Program Overview and Benefits

The Department of Energy's Isotope Program produces and sells radioactive and stable isotopes, byproducts, surplus materials, and related isotope services worldwide, and operates under a revolving fund established by the 1990 Energy and Water Appropriations Act (Public Law 101–101), as modified by Public Law 103–316. The combination of an annual direct appropriation and collections from isotope sales are deposited in the Isotope Production and Distribution Program Fund, the revolving fund. This revolving fund allows continuous and smooth operations of isotope production, sales, and distribution independent of the federal budget cycle. The fund's revenues and expenses are audited annually.

The Program's appropriation is received via the Office of Science's Nuclear Physics program. Appropriated funds are used to support the core scientists and engineers needed to carry out the Isotope Program and to operate and maintain isotope facilities to assure reliable production. In addition, the appropriation provides support for R&D activities associated with the development of new production and processing techniques for isotopes, operations support for the production of research isotopes, and support for the training of new personnel in isotope production. Each of the sites' production expenses for processing and distributing isotopes is offset by revenue generated from sales. The Isotope Program cannot be sustained on revenues alone; it requires a combination of appropriated funds and revenue from sales to maintain its viability. Of the total resources in the revolving fund, about 75 percent is used for operations, maintenance, isotope production, and R&D for new isotope production techniques, with roughly 25 percent available for process improvements, unanticipated changes in volume, and purchases of small capital equipment, such as assay equipment and shipping containers needed to ensure on-time deliveries.

The Department has supplied isotopes and related services for more than 50 years to medical institutions, universities, research organizations, and industry. Isotopes are also provided to many Federal agencies, including the National Institutes of Health and its grantees, the Environmental Protection Agency, and the Department of Homeland Security. As the range of available isotopes and the recognized uses for them increased, new or improved isotope products contributed to progress in medical research and treatment, new industrial processes, and scientific investigation. Substantial national and international scientific, medical, and research infrastructure has relied upon the use of isotopes and is strongly dependent on the Department's products and services. Isotopes are now used for hundreds of applications that benefit society every day such as cardiac imaging, cancer therapy, smoke detectors, neutron detectors, explosives detection, oil exploration, and tracers for climate related research. For example, radioisotopes are used in the diagnosis or treatment of about one of every three hospital patients[a]. Each day, over 40,000 medical patients receive nuclear medicine imaging and therapeutic procedures in the United States[b]. Such nuclear procedures are among the safest and most effective diagnostic tests available. Isotopes enhance patient care by avoiding exploratory surgery and similar procedures. For example, the use of Positron Emission Tomography-based myocardial perfusion imaging in emergency room chest pain centers can reduce the duration of stay from 23 hours to 1-2 hours compared to conventional protocols[c]. Adequate supplies of medical and research isotopes are essential to the Nation's health care system and to basic research and industrial applications that contribute to national economic competitiveness. Isotope uses in homeland security applications are also increasing and include portal monitors used to find radiological material, imaging systems used to find densely shielded material, and systems to detect explosives, biological and chemical weapons, and narcotics.

Isotopes are primarily produced and processed at three facilities, which are stewarded by the Isotope Program: the Isotope Production Facility (IPF) at Los Alamos National Laboratory, the Brookhaven Linac Isotope Producer (BLIP) at Brookhaven National Laboratory, and processing facilities at Oak Ridge National Laboratory (ORNL). Accelerator production capabilities are provided

[a] http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/med-use-radactiv-mat-fs.html
[b] http://interactive.snm.org/docs/whatisnucmed.pdf
[c] http://www.positron.com/?page_id=437

by IPF and BLIP which supply isotopes such as strontium-82 and germanium-68 to serve the Nation's health care needs and other isotopes to researchers in a wide variety of fields. Reactor production capability is provided by the High Flux Isotope Reactor (HFIR), which has the highest neutron flux available for isotope production in the U.S. and presently produces isotopes such as californium-252, berkelium-249, nickel-63, and selenium-75 for the Isotope Program. In addition, the Isotope Program manages cobalt-60 production at the Advanced Test Reactor at the Idaho National Laboratory. It will expand production activities at the reactor to produce radiosotopes such as gadolinium-153 and short-lived radioisotopes, making use of the recently installed target shuttle system that allows insertion and removal of isotope production targets while the reactor is operating. At the Pacific Northwest National Laboratory (PNNL), the Isotope Program will continue to distribute strontium-90, a byproduct material of past weapons programs, and has processed byproduct material to recover actinium-227, which will now be used to provide radium-223 for medical research. The Isotope Program is increasing productivity by broadening the suite of production facilities to include university accelerator and reactor facilities which can provide cost-effective and unique production capabilities; these include the Washington University, the University of California at Davis, and the Missouri University Research Reactor.

The resources available in the revolving fund in FY 2011 totaled $48.5 million. This consisted of $19.7 million from the FY 2011 direct Nuclear Physics appropriation and collections of $28.8 million, which are used to cover expenses, support research into alternative production and processing techniques, and develop new production capabilities. Collections increase or decrease depending on customer demand, production efficiencies, and the availability of facilities. The collections in FY 2011 represented an increase relative to FY 2010 due to an increase in sales and production of californium-252, selenium-75, and strontium-82. Californium-252 has a variety of industrial and medical applications, selenium-75 is used as a radiography source, and strontium-82 has gained world-wide acceptance for use in heart imaging which has resulted in increased sales over the last several years. Effective management of the Isotope Program requires constant diligence as factors which influence the program are dynamic by their nature. The revolving fund helps to mitigate impacts from what can be significant and often unanticipated fluctuations in sales.

In FY 2011, the Isotope Program served over 150 customers including major pharmaceutical companies, industrial users, and approximately 100 researchers at hospitals, national laboratories, other Federal agencies, universities, and private companies. There continues to be about ten high-volume and moderately priced isotopes among the many produced by the Program; the remaining isotopes are low-volume research isotopes and thus more expensive to produce. Progress has been made in the past year in evaluating the pricing of isotopes in an effort to make research isotopes more affordable; these efforts are continuing. Commercial isotopes will continue to be priced to recover full cost. Research isotopes are provided at reduced prices that provide compensation to the government while encouraging research and development. For example, expenses supported with appropriated funds are not charged to the researcher, reducing the price of the isotope. Improved communication with the user community and federal agencies has improved the ability to forecast demand of needed isotopes, which positions the Isotope Program to better meet the projected needs of the community, resulting in a more reliable supply of research isotopes. A Federal workshop in FY 2012 initiated by the Isotope Program will provide further valuable information to assist the Isotope Program in optimizing utilization of its resources to assure the greatest availability of isotopes.

Of the isotopes produced and sold by the Isotope Program, the majority are for medical research. A total of 460 shipments were made in FY 2011. Roughly a third of these shipments were to foreign countries with the remainder sold domestically, including 10% or less to other Federal agencies. Customer satisfaction with product specifications continues to be high; over 98% of products and services provided met the terms of the contract/sales order in FY 2011.

For FY 2013 and the future, the Department foresees more than moderate growth in isotope demand, coupled with the possible need for new isotope products for homeland security, medicine, and industry. In order to satisfy the needs of its customers, the program seeks to meet supply requirements for year-round availability of isotopes for scientific and medical research and, in particular, for human clinical trials. The program's

production capability may be called upon for initial ramp-up of production of major new isotope products until market forces bring in private producers that are willing to invest and produce the needed isotopes.

Program Accomplishments

The Isotope Development and Production for Research and Applications (IDPRA) program made recent advances in several areas of national isotope needs. One such advance was the production in FY 2011 of nickel-63 of much higher purity than previously available. Nickel-63 is used in national security applications such as explosives detection systems.

A second advance was the development and implementation, in collaboration with NNSA, of a plan to avert a potential critical shortage of the isotope americium-241. To initiate this plan, the Isotope Program has begun preparations for americium-241 production at the Los Alamos National Laboratory. Americium-241 is used commercially in smoke detectors and in neutron sources for oil and gas exploration.