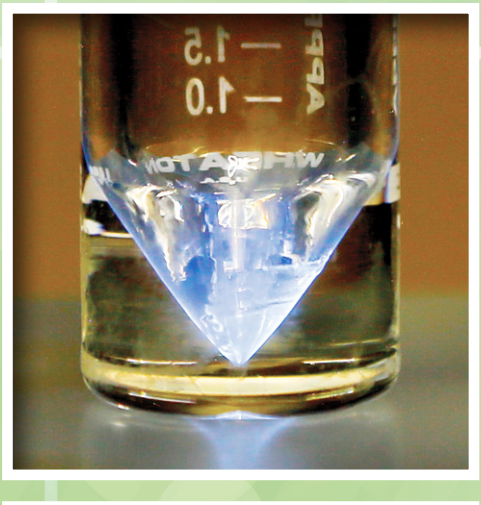


MEDICAL ISOTOPES

Isotope Program

U.S. Department of Energy

U.S. DEPARTMENT OF ENERGY | Office of Science

Advancing Medical Innovation

The routine use of radioisotopes in the fields of biology, medicine, and pharmaceuticals has led to safer and more effective diagnoses and treatments of numerous medical conditions, including cancer. As a result, millions of patients worldwide have experienced improved health and quality of life.

Through its extensive network of national laboratories and partnering universities, the U.S. Department of Energy Isotope Program develops, produces, and supplies isotopes that are critical components of these medical diagnostic and treatment options. Particle accelerators, research reactors, medical cyclotrons, and radiochemical processing laboratories are among the facilities that help the program meet this objective.

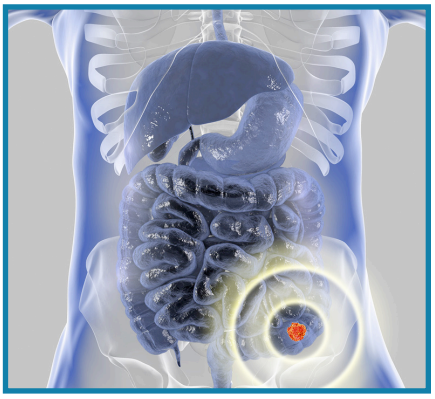
The DOE Isotope Program's portfolio has grown over time to include more than 35 medically relevant isotopes available through the National Isotope Development Center (NIDC) catalog (www.isotopes.gov), with several more under investigation at universities and national laboratories.

Medical Research

The development of new isotopes is critical to advancements in the medical field, ranging from new molecular imaging agents to targeted radiotherapeutics. Additionally, new production methods that provide adequate supply and reduce costs are under constant pursuit.

Diagnostic Imaging

Some isotopes emit radiation, enabling specialists to visualize the progression of disease throughout the body based on biological and physiological features. With these images, doctors can better assess how to treat the diseased tissue and also can detect small cancers before they metastasize.



Cancer Therapy

Certain radioisotopes serve as therapeutic agents by delivering highly targeted radiation to cancerous cells while sparing side effects to normal tissues. These radioisotopes are often administered by either direct infusion or attachment to targeting vehicles, like monoclonal antibodies or peptides.

Medical Isotopes Available from the DOE Isotope Program

ISOTOPE	HALF-LIFE	APPLICATION
Ac-225	10.0 d	Cancer therapy R&D (used directly or as the parent of Bi-213)
Ac-227	21.8 y	Cancer therapy
Al-26	717,000 y	Radiotracer
As-73	80.3 d	Radiotracer
At-211	7.21 h	Cancer therapy R&D (leukemia, lymphoma, multiple myeloma)
Au-199	3.14 d	Treatment of arthritis and cancer therapy
Be-7	53.2 d	Radiotracer
Cd-109	462 d	Diagnostic imaging
Cf-252	2.65 y	Cancer therapy
Co-60	5.27 y	Cancer therapy
Cu-67	2.58 d	Cancer therapy/diagnostics and planar imaging
Fe-52	8.28 h	PET imaging
Fe-55	2.74 y	Medical research
Ge-68	271 d	Parent of Ga-68; PET imaging
Lu-177	6.65 d	Cancer therapy
Na-22	2.60 d	Radiotracer
Ra-224/Pb-212/Bi-212	10.6 h	Cancer therapy R&D
Ra-223	11.4 d	Cancer therapy
Se-72	8.40 d	Diagnostic imaging and generator for As-72
Se-75	120 d	Radiotracer
Sn-117m	14.0 d	Bone cancer pain relief
Sr-82	25.3 d	Parent of Rb-82; PET imaging
Sr-89	50.6 d	Bone cancer pain relief
Sr-90	28.8 y	Parent of Y-90; cancer therapy
Tc-96	4.28 d	Medical research
Te-123m	119 d	Diagnostic imaging
Th-227	18.7 d	Cancer therapy R&D
Th-228	1.91 y	Cancer therapy R&D
W-188	69.8 d	Parent of Re-188; cancer therapy R&D
Xe-127	36.4 d	Diagnostic imaging
Xe-129	8.88 d	Polarized lung imaging
Y-86	14.7 h	PET imaging
Y-88	107 d	Y-90 substitute in cancer R&D
Zn-65	244 d	Medical research

Medical Isotopes Under Development

ISOTOPE	HALF-LIFE	APPLICATION
Bi-205	15.3 d	Potential theranostic isotope
Ca-47	4.54 d	Radiotracer
Ce-134	3.16 d	Imaging analog for Ac-225
C-14	5,700 y	Radiotracer
Fe-59	44.5 d	Radiotracer
Gd-153	240 d	Brachytherapy and bone density measurement
Ir-192	73.8 d	Cancer therapy
Kr-76	14.8 h	Parent of Br-76; PET imaging
Mn-52	5.59 d	Bi-modal imaging
Nb-90	14.6 h	PET imaging
Pt-195m	4.01 d	Biomedical imaging
Re-186	3.72 d	Accelerator-based production for high-specific activity; potential theranostic isotope
Re-189	24.3 h	Potential theranostic isotope
Rn-211	14.6 h	Parent of At-211; generator for At-211
Sc-47	3.35 d	Cancer therapy R&D
Te-119	16.1 h	Parent of Sb-119; cancer therapy R&D
Ti-44*	59.1 y	Parent of Sc-44; potential therapeutic isotope
U-230	20.8 d	Parent of Th-226; cancer therapy R&D
Xe-129	8.89 d	Lung imaging

*Now available for evaluation. Contact the NIDC to request samples.

Front Cover Captions: Top image: CT Scan of brain (image courtesy of Oak Ridge National Laboratory); Center image: Sample of actinium-225 in a glovebox at ORNL's Radiochemical Engineering Development Center (image courtesy of Oak Ridge National Laboratory); Bottom image: Preparing for production of theranostic radioisotopes at ANL's Low Energy Accelerator Facility (image courtesy of Argonne National Laboratory)

Other Photo Credits: ORNL's Rose Boll and Jody Rayburn conduct medical radioisotope research (Image courtesy of Oak Ridge National Laboratory)

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