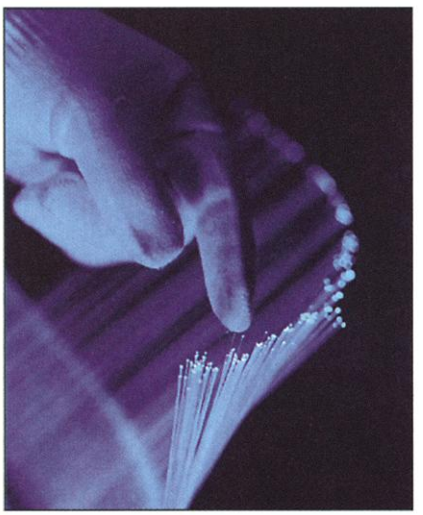
New Effort Puts Radiation Sentinels at the Borders

VIENNA—Travelers and luggage passing through customs here at the international airport face more than a collection of surveillance cameras and x-ray machines: For the last several months, they also have been scanned by a neutron and gamma ray detector. So far the focus has been on the detector's performance. But the stakes will go up this summer, when officials begin to search any baggage that triggers the radiation sentinel in an effort to catch nuclear smugglers.

A rise in trafficking of radioactive materials has been one of the most chilling consequences of the breakup of the Soviet Union (see main text). Only recently, however, have European governments begun to crack down on smuggling. A priority is tightening porous borders.

Leading these efforts is the Illicit Trafficking Radiation Detection Assessment Program. Sponsored by the Austrian government and run by scientists from the Austrian Research Centers in Seibersdorf, the program first tested detectors at the Nickelsdorf border crossing between Austria and Hungary. In a 6-month period last year at Nickelsdorf, the detectors revealed a mind-boggling array of radioactive materials crossing the border. Some 13 trucks a day, out of 900 that cross the border, set off the alarms; the rate was lower, but still startling, for passenger vehicles, at one alarm every other day. Border guards discovered everything from contaminated scrap metal to blueberries mysteriously tainted with radioactive cesium. No weapons-grade nuclear materials were intercepted, but such a coup would have been a long shot: "We did not expect to find smugglers," says the project's manager, Peter Beck, a health physics researcher at the Austrian Research Centers, which heavily promoted the study.

The detectors tested at Nickelsdorf aren't foolproof, however. The devices record collisions between gamma rays and neutrons and sodium iodine or plastic scintillation detectors, producing flashes noted by a photomultiplier and registered by a counter. But such detectors can miss the isotopic signature of smuggled material hidden inside a large shipment of legally transportable isotopes or inside a shielded container, says Rolf Arlt of the International Atomic Energy Agency's Safeguards program. "If several isotopes are present," he says, "the current generation of isotope identifiers cannot sort them out properly." Instead, the counters display only the strongest energy peak.



Pointing the way. Fiber optics are being incorporated into experimental radiation detectors. Ionizing radiation interacts with the scintillating fibers and produces light, which is converted to an electrical signal.

Arlt and other scientists are now testing a new generation of portable detectors, with a cadmium-zinc-tellurium semiconductor that sheds electrons when irradiated by gamma rays or neutrons. These detectors "cannot do miracles," says Arlt, but their sharper resolution makes them better than the scintillation detectors at distinguishing isotopes.

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gold bars tainted with iodine-131 or U.S. dollars sprayed with zirconium-95. But on at least 16 occasions, police in Europe and Asia have seized HEU or plutonium.

The most high-profile incident occurred in 1994, when a German lab traced 363 grams of plutonium powder back to Russia (see sidebar on p. 1634). "That case helped us realize there was a problem," says Nikolai Kravchenko, chief of nuclear interdiction at Moscow's Sheremetyevo airport. "We had no knowledge, no idea what equipment was needed." However, it wasn't until April 1996, at the Nuclear Safety Summit in Moscow, that Russia officially acknowledged the threat of nuclear smuggling along its 20,000-kilometer border with 14 countries, says Paula Knepper of Los Alamos National Laboratory in New Mexico.

In the wake of that meeting, increased vigilance on the borders and beefed-up security were credited with the fact that no seizures of fissile material were reported to the IAEA between 1996 and 1998. But in late 1998, Russia's Federal Security Service foiled an attempt by insiders to spirit 18.5 kilograms of HEU from a weapons lab in the Ural Mountains, potentially enough for a workable atomic bomb. (It's unclear where the material was headed.) "That's the case I'm most worried about," says analyst Scott Parrish of the Center for Nonproliferation Studies in Monterey, California. He points out that insider conspiracies, which can defeat even modern security measures, pose a continuing threat. And in the past 2 years, six incidents have been reported, including the April 2000 seizure of nearly a kilogram of HEU in the form of fast reactor fuel pellets in the Republic of Georgia (see map). These incidents are alarming enough, but "we're seeing only a small portion of the problem," argues Strauss. "We really are on the edge of the unknown."

Russia's nuclear arsenal of about 20,000 strategic and tactical warheads poses some risks, but the warheads are not the main problem, experts say; they are relatively well secured, and their fissile material is hard to remove. The real threat comes from the world's largest stockpile of HEU and plutonium—about 600 metric tons—that's not already incorporated into warheads. This nuclear legacy is stored at weapons labs, civilian research centers, and naval shipyards. As the case in the Urals indicates, much of the material is vulnerable to inside jobs, because many Cold War–era safeguards still in place—guards, guns, and gates—"were designed with spies in mind," says Alexander Schmid of the United Nations Terrorism Prevention Branch in Vienna.

Interpol and domestic intelligence agencies have shared sketchy information about organizations that may be involved in nuclear trafficking and about their motives. Most worrisome are the aspirations of nations that can accrue the expertise necessary to process uranium and plutonium into warheads. Take Iran, for example. Russia has provided assistance and equipment for Iran's nuclear power industry and had cut a deal to sell Iran laser isotope separation technology that could be used to enrich uranium; the deal was scuppered after U.S. objections. "I think this relationship with Iran has been a conduit for all kinds of nuclear material we don't know about," worries Rensselaer Lee, a senior fellow at the Foreign Policy Research Institute in Philadelphia.

"There's an undeniable trend toward proliferation [by] states. If this trend spills over into nonstate actors, we're in real trouble," says Schmid. The U.S. Central Intelligence Agency has drawn up a list of a dozen terrorist groups known to be attempting to acquire weapons of mass destruction, including Osama bin Laden's Al Qaeda. Whereas some groups