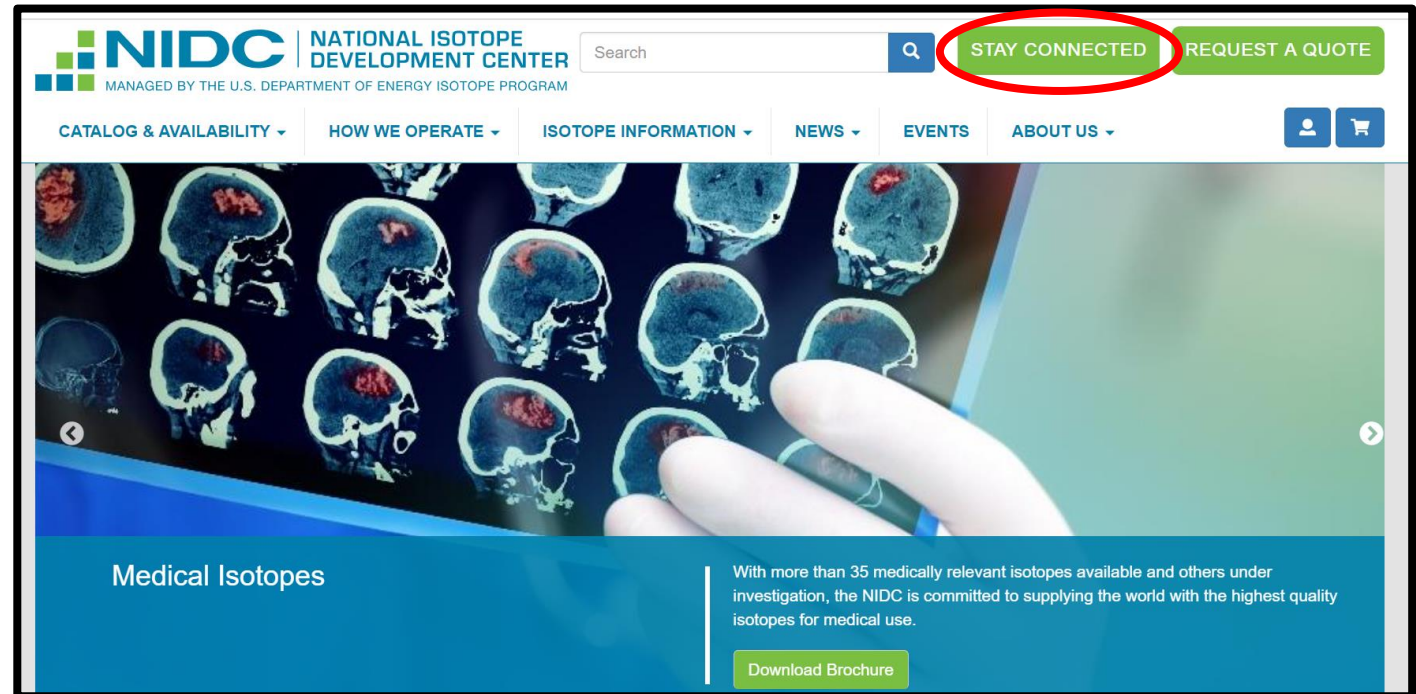
DOE IP can remain in backup capacity



- ▶ The NIDC (located at Oak Ridge National Laboratory) is the business arm of DOE IP: coordinates sale and distribution of DOE isotope products and services available from DOE and UIN partner facilities.
- ▶ Contractual discussions with customers.
- ▶ Transportation, Q&A, public relations, cross-cutting technical topics, marketing strategy and assessments.

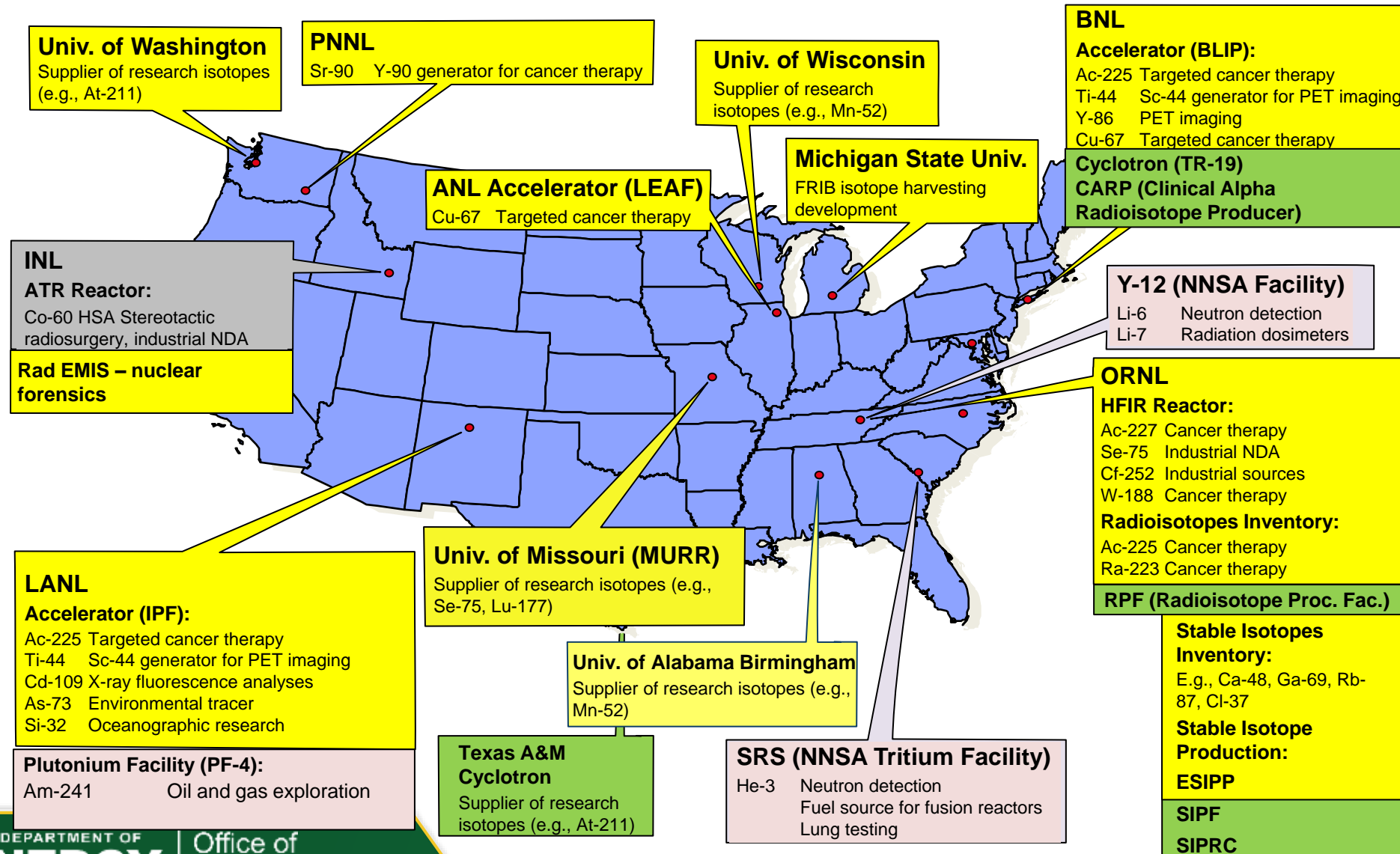
▶ www.isotopes.gov

Sign up here for DOE IP newsletter



DOE IP Production Sites- 2024

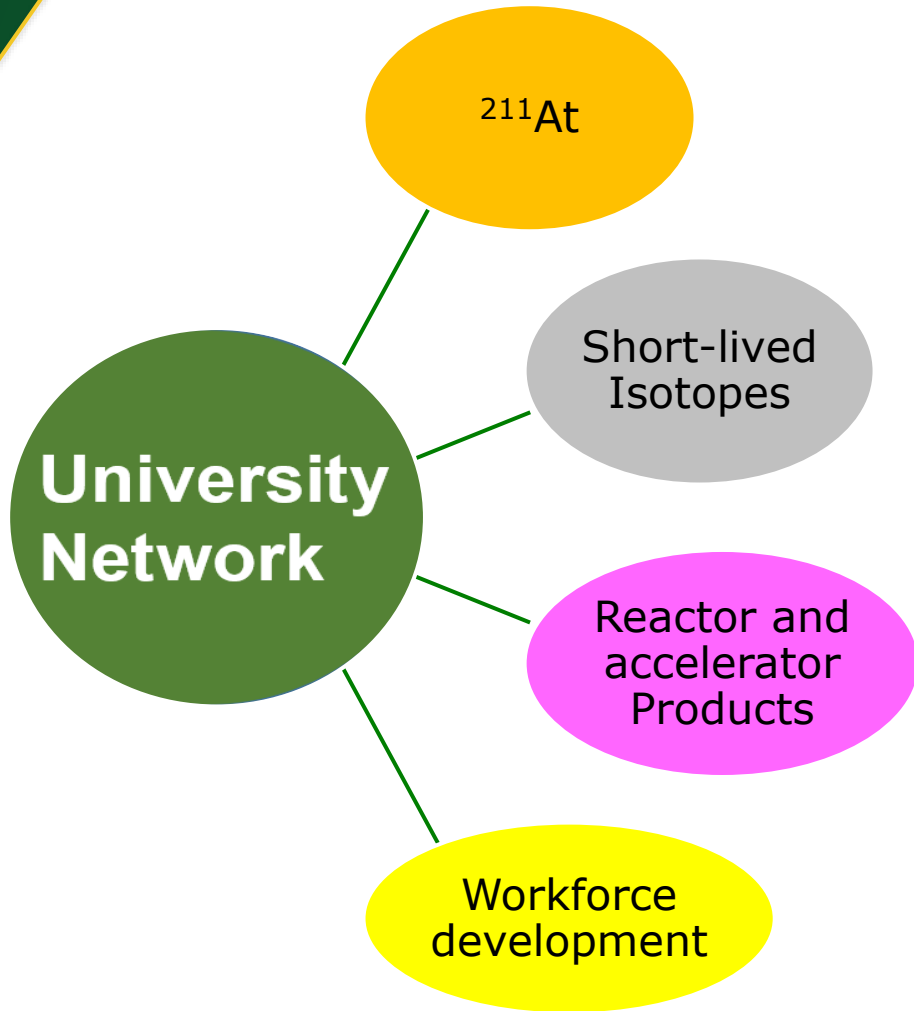
Unique collection of accelerators, reactors, other capabilities



Green boxes under development

13/19 facilities added while under SC management

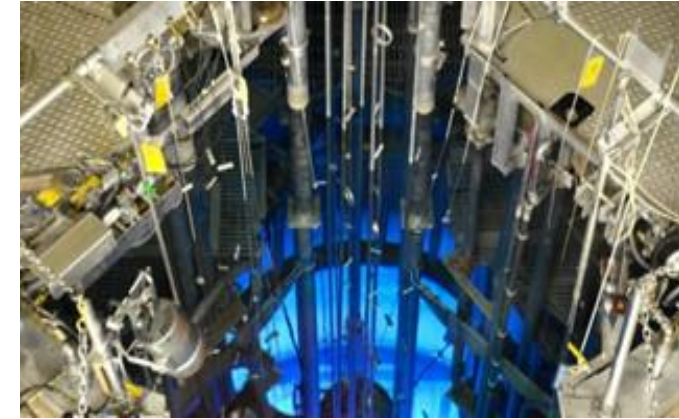
University Isotope Network



University Network continues to grow

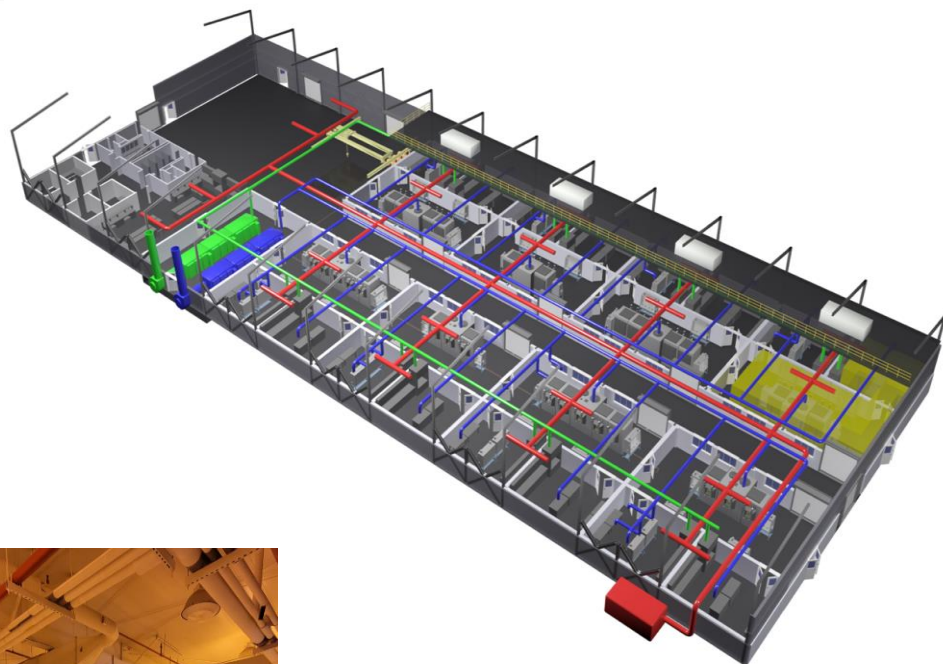
- ▶ UW, UMO/MURR, MSU, **UAB, UWM**
- ▶ Next: TAMU

- ▶ Cost-effective
- ▶ R&D on isotope production
- ▶ Boutique isotope production
- ▶ Workforce development



Independence requires additional radiochemical processing

RPF



CARP



LANL

- ▶ **Radioisotope Processing Facility (RPF)** at ORNL for reactor target processing.
 - HAZCAT 2 nuclear facility with modular hot cells, cGMP cleanroom
 - Estimated TPC ~ \$310-615M
 - CD-0 April 2021
- ▶ **Clinical Alpha Radionuclide Producer (CARP) Facility** for accelerator processing at BNL
 - Haz Cat 3 facility in repurposed building. Estimated TPC ~ \$60-80M
 - CD-0 December 2022
- ▶ **Radiochemical Processing Enhancements** at LANL: Add glove boxes and hot cells to new facility being constructed by NNSA/LANL

Stable Isotopes

Stable Isotopes are found naturally and do not decay.

Enriched stable isotopes are used in a variety of direct applications as well as to produce radioisotopes.

Samples enriched with a particular stable isotope are most desirable for applications. Enrichment technology emerged from the war-time era to enrich Uranium-235 and can be classified due to dual use technology.

Three common methods to enrich isotopes:

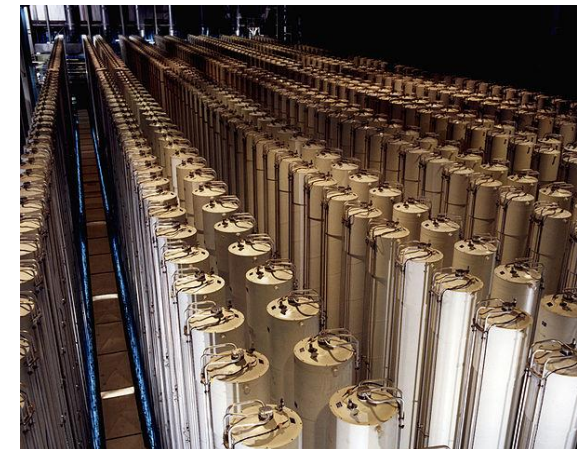
Distillation: Effective if large mass difference between isotopes – often used to separate light elements.

Gas Centrifuge: Gas rotated in cylinder at high speed to separate different masses by centrifugal force. Requires a gaseous form of element or compound. Best for higher throughput, lower enrichment.

Electromagnetic Separation: Isotopes are separated by a strong magnetic field. Best for higher enrichment, lower throughput.



Manhattan project Calutrons that enriched uranium via electromagnetic separation – no longer operating



Gas centrifuges from Piketon Plant- no longer operating

Stable Isotope Production and Research Center Strong U.S. Enrichment Capability



Stable Isotope Production and Research Center (SIPRC)

- **Expand our nation's ability to perform multiple isotope production campaigns at large scale production; mitigate foreign dependence; promote economic resilience.**
- DOE IP vision is to nurture core competencies in a broad suite of enrichment technologies

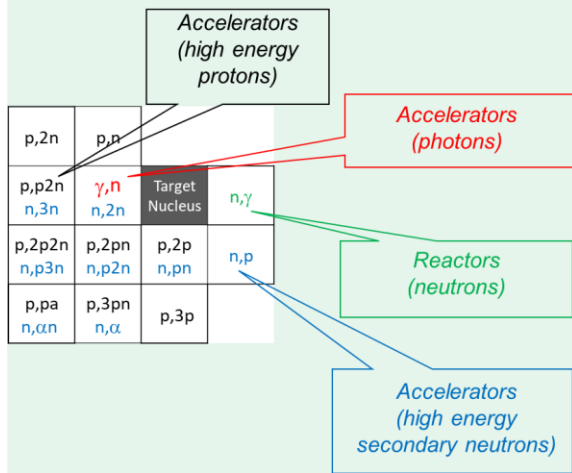


Groundbreaking Ceremony 10/22

Variety of R&D

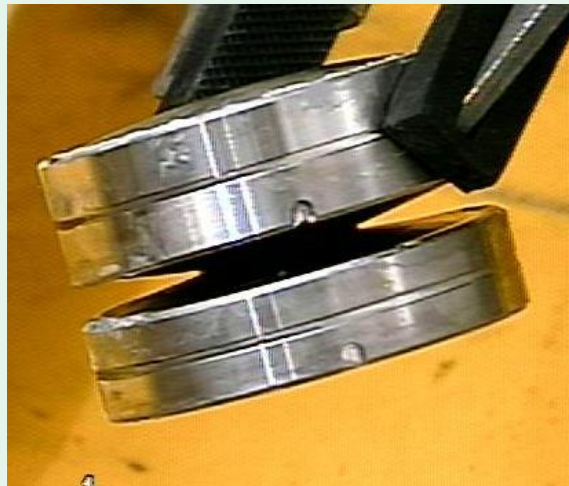
Transmutation

Radioisotope production enabled by nuclear data through neutron, charged particle, and photo nuclear reactions.



Targetry

Thermal hydraulics
Materials
Particle transport modeling



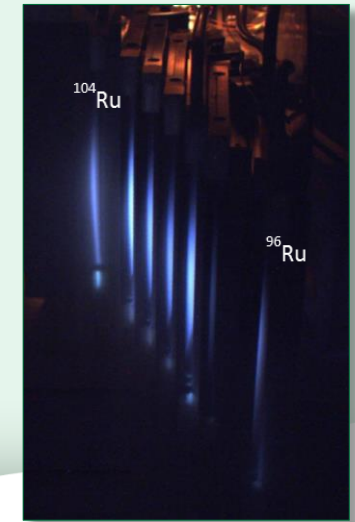
Processing

Separations science for the recovery and purification of radio isotopes
Process automation and remote handling



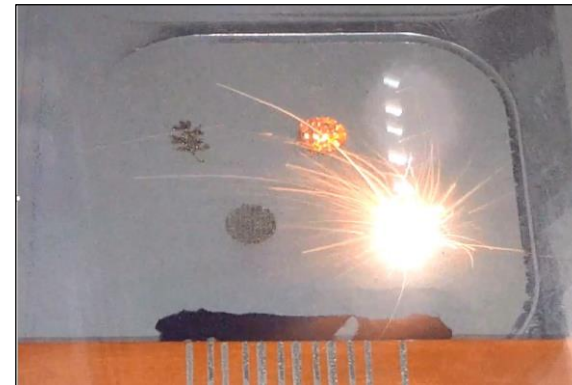
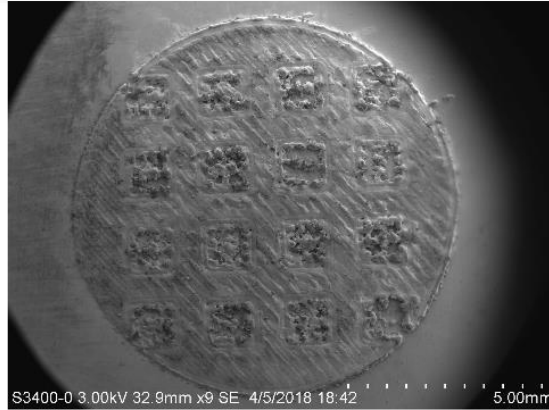
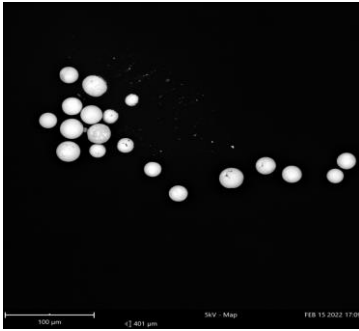
Enrichment

Isotope Program manages the Nation's inventory of stable isotopes
Have re-established enriched stable isotope production in the United States

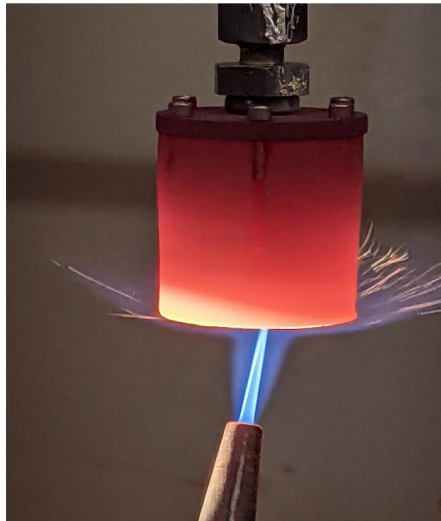
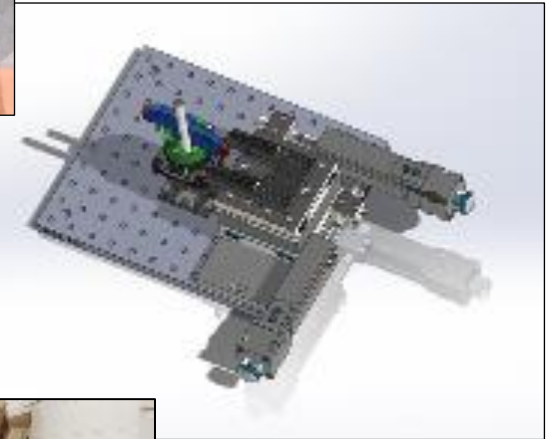


Variety of R&D

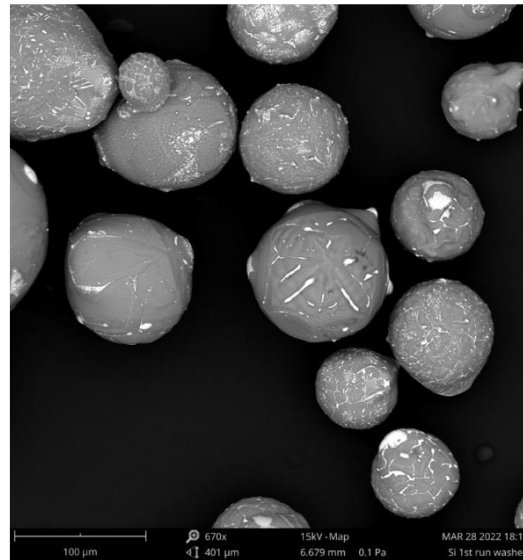
Precision dispensing: 19 Tungsten powder particles totaling 21 μg



Additive manufacturing of complex targets



Precision feedstock for additive manufacturing of functional materials – spheroidal powders with controllable properties. Aerosol jetting is one technique developed.



Si-28 as a spheroidal powder



Robot for extraction of irradiated targets

Custom Designed and Fabricated Biofluidix Inkjet Printer for targets

- ▶ Research, RENEW, FAIR, HIPPO
- ▶ Annual SC Early Career Research Program FOA
- ▶ Annual SC EPSCOR Program FOA
- ▶ SC Graduate Student Research (SCGSR) and SC Summer Undergraduate Laboratory Internship (SULI)
- ▶ Minority Educational Institution Student Partnership Program (MEISPP) Internships
- ▶ Support student and postdoctoral travel bursaries for conference attendance
- ▶ DOE IP co-funds the annual Nuclear and Radiochemistry Summer School with BES & NP
- ▶ Organized student seminar series during COVID to promote networking

Conclusions

- DOE IP is a small Federal Program which makes a very large impact.
- DOE IP develops and maintains world-leading radio- and enriched stable isotope production and processing capabilities.
- DOE IP is making substantial investments in workforce development.
- In response to increasing market demand DOE IP is increasing the processing capability of several DOE IP sites.
- Multiple new products have been added to the product catalog in the past 2-years.

Upcoming Events

- Isotope R&D and Production (DOE IP) DOE IP will hold virtual office hours on the second Monday of the month, 2-3pm ET. In cases where the second Monday falls on a federal holiday, the office hour will slide to the third Monday of the month. Upcoming topics include:
 - Monday, April 8, 2024, at 2pm ET – Competitive DOE IP Funding Opportunities for R&D and Training
 - Monday, May 13, 2024, at 2pm ET – Working with a Program Manager Before, During, and After an Award
- For more information on DOE IP office hours, including registration, upcoming topics, slides, and recordings, please visit <https://science.osti.gov/Isotope-Research-Development-and-Production/officehours>.
- We look forward to having you join our Office of Science network and office hours!

Thank You!

