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 an annual appropriation 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.

The annual appropriation in NP funds a payment into the revolving fund to maintain mission-readiness of facilities by supporting the 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 now 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 climate-related 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; for example, in November 2016, the Isotope Program organized the fifth annual Federal workshop to assess 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 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, Pacific Northwest National Laboratory, the Y-12 National Security Complex, 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. The Isotope Program is 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, including facilities at the University of Washington, Duke University, Washington University, Texas A&M

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

University, the University of California at Davis, and the Missouri University Research Reactor. Most of these facilities reside in university medical departments.

In FY 2016, a total of $69.12 million was deposited in the revolving fund. This consisted of the FY 2016 appropriation of $21.63 million paid into the revolving fund from the Nuclear Physics program, plus collections of $47.49 million to recover costs related to isotope production and isotope services. Collections in FY 2016 included sales of californium-252, helium-3, selenium-75, cobalt-60, nickel-63, germanium-68, actinium-225, and strontium-82. Californium-252 has a variety of industrial applications; 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 2016, the Isotope Program served 130 customers including major pharmaceutical companies, industrial users, and researchers at hospitals, national laboratories, other Federal agencies, universities, and private companies, with the sale of 140 different radioactive and stable isotopes. Among the isotopes produced, eight 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 has 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 at the ending of FY 2016. U.S. inventories of important enriched stable isotopes can now start 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. The prototype facility is planned to be upgraded over the next few years to enable production of kg-quantities of high priority isotopes (Stable Isotope Production Facility) and the reduction of U.S. dependency on foreign supply.

Raising the Bar Using Proton Beam Rastering and Higher Current to Dramatically Increase Isotope Production at BLIP. The growth in utilization of two important medical imaging isotopes, strontium-82 (Sr-82) and germanium-68 (Ge-68), produced by the DOE Isotope Program at the Brookhaven Linac Isotope Producer (BLIP) and the Isotope Production Facility (IPF) at LANL, led to demand that exceeds production capabilities. To address this need, the DOE Isotope Program approved the BLIP Raster and Linac Intensity Upgrade accelerator improvement projects. The goal of these modest upgrades was to design and install a proton beam raster system to more evenly distribute the beam on isotope production targets by manipulating its position on the target surface in a series of circular patterns, and to increase the proton beam pulse width to effectively increase the current produced by the BNL linac. The rastered beam decreases the power density across targets (reduces the development of thermal “hot spots” on targets that can lead to target failures) which enables use of the greater proton beam current provided by the linac intensity upgrade. The combination of beam rastering and increased beam current has resulted in a 40% increase in isotope production while also reducing the risk of target failures.

Highlights of the FY 2018 Budget Request

For FY 2018, the Department foresees moderate 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, increase radioisotope production capabilities and availability to meet demand, and upgrade proton beamline equipment at IPF to enhance the reliability of facility operations and increase isotope production yields. SC is requesting funding in the FY 2018 Nuclear Physics budget for the Stable Isotope Production Facility (SIPF) MIE, at a reduced pace relative to original plans. Originally proposed as a new start in the FY 2017 President’s Request, 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.