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Despite New Tools, Detecting Nuclear Material Is Doubtful

By JAMES GLANZ

Since Sept. 11, the federal government has sharply increased support for research into advanced sensors that could detect nuclear weapons or so-called dirty bombs if they fall into the hands of terrorists in the United States.

Last week, several national laboratories unveiled an ultrasensitive hand-held radiation detector weighing 10 pounds that could join bomb- sniffing dogs as an essential tool for emergency response teams. But nuclear terrorism experts say that even the latest detection technologies — and others that are the focus of research — face forbidding odds. Ultimately, the experts said, all detectors are likely to meet a brick wall imposed by the laws of physics.

Without intelligence information to narrow the search, "needle in a haystack" is far too mild a phrase, said Dr. Steven Fetter, a physicist and security expert who is a professor of public policy at the University of Maryland. "If you tell me there's a warhead in New York, it's just hopeless," Dr. Fetter said. "You just hope you never get to the point where you have to track down one of these in a city."

The question that the post-Sept. 11 world has put to security officials is in a sense simple: If terrorists with nuclear material were loose in the United States, how would anyone know, and how could such weapons be hunted down if the nation knew they were out there, somewhere?

The question is not hypothetical. Terrorist groups like Al Qaeda have made recent efforts to obtain nuclear materials, and a senior administration official said in an interview that the government had been forced to deploy its Nuclear Emergency Search Team in the months since the World Trade Center attacks. The official would not elaborate, saying only that the NEST deployments had taken place in the United States.

To anyone without a background in nuclear physics, the answers may be unexpected and more than a little disconcerting. The question boils down to whether the radiation emitted from an illicit weapon would announce its presence to state-of-the- art detectors, allowing the material to be found and a horrific act stopped. Several facts of physics make such a search overwhelming at best.

The first problem may be obvious. A sophisticated terrorist could shield a bomb in a radiation-blocking material like lead. On the positive side, the shield might have to be so bulky that a terrorist could not move quickly without being noticed.

But some of the most dangerous nuclear materials, those that could be used in an atomic bomb, are not very radioactive, giving searchers little to go on. Moreover, earth's natural radiation can easily mask a distant radiation source's signal.

Scientists seem to agree that arrays of permanent nuclear detectors should be deployed in heavily populated areas and politically and symbolically important buildings. But they add that the nation also has to promote tight controls on nuclear materials, some of which have common industrial and medicinal uses.

"We plainly need to take a new look at the procedures by which people obtain these high levels of radioactive material," said Dr. Henry Kelly, president of the Federation of American Scientists, who spoke at a Senate hearing this month. "The risks are quite high."

The threats from radioactive materials come in two forms. One, the dirty bomb, would use a conventional explosive to disperse a radioactive material to sow terror and cause health problems, including cancer. Dirty bombs would rely on substances like radioactive cesium, cobalt, iridium and strontium that are used to kill pathogens in food processing plants, as probes to test welds and pipelines and in many medical treatments.

All those materials are intense emitters of gamma rays, a kind of high-energy version of X-rays. While gamma rays are what make the materials useful for medicine and industry, extremely high doses can also increase the cancer risk in people.

The hand-held Cryo3 detector, based on the radiation-sensitive element germanium, was developed to find gamma ray "fingerprints" of such materials in a collaboration between three Energy Department national laboratories: Lawrence Berkeley, Los Alamos and Lawrence Livermore. Germanium is not only highly sensitive to gamma rays; it also determines their precise energies. Since each type of radioactive material emits different gamma ray energies, "you can make a much more informed decision about what your next step might be," said Michael O'Connell, a program leader in the National Nuclear Security Administration.

Germanium detectors are generally bulky, laboratory-scale devices, Mr. O'Connell said. Because of several technical advances, including a miniaturized cooling engine for the germanium, the new system could be used by urban bomb squads as well as NEST groups, he said.

Since Sept. 11, the security administration's annual budget for nuclear sensor development has been doubled, to $20 million. A spokeswoman estimated that federal laboratories are spending another $14 million to $18 million on the problem.

Much deadlier, and harder to obtain, would be nuclear bombs based on uranium or plutonium. Experts' worst nightmare is that a small nuclear weapon from the former Soviet arsenal would be smuggled into the United States.

These elements are relatively feeble emitters of gamma rays, as Dr. Richard A. Muller, a professor of physics at the University of California at Berkeley, points out. The trick in detecting them is to look for neutrons, subatomic particles with no electrical charge. Neutrons are difficult to detect.

The government is working on improved and more mobile neutron detectors, Mr. O'Connell said.

Even before the new advances, the nation was not without a capacity to respond quickly to potential nuclear threats. The NEST squads are outfitted with equipment like belt-clip detectors the size of pagers and more powerful sensors in vehicles.

How likely is it that a team could detect a dirty bomb or small nuclear weapon in a van taking Interstate 95 to Washington? Dr. Frank N. von Hippel, a physicist who teaches science policy at Princeton University, said Russia and the United States ran a joint exercise in 1989 that found that under ideal conditions warheads could be detected from more than 200 feet away. "They showed that U.S. and Soviet warheads were quite detectable," Dr. von Hippel said. "That might not necessarily be true for a terrorist warhead."

But given the uncertainty surrounding the unthinkable prospect of a chase for loose nuclear weapons or dirty bombs, most authorities agree that the sole airtight solution is to control the materials at their source.