Isotope Production and Distribution Program Fund

Overview

The Department of Energy's Isotope Program produces and sells radioactive and stable isotopes, byproducts, surplus materials, and related isotope services world-wide. It operates under a revolving fund, the Isotope Production and Distribution Program Fund, established by the 1990 Energy and Water Development Appropriations Act (Public Law 101-101), as amended by the 1995 Energy and Water Development Appropriations Act (Public Law 103-316). Funding for the Isotope Production and Distribution Program Fund is provided by the combination of annual appropriations from the Isotope Development and Production for Research and Applications subprogram within the Nuclear Physics (NP) program in the Science appropriation account, and collections from isotope sales; both are needed to maintain the Isotope Program's viability. This revolving fund allows continuous and smooth operations of isotope production, sales, and distribution independent of the federal budget cycle and fluctuating sales revenue. An independent cost review of the fund's revenues and expenses is conducted annually by an external contractor.

Annual appropriations in NP funds a payment into the revolving fund to maintain mission-readiness of facilities, including the support of core scientists and engineers needed to carry out the Isotope Program and the maintenance of isotope facilities to assure reliable production. In addition, appropriated funds provide support for research and development (R&D) activities associated with development of new production and processing techniques for isotopes, production of research isotopes, and training of new personnel in isotope production. Each site's production expenses, including processing and distributing isotopes, are offset by revenue generated from sales. About 80 percent of the resources in the revolving fund are used for operations, maintenance, isotope production, and R&D for new isotope production techniques, with approximately 20 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 supplies isotopes and related services to the Nation under the authority of the Atomic Energy Act of 1954, which specifies the role of the U.S. Government in isotope distribution. Substantial national and international scientific, medical, and research infrastructure relies upon the use of isotopes and is strongly dependent on the Department's products and services. Isotopes are used for hundreds of applications that benefit society every day, such as diagnostic medical imaging, cancer therapy, smoke detectors, neutron detectors for homeland security applications, explosives detection, oil exploration, and tracers for environmental research. For example, radioisotopes are used in the diagnosis or treatment of about one-third of all patients admitted to hospitals.[a] Nearly 18 million Americans undergo nuclear medicine procedures each year for a variety of conditions, including cancer, cardiovascular disease, neurological conditions, and other physiological problems.[b] Such nuclear procedures are among the safest and most effective diagnostic tests available and enhance patient care by avoiding exploratory surgery and other invasive procedures. The Isotope Program continuously assesses isotope needs to inform program direction including biennial Federal workshops to evaluate stakeholder requirements in order to optimize the utilization of resources and assure the greatest availability of isotopes.

Isotopes are primarily produced and processed at three facilities stewarded by the Isotope Program: the Brookhaven Linac Isotope Producer (BLIP) and associated processing labs at Brookhaven National Laboratory (BNL), the Isotope Production Facility (IPF) and associated processing labs at Los Alamos National Laboratory (LANL), and processing facilities and the Enriched Stable Isotope Prototype Plant (ESIPP) at Oak Ridge National Laboratory (ORNL). In addition, production and distribution activities are supported at the Advanced Test Reactor (ATR) at Idaho National Laboratory, the High Flux Isotope Reactor (HFIR) at ORNL, the Y-12 National Security Complex at ORNL, the Low Energy Accelerator Facility at Argonne National Laboratory, and processing facilities at the Pacific Northwest National Laboratory and the Savannah River Site. IPF and BLIP provide accelerator production capabilities, while HFIR and ATR provide reactor production capability. HFIR has the highest neutron flux available for isotope production in the United States. ESIPP represents the re-establishment of general enriched stable isotope production capabilities in the U.S. and started operations in 2016. The Isotope Program is further broadening capability by including university-supported accelerator and reactor facilities used for research, education, and isotope production that can provide cost-effective and unique production capabilities, as the University of Washington and

[a] http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/med-use-radioactive-materials.html
[b] http://interactive.snm.org/docs/whatisnucmed2.pdf

the Missouri University Research Reactor are now part of the DOE Isotope Program University Production Network. Many other universities have expressed interest in participating in the network.

In FY 2017, a total of $93.22 million was deposited into the revolving fund. This consists of the FY 2017 appropriation of $28.85 million paid into the revolving fund from the Nuclear Physics program, plus collections of $64.37 million to recover costs related to isotope production and isotope services. Collections in FY 2017 included sales of actinium-227, californium-252, helium-3, selenium-75, cobalt-60, nickel-63, germanium-68, actinium-225, and strontium-82. Actinium-227 provides radium-223 for Xofigo, which was recently the first alpha particle-emitting radioisotopic drug approved by the FDA; Xofigo extends patient survival and alleviates the excruciating pain associated with cancer that has metastasized to bone. Californium-252 has a variety of industrial applications, including oil and gas well-logging, and fission start-up in nuclear reactors; helium-3 is used in neutron detectors for national security; selenium-75 is used as a radiography source; cobalt-60 is used in gamma-ray cancer surgery; nickel-63 enhances national security through its use in detectors for explosives and illicit material; germanium-68 supports development of gallium-68 diagnostic imaging pharmaceuticals; actinium-225 is used in pharmaceuticals being developed to more effectively treat cancer and other diseases; and strontium-82 has gained world-wide acceptance for use in heart imaging. In FY 2017, the Isotope Program sold 172 different radioactive and stable isotopes to a broad range of research and commercial customers, including major pharmaceutical companies, industrial users, and researchers at hospitals, national laboratories, other Federal agencies, universities, and private companies. Among the isotopes produced, nine are high-volume, moderately priced isotopes; the remaining are low-volume research isotopes, which are more expensive to produce. Commercial isotopes are priced to recover full cost or the market price, whichever is higher.

Program Accomplishments

An Enriching Experience with Stable Isotopes. To re-establish a general capability for stable isotope enrichment in the U.S. that has not existed since 1998, the DOE Isotope Program made investments in R&D and prototype capabilities to develop a Federal stable isotope enrichment capability, as recommended by the Nuclear Science Advisory Committee. This prototype facility, which uses state-of-the art electromagnetic and gas centrifuge enrichment devices at ORNL, commenced operation in 2017. U.S. inventories of important enriched stable isotopes have started to be replenished, and research quantities of enriched stable isotopes will be fabricated to support a broad range of U.S. research in fields such as medicine, biology, chemistry, physics, and national security. This prototype facility is the basis for the Stable Isotope Production Facility (SIPF) Major Item of Equipment (MIE), which will enable production of kilogram quantities of high priority isotopes, reducing U.S. dependency on foreign supplies.

Adding Functionality, Efficiency, and Reliability to Dramatically Increase Isotope Production at IPF. The growth in demand of isotopes produced at the Isotope Production Facility (IPF) at LANL drove the need for increased production capabilities. To address this need, the DOE Isotope Program implemented an upgrade to the IPF. The goal of this increased capability was to increase beam current and to design and install an “active-adjustable collimator” and beam monitoring detectors. These improvements enhance facility reliability by increasing the beam current from 230 μA to 380 μA (a projected 65% increase in production yields). Also, they afford the ability to dynamically make beam energy, current, profile, and emittance measurements in real time. The active adjustable collimator provides the ability to expand or narrow down the beam, improving R&D capabilities and efficiency.

DOE Works to Re-establish Americium-241 production. Americium-241 (Am-241) was once produced by DOE’s Isotope Program to support a number of commercial and industrial uses. Most notably, domestic oil and gas production is heavily reliant upon using Am-241 sealed sources to take crucial measurements of rock porosity in new oil wells in the United States. Since 2004, the petroleum industry has been reliant upon Am-241 imported from foreign countries to meet this critical need. In FY 2017, Los Alamos National Laboratory completed construction of a new Am-241 production line and the DOE/NNSA field office granted safety authorization to begin operations. In 2018, DOE’s objective is to deliver the first 200 grams of newly produced Am-241 to its customers.

Highlights of the FY 2019 Budget Request

For FY 2019, the Department foresees growth in isotope demand, with particular interest in alpha-emitters for cancer therapy and stable isotopes to exploit the newly established domestic production capabilities. The portfolio of the isotope

program continues to grow as isotope availability is increased by the program. Revolving fund resources will be used to support efforts to produce isotopes and increase radioisotope production capabilities and availability to meet demand. SC is requesting continued funding in the FY 2019 Nuclear Physics budget for the SIPF MIE, with planned completion of the facility in FY 2023 based on a technically-driven schedule. Initiated in 2017, SIPF will provide increased domestic capability for cost-effective production of critically needed enriched stable isotopes and reduce the nation's dependence on foreign suppliers. NP will make investments in aging isotope production infrastructure to maintain productivity and to provide enhanced facility infrastructure for increased production of Ac-225, a promising cancer therapeutic.