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Nuclear nightmare: Radiological weapons

Security vulnerabilities in controlling radioactive materials threaten national security

Last month's elevation of the homeland security threat level served as a sobering reminder during the holiday season of the ongoing terrorist threat against the United States. The change was prompted by a significant increase in the volume of threat-related intelligence reports, with some "chatter" indicating potential assaults to rival the attacks of September 11, 2001. Many experts agree that such an attack could involve a weapon of mass destruction (WMD), including chemical, biological or radiological weapons.

The December 15, 2003, issue of The Lipman Report *examined the chemical and biological terrorist threat, as well as the U.S. preparedness to handle such an event. This edition addresses the dangers of radiological devices, ideally suited for creating widespread panic and economic turmoil—two primary goals of terrorists.*

Radiological weapons: An overview

Unlike nuclear bombs, which generate explosions by splitting atoms, radiological dispersal devices (RDDs) use conventional explosives to spread radioactive materials. Commonly referred to as "dirty bombs," these devices do not produce the mass casualties of nuclear weapons, although they are extremely effective weapons of terror. The scattered radiation contaminates facilities, terrain and personnel, and long-term exposure to the radiation may eventually prove harmful or possibly fatal.

RDDs present a greater risk as a potential terrorist weapon for several reasons. First, the materials required to assemble such devices are more widely accessible than those used to manufacture conventional nuclear explosives. RDDs can use any nuclear material, including waste or medical isotopes. An industrial device the size of a lunch box can house a potentially lethal nugget of radioactive material smaller than a pea—one example of the many possible radiation sources that can be found in hospitals, universities, laboratories, and in construction and manufacturing facilities. More than 21,000 organizations in the United States have licenses to use radioactive materials. While the vast majority of these sources would not be suitable for constructing a weapon, the terror and disruption produced could still be significant.

Second, RDDs do not require as much technical expertise as conventional nuclear weapons. In addition to the primary type of RDD described above, these weapons can also disperse radiation in a passive manner, without an explosion. Terrorists could hide a powerful radioactive source in a public place, where a large number of passers-by could receive a significant dose of radiation.

Effects of a radiological attack

An assault using a dirty bomb would produce a relatively small number of casualties in the initial blast, depending on the amount of conventional explosive used. For this reason, experts describe radiological bombs not as weapons of mass destruction, but as weapons of mass disruption. A report issued by the U.S. Department of Defense describes the impact of RDDs as threefold: the blast and fragmentation generated by the explosion, the dissemination of radioactive material, and the fear and panic created in the targeted area.

The health risks associated with an RDD depend on the type and quantity of radiation emitted. Gamma rays, which travel great distances at high velocity, pose the greatest external danger; this type of electromagnetic radiation penetrates most materials. Intense gamma rays can produce immediate tissue damage and result in acute radiation poisoning, causing fatalities in high doses. Alpha and beta radiation travel more slowly, with less penetration. Beta radiation can penetrate human skin to the germinal layer, where new skin cells are formed, and extended exposure can damage the skin. Alpha particles cannot penetrate the skin, but can cause significant damage if inhaled, ingested or absorbed through breaks in the skin.

The Federation of American Scientists (FAS) simulated an attack involving the dispersal of a single piece of radioactive cobalt detonated at the southern tip of Manhattan. Although difficult to obtain because of security controls, the cobalt "pencil" used in the exercise typified those used in food

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irradiation plants—approximately one inch in diameter and one foot long. The initial radioactive cloud released would be relatively harmless and may not require immediate evacuation, but it could ultimately contaminate an area of one thousand square kilometers over three states. Residual radiation could make the entire borough of Manhattan uninhabitable for decades, potentially requiring demolition and resulting in trillions of dollars in economic losses.

The scientific community generally believes that a catastrophic assault with a radiological weapon is highly unlikely, due to the technical difficulties associated with constructing and deploying an effective RDD. Even so, experts concede that almost any use of even a crude RDD could produce a tremendous psychological and political impact.

Less than one gram of a dangerous radioactive material dispersed over one square mile would render the area uninhabitable by current environmental standards, even though the long-term health effect on residents would be minimal: an estimated four cancer deaths per 100,000 people exposed. The emotional trauma would be staggering. Potential psychosomatic effects would manifest as increased fear of leukemia and other forms of cancer, a rise in alcohol and substance abuse, and discrimination against individuals in the area of exposure, including self-discrimination. The financial impact of such an event could exceed billions, encompassing the costs associated with widespread testing for exposure, medical surveillance, evacuations, business disruption and decontamination.

Historic examples and current threats

Scavengers broke into an abandoned cancer treatment facility in Goiania, Brazil, in September 1987 and stole a lead capsule containing radioactive cesium, not realizing what was inside. They sold the capsule to a scrap dealer for cash. Employees broke open the casing and discovered a gleaming blue stone, which they showed to family and friends in the community, with some individuals breaking pieces off as souvenirs. Eight people developed radiation sickness, and four died. Only 250 people were actually exposed to the cesium, but fear of contamination prompted thousands of healthy individuals to flood local emergency rooms, displaying psychosomatic symptoms of radiation sickness, including nausea and dizziness.

Historically, the loss of radioactive materials has almost always been the result of either an accident or financially motivated theft. In late 1995, Chechen rebels obtained 32 kilograms of cesium-137, which had been used as the core of a cancer treatment device. They placed the cesium in a plastic bag in a Moscow park, but then told Russian reporters of the bag's location, resulting in its prompt recovery. Prolonged, unprotected contact with the substance could have proven fatal.

Likewise, Osama bin Laden and members of the al Qaeda terrorist organization have publicly declared their desire to use weapons of mass destruction against the United States. At one meeting of senior al Qaeda leaders taped in Afghanistan in 2001, a member of the network brandished a cylinder, claiming that it contained radioactive material that could be used in manufacturing a dirty bomb. U.S. intelligence officials in Afghanistan uncovered piles of information indicating that the group was attempting to learn how to construct a nuclear weapon. Among the papers was a hand-drawn diagram for making a crude RDD.

The deadly mission of the nation's enemies becomes more threatening in light of an increase in the smuggling of radioactive materials. Last May, police detained a suspicious taxi in Tbilisi, Georgia, in the former Soviet Union and discovered two capsules of highly radioactive materials—strontium and cesium—in the trunk. Previously the domain of lone opportunists in search of fast profit, trafficking in radiological materials has attracted the attention of organized criminal groups. This development may have contributed to the relatively

advanced state of the Libyan nuclear weapons program, the materials for which appear to have come largely from the international black market, according to recent media reports. U.S. experts predict that the involvement of professional smugglers will increase the likelihood of terrorists obtaining powerful radioactive materials.

Implementing current security standards

The U.S. Nuclear Regulatory Commission (NRC) works closely with other federal agencies and with individual states to regulate radioactive materials and radioactive exposure. The NRC requires those organizations licensed to use such materials to appoint a radiation safety officer (RSO), who is responsible for implementing the radiation protection program. Currently, most security measures focus on protecting employees who come into regular contact with radioactive materials, although the safety precautions shielding more dangerous substances also serve as effective deterrents against their potential misuse.

In medical facilities, the most widespread use for radiation is diagnosis. The substances used deteriorate too rapidly to cause real harm. Clinics and hospitals store these materials in locked cooling units in locked rooms. One institution on the East Coast maintains a careful chain of custody from the time a vendor delivers a radioactive substance to the moment the diagnostic test is performed. Following the terrorist attacks of September 11, 2001, this same facility heightened security by replacing traditional locks with electronic key cards and conducting background checks on all personnel who handle radiation.

The isotopes used in therapeutic radiation present a significant risk; they are highly toxic for a long period of time. As a safety and security precaution, the radioactive sources are shielded in lead and built into the treatment devices. A would-be thief would need a blowtorch and several hours to access the radiation source, according to the RSO of the institution cited above. The resulting exposure would kill a person shortly thereafter.

To ensure compliance with safety and security procedures, facilities conduct daily surveys, which are supplemented by weekly, unannounced surveys by the RSO. Representatives of the state and the NRC also perform unannounced inspections.

Weaknesses in security controls

While such procedures may appear sound, flawed execution could create vulnerabilities. According to a recent report released by the U.S. General Accounting Office (GAO), security at facilities that use sealed radioactive sources—radioactive material encased in stainless steel or other metal—varies, constituting a national security threat. One manufacturer of medical devices visited by GAO officials implemented extensive security measures, including the creation of an internal task force to develop and test scenarios for potential terrorist attacks. Another manufacturing facility likewise demonstrated tight security procedures, which included use of a computerized system to track all sealed sources installed in their products from initial manufacture to use and eventual disposal.

Inspectors also encountered poor security practices. One hospital indicated that it stored all sealed sources in a restricted-access room protected by an electronic lock. While touring the facility, GAO representatives encountered the room unlocked and unattended, with the door propped open. The guiding hospital official explained that this was an extremely unusual situation and locked the door before resuming the tour. When the group passed by the room a short while later, they again found it unlocked and open, unprotected by security personnel. The report noted that the storage room was accessible to any hospital employee and located near an unguarded public entrance.

Defense strategies against radiological attack

Several government agencies—including the NRC, the U.S. Department of Energy (DOE) and the National Nuclear Security Administration—and numerous nonprofit organizations are committed

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to reducing the threat presented by WMDs, including radiological bombs. Many of the recommendations require international collaboration, but members of the private sector can take direct action to enhance national security initiatives.

Restrict access to radioactive materials. This goal can be approached at several levels, from implementing stringent procedures at individual facilities to removing and securely storing unwanted radiological matter to developing alternatives for radioactive materials used in industry.

- The federal government must increase funding for radioactive recovery and storage programs. Thousands of facilities throughout the country possess radioactive materials that are not used, creating a dangerous situation where securing these materials might not receive the attention required. Only the DOE has the authority to recover and dispose of these substances, and a separate report issued by the GAO indicates that inadequate funding of this program continues to delay recovery efforts.
- Industries that use radioactive sources for commercial purposes need to research inexpensive alternatives to radiation. Such programs might qualify for financial incentives from the U.S. government or possibly funding from nonproliferation organizations.

Develop effective methods of early detection. Several systems have been developed to detect dangerous levels of radiation, but their deployment is limited. Currently, the world spends an estimated $10 billion each year in response to the Cold War-era threat of a strategic nuclear strike by a rogue state, compared to $100 million spent annually on the modern threat of a nuclear/radiological terror attack. The United States must adapt its defense spending to more accurately reflect the nature of the current terrorist threat. In keeping with this focus shift, private industry needs to invest more money in developing effective, low-cost sensors to fill this growing need.

The stakes in the terrorist war against the United States have been raised, and the nation must respond by preparing to defend against unconventional attacks. As a precaution against future assaults like the deadly strikes of September 11, 2001, the government of the United States of America has requested foreign cooperation in placing armed air marshals on certain international flights that enter U.S. airspace. At the same time, the country must also prepare for new, previously unthinkable threats like radiological weapons. No one has successfully launched such an attack before, but that does not ensure the nation's safety against radiological dispersal devices in the near future. Consequently, nonproliferation programs such as the one initiated by Senator Richard Lugar (R-Ind.) and then-Senator Sam Nunn (D-Ga.) in 1991 have even greater relevance in today's society. Both men continue to fight this battle: the former as a leader within the U.S. government, the latter as the co-chairman of a nonprofit, nonpartisan think tank.

The nation must mobilize its resources to defend against this threat at every level, from private industries and local communities to state and federal law-enforcement agencies and research institutions. Chief executive officers of health-care facilities and other organizations that use radioactive materials must ensure that security procedures have tightened since September 2001. Americans live in a new world, one that operates on a new level of life and death. Corporate leaders must inform their boards of directors of this danger and use outside consultants to make sure they have done all they can to protect not only those inside the organization, but also the community at large. The weakest link in the system is the one that U.S. enemies will strike.

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