NP Isotope Program and Facilities and the SBIR Program

Wolfgang Runde, PhD
Assoc. Director, National Isotope Development Center

Bob Atcher, PhD, MBA
Director, National Isotope Development Center

Isotope Development and Production for Research and Application
DOE Office of Nuclear Physics

History

- Congress entrusted the U.S. Department of Energy with the authority and responsibility to produce stable and radioactive isotopes for medicine, science, and industrial applications (Atomic Energy Act, 1954).
- The isotope program was created in the late 1980s to consolidate isotope production activity in DOE
- In FY2009, the program was moved from Office of Nuclear Energy to the Office of Nuclear Physics in the Office of Science.
- Better alignment with production labs was achieved – BNL, ORNL, PNNL are Office of Science labs.
- LANL (NNSA) and INL (NE) maintain participation in the program.
- Program was re-christened the *National Isotope Development and Production for Research and Applications Program*

Mission of the DOE Isotope Program

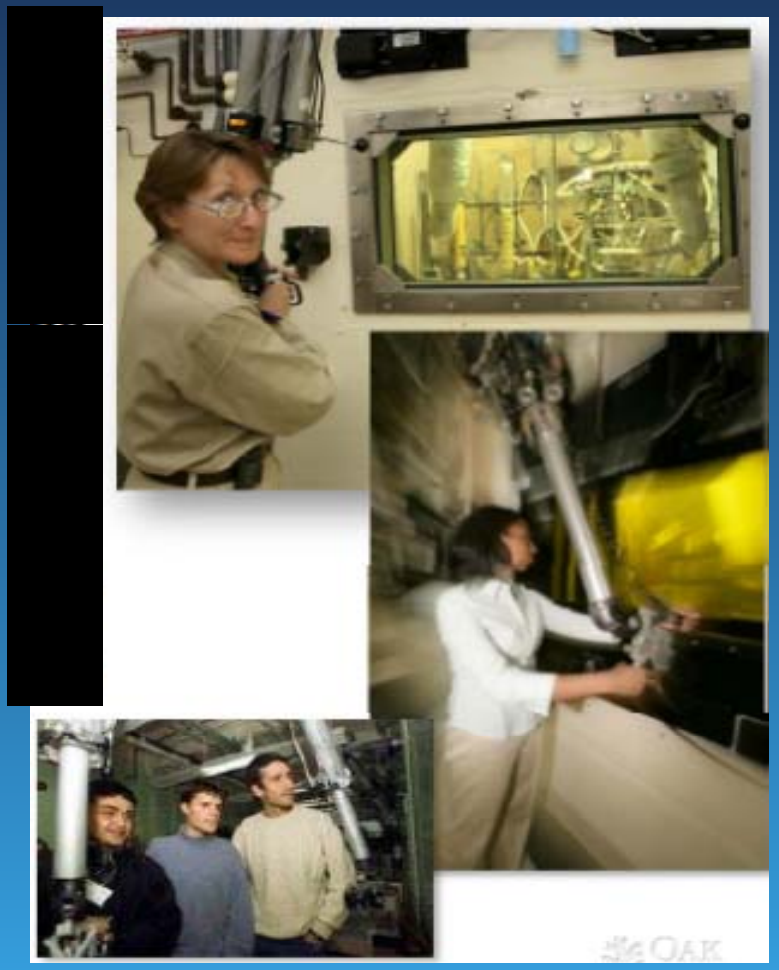
- Produce and distribute radioactive and stable isotopes that are in short supply, associated byproducts, surplus materials and related isotope services.
- Maintain the infrastructure required to produce and supply isotope products and related services.
- Conduct R&D on new and improved isotope production and processing techniques which can make available new isotopes for research and applications.

Present

- The program is managed from HQ
- Issues of substance will be conducted “Fed to Fed”
- A clear revision of its focus was adopted
  - Workshop in August 2008, Fed Workshop January 2012
  - NSAC subcommittee reports
- The *National Isotope Development Center* was established to coordinate business operations and production planning
- Peer review will be utilized
- Funds for STTR & SBIR are available

National Isotope Development Center (NIDC)

- As part of the move, NIDC was set up. NIDC is a virtual center responsible for five activities:
  - Manage the Isotope Business Office at ORNL
  - Oversee production scheduling
  - Oversee shipping and distribution
  - Communications and Customer interactions
  - Identify QA/QC support



Isotope Production Planning

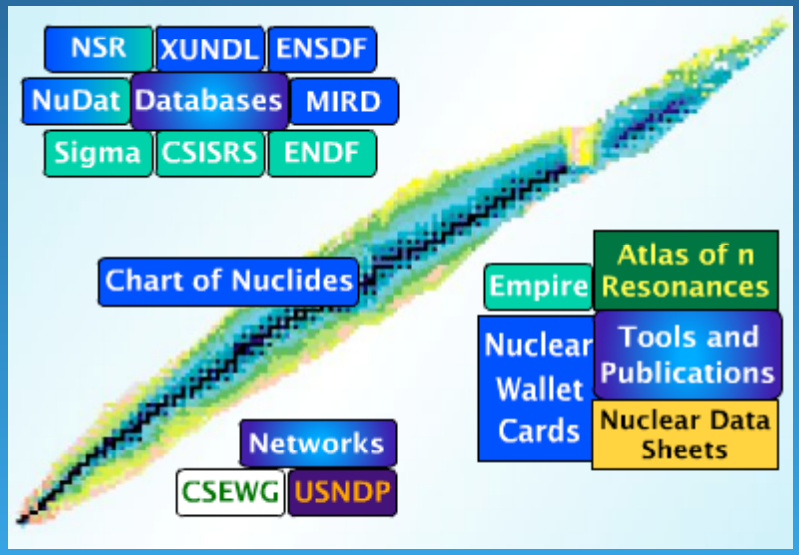
Align production capability and demand:

- Assess capabilities of sites (domestic and international)
- Review operating schedule vs. delivery dates
- Determine most cost effective option
- Work with customer to determine specifications for material
- Monitor operating schedule
- Revise any production plan if necessary

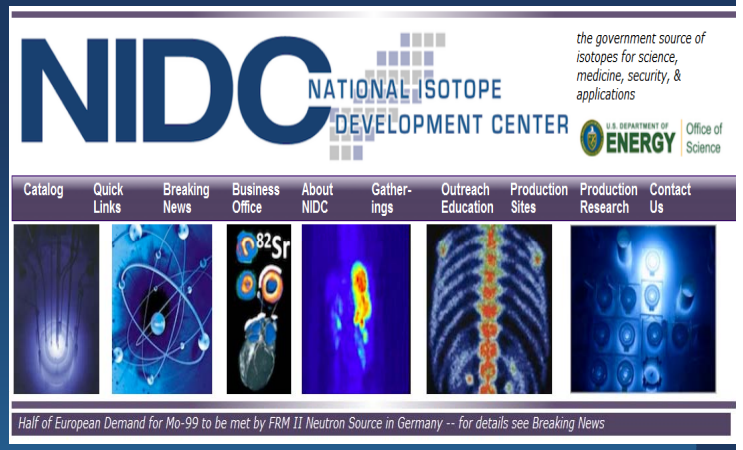
Engagement of Expert Resources

Examples:

- Identify experts to advise on issues related to QC and QA
  - Calibration
  - Assessing production
  - Drug Manufacturing Files
  - Good Manufacturing Practice
  - ICH Q7A
  - ISO 9000
  - Audit existing activity
  - Train sites for new work compliance



Communications via NIDC



- Website has been updated
  - www.isotopes.gov
  - Searchable by isotope or element
  - Linked to IBO to facilitate inquiry on price and schedule
  - Archive of newsletters and other communications
- Re-established Newsletter
- Point of Contact for customers
- Staff booth at SNM, ACS and other meetings
- Act to inform both the stakeholders and DOE mgmt. on developments related to isotope use

Shipping and Distribution

- Provide oversight for the entire program
- Monitor incoming shipments from external production sites
- Track location and movement of shipping containers
- Monitor shipments from production sites to customers
- Interact with freight companies, customs agents, and others to expedite material movement
- Work with shipping container suppliers for new designs
- Organized task group to provide guidance

NSAC Research Isotopes Recommendations

Compelling Research Opportunities using Isotopes:

- Invest in new production approaches of alpha-emitting radionuclides, e.g. Ac-225, At-211.
- Invest in coordination of production capabilities and supporting research.
- Produce isotopes of the heavy elements, e.g. Cf, Ra, TRU.
- Focused study and R&D on new or increased production of He-3.
- Re-establish domestic production and supply of stable isotopes.
- Robust investment into education and training.

Isotopes for the Nation's Future – A Long Range Plan
NSAC Recommendations (1)

- **Maintain a dialogue** with all interested federal agencies and commercial isotope customers to forecast and match realistic isotope demand and achievable production capabilities.
- **Coordinate production capabilities and supporting research** to facilitate networking among existing DOE, commercial, and academic facilities.
- **Support a sustained research program** in the base budget to enhance the capabilities of the isotope program in the production and supply of isotopes generated from reactors, accelerators, and separators.
- **Invest in workforce development** in a multipronged approach, reaching out to students, post-doctoral fellows, and faculty through professional training, curriculum development, and meeting/workshop participation.

Isotopes for the Nation's Future – A Long Range Plan
NSAC Recommendations (2)

- Devise processes for the isotope program to **better communicate** with users, researchers, customers, students, and the public and to seek advice from experts:
- Encourage the use of isotopes for research through reliable availability at **affordable prices.**
- Increase the robustness and agility of **isotope transportation** both nationally and internationally.
- Construct and operate an **electromagnetic isotope separator facility.**
- Construct and operate a **variable-energy, high-current, multi-particle accelerator** and supporting facilities that have the primary mission of isotope production.

Key Isotopes Produced and Distributed

Reactor Isotopes

Cf-252	**Cancer therapy**
Ni-63	**Gas sensing devices**
W-188	**Re-188 for prevention of arterial restenosis, Bone pain from cancer**
Se-75	**GAMMA Radiography sources**

Accelerator Isotopes

Ge-68	**Calibration sources for PET equipment, antibody labeling**
Na-22	**A positron-emitter used in various applications**
Sr-82	**Rb-82 for Cardiac imaging**

Isotope	*Half Life*	*Maximum Quantity Shipped in Type A*	*Produced*	*Application*
Cf-252	2.6 y, α	.02 Ci	Reactor	Neutron sources cancer therapy
Cd-109	32.2 y , γ	27 Ci	Both reactor accelerator	X-ray instrument calibration
Co-60	5.27 y , γ	10.8 Ci	Reactor	Sterilization
Sr-82	25-d, positron	5.41 Ci	Accelerator	Cardiac imaging
W-188	69-d , β/γ	5.41 Ci	Reactor	Cancer Treatment

Reactor Sites: HFIR (ORNL) and ATR (INL)

High Flux Isotope Reactor (HFIR) at ORNL:

- High neutron flux (≤3x10^{15} n/cm^2 s)
- Multiple hydraulic tubes
- Several hot cell facilities
- Key Isotopes: Cf-252, W-188, Ni-63, Se-75

Advanced Test Reactor (ATR) at INL:

- Moderately high neutron flux (≤4x10^{14} n/cm^2 s)
- Hydraulic tube installed in 2008
- Key Isotope: Co-60

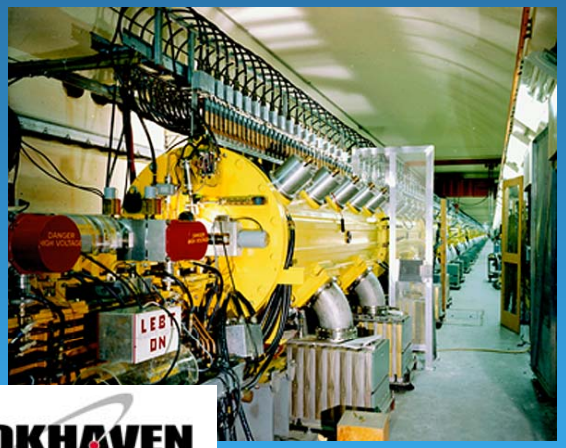
OAK RIDGE National Laboratory

INL Idaho National Laboratory

Accelerator Sites: BLIP (BNL) and IPF (LANL)

Brookhaven Linac Isotope Producer (BLIP) at BNL:

- 200MeV proton beam
- Well-equipped hot cell facility
- Target insertion and retrieval
- Main isotopes: Ge-68, Sr-82
- R&D: Cu-67, Y-86



Isotope Production Facility (IPF) at LANL:

- 100 MeV proton beam
- Well-equipped hot cell facility
- Available 30-40 weeks per year
- Main isotopes: Ge-68, Sr-82
- R&D

BROOKHAVEN NATIONAL LABORATORY

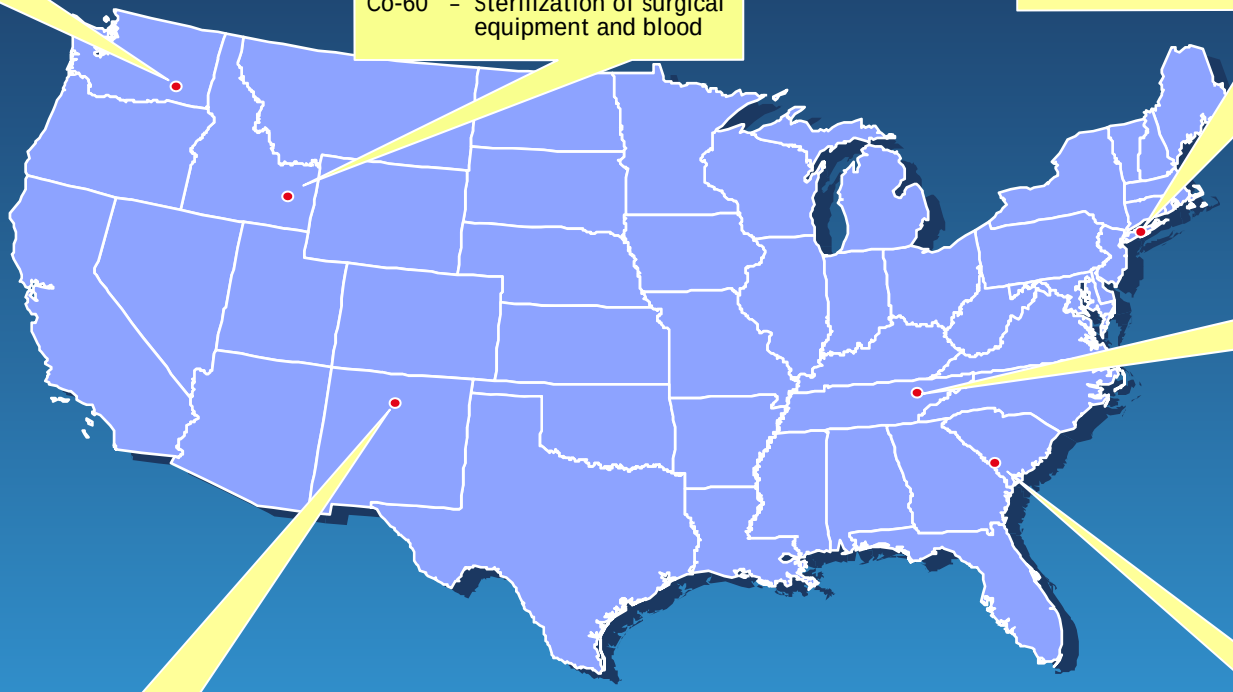
Los Alamos NATIONAL LABORATORY EST. 1943

Chemical and Materials Laboratory at ORNL

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**
- *Arcmelting 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**

Network of Domestic Production Sites



Richland:

Sr-90 – Y-90 gen for cancer therapy

Idaho – ATR:

Co-60 – Sterilization of surgical equipment and blood

Brookhaven – BLIP:

Ge-68 – Calibration sources for PET equipment; Antibody labeling

Sr-82 – Rb-82 gen used in cardiac imaging

Cu-67 – Antibody label for targeted cancer therapy

Oak Ridge – HFIR:

Se-75 - Industrial NDA; Protein studies

Cf-252 - Industrial source

W-188 - Cancer therapy

Stable Isotopes Inventory

Inventory:

Ac-225 - Cancer therapy

Los Alamos – LANSCE/IPF:

Ge-68 – Calibration sources for PET equipment; Antibody labeling

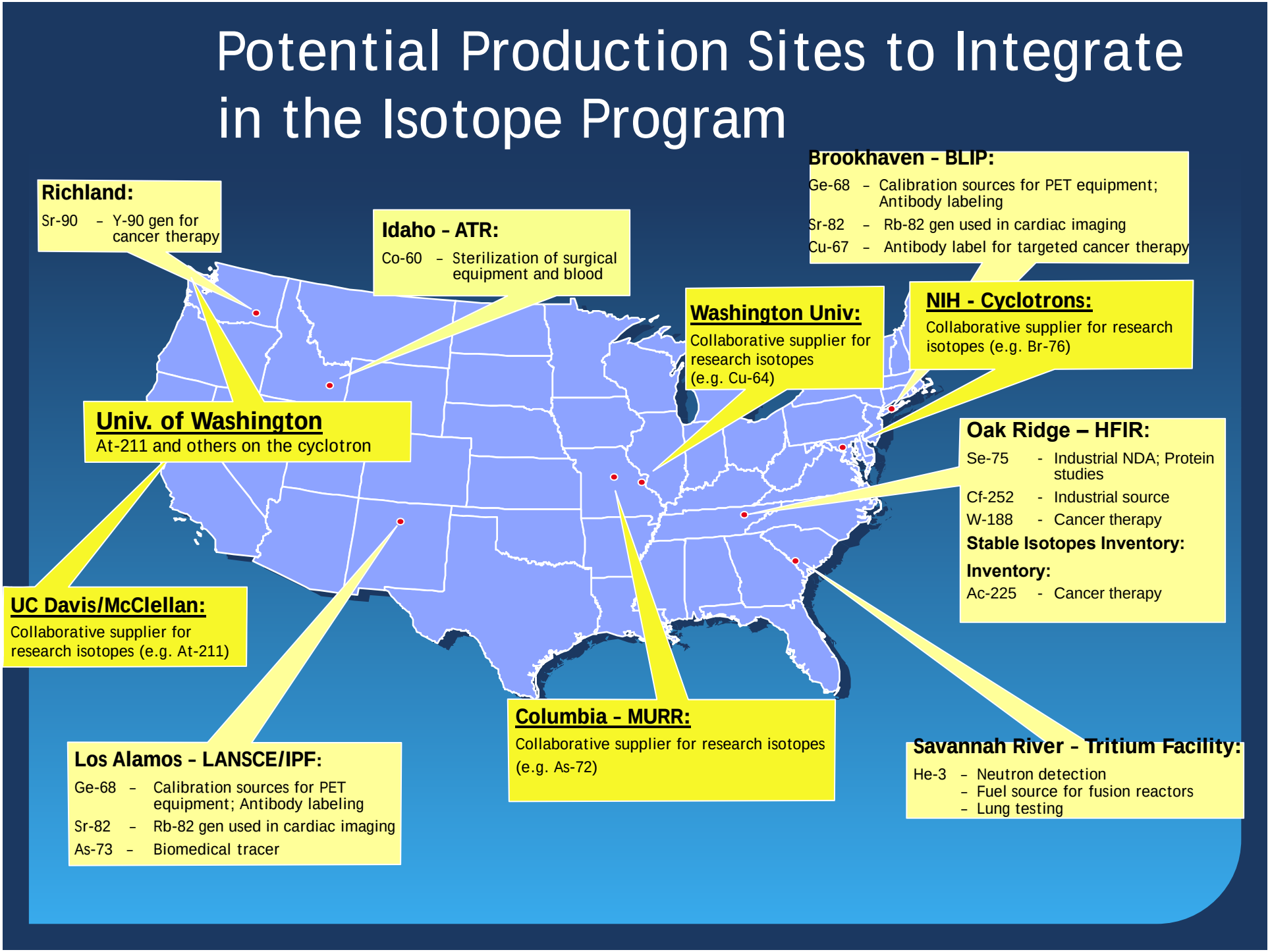
Sr-82 – Rb-82 gen used in cardiac imaging

As-73 – Biomedical tracer

Savannah River – Tritium Facility:

He-3 – Neutron detection
– Fuel source for fusion reactors
– Lung testing

Potential Production Sites to Integrate in the Isotope Program



Opportunities for Small Business (1)

- The Isotope program has substantial interactions with industry as a supplier of stable enriched and radioactive isotopes
- Small business can provide support for the program in a variety of areas:
  - Stable isotope enrichment
    - Improved electromagnetic enrichment capability
    - Improved centrifugal enrichment capability
    - New technology for isotope enrichment
  - Accelerator production of radioisotopes
    - New accelerator technology
      - Cyclotron
      - LINAC
      - Injector technology

Opportunities for Small Business (2)

Small business could provide support for Radioisotope Production:

- Radioisotope production
  - New isotopes for industrial and other applications
    - Radiation and Power sources
    - In core neutron irradiations
  - Targetry, e.g. fabrication, new materials
  - Alternative neutron sources
  - Novel target transport systems
  - Separation chemistry
    - Ion exchange materials
    - Automation
  - Radioisotope Generators

Opportunities for Small Business (3)

Small business could provide support for :

- Software to support isotope production
  - Automation
  - Modeling and theory
  - Other applications
- Isotope Program
  - Shipping and distribution, e.g. containers
  - Business office operations
  - Public private partnerships

Contact Information

HQ:

- Jehanne Gillo – Director
  jehanne.gillo@science.doe.gov
- Marc Garland – Program Manager (Facilities & Operations)
  marc.garland@science.doe.gov
- Dennis Phillips – Program Manager (R&D)
  dennis.phillips@science.doe.gov

NIDC:

- www.isotopes.gov
- Robert Atcher, PhD, MBA – Director
  Los Alamos National Laboratory, Science Programs Office
  (505)663-5596, ratcher@lanl.gov
- Wolfgang Runde, PhD – Assoc. Director
  Los Alamos National Laboratory, Science Programs Office
  (505)667-3350, runde@lanl.gov
- IBO: isotopes@ornl.gov