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Stopping Rogue Nukes

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Illustration by Paul Dimare

In less than 30 seconds, the Los Alamos detector could spot a hidden bomb.

Every so often nature surprises us by offering a simple solution to a seemingly impossible problem. After millennia of searching, surgeons found that a few breaths of nitrous oxide, a compound made from nitrogen and oxygen in the air, could banish the pain of the scalpel. Infectious diseases were felled by penicillin, an antibiotic derived from the mold in dirt beneath our feet. And now it seems that the great scourge of the 21st century, rogue nuclear weapons, also may yield to a natural remedy--sunlight.

Homeland security experts worry less about a repeat of the events of September 11 than they do the detonation of a crude nuclear weapon in a major city. Their nightmare scenario derives from two facts. The first is that the world is awash in dangerous nuclear materials. A small amount exists in the form of enriched uranium and plutonium--needed

to make atomic bombs. More worrisome are the massive quantities, measured in tons, of medical and industrial waste that are seeping into the black market. Not long ago, the U.S. Department of Energy told Florida Rep. Cliff Stearns that Russian law enforcement personnel had stopped 250 shipments of radioactive materials. Wrapped around conventional explosives, this radioactive material produces fallout effects similar to, and in some cases worse than, those of a nuclear blast.

Many within the intelligence community are convinced that the ingredients for making rogue nuclear weapons are heading to the United States. Therein lies the second problem: There is no effective means to detect this lethal cargo.

Awash With Containers

"Across the country we handle over 2 billion tons of domestic and international freight, and the majority of that is moved in containers," says Sen. John Warner of Virginia. "New York and Virginia have a tremendous percentage of that freight, and the fact is not more than 2 percent of it is inspected."

The containers to which Warner refers are the common corrugated steel boxes you see each day on trains and trucks. Most begin their journey at a U.S. port, where they are offloaded from containerized cargo ships. "Eighteen million cargo containers enter the United States every year," says Arnaud de Borchgrave, a Senior Fellow for the Center for Strategic and International Studies and Director of the Transnational Threats Initiative, a Washington-based think tank.

In congressional hearings, U.S. Customs and Border Protection officials have insisted they are doing a good job of monitoring what is inside these steel boxes. Rep. Mark Souder of Indiana suggests that the facts speak differently. "If we cannot stop tens of thousands of illegal immigrants, it does not breed a lot of confidence that we can stop all terrorists." Simply put, there are too few hands to carefully check each container. About 400 ships enter U.S. ports each day. Add to that a thousand or so official and unofficial roads and train tracks into the United States from Canada and Mexico. The danger is expected to escalate in the coming years. In late 2003, a new generation of containerized ships were launched from Korean and Japanese shipyards. Each is nearly as long as four football fields and can hold 8000 20-ft. containers. That is one-third more than the behemoths that now call at U.S. ports.

The Cosmic Connection

It is on this bleak picture that Los Alamos National Laboratory researcher Chris Morris has cast a genuine ray of light. At a recent visit to the New Mexico lab, Morris and his colleagues showed POPULAR MECHANICS the prototype of the machine that could provide a security blanket against both fission and radiological bombs.

The Earth is continuously bombarded by energetic stable particles, mostly protons. These cosmic rays originate from the stars. "The protons interact with the upper atmosphere to produce showers of short-lived particles called pions," Morris explains. Pions decay into other subatomic particles, called muons.

Muons are passing through your body as you read this. However, when muons strike very dense matter, like plutonium, uranium or the lead shielding used to absorb the radiation from these elements, the subatomic particles fly off at an angle.

More than 30 years ago, Morris began studying the way subatomic particles react when they strike massively dense metals. For this work, he built sensor panels that could note the precise place a muon struck the grid of sensors. Similar sheets of sensors below and around the object being studied tracked muons that passed straight through or were flung to the side.

The advantage of working with muons is that while they are plentiful as long as the sun shines, they are sufficiently rare, so each particle can be tracked as it moves through sensor grids. Too many scattered muons spell trouble. In one simulated test of real-world smuggling conditions, a radioactive object the size of a small nuclear bomb was loaded in a cargo container under layers of automobile differentials meant to disguise it. A computer calculated how the muons scattered. After 15 seconds it displayed the results. A mock bomb target appeared as a faint glow on a computer monitor. After 30 seconds, it lit up like a single bulb on a Christmas tree.

Morris estimates that 500 machines would be sufficient to check each vehicle crossing into the States from Mexico and Canada. Units placed at foreign ports would ensure that suspect containers don't leave home. The best part is that the system is completely passive. Cosmic rays are, after all, nothing more than sunlight from our own and distant stars.