Reducing Risk in Our Global Community

Learn More About Permanent Risk Reduction and Incentives Offered by ORS

National Nuclear Security Administration

ORS
Office of Radiological Security
Protect · Remove · Reduce

Reducing Risk in Our Global Community

Radioactive sources play an important role in commercial, medical, and research activities worldwide. While these sources have many benefits, including treating cancer and irradiating blood, they can pose a great risk to our communities should they become lost or stolen. In the wrong hands, even a small amount of high-activity radioactive material could be used in an act of radiological terrorism.

Recognizing the magnitude of this threat, the Department of Energy/National Nuclear Security Administration's (DOE/NNSA) Office of Radiological Security (ORS) is working with international partners to take action to protect, remove, and reduce high-activity radioactive sources. One strategy ORS employs to achieve this mission is to reduce global reliance on high-activity radioactive materials by promoting the development and adoption of non-radioisotopic alternative technologies.

"…the U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) continues to provide voluntary security enhancements and specialized training to holders of such sources…at sites that use Category 1 and 2 radioactive sources. Entities that participate in these programs must first meet all regulatory requirements. Both appropriate facility personnel and local law-enforcement agencies are eligible for [ORS] training programs."

— The 2014 Radiation Source Protection and Security Task Force Report

A salt shaker could hold several thousand curies of materials, which is more than enough curies of radioactivity for a significant radiological dispersal device.

Reduce Strategy at a Glance

For permanent risk reduction, ORS is encouraging the transition to non-radioisotopic alternative devices where possible. Working with international, federal and state governments, industry, and other key stakeholders, ORS is currently focused on replacement options for cesium-137 (Cs-137), cobalt-60 (Co-60), americium-241 (Am-241), and iridium-192 (Ir-192) due to the higher risk associated with these materials as well as the number of sources in use.

International Reduce Partnership Activities

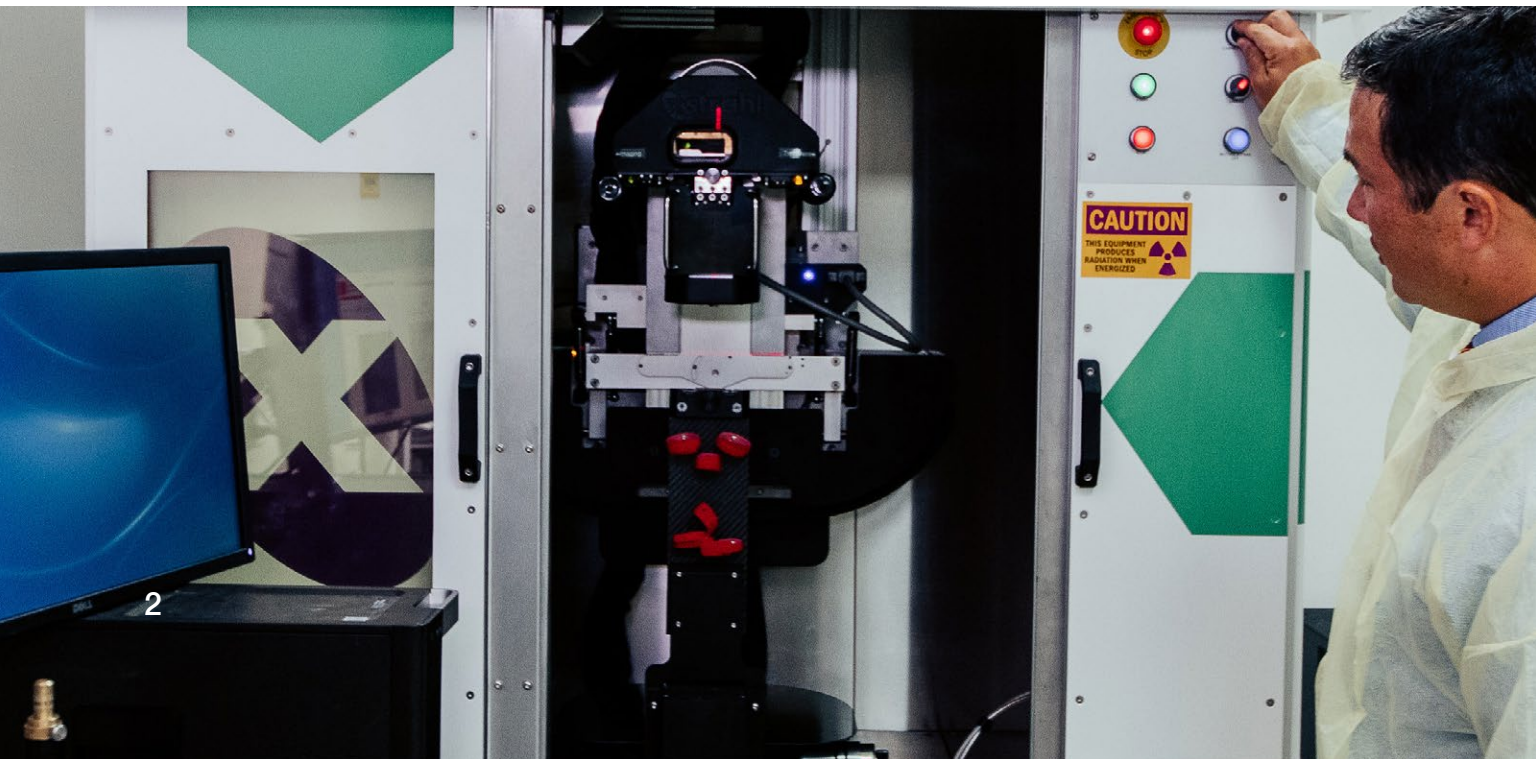
ORS works with international partners who would like to maintain the function of their current device but choose to do so with an alternative technology. Replacing the existing device with one that does not contain radioactive sources permanently reduces the risk of radioactive materials being stolen or used in acts of terrorism. ORS programs to achieve global permanent risk reduction include:

- **ORS Global Cesium Security Initiative**, or GCSI, partners with countries and facilities that use Cs-137-based devices or materials to provide advanced security enhancements, assistance to replace Cs-137 devices with viable alternative technologies, or support for removal or consolidation of disused Cs-137 devices.
- **Outreach and Education** including events and international workshops, such as those sponsored by the World Institute for Nuclear Security, and collaboration with agencies, such as the IAEA, to promote information sharing and assessments on alternative technologies.
- **Policy Engagement** through a multilateral working group with 22 IAEA Member States on alternative technology and interagency coordination on relevant international policy documents.
- **Research** nuclear sciences and applications, provide analytical support and technology demonstrations, and participate in comparison studies.

Technical Considerations

Thanks to the maturation of technology, viable alternatives exist for most of the major applications of high-activity radioactive materials, including blood and research irradiation, cancer treatment, and industrial sterilization. These alternatives have already been adopted and are in use by many facilities throughout the U.S. and Europe. Benefits of new technology and devices include:

- Mitigation of security risks, liability, and costs.
- Elimination of need to dispose of disused radiological sources.
- User-friendly equipment.
- Easier access to equipment and surrounding areas.
- Outperformance in terms of throughput and number of patients treated as well as consistent throughput over the lifetime of the device.
- More targeted radiation treatment options using a linear accelerator (LINAC), allowing health care providers to treat patients they would not be able to treat using the less-targeted radiation beam of cobalt-60 devices.



Application/ Device	Typical Radioisotope	Alternative Technologies	Considerations
Blood irradiation (Self-contained irradiator)	Cesium-137	X-ray	• Approved by the Food and Drug Administration (FDA). • In use in U.S. and Europe. • Operational considerations including costs and maintenance.
		UV Pathogen Reduction	• In some uses depending on regulatory and standards approval.
Research irradiation (Self-contained irradiator)	Cesium-137, Cobalt-60	X-ray	• In use in U.S. and Europe. • Comparison of research results from current isotopic sources is a challenge to move to replacement technologies. • Technical considerations including energy spectrum and dose penetration.
Industrial irradiation (Panoramic irradiator)	Cobalt-60	X-ray	• In use worldwide. • Product validation using contract sterilization facilities needed. • Operational considerations including technology choices in new facilities.
		E-beam	• In use in U.S. and Europe. • May have dose penetration challenges for large or high-density products.
External radiotherapy (Gamma knife; teletherapy)	Cobalt-60	LINAC	• Approved by the FDA and included in the IAEA guidance. • In use in U.S. and Europe. • Operational considerations including costs and maintenance.
Radiography (Camera)	Iridium-192	X-ray	• In use in Europe, limited use in U.S. • Operational considerations including portability.
Well logging (Neutron emitter)	Americium-241, Cesium-137	D-T Generators	• Additional R&D needed before replacement will be feasible.

"By implementing the X-ray irradiator, OneBlood has further enhanced the safety of the blood supply and increased the security of our facilities. At the same time, the X-ray irradiator has enabled us to increase our blood irradiation throughput and has exceeded our expectations for performance and reliability."

— Alicia Belldo Prichard, OneBlood, Inc.

New York City Case Study

New York City (NYC) is a world leader in the field of radiological security and the first city in the world to launch a city-wide initiative to replace Cs-137-based irradiators with alternative technologies. NYC medical facilities and universities are partnering with ORS, the New York City Department of Health and Mental Hygiene (DOHMH), and the Nuclear Threat Initiative (NTI) to replace all of the irradiators containing high-activity Cs-137 sources (around 4.5% of the U.S. Cs-137 irradiator inventory). Alternative technologies, such as X-ray irradiators, can permanently reduce the risk of Cs-137 sources being misused in acts of terrorism. This combined effort will serve as a way to reduce the risk of a terrorist acquiring this material for a radiological dispersal device ("dirty bomb").

As a target for terrorism in the past, and for the foreseeable future, the New York Police Department (NYPD) takes an extensive and proactive approach to security against terrorism, including radiological terrorism, earning recognition as one of the best law enforcement organizations on radiological threat matters in the country. For many years, NYC users of high-activity radioactive sources, the DOHMH, and the NYPD have partnered with ORS to enhance the physical security of radioactive sources and to ensure that law enforcement is well-prepared to respond to any attempted theft of materials.

University of Wisconsin–Madison Case Study

The University of Wisconsin (UW)–Madison volunteered to replace two Cs-137 irradiators with an X-ray irradiator and convert a Co-60 radiotherapy machine to a linear accelerator (LINAC).

In addition to reducing radiological risks, UW–Madison clinicians report that the treatment they can deliver to their patients using the X-ray irradiator is an improvement over the treatments using cesium devices. The X-ray irradiator also offers better uptime, requires less training, and is easier for clinicians to access, which all results in more patients being served.

For the radiotherapy technology replacement, UW reported that the decision to switch to a LINAC ultimately came down to two factors: the security challenges and liability involved in having radioactive material present on site and the superior treatment options. With greater uptime, the LINAC is also more available for patient care and offers a precision beam that enables clinicians to treat patients that would not have been treatable by the Co-60 radiotherapy machine.

ORS provided a grant for the purchase of alternative technology replacements and removed their disused sources. ORS and UW–Madison continue to work closely by exchanging information and sharing perspectives and ideas for partner transitions to alternative technologies.

About ORS

The Office of Radiological Security provides world-class security resources and technologies to businesses that utilize radioactive sources.

How Can You Learn More?

For more information, please contact ORS at ORSinfo@nnsa.doe.gov

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