Counter Terrorism

Keeping Nuclear Materials Out of the Wrong Hands

What is the Threat?

The threat of illicit nuclear materials movement is real and ongoing. As recent news stories point out, among the most potentially daunting threats made by U.S. enemies is the statement that they have acquired nuclear weapons or the materials and know-how to produce them.

Only a small amount of active material is needed to construct a potent nuclear, chemical or biological weapon. Eight kilograms—less than 18 pounds—of plutonium is considered a "significant quantity" by the International Atomic Energy Agency and must be very carefully protected, tracked and accounted for to prevent its theft. Eight kilograms of plutonium no larger than a grapefruit could be packaged to create an explosion the size of the blasts that ended World War II.

The low natural abundance and difficult production processes required for nuclear materials help limit their illicit spread. In addition, fissile materials useful for nuclear weapons are very carefully controlled, even when legitimate commerce for peaceful purposes—such as electricity-producing nuclear power reactors—require international shipments of tons of fuel rods containing plutonium and uranium.

U.S. laws and various Department of Energy (DOE) and other federal regulations are in place to protect and track far smaller amounts of nuclear materials to ensure they are used only for peaceful purposes. In addition, DOE programs with organizations in the former Soviet Union are in place to help enhance the security of nuclear materials at production and storage sites, as well as at facilities using sensitive nuclear materials for research and manufacturing.

Our Solutions

Preventing the theft or illicit transport of nuclear materials requires a three-level approach in detection technology:

- Deter the presence of materials on a person, vehicle or container
- Locate the exact hiding place of the materials on the person, within the vehicle, or inside the container
- Identify the nature of the elements; that is, whether they are medical isotopes, depleted uranium or stolen reactor fuel.

Truck monitors like the one shown can signal radiation received from hidden sources within the truck's load.

These detection tools can be placed in a nuclear facility to ensure materials remain in proper storage, but they also have utility in a second realm of protection: the borders and transport hubs across which materials could be smuggled.

Step One: Detection

Pedestrian and package monitors in airports and at customs checkpoints can alert authorities to the attempted movement of hidden materials. Truck, train and transportation units can signal radiation received from hidden sources within their loads.

The pedestrian monitor available today relies on infrared occupancy sensors to detect an individual's presence. Until the occupancy sensor provides a signal, the radiation monitors—scintillating crystals within the metal panels—monitor background radiation levels.

Once occupancy sensors are triggered, the crystals cease background analysis and focus on the object within the portal. The monitors can react to either neutron or gamma signals, or to both, depending on the requirements of the location.

For the pedestrian portal monitor:

- The false-alarm rate is less than one in 1,000
- The monitor can be adjusted for different levels of natural background radiation
- It uses on-line, real-time analysis from internal firmware to make decisions about the object under scrutiny

Since 1943, Los Alamos has created and applied advanced science and technology to solve critical challenges in national defense and civilian research.

Industrial partners with Los Alamos National Laboratory in this technology include TSA Systems, Ltd., of Longmont, Colorado and Canberra Industries, Inc. of Meriden, Connecticut.

Steps Two and Three: Location and Identification

Once a source is detected, handheld detectors are put to use, identifying the exact location of the nuclear sources within the vehicle or on the person. Depending on the unit in operation, these handheld units can provide data about the exact nature of the nuclear source at hand, its amount and the isotopes present.

The hand-held instrument is operated through the user interface of a standard Palm Pilot computer. It detects gamma signals through a cadmium-zinc-telluride crystal and neutron signals through a ^{3}He detector.

Unlike other generations of gamma detectors, which needed extensive cooling technology, this unit operates at room temperature. It is field-portable, rugged and, thanks to a simple interface, it can be provided to customs, facility or inspections staff without extensive training requirements.

Los Alamos NATIONAL LABORATORY

Los Alamos National Laboratory is operated by the University of California for the U.S. Department of Energy's National Nuclear Security Administration

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