The 2021 National Academies Study on Radioactive Sources and Alternative Technologies

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From 2020-2021, the U.S. National Academies of Sciences, Engineering, and Medicine, at the request of Sandia National Laboratories, assessed the status of applications of radioactive sources and alternative (non-radioisotopic) technologies in the United States and internationally, focusing on the higher risk Categories 1, 2, and 3 sources. The assessment is intended to inform existing and future activities under the National Nuclear Security Administration (NSSA) Office of Radiological Security program to reduce the current use of high-risk radiological materials and promote alternative technologies. The National Academies report can be accessed free of charge here: https://www.nap.edu/catalog/26121 .

Progress with developing and adopting alternative technologies has been uneven across different applications and radionuclides. The most notable progress is the worldwide adoption of x-ray technologies to replace the use of cesium-137 for blood and research irradiation. In the United States, that progress was facilitated in large part by financial incentives provided by the government. Also, in high- and many middle-income countries linear accelerators have almost entirely replaced cobalt-60 teletherapy. For most applications, however, there are no broadly accepted replacement technologies. A progressive transition to alternative technologies is taking place in sterilization applications, with the use of electron-beam (e-beam) technologies in medical device sterilization increasing during the past 10 to 15 years both domestically and internationally. For some applications, for example well logging, no suitable replacement technology has been developed.

The study also found that consideration and adoption of alternative technologies for medical applications such as cancer therapy in low- and middle-income countries should consider stark disparities in access to healthcare and resources. For example, adoption of alternative technologies for cancer therapy in some low- and middle-income countries has had unintended negative impacts on patient care because of lack of trained workforce, required resources, and infrastructure to make these alternatives viable options. In situations in which local resources and infrastructure cannot support alternatives, efforts should instead focus on enhancing security and assisting with infrastructure building.