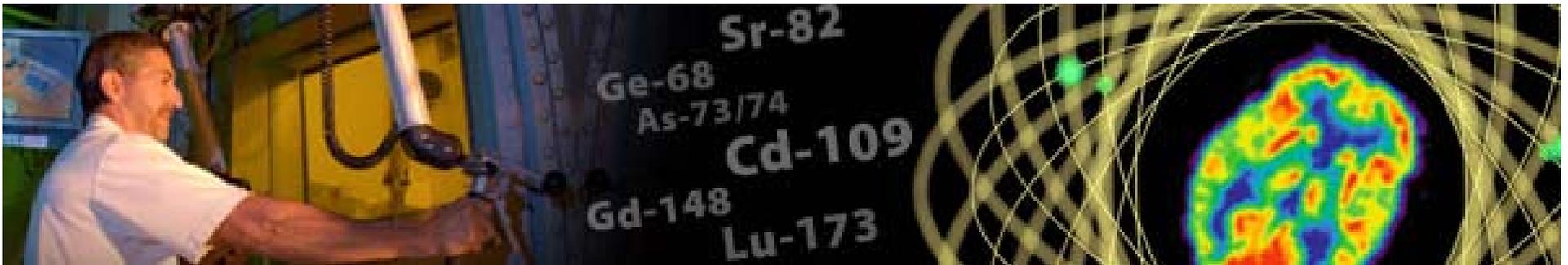




U.S. DEPARTMENT OF  
**ENERGY**

OFFICE OF  
**SCIENCE**

## *Overview of DOE Isotope Program*



1<sup>st</sup> Workshop on Isotope Federal Supply and Demand  
January 11-12, 2012

*Dr. Marc Garland*

*Program Manager, Isotope Facilities*

*Office of Nuclear Physics, Office of Science, U.S. Department of Energy*

# Isotope Program

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- **Congressional legislation assigned responsibility for isotope production and distribution to a central organization which is now the Isotope Program in NP**
  - Production, sales, and distribution are managed by the NP Isotope Program
  - IP provides services to manage distribution of isotopes that are owned by other programs
    - Most of these are legacy materials owned by other programs (e.g., NNSA, EM, NE)
- **Mandate is to provide isotopes in short supply**
  - Maximize impact of program funding on isotope availability
  - Legislation governs competition with private industry
    - Analyses performed when considering entering/exiting the market
- **Isotope pricing**
  - Commercial customers: full cost recovery
  - Research customers: possible subsidy through waiver of certain indirect costs
- **Benefits of move to the Office of Science**
  - Management of program as a scientific endeavor
    - Established R&D program
    - Peer-review of program elements
  - Synergy with the Office of Nuclear Physics which has targetry and accelerator expertise

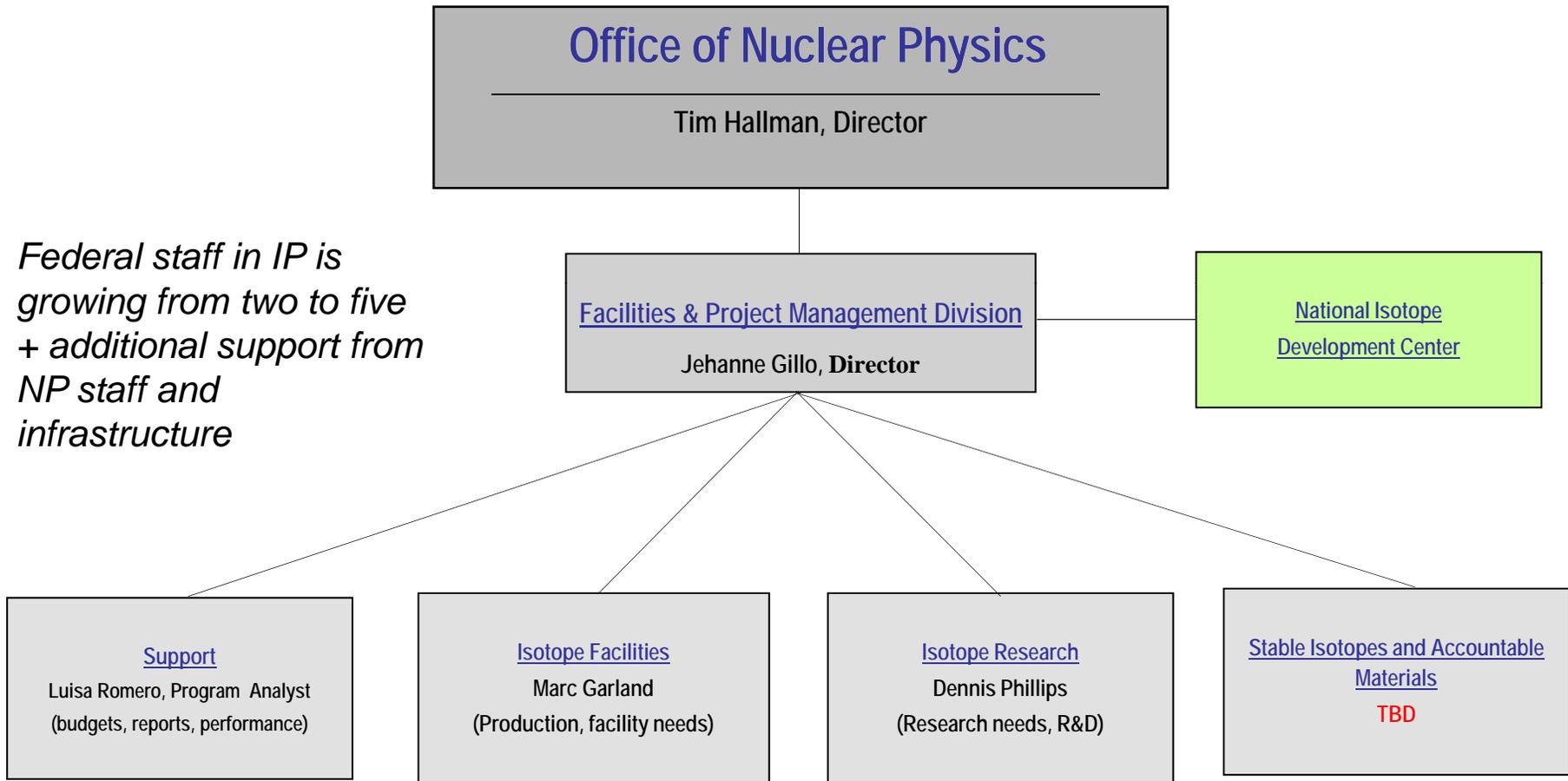
## IP Distribution Services

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- The IP provides services to manage the distribution of isotopes that are owned by other programs
  - Most of these are legacy materials owned by other programs because of stockpile stewardship
  - NNSA, EM, NE
  - Communication strengthened with creation of NNSA Office of Nuclear Materials Integration
  - SC involved in internal Working Groups
  - IP access to materials before disposed
  - IP access to size of inventories
  - IP participated in National Strategic Plan for Nuclear Materials
  - Provides effective interface for communication and strategic planning



# New Isotope Program Organization



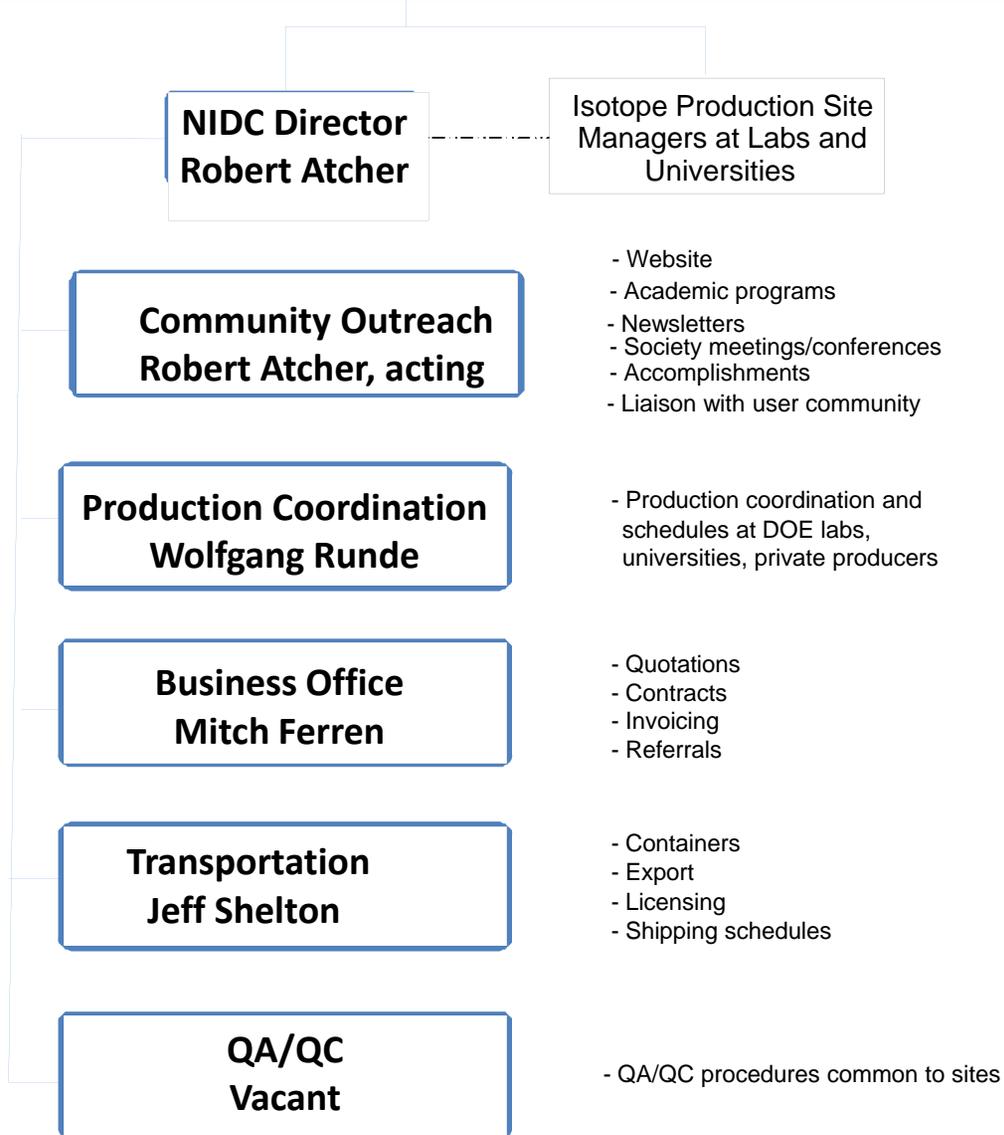


Office of Nuclear Physics Isotope Production and Applications

New

National Isotope Development Center

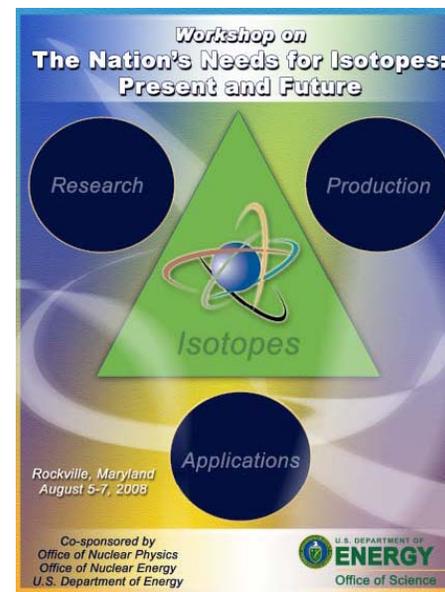
IBO has developed into NIDC and IBO staff is increased



## *The Nation's Needs for Isotopes: Present and Future*

August 5-7, 2008

- Assemble for the first time broad representation of stakeholders (users and producers of isotopes)
  - to establish communication with and between stakeholders
  - to discuss Nation's current and future needs for stable and radioactive isotopes
  - to identify key isotopes with supply shortages and options for improving availability
  
- **Workshop Questions:**
  - Who uses isotopes and why?
  - Who produces them and where?
  - What is the status of the supply and what is missing?
  - What are the needs today and in the future?
  - What are the options for increasing availability and associated technical hurdles?
  
- **Plenary session on the first day open to all registrants followed by three Working Groups (invitation only)**
  - Stable and Enriched (both research and applied)
  - Radioisotopes for Research and Development
  - Radioisotopes for Applications
  
- **The deliverable: a report which articulates the Nation's needs for isotopes across the various disciplines, the challenges in meeting those needs and options for improving the capabilities for meeting the demands.**
  - ✓ First step towards development of comprehensive and prioritized strategic plan
  - ✓ NSAC will use this input (and others) to develop a long range plan



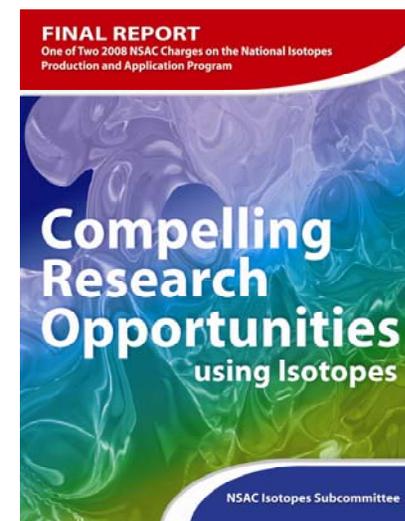
# NSAC Research Isotope Recommendations

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## 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.

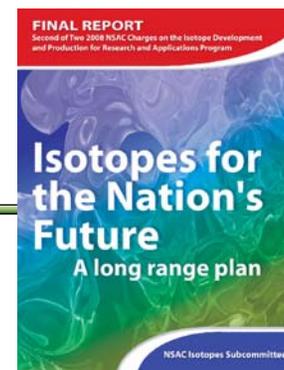
All recommendations are being addressed  
by the program





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# NSAC Long Range Plan Recommendations

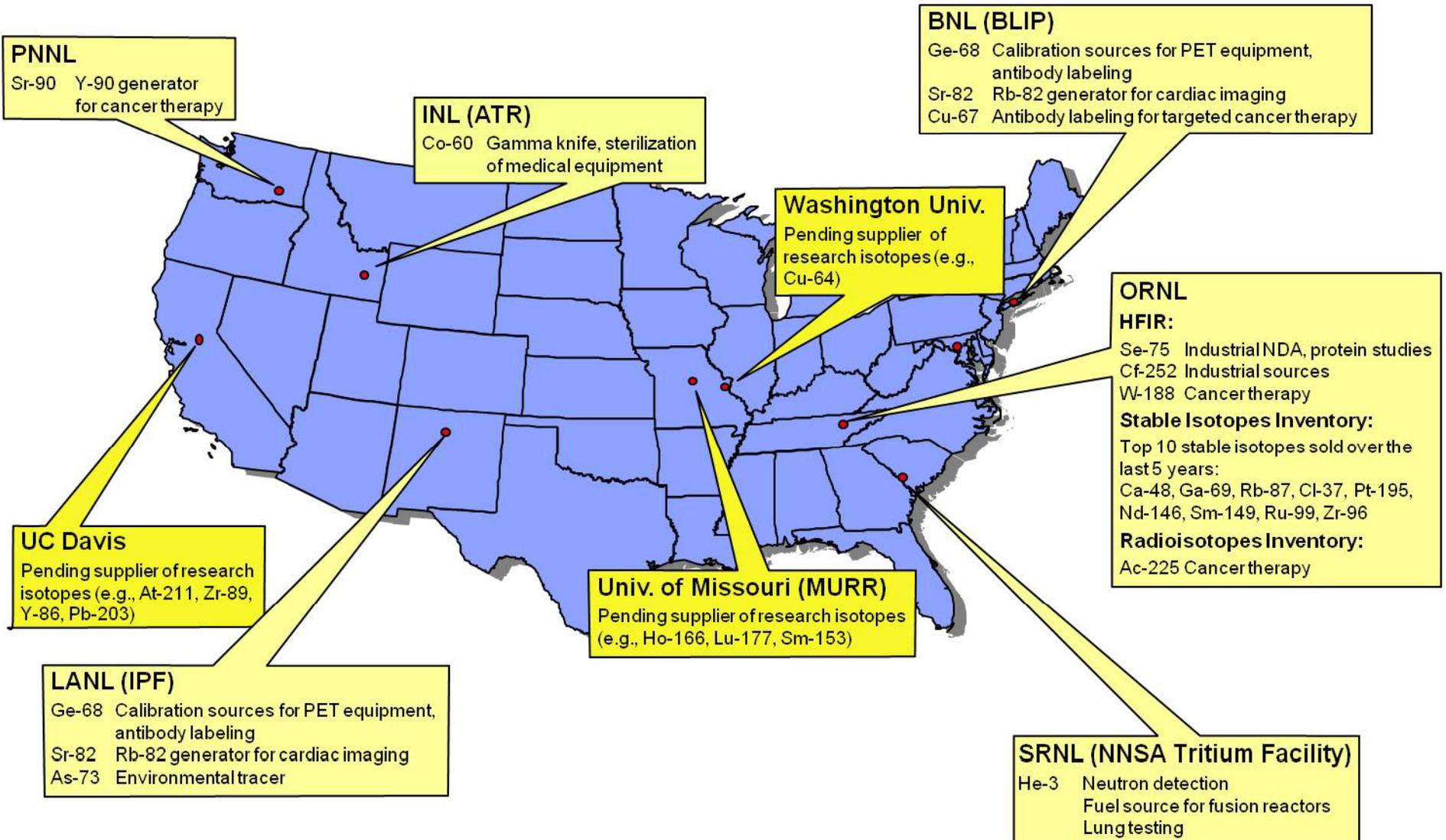


## Isotopes for the Nation's Future A Long Range Plan

- Maintain a continuous 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.
- 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.
- 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.
- Construct and operate an electromagnetic isotope separator facility for stable and long-lived radioactive isotopes.
- Construct and operate a variable-energy, high-current, multi-particle accelerator and supporting facilities that have the primary mission of isotope production.



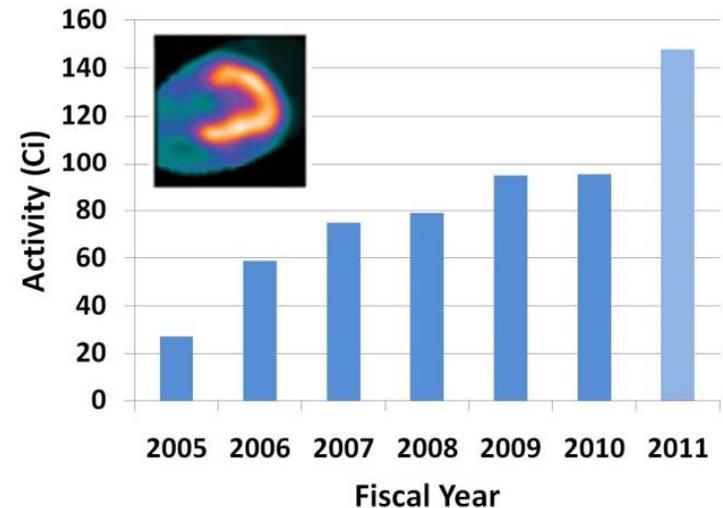
# Production Sites and Primary Products





## Efforts to Increase Availability – National Labs

- **Actively working on making other isotopes available in FY12**
  - Gd-153
  - Ir-192
  - U-234
  - Am-241
  - Moving Co-60 production from INL to IP
  - Sr-89
  - Si-32
  - Pb-202, Pb-205
  - Additional quantities of Ra-226
  - Additional quantities of Ac-225
  - NP is increasing strontium-82 production for cardiac imaging
    - DOE supplies ~ 75% of domestic market





## Efforts to Increase Availability – External Partners

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- **Establishing Production Capabilities/Developing Agreements for Production**
  - Universities
    - University of Missouri
    - Washington University
    - University of California Davis
    - University of Washington
    - Others
  - Other Federal Agencies
    - National Institutes of Health
  
- **Pursuing options in private-public partnerships to increase capabilities**
  
- **Considering options for a dedicated facility**

- **Production**

- Annual Solicitation
  - Establish production capabilities (e.g., startup funds)
  - Production based on well-established methods
- Special Initiatives
  - Production of specific isotopes to meet customer needs (e.g., Am-241)
  - Isotope Program develops cost estimates
  - Customer(s) fund startup costs in advance, production costs as incurred

- **Research and Development**

- Annual Solicitation
  - New or improved methods of isotope production and separation

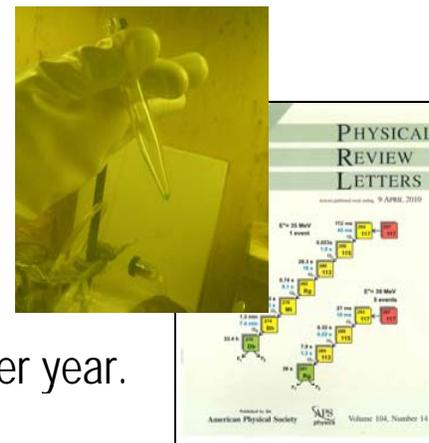
### ■ Base Funding for National Laboratory R&D

- BNL: enhanced Ge-68 production, Fe-52 for PET/CT, Zr-89 production, Ac-225 production
- LANL: enhanced Ge-68 production, Ac-225 production, high power targetry
- ORNL: stable isotope enrichment, enhanced heavy element/actinide production, computational methods and targetry technologies to optimize radioisotope production

### ■ Annual Solicitation

- FY 2009 Recovery Act Funds: \$8.6M (10 Laboratory)
- FY 2009 Program Funds: \$3.5M (4 Laboratory, 5 University, 1 Industrial)
- FY 2010 Program Funds: \$4.5M (2 Laboratory, 2 University, 1 Hospital)
- FY 2011 – FY 2012 Funds: \$5.8M (3 Laboratory, 4 University, 1 Industrial)
- Research supported
  - Therapeutic alpha emitters (At-211, Ac-225, separations technology)
  - Diagnostic dosimetry for therapeutic agents (Cu-64, Y-86)
  - Therapeutic beta-emitter (Cu-67)
  - Educational programs/development
  - Stable isotope enrichment

- Production of Bk-249 for heavy element discovery experiments
- Alpha-emitter production
  - Highest priority NSAC recommendation
  - Actinium-225
    - Continue to process the Th-229 for Ac-225; up to about 360 mCi per year.
    - ORNL conducting R&D on accelerator production of Th-229
    - ORNL conducting R&D on ionic liquids as solvents for improved separation and purification of alpha-emitting radioisotopes
    - LANL/BNL/Northstar conducting R&D on accelerator production of Ac-225
  - Actinium-227
    - ORNL/PNNL recovered Ac-227 from AcBe sources (source of Th-227 and Ra-223)
  - Astatine-211
    - University of Washington developing capability to routinely supply At-211
- Involved with NNSA and other federal agencies in R&D on alternatives to He-3
- Provide technical expertise to NNSA on Mo-99 production



## Conclusions

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- Isotope Program is synergistic with Nuclear Physics program and benefits from the move to the Office of Science
- Isotope Program is undergoing significant change in terms of management, mission, scope and capabilities
- There are continuous challenges that the program faces
- Much progress has already been made in addressing NSAC recommendations and more
- A high priority goal is to develop a coordinated, national strategy to meet present and future demand for isotopes in short supply for research and applications
- Isotope Program provides many opportunities for producing/making available isotopes to meet National needs