

# PREVENTING THE NEXT CASE

## RADIOACTIVE MATERIALS & ILLICIT TRAFFICKING

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**R**adiation sources under little or no regulatory control are turning out to be a key part of a larger problem challenging the international community in the 1990s — illicit trafficking in nuclear and other radioactive materials.

In and of itself, trafficking is not a new phenomenon. But global concerns about an atomic “black market” have increased dramatically, perhaps initiated by several well-publicized incidents involving weapons-usable materials in 1994 in Europe. Although the number of illicit trafficking cases has risen substantially since the break-up of the former Soviet Union, the overall extent of the problem goes beyond Europe and nuclear proliferation issues.

Based on reports tracked by the IAEA, cases involving radioactive sources, as well as low-enriched, natural and depleted uranium, far exceed (by a ratio of more than nine to one) the frequency of incidents involving the types of material that could be used for nuclear weapons. The situation raises public health and safety concerns for all States, namely, the prospect that radioactive contraband can cross borders to contaminate workers, the general public, and the environment.

Already, the consequences of uncontrolled radioactive materials have been clearly demonstrated by a number of particularly serious events. Examples range from the well-known Goiania accident in Brazil in 1987, which caused multiple death and contamination of large parts of a city, to the more recent discovery of a French radiation source, caesium-137, on the scrapyard of a metal foundry in Germany.

It has to be expected that such cases — where radiation sources used for industrial gauging, non-destructive testing or radiation therapy have crossed borders and ended up uncontrolled and unprotected due to theft, careless or fraudulent disposal — will increase in frequency. The spectre even has been raised that in the hands of terrorists radioactive materials could be used as simple and crude but highly dangerous radiological weapons.

At the global level, greater efforts are being made to more effectively combat illicit trafficking of nuclear and radioactive materials. In 1998, important new ground was broken by the first global conference on the safety and security of radioactive materials; it was held in France, co-sponsored by the IAEA,

European Commission, World Customs Organization (WCO), and International Criminal Police Organization (INTERPOL). Sessions focused largely on radioactive materials, one component of the illicit nuclear trafficking picture and the central topic of this article.

Major points addressed in this report are related to the IAEA's work to provide safety guidance for national and international authorities on ways to prevent, detect, and respond to illicit trafficking in radioactive materials. Not covered are aspects related to the security of nuclear material, or associated matters related to nuclear safeguards and physical protection; major activities in these areas are carried out in the IAEA Department of Safeguards.

### GUIDANCE & SUPPORT

One major emphasis of the IAEA's activities is strengthening assistance to authorities on the front lines of the fight against illicit nuclear trafficking. Toward this end, a draft Safety Guide was completed this year. Additionally, an Agency-

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sponsored pilot study is targeted on improving the detection of contaminated material at borders. (*See box.*)

**Levels of Defense.** Three fundamental levels of defense — prevention, detection and response -- form the backbone of cooperative efforts and the Agency's guidance. The levels incorporate several elements.

■ Prevention is the most important line of defense. National legal and technical infrastructures, physical protection, -at least for nuclear materials, and adequate measures for source security and import/export control are the most effective means of preventing illicit trafficking.

■ Detection of cross-border movements will be required if prevention fails. The Agency's pilot study on border monitoring systems is helping to define the best technical and economical approaches..

■ Response measures are needed if illicit trafficking has been detected. Customs and law enforcement officers need Standard Operating Procedures about how to react, protect themselves and the public, analyse the seized material, safely dispose of the material and inform the proper authorities.

■ Training activities and exchange of information are essential.

**Safety Guide.** To assist its Member States in taking measures against illicit trafficking of radioactive materials, the IAEA is issuing a Safety Guide that covers prevention, detection, and response; the Guide is being co-sponsored by the WCO and INTERPOL. The regulations, controls and

methods it describes, as well as details contained in the supplementary technical manuals, are intended to help customs officers, border police, other law enforcement officers, regulatory authorities and other relevant national bodies in their efforts. The Safety Guide covers aspects of radiation protection, waste management, and nuclear safety as well as the regulations concerning law enforcement and border control activities. It refers to all kinds of radioactive materials, including radioactive sources, radioactive wastes, and nuclear materials.

## PREVENTION

The safety and security of radioactive materials are covered in two internationally recognized standards, the *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources* (BSS) and the IAEA *Regulations for the Safe Transport of Radioactive Materials*. The BSS provides the background and scientific foundation for Safety Guides that serve as direct input to national legislation. It requires that radiation sources and radioactive materials are kept secure with close control and requests immediate reporting to the regulatory authorities in case of decontrolled, lost, or stolen sources. It further includes requirements for authorization of possession and use by registration, notification or licensing, as well as for periodic inventories of radioactive materials and adequate records of accountability, to ensure that

they are secure and in their assigned locations.

The Agency's new Safety Guide covers a range of illegal actions, including unauthorized receipt, possession, use, transfer, import, export and disposal of radioactive materials. The foundation for prevention is a national regulatory authority, empowered to issue regulations and grant authorizations for justified practices such as receipt, possession, import, export, use, transfer and disposal. The regulatory authority should also conduct inspections, and implement an enforcement policy to correct noncompliance with regulatory requirements.

Detailed requirements are given in the Guide concerning authorization to transfer, store and dispose of radioactive materials. Of particular importance are regulations on the security of radioactive materials. This includes the requirement for records of accountability and periodic checks of inventories and notification of loss of control. It further covers requirements for the level of security, depending on the particular practice, the level of hazard and the risk of loss. Specific elements of physical security and control are also applied to radioactive materials in use, storage or transport. Such measures should be according to the concept of defense-in-depth, and commensurate with the activity and properties of the materials. Controls may start from the existence of a clearly designated and exclusive place for handling and storage, controlled access to the place of use or storage area, by

means of doors and physical barriers or any other appropriate means to prevent an unauthorized access or other means to provide physical security of the area.

## DETECTION

The task of detecting radioactive materials that are being illicitly trafficked necessarily takes place in an environment where radiation already is present, both from natural and anthropogenic sources that will vary from place to place and time to time. Any criterion (or investigation level) for deciding that the radiation from any particular shipment indicates the presence of illicitly trafficked radioactive materials has to take this variable background radiation environment into account.

Another factor is that not all radiation sources or radioactive materials are subject to regulatory control. Exposures to radiation that are part of the natural human environment also are mostly regarded as unavoidable and it is usually not practicable to control them through regulation.

If radioactive materials in a given application pose a low radiation risk, a regulatory authority may have exempted the practice of applying them in the prescribed way. Examples are the application of radionuclides in smoke detectors and luminous dial watches. If it can be shown that the exposures from release of radioactive materials will be trivial, a regulatory authority may clear them from control. Such clearance can apply both to materials that are being discarded as waste and to

materials intended for further use or recycling. It is implicit to the concept of clearance that materials, once cleared, are subject to no further regulatory restriction or control.

The level of radiation signal that is selected for deciding that a monitored vehicle, passenger or cargo may be transporting radioactive material illicitly is a compromise. On the one hand, the desire is to detect any illicitly trafficked radioactive materials, e.g. sources in shielded containers which may be buried deeply in scrap metal or other non-radioactive goods. On the other hand, there is a need to avoid unnecessary nuisance alarms, rejections and delays at border crossings.

Monitoring of gamma radiation is essential for detecting radioactive materials that are being illicitly moved. For detecting the illicit movement of nuclear materials, neutron detection will be necessary, particularly in order to detect shielded materials. Both gamma and neutron monitoring allow non-invasive interrogation of flows of people, goods and transport vehicles crossing checkpoints.

For radionuclides emitting gamma radiation, the Safety Guide recommends an investigation level to decide whether illicit radioactive material is being transported as a dose rate, measured on the outside of a vehicle. The final value will be determined based on the results of the pilot study on border monitoring instrumentation being done at the Austrian Research Center Seibersdorf. If the measured dose rate is below this value,

then it can be taken that there is no indication of illicitly trafficked radioactive material. Investigation levels also are being determined for nuclear materials emitting neutrons from spontaneous fission, such as plutonium.

**Instrumentation.** There are three basic types of instruments for detecting radioactive materials that may be being moved illicitly:

### ■ *Pocket-sized instruments.*

Considering the intended application, these should be easy to use, even by non-specialized staff and allow quick, qualitative assessment of suspect materials. They have to be battery-powered, and shock- and water-resistant with low maintenance requirements. Auto-ranging, an alarm function and some indication of the radiation level are further requirements. Instruments using Geiger-Mueller counters as radiation detectors are not sensitive enough for this application.

### ■ *Hand-held and mobile instruments.*

Hand-held instruments are used for localization and identification. They are more bulky than the pocket-sized ones but generally have more features. They typically use an inorganic (e.g., sodium iodide) or a plastic scintillator as detector and may include a multi-channel analyzer for gamma spectroscopy so that the radioactive materials can be identified by the gamma ray energy signature.

However, these instruments need more specialized training of the staff than do the pocket-sized instruments. In addition, more complex systems have been developed

that are mobile, generally with greater sensitivity than the hand-held instruments. They can be mounted on vehicles, helicopters or vessels and can be applied to searching over areas or to detecting weak radiation fields from small amounts of activity or from well-shielded radioactive materials at a larger distance.

■ *Fixed installation instruments.* These are designed to be located at border control stations, airports, ports of entry, etc. Monitors should be installed as close as possible to the object to be monitored in order to obtain the greatest practical sensitivity. Alarms and display instruments are usually installed in an area away from the detector and monitored passageway. Use of these widely automated systems should require no highly specialized training and allows a continuous flow of persons, luggage or vehicles to be monitored with reasonable speed.

The sensitivity of the instrumentation that is required depends on several parameters. Judgment at any particular location is needed to achieve the best compromise between too high a sensitivity that will result in too many alarms because of naturally radioactive materials and too low a sensitivity that fails to indicate quantities of radioactive material that should be of concern.

## RESPONDING TO EVENTS

A response of some kind is needed when radioactive materials have been detected or information is uncovered that

## MONITORING THE BORDERS

One problem facing the international community is the detection of radioactive materials contained in scrap metals. Recycling programmes have added to the problem, since aluminum, copper, lead, steel, and other recycled metals are frequently transported around the world. An important aim of international efforts is to advise authorities about such transboundary traffic, and to provide technical and administrative procedures for detecting radioactive materials at borders.

Radiation monitoring systems have been used successfully in steel plants and larger scrapyards for years. Though they provide a barometer of what can be done, border monitoring brings special conditions that must be met. Free and undisturbed movement of goods over borders is economically important, and law enforcement officers at borders have multiple priorities. Time for checks of scrap shipments is limited, and multiple checks are not practicable or always possible. Moreover, the monitoring systems can not be so sensitive that they raise false or misleading alarms.

Through a study initiated in 1995, the IAEA is working with the Austrian Research Centre-Seibersdorf and 21 manufacturers from 15 countries to develop and test effective border monitoring instrumentation for detecting illicit movements of radioactive materials. The study includes laboratory testing at Seibersdorf and field testing at the Austrian-Hungarian border and Vienna airport. One main objective is to develop a proposed "investigation level" -- that is, a measured radiation level above which a scrap transport would be stopped and closely investigated -- that officials can apply at borders.

Once developed and fully field tested, the border monitoring instruments will help, but not solve, radiation-related trafficking problems. Such systems cannot guarantee that all radioactive sources, including those of high activity, always will be detected if they are inside shielded containers or buried in large volumes of scrap -- additional measures and checks would be required. However, they would provide indications that the detected contamination is acceptably low and that no immediate risk of external exposure exists. They would help to ensure that radiation sources or radioactive materials with the potential to cause serious exposures are discovered before they endanger public health and safety.

they are not under appropriate authorized control.

Irrespective of whether or not the radioactive materials are of domestic or foreign origin, the need for response should be recognized and carried out by the Member State where the radioactive materials currently

reside. In this context, response refers to actions taken to regain control of radioactive materials; implement appropriate radiation protection procedures to mitigate hazards to health and bring the situation under appropriate radiation

protection control; provide any medical treatment needed; and apply any penalties in accordance with national regulations.

A number of circumstances require response. They include:

- Detection through radiation monitoring of the unauthorized or uncontrolled presence or movement of radioactive materials;
- Reports that radioactive materials have been found in an unauthorized location;
- Reports about something suspected to contain radioactive materials;
- Reports about an accident involving, or suspected to involve, radioactive materials;
- Reports about the detection of instances of noncompliance with the transport regulations;
- Discrepancies found in the inventory of radioactive materials; and
- Reports about illicit transboundary movement of radioactive materials.

Member States should have a plan ready for any needed response to the detection or suspicion of illicit trafficking in or loss of control of radioactive materials. The plan should be implemented whenever the regulatory authority becomes aware of possible loss of control or illicit trafficking.

The type of response depends very much on the particular circumstances. For example, the circumstances include the type of radioactive materials, where they are located, and potential pathways of exposure.

The topics covered in the plan should include:

- Whom to notify (customs officials, law enforcement

officials, emergency response units, etc.);

- What information should be supplied to aid recovery of control;

■ Measurements to be made for detection and analysis;

■ Temporary storage arrangements for any radioactive material that might be found;

■ Arrangements for transport to a final authorized storage or disposal facility; and

■ The type of information needed for alerting and informing the public about lost or illicitly moved radioactive materials.

**Training.** Training in preventing, detecting, and responding to loss of control and the detection of illicit trafficking is essential for customs officers, border control, and other law enforcement staff. Training must be matched in scope and detail to the organizational level, knowledge and roles of the trainees. A typical training syllabus should include information on the nature and effects of ionizing radiation; \* the properties and applications of radioactive materials; monitoring and detection principles and techniques; national and international radiation protection, safety and security requirements (including regulations and procedures for personal protection); and the proper response activities in case of detected radioactive materials.

Training courses should be repeated regularly to ensure that sufficient familiarity with the equipment and procedures is maintained, so that vigilance is not diminished as staff

change and that any needed response can be prompt. Such training should include practical, "hands on" exercises and drills.

The WCO in close cooperation with the IAEA, has developed a Customs Enforcement Training Module on nuclear and other radioactive materials smuggling. The overall objective of this module is to provide customs training units with a basis or framework to enable them to design their national training courses if they desire. With the assistance of this module, national training courses could be conducted not only for beginners to provide basic awareness and knowledge but also for multi-agency courses to improve mutual understanding between customs and other relevant agencies.

The WCO and the IAEA training strategy has been to give priority to the Eastern and Central European region. The first joint IAEA/WCO training course was held in Vienna for Customs Trainers in June 1997. A second course, for customs and police officers of the same region, was held in September 1998 in cooperation with the WCO and INTERPOL.

The training courses are a part of ongoing cooperation between the IAEA and international organizations. Other joint activities include technical and inter-agency meetings that help to foster the exchange of experience and information for more effectively combating illicit trafficking of radioactive materials. □