U.S. DEPARTMENT OF ENERGY | Office of Science

NIDC Newsletter - July 2023

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July 2023 | National Isotope Development Center

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Feature News

Streamlined Ac-225 Processing through new All-Purpose Hot Cells

Since 2014, the DOE Isotope Program has sponsored the Tri-Lab research effort to provide accelerator-produced Actinium-225 for radiotherapy. Thorium-232 targets are irradiated in proton accelerators at Los Alamos and Brookhaven national laboratories, then shipped to Oak Ridge National Laboratory, which performs chemical processing and Ac-225 separation. This collaboration has established reliable, routine Ac-225 production, demonstrating that the process is scalable.

While the DOE IP has been ramping up production, however, available hot cell space to process Ac-225 has been a limiting factor. In the 1990s, Brookhaven National Laboratory metallurgical hot cells were shut down. Those hot cells were dormant until 2018, when an $8.5 million refurbishment project brought them back to life. The renovation included retrofitting the obsolete hot cell facility and labs to create a new All-Purpose (AP) Hot Cell facility to enhance BNL Isotope Program processing capabilities.

Read more

Program News

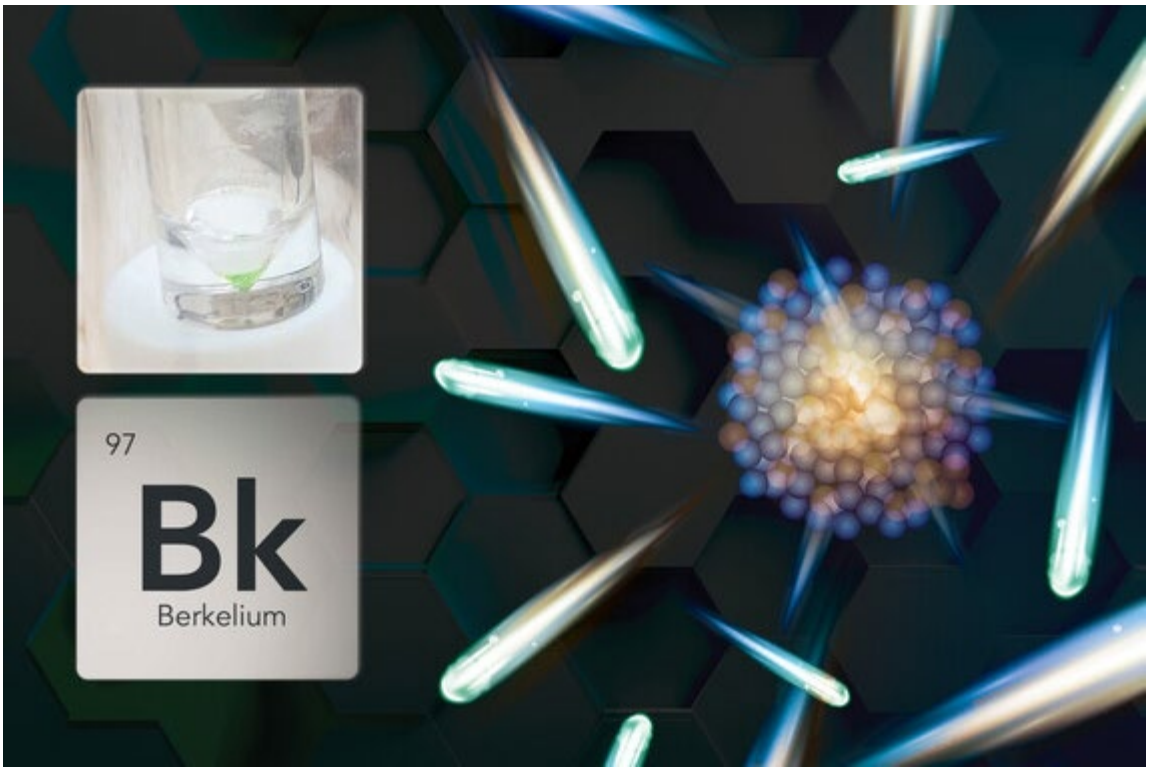


Image courtesy of Jaimee Janiga, Oak Ridge National Laboratory

Getting Purer Berkelium, Faster than Ever

A new method of purifying berkelium-249 (Bk-249) separates the isotope using a stacked column. The method is faster, results in very high purity, and is simpler, with less room for error. The method could be applied to other actinides in the future.

Researchers need a better way to extract individual heavy metal elements, called actinides, to obtain a purer product. In 2018, researchers discovered that the actinide berkelium, when oxidized, does not form negatively charged ions in solutions of high nitric acid, as other actinides do. This meant an anion exchange column could separate berkelium by absorbing other actinides with negatively charged ions. This system moves berkelium dissolved in highly concentrated nitric acid through a series of columns. The top column blocks negatively charged impurities. The lower column collects berkelium while positively charged impurities pass through. Nitric acid then strips purified berkelium from the lower column. This produced the world's purest Bk-249 to date.

Learn more

Nations join together to announce the World Astatine Community

Unveiled at the 12th International Symposium for Targeted Alpha Therapy, representatives from United States, Japan and the European Union (EU) announced a collaborative effort to share astatine production technology for the advancement of science and healthcare. The U.S. was represented at the symposium by Dr. Ethan Balkin of the Department of Energy Isotope Program, and the European Union was represented by Dr. Jean-Francois Gestin, a researcher and member of Nuclear Medicine Europe—an industry association with direct ties to the EU Commission. Japan was represented by Dr. Takashi Nakano.

Astatine-211 (At-211) has demonstrated significant potential in the treatment of blood, ovarian, and specific types of brain cancers. The Department of Energy Isotope Program (DOE IP) plays a crucial role in the production of At-211 in the U.S. through DOE IP's University Isotope Network institutions. R&D investments continue to make globally significant contributions to the scientific knowledgebase. However, its short half-life of 7.2-hours presents a challenge in generating substantial quantities necessary for therapeutic doses in patients.

The WAC aims to facilitate communication, sharing of technology, and collaborative research globally to optimize and grow regional At-211 production networks internationally. Increased availability of this promising isotope through international cooperation will motivate clinical interest and make viable clinical medical trials.

Learn more

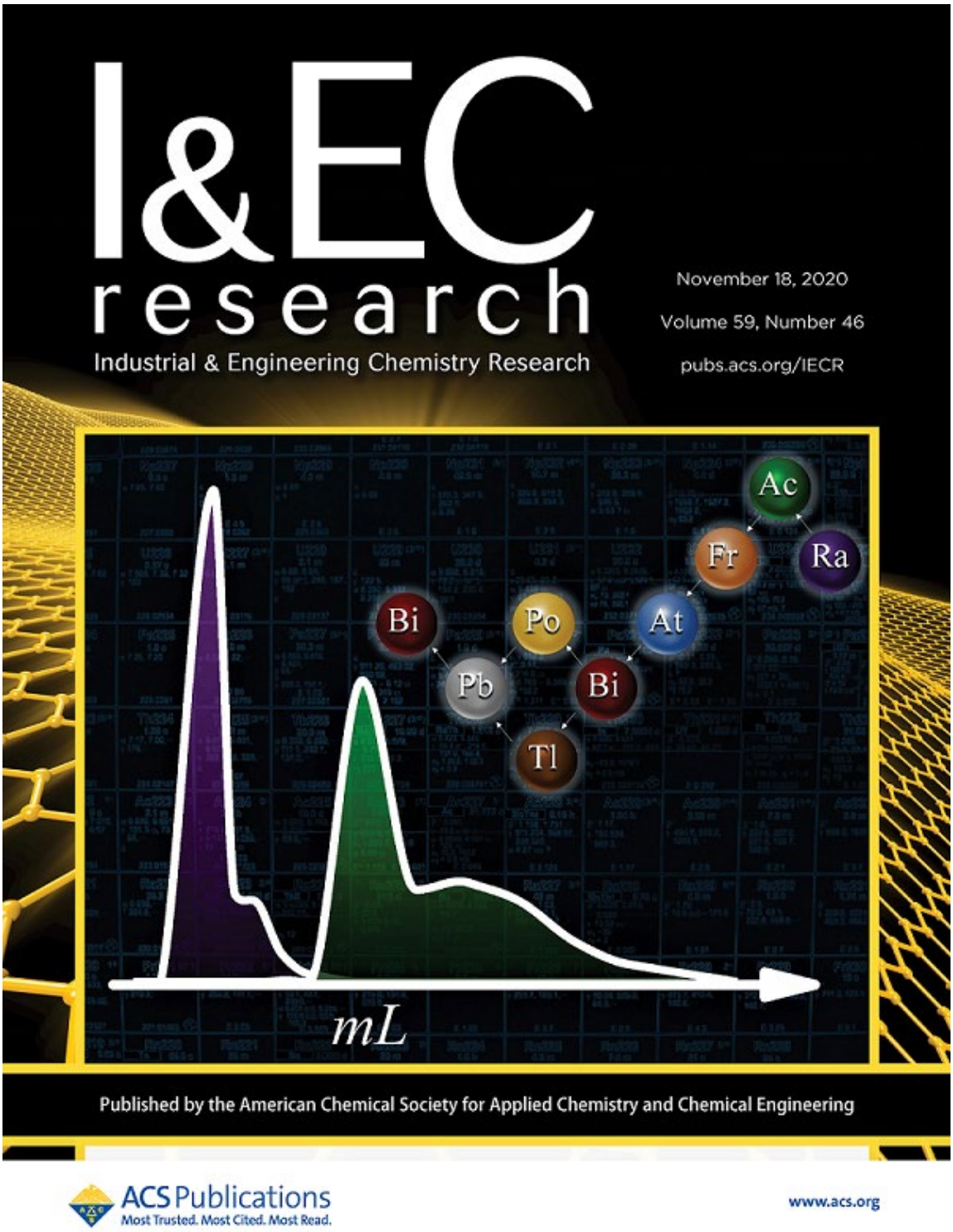


Image courtesy of Brown, M.A., Metal Oxide Sorbents for the Separation of Radium and Actinium, Industrial & Engineering Chemistry Research, 59, 20472-20477 (2020). [DOI: 10.1021/acs.iecr.0c04084] The separation of radium and actinium is a major component in the production, distribution, and purity of targeted alpha therapy isotopes. This image shows the separation profiles of radium (purple) and actinium (green) across a zirconia resin.

Scientists Develop Inorganic Resins for Generating and Purifying Radium and Actinium

Research by scientists at Argonne National Laboratory explored new materials that could support and facilitate the efficient separation of radium and actinium in the context of the large-scale production of radioisotopes used in targeted

alpha therapy. While these radioisotopes have the potential to produce powerful results in the treatment of cancers, scaling up production to meet the high demand of these radioisotopes comes with increasing radiation levels. This creates new sets of challenges, particularly radiation damage to process equipment.

The researchers explored this new class of radiation-resistant materials with respect to the fundamental radiochemical separations of radium, actinium, and lead. Through rigorous screening based on separation efficiency and chemical durability, they ultimately determined that zirconium-based materials are the optimal platform. The results showcased excellent separation capabilities of radium from actinium, accompanied by impressive levels of radiochemical purities achieved through the utilization of straightforward chemical processes. These efforts advance the DOE Isotope Program and its mission to conduct research and development on new and improved isotope production and processing for high-priority, cancer-fighting radioisotopes.

Learn more

Events

DOE Isotope Program virtual roundtable with NRC on accelerator-produced actinium-225

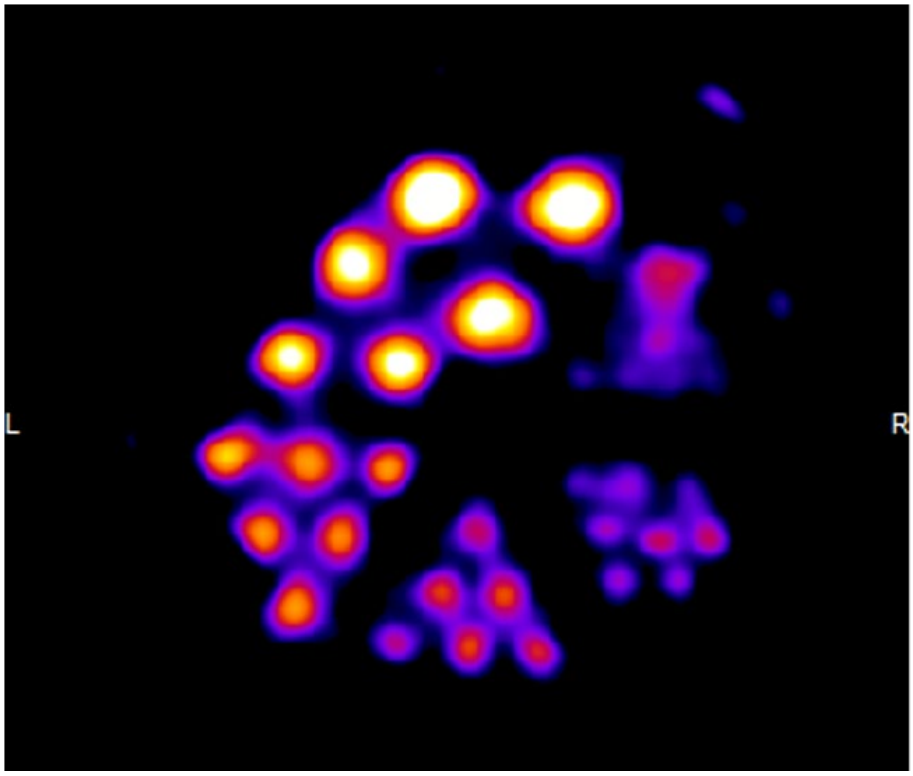
On Tuesday, March 21, 2023, the DOE IP held a Virtual Roundtable on Accelerator-Produced Ac-225 with the Nuclear Regulatory Commission (NRC). As the DOE IP is increasing routine supply of Ac-225, one production method is irradiation of thorium with high energy protons to produce Ac-225 through spallation which has the ability to produce significant quantities of Ac-225. This method co-produces Ac-227 that is ≤ 2% of total activity at time of product release. Users of this Ac-225 product are reporting tremendous labeling and research successes. The growing community of customers have questions regarding the regulatory landscape for using this material in their research. In response, the DOE IP hosted a virtual roundtable where the DOE IP and the NRC presented information related to accelerator-produced Ac-225 followed by a Q&A.

Watch the roundtable

It was great to see you at SNMMI

The U.S. DOE Isotope Program and the NIDC express our gratitude to all who engaged with us at the SNMMI 2023 Conference in Chicago, IL. Your valuable feedback enables us to remain at the forefront of the nuclear medicine community's needs. We look forward to seeing you again in the future.

Isotope Availability



SPECT image of 0.8 mCi of Pb-203 as PbCl2 in solution. The material was placed in a small device used to gauge resolution capabilities of the imaging camera against the source isotope. Image courtesy: Suzanne E. Lapi and Shefali Saini, UAB

Announcing domestic supply of lead-203

The U.S. Department of Energy Isotope Program is pleased to announce lead-203 (Pb-203) has been added to our catalog and is available for purchase. Pb-203 has drawn interest as a SPECT imaging isotope analogue to the therapeutic Pb-212, an alpha-emitter. Its addition to the NIDC Catalog establishes a theranostic matched pair of isotopes. Pb-203 will be shipped on a monthly basis.

The new lead isotope will be produced by the **University of Alabama at Birmingham (UAB) Cyclotron Facility,** a university partner in the DOE IP University Isotope Network. The Isotope Program is filling a gap in the market as there are currently no other domestic producers. For further inquiries about Pb-203 please contact the NIDC at contact@isotopes.gov or click the link below to request a quote.

Request a quote

Cerium-134

Cerium-134 (Ce-134) is in routine monthly production and available for purchase. A robust supply of Ce-134 is an essential step in advancing the use of alpha emitters for cancer therapy due to its promise as a PET imaging analog for actinium-225 (Ac-225) and thorium-227 (Th-227).

Cerium-134 is produced using high-energy proton linear accelerators at the Isotope Production Facility at Los Alamos National Laboratory and the Brookhaven Linac Isotope Producer facility at Brookhaven National Laboratory. Together, these sites enable year-round production of this high impact radionuclide. This is the first global

supply chain for Ce-134, enabling emerging technologies and advancing new treatments to combat cancer.

Accelerator-Produced Actinium-225

Alpha-emitter actinium-225 has gained considerable interest within the medical community for their radioimmunotherapy applications.

The actinium-225 (half-life of 9.92 days) is routinely produced at the DOE Isotope Program's high-energy accelerators at both Los Alamos and Brookhaven National Laboratories through the proton bombardment of natural thorium targets, then separated and purified at Oak Ridge and Brookhaven National Laboratories. Actinium-225's decay product bismuth-213 is also available from an Ac-225/Bi-213 generator. Please visit the product catalog to view product specifications and to request a quote.

Gold-199

Gold-199 (Au-199) has drawn interest with its theragnostic potential, as nanoparticles for biomedical applications in radiopharmaceutical development, and in detection of environmental compounds.

The Au-199 is available upon request at the Missouri University Research Reactor, a university partner in the DOE IP University Isotope Network.

Iron-59

The Department of Energy Isotope Program is pleased to announce the quarterly availability of iron-59 (Fe-59) through our partnership with the University of Missouri Research Reactor Center (MURR®).

Fe-59 is a radioisotope commonly used in biomedical research including in vitro and in vivo analyses of the cell and systemic metabolism in human health and disease (for example, iron uptake and excretion studies). The Isotope Program is filling a gap in the market as there are no other domestic producers of this radioisotope, and mitigating risk associated with supply chains from sensitive foreign countries.

View catalog

Job Opportunities

Isotope Processing Research Technician - Los Alamos National Laboratory

Director of UW Medical Cyclotron Facility - University of Washington

Postdoctoral Appointee - Radiochemist - Argonne National Laboratory

Market Analyst - National Isotope Development Center

Stable Isotope Research Professional - Oak Ridge National Laboratory

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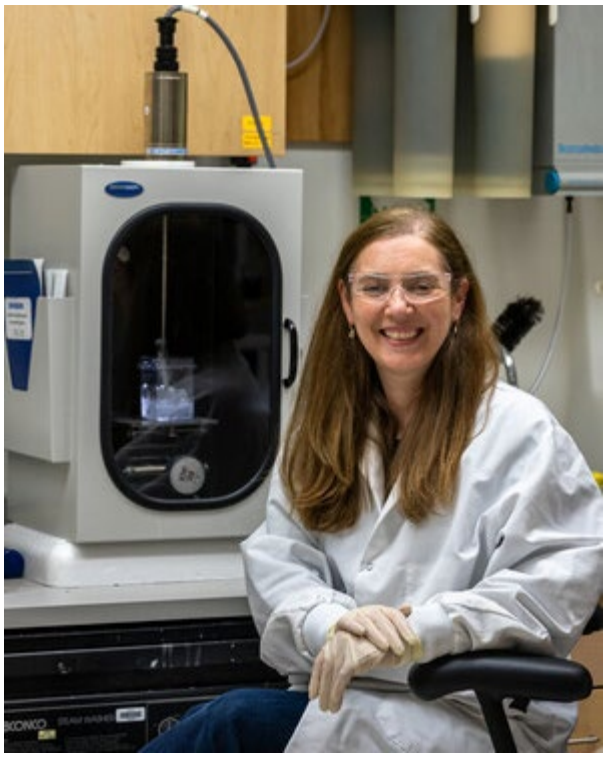
Staff News



Sandra Davern elected fellow for the American Association for the Advancement of Science

Sandra Davern leads the Radioisotope Research and Development Section in the Radioisotope Science and Technology Division at Oak Ridge National Laboratory. She is the initiative lead for Accelerating Radiotherapeutics through Advanced Molecular Constructs and the Accelerating Radiotherapeutic Innovations and Applications at ORNL, for which she organized three international workshops. Much of her research centers around advancing the use of radioisotopes for medical applications, including targeted alpha therapy for cancer treatment. She has been principal investigator for multiple studies in radioisotope applications and radiobiology. Her teams' inventions include a deployable human bioindicator, a system using vertically aligned carbon nanofiber arrays for the microdelivery of biomolecules to plants, monoclonal antibodies with immunodiagnostic capabilities and nanoconstructs for radionuclide delivery to cancer cells.

Davern's fellowship election recognizes her "for contributions to the field of targeted radionuclide therapies, particularly for the development of nanomaterials to deliver radionuclides to cancer cells and novel methods assessing DNA

damage and radiobiological effects."

She came to ORNL in 2015 as a radioisotope researcher in isotope and fuel cycle technology. She holds a doctoral degree in cell biology from University College Dublin and a bachelor of science degree in biotechnology from Dublin City University, both in Ireland.

Stosh Kozimor elected fellow for the American Association for the Advancement of Science

Dr. Stosh Kozimor is honored for seminal contributions that have advanced fundamental science and solved applied problems in heavy-element chemistry, separations, isotope production and national security. As a technical staff member at Los Alamos National Laboratory (LANL), Kozimor has had the good fortune to work alongside more than 60 students and post-doctoral researchers. Together, this team has conducted research focused on advancing fundamental science and solving technical problems important to the DOE missions. Their efforts reside at the convergence of two distinct fields (namely Radiochemistry and Inorganic Chemistry).

Kozimor started his career after receiving a B.S. in chemistry and a minor in mathematics from Fort Lewis College and a Ph.D. in inorganic chemistry from the University of California, Irvine. His thesis work focused on exploring the effects of steric crowding on the chemistry of f-element complexes under the direction of Prof. W. J. Evans. Next, Kozimor was a postdoctoral fellow at the University of California, Berkeley, where he studied actinide molecular magnetism with Prof. J. R. Long. Subsequently, he joined LANL as a distinguished Frederick Reines Fellow under mentorship from Drs. C. J. Burns and D. L. Clark. He was converted to technical staff, where he began leading fundamental chemistry studies on actinides and conducted operational environmental monitoring efforts for Chemistry Division's Nuclear and Radiochemistry group. He later joined the Isotope Production Team, whose mission is to secure the nations supply of radioisotopes, and is P.I. for the Office of Science Heavy Element Chemistry program at LANL.

Clarice Phelps is in demand as a public speaker and media guest for her role as the first Black woman involved in the discovery of an element on the periodic table, her support of Yo-STEM, her career in science, and her personal journey.

Congratulations to Clarice Phelps

Congratulations to Clarice Phelps from Oak Ridge National Lab on many high-profile media appearances and speaking engagements this year. Clarice has had a unique and compelling life journey, and her involvement as the first Black woman in the discovery of an element is inspiring people of all backgrounds to pursue their interest in science.

For those who'd like to keep up with her latest engagements, these include:

- Spoke at the National Institute of Standards and Technology (NIST) luncheon for Black History Month
- Featured in an article on CNN
- Mentioned in a Digital Journal article, "Amazing Black Scientists"
- Interviewed by WATE's Tearsa Smith
- Spoke at the Tennessee Science Bowl
- With NSD's Candice Halbert, interviewed for an upcoming article in People magazine
- Interviewed by CNN's Fredricka Whitfield
- Mentioned on "The Drew Barrymore Show"
- Appeared on CBS's "The Talk"
- Subject of an article in Popular Mechanics newsletter (scroll down for Clarice article)
- Participated in a panel discussion on March 7 at the New Hope Center on "Understanding Your Purpose"
- Appeared on the Nashville-based online Scenario Radio Show
- Appeared on a streaming show "It's Sybil"
- Attended the Tennessee Congress' Women's Month luncheon as a guest of Senator Charlane Oliver
- Was a panelist for the ANS Student Conference
- Was the Keynote Speaker at Meharry Medical College's "STEAM for You and Me" event
- Appeared on Real Talk Memphis podcast with Chip Washington
- Scheduled to speak with Diversity in Action magazine
- Interviewed with WBIR
- Recipient of Resolution from the Tennessee Senate Democratic Caucus for the Women's History Maker Tea

Welcome Michael Cody to the NIDC

Michael joined the NIDC in May 2023 as a Quality Assurance and Regulatory Affairs Manager. In his role, Michael works directly with the NIDC, DOE, and production site managers to develop, implement, and maintain quality systems that meet regulatory, operational, and customer specifications for stable and radioisotope products produced by the Isotope Program. He is responsible for assisting DOE IP sites in evaluating, designing, and implementing cGMP processes and providing technical and administrative leadership in all aspects of QC/QA functions.

Before joining the NIDC, Michael spent over 20 years in the global pharmaceutical and medical device manufacturing industry, where he developed, implemented, and maintained Quality Management Systems designed to ensure compliance with global regulatory requirements, industry standards, and certifications. He holds a BS in Business Administration with a focus on Management of Information Systems from Tennessee Technological University.

Isotope Program
US Department of Energy

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