



Nuclear Forensics

Scientists are tracking the sources of stolen uranium

At the Y-12 National Security Complex in Oak Ridge, Tennessee, scientists are quietly assembling what they hope will be the world's most radioactive library. The idea behind the National Uranium Materials Archives is to create the equivalent of a fingerprint database that will help scientists sleuth out the origins of nuclear materials on the black market or detonated in an attack.

The archive, launched last spring, is part of the rapidly advancing field of nuclear forensics, which aims to trace clandestine nuclear material to the nation and even the reactor it came from. Authorities seize black

market nuclear samples each year, including byproducts of nuclear power generation and weapons-grade uranium left over from the cold war. "The basic principle is to read what we call 'signatures' in the nuclear material," explains Klaus Mayer, head of nuclear forensics at the Institute for Transuranium Elements, in Karlsruhe, Germany. "We then analyze these signatures to learn about its origin."

Enriched uranium—the fuel for nuclear weapons and power plants—has distinctive chemical signatures (such as the concentration of radioactive isotopes) as well as physical ones (the

size of grains or pellets, the presence of impurities). "We use the exclusion principle," Mayer says. "So if the pellet diameter is bigger than such and such, we can exclude Western-type reactors. If the enrichment is above 5 percent, we can exclude material intended for use in power reactors. We try to narrow down the possible origins as much as possible." Over the past seven years, Mayer says, his lab has helped to identify samples in some 20 different incidents involving unauthorized possession of nuclear material.

Since 1993, there have been 419 cases of smuggled or stolen nuclear materials worldwide, and experts say the threat is increasing. "There is strong evidence that more than one terrorist group over the last 20 years has seriously pursued nuclear weapons," says Matthew Bunn, a principal investigator at Harvard's Project on Managing the Atom. "There are also repeated cases of potential bomb material being stolen and showing up for sale in various countries

"I think one country with nuclear weapons is one too many."

—MOHAMED ELBARADEI

around the world." Details recently surfaced, for instance, about an incident last April in the former Soviet republic of Georgia, where authorities arrested three Turkish men, acting on behalf of an unknown client, who attempted to buy weapons-grade uranium from a Georgian smuggler.

The hope is that forensics will deter nuclear crime. If it became widely known that investigators can trace the fallout of a "dirty bomb" or nuclear weapon explosion to the weapon's country of origin, governments or organizations inclined to sell plutonium or uranium to terrorist groups might refrain from doing so.

The secretive new archive at the Y-12 facility, named for the Manhattan Project initiative there to enrich uranium, reportedly holds about 20 uranium samples, with more to come from around the world. Michael Kristo, a nuclear scientist at the Lawrence Livermore National Laboratory, says the archive "will really help nuclear forensics experts to establish connections and answer security questions of interest." —JOSEPH STROMBERG

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