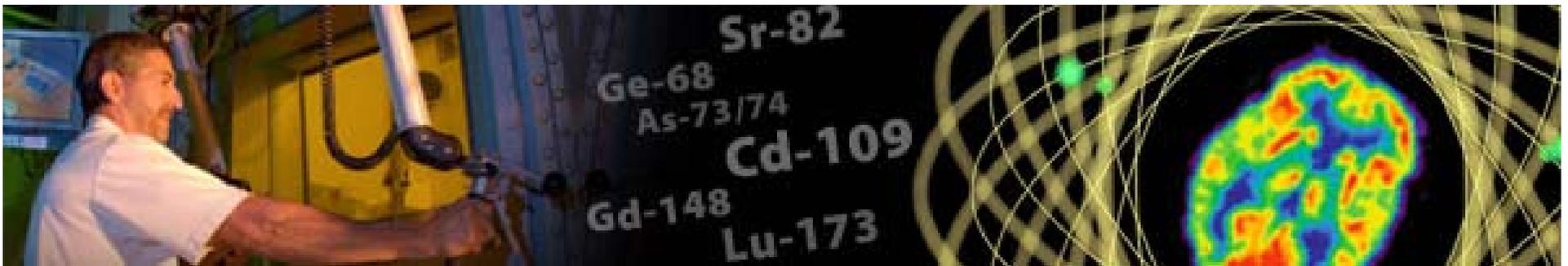




U.S. DEPARTMENT OF
ENERGY

OFFICE OF
SCIENCE

Overview of DOE Isotope Program



1st 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

- **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

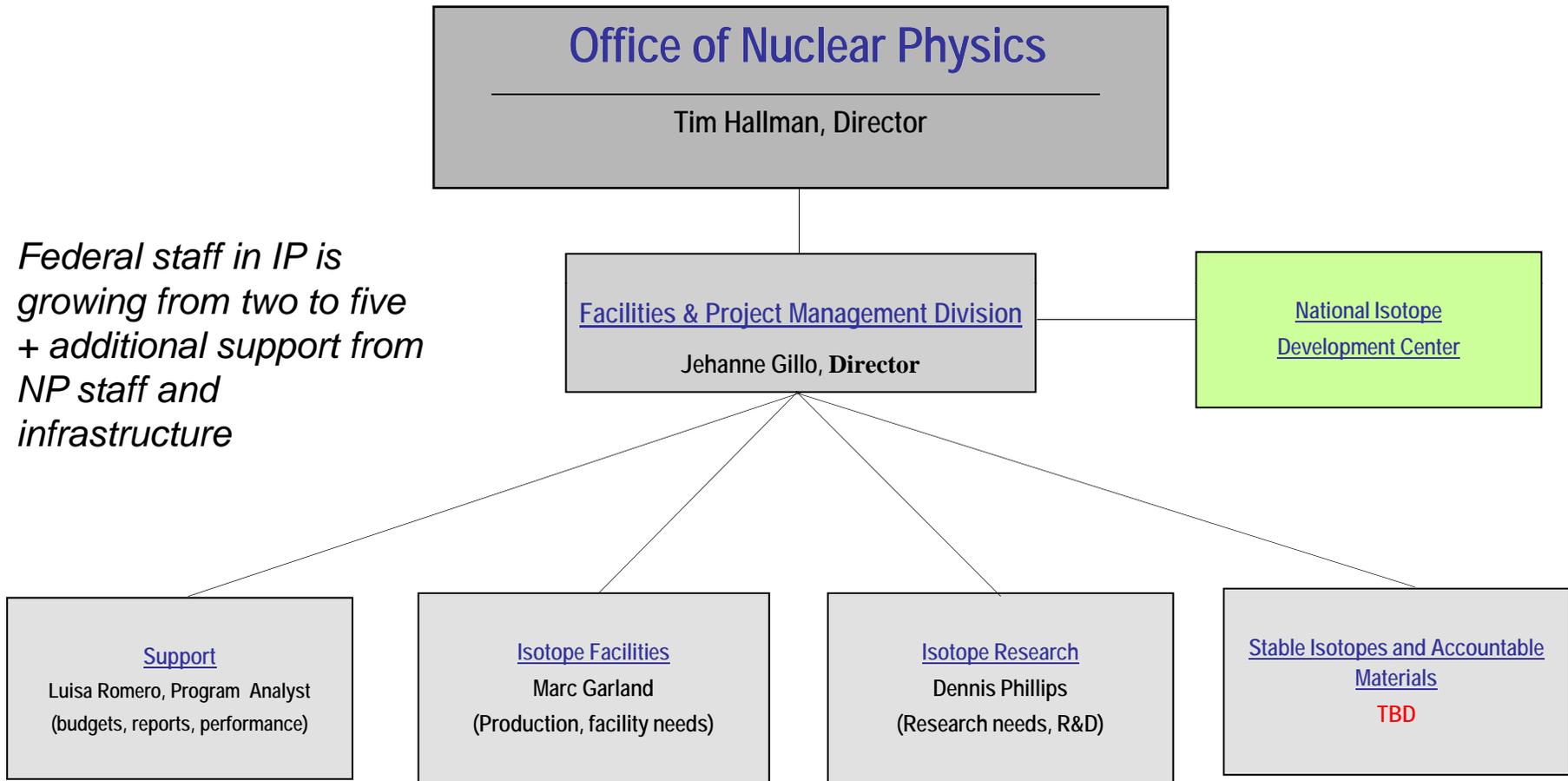


IP Distribution Services

- 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



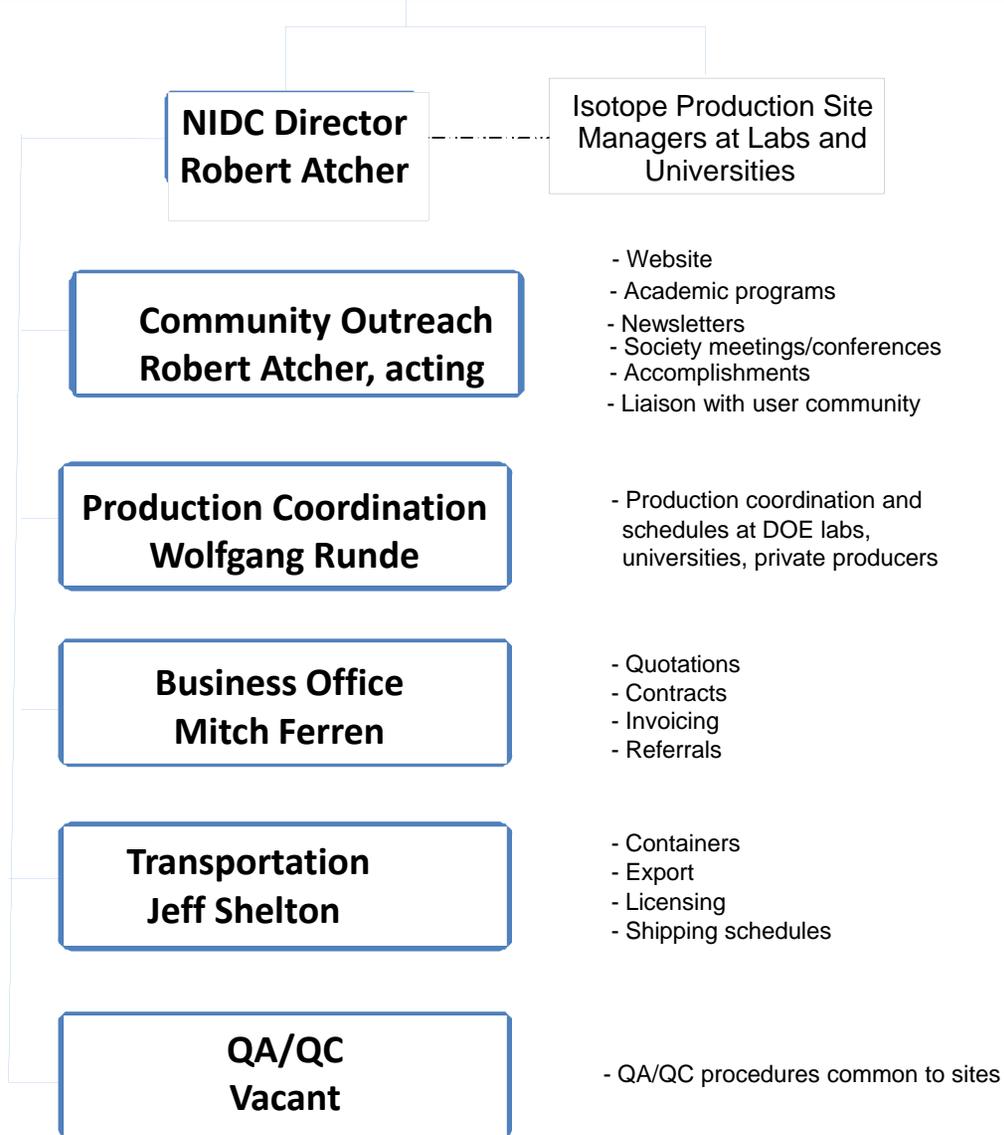


Office of Nuclear Physics Isotope Production and Applications

New

National Isotope Development Center

IBO has developed into NIDC and IBO staff is increased



The Nation's Needs for Isotopes: Present and Future

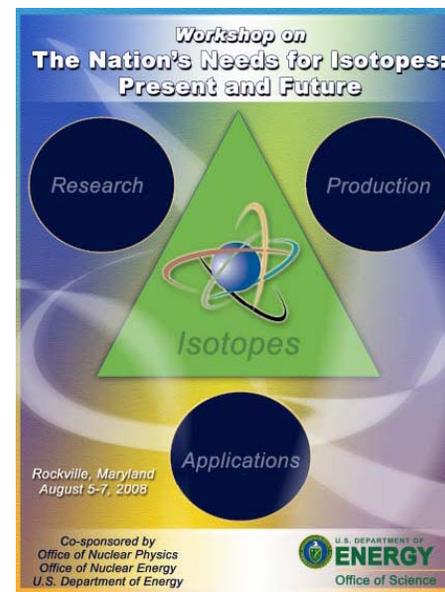
August 5-7, 2008

- 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

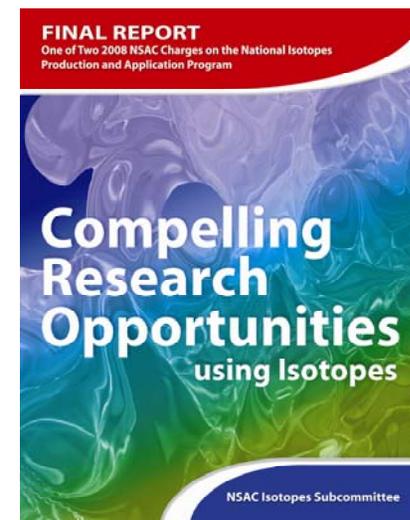


NSAC Research Isotope Recommendations

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.

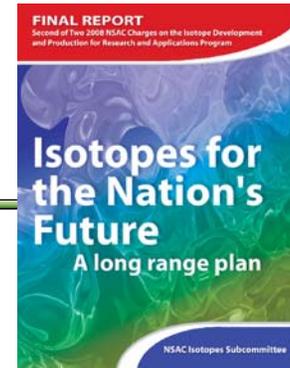
All recommendations are being addressed
by the program





U.S. DEPARTMENT OF
ENERGY

NSAC Long Range Plan Recommendations

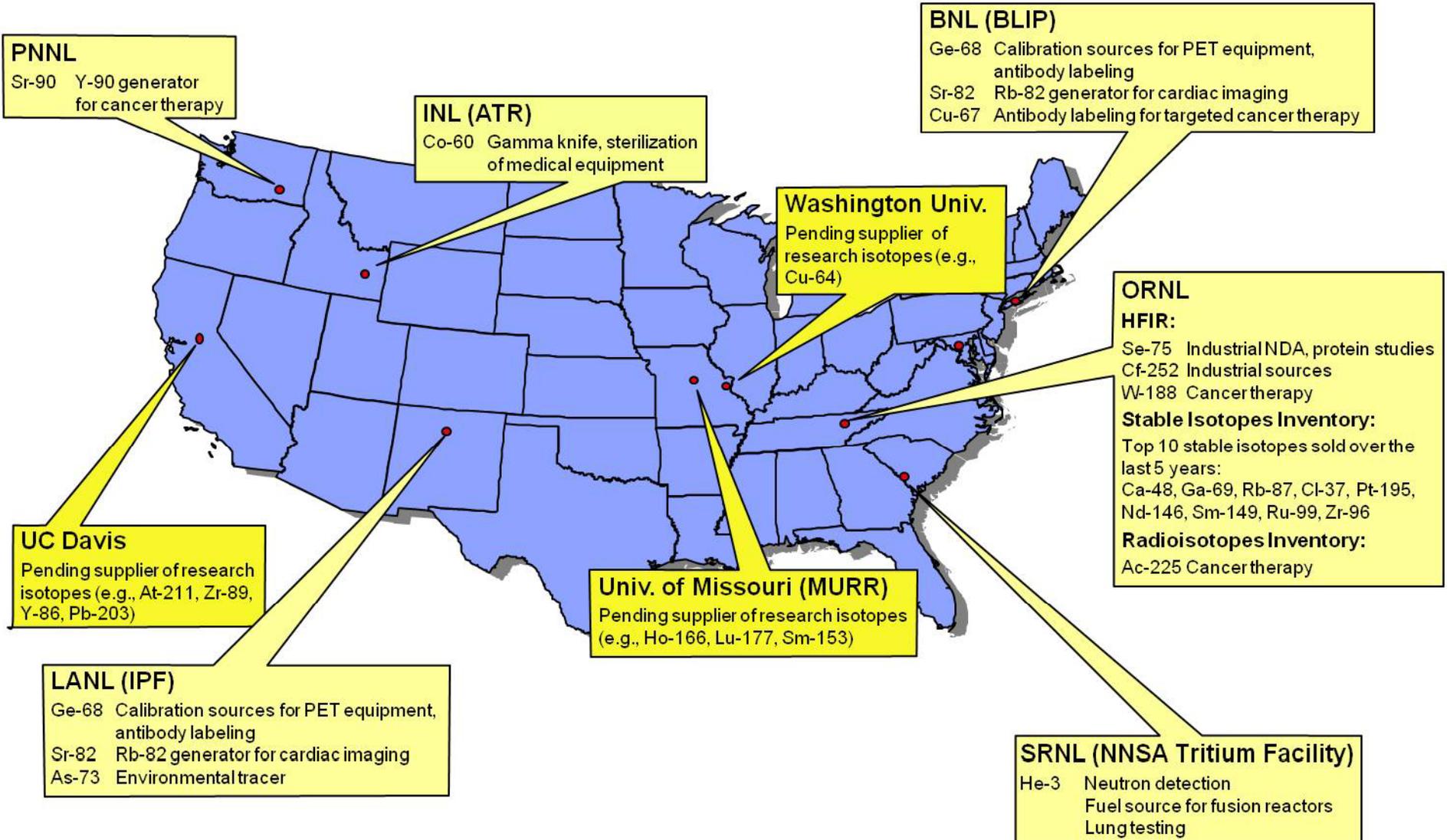


Isotopes for the Nation's Future A Long Range Plan

- 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.



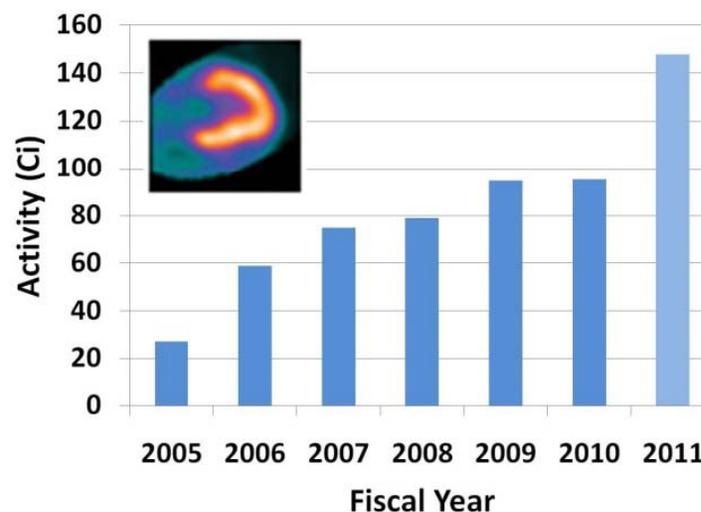
Production Sites and Primary Products



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

- **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



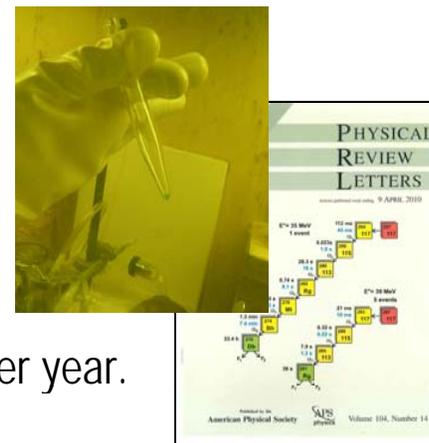
■ Base Funding for National Laboratory R&D

- 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

- 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