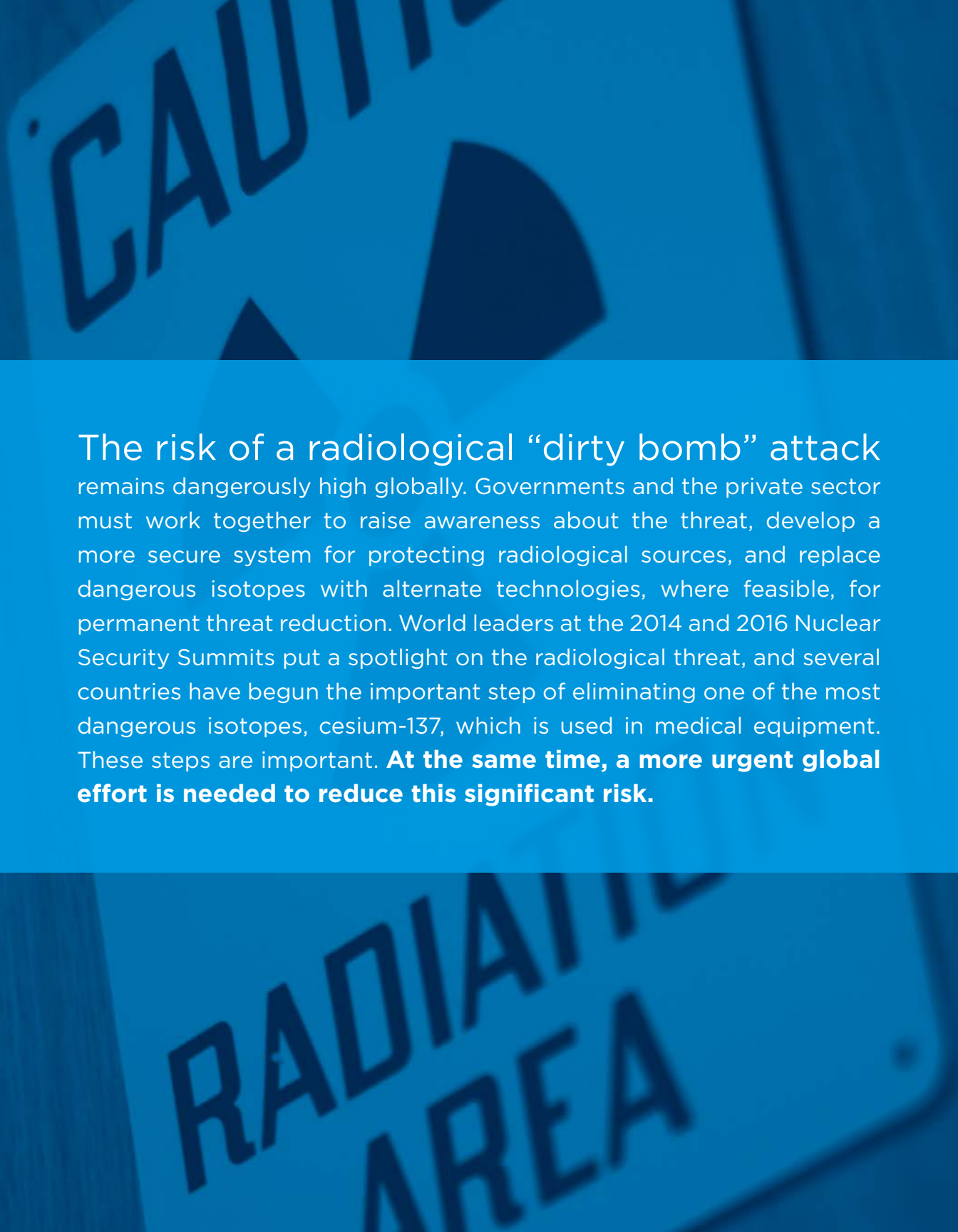




# Preventing a Dirty Bomb

Effective Alternative Technologies for Radiological Security



The risk of a radiological “dirty bomb” attack remains dangerously high globally. Governments and the private sector must work together to raise awareness about the threat, develop a more secure system for protecting radiological sources, and replace dangerous isotopes with alternate technologies, where feasible, for permanent threat reduction. World leaders at the 2014 and 2016 Nuclear Security Summits put a spotlight on the radiological threat, and several countries have begun the important step of eliminating one of the most dangerous isotopes, cesium-137, which is used in medical equipment. These steps are important. **At the same time, a more urgent global effort is needed to reduce this significant risk.**

# The Stakes and Solutions

The ingredients for a radiological “dirty bomb”—the very same isotopes that can make life-saving blood transfusions and cancer treatments possible—are located at thousands of sites in more than 150 countries, many of them poorly secured and vulnerable to theft. As a result, experts believe that the probability of a terrorist detonating a dirty bomb is much higher than that of an improvised nuclear weapon.

The vulnerability of these radiological sources, particularly the cesium-137 used in blood irradiators in hospitals and other open environments, has caused concern for years—but today the risk is growing. Radical terrorist organizations such as the Islamic State have said they are looking to acquire and use radioactive material in a dirty bomb. In 2016, Belgian investigators discovered terrorists monitoring an employee at a highly enriched uranium reactor that also produces medical isotopes for a large part of Europe. In addition, media reports out of Iraq in recent years indicate that Islamic State extremists may have already stolen enough material to build a radiological bomb.

Although radioactive isotopes also are used for various purposes at universities and research centers, in agriculture and industry, and by governments, they are



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## Stolen radioactive material found in Mexico

*Thieves took cargo truck that was hauling obsolete medical equipment containing cobalt-60 used in cancer treatment.*

Mexican authorities on Wednesday recovered a truck and the radioactive medical equipment it was hauling to a waste facility when gunmen stole it from a gas station two days ago.

The radioactive material, cobalt-60, was found about a half-mile from the truck and its empty protective lead container near Mexico City, said Juan Eibenschutz, director general of the National Commission of Nuclear Safety and Safeguards.

Radioactivity was detected in the area near Hueypoxtla, an agricultural town of about 4,000 people. Authorities cordoned off the unpopulated area and said the stolen material posed no threat.

considered most vulnerable in busy, often unguarded, medical settings where staff turnover can be high and many people have access to the machines housing the isotopes.

## The Potential Consequences

Unlike a nuclear weapon, a radioactive dirty bomb would not cause catastrophic levels of death and injury, but depending on its chemistry, form, and location, it could cause billions of dollars of damage due to the costs of evacuation, relocation, and cleanup.

There are several radiological isotopes of concern, but a bomb that intentionally spreads cesium-137 would have the most devastating consequences. Some of the other potentially dangerous isotopes are hard metals that likely would be dispersed as fragments and could be picked up from the ground or extracted from buildings after a detonation. Cesium-137, however, is a highly dispersible powder, so exposed buildings might need to be demolished and the debris removed. Following that, access to the contaminated area likely would be denied for years while the site was cleaned up well enough to meet minimal environmental guidelines for protecting the public.

## Effective Alternatives Available

Cesium-137 blood irradiators once were regarded as the most effective technology for sterilizing blood. In recent years, however, there have been significant technological advances in developing effective and safe alternative technologies that do not use radiological isotopes but have equivalent medical outcomes. In the United States, for example, the U.S. Food and Drug Administration in 2012 approved the use of non-radioactive x-ray devices for sterilizing blood. As of 2015, two types of these devices are available with a typical cost of approximately \$270,000 per unit.

In addition to being a relatively inexpensive replacement for cesium-137 blood irradiators, the x-ray units require

far less security and shielding, eliminate liability, and require no expensive disposal at the end of the machine's life-cycle. That makes replacement much more cost effective than increasing security around radiological sources—and it completely eliminates the threat. Replacement also protects hospitals that don't have insurance to cover terrorism losses; otherwise, there is a possibility of financial devastation from having to pay huge damages in the wake of a dirty bomb attack using hospital materials.

## NTI's Work to Prevent Dirty Bombs

The Nuclear Threat Initiative works globally with governments and industry on strategies to better secure and eliminate dangerous radiological materials. Our initiative to eliminate cesium-137 blood irradiators is one element of our program to reduce radiological risks. We work with international advisors to develop recommendations, strengthen the international regulatory framework around radiological sources, encourage voluntary actions, accelerate the development of alternative technologies, and strengthen the role of the private sector. NTI also tracks countries' progress in securing and eliminating sources, works with hospitals in the United States, and works with other key stakeholders to promote alternative technologies.

# Countries Phase Out Cesium Irradiators



## France

In 2006, the company that made and supplied its blood irradiators decided to stop manufacturing and supplying cesium-137 sources. In response France instituted a 10-year plan to replace all 30 of its cesium-137 irradiators at the country's national blood transfusion centers. The government directive was implemented by the independent French Nuclear Safety Authority, which worked with both operators and manufacturers of the devices to replace and dispose of them properly. All of France's cesium-137 blood irradiators were replaced with x-ray equipment by the end of 2016.



## Japan

Japan has been phasing out the use of cesium-137 for two decades. Today, about 75 percent of the institutions that use blood irradiation equipment have switched to x-ray-based technology. Unlike France and Norway, the government did not mandate the change. Instead, the burden of regulations around cesium use and a

significant and understandable long-held public fear of radiation—compounded in 2011 by the disaster at Fukushima—prompted operators to make the switch to x-ray technology.



## Norway

Norway's decision to phase out cesium-137 blood irradiators—a job that was completed in 2015—was influenced by two key factors: a government study on the potential economic impact of a radiological dirty bomb detonation and the contents of a manifesto written by the perpetrator of two terrorist attacks that killed 77 people on the same day in 2011. Those attacks involved a car bomb and shooting spree. But in his manifesto, Anders Breivik warned of more attacks with weapons of mass destruction and disruption, including radiological bombs. He noted that radiological materials were widely available on the black market and easy to steal as they were generally “unsecured.”

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***“In order for us to construct and detonate a radiological bomb, we must acquire radioactive material by stealing it or buying it through legal or illegal channels. Possible RDD material could come from millions of radioactive sources used worldwide...”***

***~ from the terrorist manifesto***

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In response, the Norwegian Radiation Protection Agency worked with public hospitals and medical institutions to replace all of Norway's 13 cesium-137 blood irradiators with x-ray devices.

# Challenges for the United States

Given the availability of equally effective alternative technologies, completely replacing cesium-137 should be done to protect public health, to protect cities from long-term contamination, and to protect economies against the devastating effects of a terrorist attack with radiological materials. This is the most cost-effective approach and results in permanently eliminating the threat.

At the same time, the task is more challenging in the United States. Unlike many other countries, including those with government-run health-care systems, cesium-137 blood irradiators are held in both public and private hands. Today, there are approximately 327 licensees of 575 cesium-137 blood irradiators in the country. In the absence of government requirements to convert



*National Nuclear Security Administration team removes a cesium-137 blood irradiator from a closed New York hospital.*

## NEW YORK CITY

New York City alone has about 30 cesium-137 devices, and given its history at the center of the nation's most devastating terrorist attack, it's no surprise that New York is at the forefront of efforts to promote permanent threat reduction.

In partnership with NTI, the New York City Department of Health and Mental Hygiene and Mount Sinai Hospital, which is replacing all of its cesium-137 blood and research irradiators with x-ray technology, are prompting a city-wide campaign to eliminate all dangerous radioactive sources as rapidly as possible.

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***“Given the stated interest by terrorist groups and the widespread availability of potentially dangerous radiological sources, it is nothing short of a miracle that we have not yet seen a dirty bomb terrorist attack. We must act before our luck runs out.”***

- NTI's Sam Nunn and Andrew Bieniawski,  
August 21, 2015, *The Washington Post*

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to safer equipment, decisions to stop using equipment with radioactive sources are being made by individual hospitals or medical facilities.

They do have some government support. A Department of Energy cost-sharing incentive program encourages the move away from cesium-137 use, and the U.S. government made a commitment at

the 2016 Nuclear Summit to replace 34 devices by the end of 2020. However, given the large number of cesium devices, the U.S. needs to significantly accelerate efforts and launch a national effort to replace cesium blood irradiators as rapidly as possible.

## **ATLANTA**

Emory University Hospital in Atlanta, which received a Medical Innovation Award at the 2016 Nuclear Industry Summit for its efforts to reduce radiological threats by replacing a cesium-137 blood irradiator, is another leader.

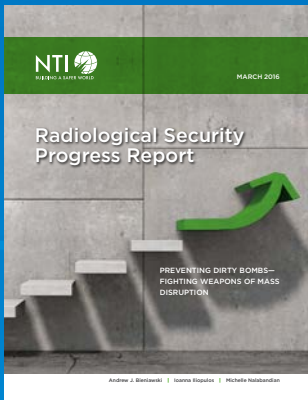
“I encourage more hospitals and research centers to look into whether they can do the same,” said NTI Co-Chairman and CEO Sam Nunn.



*Patricia Olinger accepts the Medical Innovation Award for Emory University Hospital at the 2016 Nuclear Industry Summit.*

## About the Nuclear Threat Initiative

The Nuclear Threat Initiative works to protect our lives, environment, and quality of life now and for future generations. We work to prevent catastrophic attacks with weapons of mass destruction and disruption (WMDD)—nuclear, biological, radiological, chemical, and cyber. Founded in 2001 by former U.S. Senator Sam Nunn and philanthropist Ted Turner, NTI is guided by a prestigious, international board of directors. Sam Nunn serves as chief executive officer; Des Browne is vice chairman; and Joan Rohlfing serves as president.



For more information on NTI and our work on reducing radiological risks, visit [www.nti.org/radsecurity](http://www.nti.org/radsecurity).



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