NP Isotope Program and Facilities and the SBIR/STTR Program

2013 DOE-NP SBIR/STTR Exchange Meeting
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DOE Isotope Program
Office of Nuclear Physics, Office of Science, U.S. Department of Energy
http://science.energy.gov/np/research/idpra/
Authorities and Policies

- **Atomic Energy Act of 1946**
- **Atomic Energy Act of 1954**
  - provides the statutory and legal authorities under which the DOE can produce its products and provide related services
- **AEC Policy Statement-- 2 March, 1965**
  - “The Commission’s policy is to refrain from competing with private sources of materials when they are reasonably available commercially.”
- **Public Law 101-101 (September, 1989)**
  - An appropriation establishing a revolving fund “...to cover necessary expenses...related to the production distribution, and sale of isotopes and related services”.
  - “…fees shall be set...to provide full cost recovery”
  - Administered in the DOE Office of Nuclear Energy
- **Public Law 102-104 (August, 1991)**
  - provides borrowing authority if at any time the amounts available to the fund are insufficient to enable DOE to discharge its responsibilities with respect to isotope production and distribution.
- **Public Law 103-316 (August, 1994)**
  - Allowed flexibility in the setting of fees so that isotopes used for research could be more affordable; provided an annual appropriation to cover infrastructure costs.
- **Public Law 111-8 (March, 2009)**
  - Transferred management of Isotope Program to Office of Nuclear Physics in the DOE Office of Science
- Produce and/or distribute **priority radioactive and enriched stable isotopes** that are in short supply, including valuable by-products, surplus materials and related isotope services.

- Maintain the infrastructure required to produce and supply isotope products and related services.

- Conduct R&D on new and improved isotope production and processing techniques which can make available new isotopes for research and applications.
  - Core R&D at Key Laboratories where there are Programmatically stewarded activities
  - Competitive R&D
  - SBIR/STTR, Early Career Award Program
Isotope Program Organization

Office of Nuclear Physics
http://science.energy.gov/np/
Tim Hallman, Director

Facilities & Project Management Division
Jehanne Gillo, Director

Nuclear Physics Research Division
Tim Hallman, Acting Director
Low Energy, Medium Energy, Heavy Ion, Theoretical, Accelerator Physics

Support
Luisa Romero, Program Analyst
(budgets, reports, performance)

Isotope Facilities
Marc Garland
(Production, facility needs)

Isotope Research
Dennis Phillips
(Research needs, R&D)

Stable Isotopes and Accountable Materials
Joel Grimm
(Stable, accountable materials)

National Isotope Development Center
http://www.isotopes.gov/

e-mail: firstname.lastname@science.doe.gov
National Isotope Development Center

IBO has evolved into NIDC
The Department of Energy National Isotope Development Center (includes the Isotope Business Office located at Oak Ridge National Laboratory) coordinates the distribution of all DOE isotope products and services available from DOE facilities.

Information and quotations for products and services can be obtained by contacting: National Isotope Development Center, Oak Ridge National Laboratory, Oak Ridge, TN 37831-6158, Phone: (865) 574-6984, Fax: (865) 574-6986, Email: isotopes@ornl.gov

www.isotopes.gov
Isotope Program Resources

- Isotope Production and Distribution Program Fund ("revolving fund")
- Prices charged for products and services to be based on costs of production, market value, U.S. research needs and other factors (Consistent with Public Laws 101-101 and 103-316)
- Commercial isotopes are priced at full-cost recovery; research isotopes at reduced prices.
- Program costs are financed by two resources: appropriation and revenue.
- Revolving fund and is audited annually.
Production Sites Integrated into the DOE Isotope Program

**PNNL**
- Sr-90  Y-90 generator for cancer therapy
- Ra-223 Cancer therapy
- Np-237 Research

**INL (ATR)**
- Co-60  Gamma knife, sterilization of medical equipment

**BNL (BLIP)**
- Ge-68  Calibration sources for PET equipment, antibody labeling
- Sr-82  Rb-82 generator for cardiac imaging
- Cu-67  Antibody labeling for targeted cancer therapy

**Washington Univ.**
- Pending supplier of research isotopes (e.g., Cu-64)

**Univ. of Washington**
- Pending supplier of research isotopes (e.g., At-211)

**UC Davis**
- Pending supplier of research isotopes (e.g., At-211, Zr-89, Y-86, Pb-203)

**LANL (IPF)**
- Ge-68  Calibration sources for PET equipment, antibody labeling
- Sr-82  Rb-82 generator for cardiac imaging
- As-73  Environmental tracer

**Univ. of Missouri (MURR)**
- Pending supplier of research isotopes (e.g., Ho-166, Lu-177, Sm-153)

**ORNL**
- HFIR: Se-75  Industrial NDA, protein studies
- Cf-252  Industrial sources
- W-188  Cancer therapy
- Ra-223 Cancer therapy
- Np-237 Neutron flux monitors

**Stable Isotopes Inventory:**
- E.g., Ca-48, Ga-69, Rb-87, Cl-37, Pt-195, Nd-146, Sm-149, Ru-99, Zr-96

**Radioisotopes Inventory:**
- Ac-225  Cancer therapy

**Y-12 (NNSA Facility)**
- Li-6  Neutron detection
- Li-7  Thermoluminescent dosimeters

**SRNL (NNSA Tritium Facility)**
- He-3  Neutron detection
- Fuel source for fusion reactors
- Lung testing
BLIP utilizes the beam from the proton Linac injector for the Booster, AGS, and RHIC accelerator (nuclear physics).

Excess pulses (~85%) are diverted to BLIP. Energy is incrementally variable from 66-202 MeV.

The BLIP beam line directs protons up to 105μA intensity to targets; parasitic operation with nuclear physics programs for more cost effective isotope production.
LANL Isotope Production Facilities

LANSCE Accelerator Complex

100 MeV IPF
High Flux Isotope Reactor (HFIR) at ORNL:
http://neutrons.ornl.gov/facilities/HFIR/
- High neutron flux (≤3×10^{15} n/cm² s)
- Multiple hydraulic tubes
- Several hot cell facilities
- Key Isotopes: Cf-252, W-188, Ni-63, Se-75

Advanced Test Reactor (ATR) at INL:
http://www.inl.gov/research/advanced-test-reactor-research/
- Moderately high neutron flux (≤4×10^{14} n/cm² s)
- Hot cell facilities
- Key Isotope: Co-60
Laboratories at ORNL are available to provide unique services and dispense over 200 different isotopes in a wide variety of chemical and physical forms:

- Metallurgical, ceramic, and high vacuum processing methods
- Pyrochemical Conversion: oxide to high-purity metal
- Arc-melting and alloying
- Hot and cold rolling
- Preparation of cold-rolled foils from air-reactive metals
- Drop casting
- Wire rolling/swaging (hot or cold)
- Target fabrication
Re-establish Production of Enriched Stable Isotopes in the United States

- Calutrons have not operated for over a decade.
- Isotope Program manages inventory – depleted/short for many isotopes in demand.
- Developing concepts for modern stable isotope separation technology: electromagnetic separation coupled with small configurable gas centrifuges.
- Smaller scale enrichment of specific isotopes for research
- ORNL 10 mA EMIS commissioned December 15, 2011; now developing 100mA ion source
- Successful peer review in August 2013
- Transitioning from R&D to prototype production facility – September 2013
- **Stable Isotope Enrichment**
  - High enrichment
  - High volume
  - Safe, secure operations

- **Accelerator and Reactor Radioisotope Production**
  - Targetry design and modeling
  - Separations and purification
  - Automation and remote handling
  - Safe compliant transportation of radioactive products
  - Waste management
  - New safe, secure transmutation technologies
SBIR and the Isotope Program

- **SBIR/STTR**
  - Support R&D toward commercialization of isotope products or services
  - Encourage collaboration between Labs and Industrial Partners
  - WFO, CRADA, IBO Contract

- **Expectations**
  - No adverse impacts on programmatic mission (facilities, personnel resources)
  - Development to commercialization primarily responsibility of the industrial partner
  - Independent commercialization
Thank You