



Inadequate Control of World's Radioactive Sources

The radioactive materials needed to build a "dirty bomb" can be found in almost any country in the world, and more than 100 countries may have inadequate control and monitoring programs necessary to prevent or even detect the theft of these materials, according to the International Atomic Energy Agency (IAEA).

The IAEA points out that while radioactive sources number in the millions, only a small percentage have enough strength to cause serious radiological harm. It is these powerful sources that need to be focused on as a priority.

Around the world, radioactive sources have been widely used for decades to benefit humankind — to diagnose and treat illnesses, to monitor oil wells and water aquifers, to irradiate food to eliminate microbes, and for many other uses. The IAEA has identified radioactive sources used in industrial radiography, radiotherapy, industrial irradiators and thermo-electric generators as those that are the most significant from a safety and security standpoint because they contain large amounts of radioactive material — such as cobalt-60, strontium-90, caesium-137, and iridium-192.

"What is needed is cradle-to-grave control of powerful radioactive sources to protect them against terrorism or theft," explains IAEA Director General Mohamed ElBaradei. "One of our priorities is to assist States in creating and strengthening national regulatory infrastructures to ensure that these radioactive sources are appropriately regulated and adequately secured at all times." Mr. ElBaradei points out that while a number of countries which have regulatory systems

in place are urgently stepping up security measures, many countries lack the resources or the national structures to effectively control radioactive sources.

"Orphaned" radioactive sources — a term utilized by nuclear regulators to denote radioactive sources that are outside official regulatory control — are a widespread phenomenon in the Newly Independent States (NIS) of the former USSR. Even the United States Nuclear Regulatory Commission reports that US companies have lost track of nearly 1 500 radioactive sources within the country since 1996, and more than half were never recovered. A European Union (EU) study estimated that every year up to about 70 sources are lost from regulatory control in the EU. A recent European Commission report estimated that about 30 000 disused sources in the EU that are held in local storage at the users' premises are at risk of being lost from regulatory control. The majority of these sources would not pose a significant radiological risk if used in a dirty bomb.

In a significant recent development, the IAEA, working in collaboration with the United States Department of Energy (DOE) and the Russian Federation's Ministry for Atomic Energy (MINATOM), have established a tripartite working group on '*Securing and Managing Radioactive Sources*'. On 12 June 2002, officials representing the three sides agreed to develop a coordinated and proactive strategy to locate, recover, secure and recycle orphan sources throughout the Former Soviet Union. This agreement represents the first concerted international response to the threat posed by vulnerable radioactive sources in the NIS. Funding and expertise for this initiative will be provided by DOE and MINATOM.

Background

A dirty bomb contains radioactive material, but does not use that material to produce a nuclear explosion, as is the case with a nuclear weapon. Dirty bombs would be constructed of conventional explosives and radioactive material, the detonation of which would result in the dispersion of the radioactive material contained in the bomb. As with any explosion, people in the immediate vicinity could be killed or injured by the blast itself. The dispersed radioactive material could lead to exposure of people in the vicinity. It is difficult to predict the level of exposure of persons, as this would depend on many factors such as the physical and chemical form of the radioactive material, size and type of explosive and proximity of persons to the blast. In all likelihood, the most severe tangible impacts of a dirty bomb would be the social disruption associated with the evacuation, the subsequent clean-up of contaminated property and the associated economic costs.

One known case of an attempt to terrorize using radioactive material was the 1996 case when Chechen rebels placed a container with caesium-137 in a Moscow park. Fortunately, the material was not dispersed.

Millions of Radioactive Sources Worldwide

Millions of sources have been distributed worldwide over the past 50 years, with hundreds of thousands currently being used, stored, and produced. Many of these sources are weakly radioactive, and they pose little radiological risk.

Worldwide, the IAEA has tabulated more than 20 000 operators of significant radioactive sources: more than 10 000 radiotherapy units for medical care are in use; about 12 000 industrial sources for radiography are supplied annually; and about 300 irradiator facilities containing radioactive sources for industrial applications are in operation.

In many countries, as the regulatory control of radioactive sources is weak, the inventories are not well known.

Through its program to help countries improve their national infrastructures for radiation safety and security, the IAEA has found that more than 100 countries may have no minimum infrastructure in place to properly control radiation sources. However, many IAEA

Member States — in Africa, Asia, Latin America, and Europe — are making progress through an IAEA project to strengthen their capabilities to control and regulate radioactive sources. The IAEA is also concerned about the over 50 countries that are not IAEA Member States (there are 134), as they do not benefit from IAEA assistance and are likely to have no regulatory infrastructure.

The IAEA has been active in lending its expertise to search out and secure orphaned sources in several countries. In Kabul, Afghanistan in late March, the IAEA was called in to secure a powerful cobalt source abandoned in a former hospital. In Uganda a week later, the IAEA helped the government to secure a source that appeared to have been stolen for illicit resale.

In February 2002, a Georgian team supported by the IAEA successfully recovered two unshielded and unsecured radioactive strontium-90 sources that caused injuries to three men in December 2001. In June of this year, IAEA experts assisted Georgian officials in a search for additional strontium-90 sources that may be present in the area where the sources were recovered in February 2002.

The IAEA has been working with Georgia since 1997 to improve the safety and security of radioactive sources in this country where over 280 radioactive sources have been recovered since the mid-90's. All of these sources have been placed in interim storage.

"The situation in Georgia may just be an indication of the serious safety and security implications that orphaned sources may have elsewhere in the world," explains Abel Gonzalez, IAEA Director of Radiation and Waste Safety.

Trafficking in Radioactive Sources

More than 70 States have joined with the IAEA to collect and share information on trafficking incidents and other unauthorized movements of radioactive sources and other radioactive materials. The IAEA database includes 263 confirmed incidents since 1 January 1993 that involved radioactive material other than nuclear material. In most of these cases, the radioactive material was in the form of sealed radioactive sources, but some incidents with unsealed radioactive samples or radioactively contaminated materials such as contaminated scrap metal also have been reported to the illicit trafficking database and are included in the statistics. Some States are more complete than others in reporting

incidents, and open-source information suggests that the actual number of cases is significantly larger than the number confirmed to the IAEA.

Not all these incidents reflect deliberate attempts to steal radioactive sources. The great majority of detected trafficking incidents appear to involve opportunists or unsophisticated criminals, motivated by the hope of profit. In some cases, the theft of sources was incidental to the theft of vehicles, and in other cases, the thieves may have been interested in an item's resale value as an expensive instrument or as scrap metal. Nevertheless, it is apparent that an important fraction of cases involved persons who expected to find buyers interested in the radioactive contents of stolen sources and their ability to cause or threaten harm. Customs officials, border guards, and police forces have detected numerous attempts to smuggle and illegally sell stolen sources.

If the perpetrator is willing to disregard his or her own personal safety, radioactive sources could with little effort be concealed in a truck or packed in a suitcase.

"The danger of handling powerful radioactive sources can no longer be seen as an effective deterrent, which dramatically changes previous assumptions," says Mr. ElBaradei.

Radioactive sources can be detected and their movement monitored. The effective detection range depends on the amount and type of radiation emitted by the source and also on the possible presence of shielding materials that may reduce the amount of radiation that reaches the detector. Fortunately, the most intense and dangerous sources normally are the most susceptible to detection. Several types of instruments already are in use for detecting illicit movement of radioactive materials, and more advanced systems are under development that will be more sensitive, easier to use, or more capable to identify exactly what kind of radioactive materials are present.

International Efforts to Strengthen Security

The IAEA and its Member States are working hard to raise levels of radiation safety and security, especially focusing on countries known to have urgent needs. The IAEA has taken the leading role in the United Nations system in establishing standards of safety, the most significant of which are the "Basic Safety Standards for Protection Against Ionizing

Radiation and for the Safety of Radiation Sources" and the more recent "Code of Conduct on the Safety and Security of Radioactive Sources." These guidelines promote consistent international approaches to radiation protection, safety and security.

At the request of countries, the Agency can send expert teams to help governments develop national strategies or to advise on dealing with disused sources. Its advisory teams work with countries to assess their systems for radiation control and its emergency response teams respond to radiological emergencies. Within its 2002 Action Plan on Combating Nuclear Terrorism, the IAEA established a program to ensure that significant, uncontrolled radioactive sources are brought under regulatory control and properly secured by providing assistance to Member States in their efforts to identify, locate and secure or dispose of orphan sources.

Over the long term, the Agency will work with Governments to adhere to the Code of Conduct, which was developed by the IAEA in 2001, and to update it with a greater emphasis on security.

Orphaned Sources — Major Safety Concern

The risk of accidents is the other major concern, besides terrorism, that can derive from sources that are "orphaned". Orphaned sources include: sources that were never subject to regulatory control; sources that were subject to regulatory control but since have been abandoned, lost or misplaced; and sources that were stolen or removed without proper authorization. Exactly how many orphaned sources there are in the world is not known, but the numbers are thought to be in the thousands.

Sealed sources or their containers can be attractive to scavengers for the scrap metal trade because they appear to be made of valuable metals and may not display a radiation warning label. Cases where unsuspecting people or even members of the public have tampered with sources have led to serious injury and in some cases death.

Some of the more notable such accidents include:

- In China in 1992, a cobalt-60 source was lost and picked up by an unsuspecting individual. Three persons in the family died of resulting overexposure;

- In Georgia in 1997, a group of border frontier guards became ill and showed signs of radiation-induced skin disease. Eleven servicemen had to be transferred to specialized hospitals in France and Germany. The cause of the exposures was found to be several abandoned caesium-37 and a cobalt-60 sources of varying activities, abandoned in a former military barracks that had been under the control of the former Soviet Union;
- In Istanbul, Turkey in 1998, two cobalt-60 sources in their shipping containers were sold as scrap metal and ten persons were inadvertently exposed to radiation and had to be treated for acute radiation syndrome;
- In Peru in 1999, a worker put an iridium-192 industrial source in his pocket and suffered severe radiation burns;
- The most serious of these accidents occurred in the south-central Brazilian city of Goiânia in September of 1987.

The Goiânia Accident

In the Goiânia incident, authorities believe that scavengers dismantled a metal canister from a radiotherapy machine at an abandoned cancer clinic and left it in a junkyard. During the dismantling procedure the metal capsule that contained the caesium-137 source was ruptured.

Over the next week, several hundred people in Goiânia were exposed to the caesium-137, but did not know it. Some children and adults, thinking the caesium powder was “pretty,” even rubbed it over their bodies. Others inadvertently ate food that had been contaminated with the radioactive powder.

After one week, a public health worker correctly diagnosed radiation syndrome when a sufferer visited a clinic. The Brazilian Nuclear Energy Commission sent in a team and they discovered that over 240 persons were contaminated with caesium-137, four of whom later died.

The accident also contaminated homes and businesses and this required a major clean-up operation.

Confirmed Trafficking Incidents with Nuclear Material, 1993–2001

