WMD TERRORISM

Science and Homeland Security

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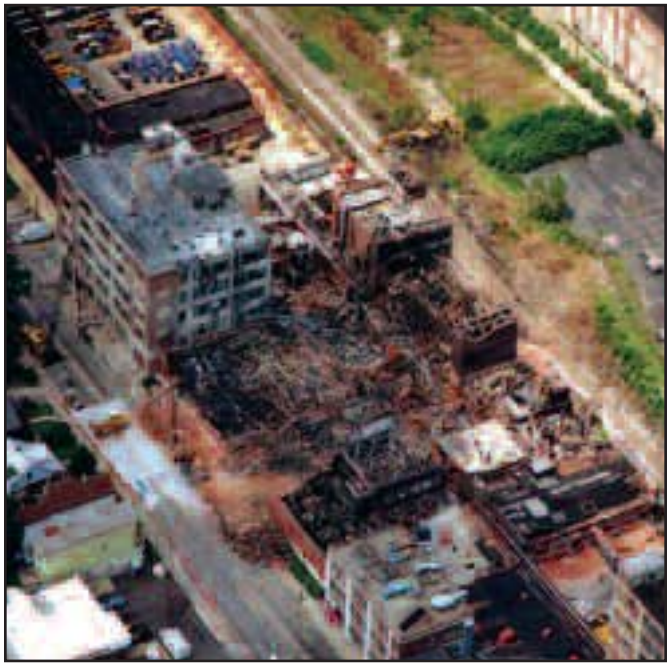
In the aftermath of 9/11, the potential use of weapons of mass destruction (WMDs) by terrorists has emerged as one of the most significant threats to U.S. national security in the first decade of the 21st century. The increased likelihood, and perhaps inevitability, that terrorists will attempt to use WMDs is a core assumption of current assessments of the threat posed to homeland security. Examples of the threat posed include chemical warfare agents or toxic chemicals releases in confined spaces; aerosol releases of biological pathogens in a building; deliberate release of non-fissile nuclear material using a radiological dispersion device (RDD) to contaminate a major port facility; detonation of a nuclear device to destroy a city; or the use of enhanced conventional explosives to produce mass casualties or damage high-value buildings or critical infrastructure.



Terrorist acquisition and use of WMDs forces decision makers to confront a wide variety of challenges in setting priorities to implement Presidential Homeland Security Directive 5's requirements for an effective National Incident Management System and National Response Plan. The problem is highly complex because the array of potential threats encompasses chemical, biological,

radiological, and nuclear terrorism, and enhanced conventional explosives.

Dimensions of the WMD Terrorism Problem

Conventional explosives and improvised explosive devices with the resultant blunt trauma and/or burn trauma have been most frequently used in terrorist incidents. However, prior events involving biological or chemical releases raise the specter of WMD use in a terrorist incident. Moreover, the shocking events of the 9/11 terrorist attacks on the World Trade Towers and the Pentagon coupled with the series of inhalation anthrax deaths after the deliberate release of anthrax spores shortly after 9/11 increased awareness of the dangers of terrorist attacks, including biological threats from introduced pathogens and newly emerging infectious diseases. Those events also demonstrate the need for prioritizing effective measures to deter, prepare for, and respond to terrorism. As a result, since 2001, the United States has embarked on a concerted program of enhancing homeland security to counter threats and reduce vulnerability.

The term 'WMD' has entered the popular lexicon. It commonly is used to represent high consequence events attributable to actual or potential terrorist use of chemicals, biological agents, non-fissile and fissile nuclear materials, or enhanced conventional explosives as weapons. However, it is technically incorrect to assume they have equal lethality in terms of mortality and morbidity or physical damages to infrastructure. Instead, the scales for human health, environmental, or physical destruction vary significantly among them.

It is well recognized that terrorism, especially WMD terrorism, differs in important ways from natural disasters. Terrorism involves intentional violent acts by humans, or the threat of violence, calculated to produce significant physical damage and/or psychological repercussions designed to instill fear and intimidation. Terrorism's goal is changing the attitudes and behavior of individuals or a society by eroding our sense of safety and sense of security. With respect to trauma, terrorist-caused injuries are different from previously known trauma types and have distinctive characteristics in terms of arrival and injury patterns. Terrorist targets include not only the individuals directly exposed, but also residents in the community in which an attack occurs and the broader society. Terrorism is directed

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against specific targets distributed across multiple spatial scales that are contingent on the target underscoring the need for realistic scenarios to support effective attack-based analysis of preparedness and response.

Most importantly, the time scale of detection for WMD terrorism typically is truncated due to frequently constrained or non-existent pre-event warning to expedite preparedness and first response activities. For example, it is virtually instantaneous for enhanced conventional explosives or nuclear terrorism, a matter of minutes before detecting a chemical or radiological incident, and hours to days before a biological pathogen release is diagnosed. This makes it essential to focus on activities providing directly usable knowledge to deter, prepare for, or respond to WMD terrorism taking into account the specific attributes of each threat.

Chemical Terrorism

Chemical warfare agents and toxic industrial or agricultural chemicals are solids, liquids or gases that adversely impact normal body function. Most classical chemical warfare agents, except for phosgene, are volatile liquids at normal ambient temperatures with the degree of volatility (i.e., vapor pressure) varying depending on the specific agent. As volatility increases, a chemical's ability to persist and remain active decreases. Chemical agents are classified based on their physicochemical and toxicological properties. Some exposures are lethal and result in death while others cause chronic or sub-chronic morbidity. In most cases, the effects are manifested virtually instantaneously depending on the dose and route of exposure with a latent period ranging from seconds to minutes, although mustard requires 2-48 hours. Nerve agents (organophosphates) cause nervous system malfunctions; pulmonary agents cause the lungs to fill with fluids and produce respiratory system damage or failure; blister agents (vesicants) and urticants cause damage to skin, eyes, or the lungs by destroying cellular tissue; blood agents (cyanides) affect the ability of the

blood system to carry oxygen or transfer oxygen to cells; tear agents (lacrimators) cause intense eye pain and tearing; vomiting agents cause regurgitation; and incapacitating agents inhibit concerted effort. Although chemical warfare agents typically are orders of magnitude more toxic, industrial or agricultural chemicals, which include pre-cursor and dual threat chemicals, can have the same physico-chemical and toxicological properties as chemical agents. Moreover, because they are used in commercial and agricultural processes, they are much easier to obtain, which may be the determining factor for chemical terrorism. And, as demonstrated by the 1984 accidental release of methylisocyanate at Bhopal, India, they can produce hundreds of casualties when dispersed as aerosols. Unlike bioterrorism, alleging chemical terrorism instead of actually using chemicals is not a viable strategy in a terrorist incident because the rapid onset of symptoms from chemical releases is likely to preclude hoaxes achieving terrorists' objectives.

Biological Agents

Most microorganisms (viruses, bacteria, fungal spores, and toxins) that cause disease may be used as biological weapons, but some are more likely candidates for use in bioterrorism incidents because they are extremely infectious and exhibit high mortality or debilitating mortality rates. Given the likelihood of delay in diagnosing some diseases caused by deliberate exposure, biological agents are potent weapons in the hands of terrorists. The U.S. Government has recognized this as a priority and has categorized pathogens into three categories based on severity of effects: 'A' which includes pathogens such as anthrax, smallpox and Dengue; 'B' which includes pathogens such as glanders, Salmonella, and viral encephalitises; and 'C' which includes pathogens such as yellow fever, drug-resistant TB, and rabies.

Radiological Dispersion Devices

The possibility exists that terrorist groups, especially non-state organizations such as Al Qaeda, might combine non-fissile material with conventional explosives in what is commonly called a "dirty bomb." Non-fissile material is stored in medical centers to diagnose and treat illnesses, research laboratories, processing plants to irradiate food to eliminate microbes, radiothermal generators, and oil well surveying instruments. Although unsuitable for producing nuclear weapons, radioactive isotopes such as 137Cs, 60Co, 90Sr, and 192Ir may be attractive for terrorists to use in an attack. As much as 3.7 x 1014Bq can be purchased legally from commercial sources depending on the isotope, and the recovery of illicit nuclear materials in Europe demonstrates the potential for terrorists to obtain illegally radioactive materials. – International

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Atomic Energy Agency, 2002: Prevention of the Inadvertent Movement and Illicit Trafficking of Radioactive Materials.

Unlike a nuclear device, a dirty bomb does not involve either fission or fusion. Instead, a RDD disperses radioactive materials as aerosols by detonating a conventional explosive, such as TNT, PETN, HMX, or RDX. Acquiring a RDD is much easier for a non-state terrorist organization than a nuclear device. The manufacturing infrastructure (U or Pu processing facilities) and linkage to a delivery system (missile technology) required to create a nuclear weapon are not needed. A RDD would not produce the mass casualties due to the blast and significant radiation exposure associated with a nuclear event. And relatively few, if any, people would die immediately after exposure to the ionizing radiation from a typical RDD using non-fissile material. – National Research Council, 1990.

However, the potential for economic and societal disruption, as well as the costs to remediate contaminated areas and structures, have transformed concerns about terrorists using a RDD into a major international security concern.

Nuclear Terrorism

In the immediate aftermath of 9/11, the October 11, 2001 false alarm of a nuclear device in New York City evoked the potential for Al-Qaeda terrorists to cause a catastrophic event on the scale of Hiroshima or Nagasaki. Nuclear terrorism represents the use or threatened use of the ultimate WMD due to the visceral anxiety or fear it generates combined with the actual magnitude of destruction. A terrorist act involving the detonation of a nuclear device, even one with a yield in the kiloton (KT) range, would be qualitatively different in terms of mass casualties and physical destruction than a chemical, biological, radiological, or enhanced conventional explosives event. To place this in perspective, even a 0.01 KT yield would be much greater than the conventional explosive that destroyed the Alfred P. Murrah Federal Building in Oklahoma City on April 19, 1995. – National Council on Radiation Protection and Measurements, 2001.

The emergence of terrorist groups such as Al-Qaeda lacking internal restraints on their willingness to use WMDs combined with the potential availability of fissile material suggests the threat is plausible.

Enhanced Conventional Explosives

Conventional explosives are the principal weapon used by terrorists to target people and property. Enhanced conventional explosives (advanced energetics) are engineered to

increase the efficiency of the thermal and blast properties of conventional explosives in terms of releasing heat and pressure. – National Research Council, 2004.

Enhancement of the energy and blast properties of conventional explosives increases the impulse delivered to the intended target. This generates a more powerful near-field blast effect thereby increasing damage within the explosive's effective range.

Developing an Effective Path Forward

In providing for homeland security, it is essential to understand what decisions need to be made, what information is required to support those decisions, potential confounding factors, and the possible consequences of any decision. The possibility that terrorist groups, especially non-state organizations such as Al Qaeda, might acquire WMDs has led to increased awareness of the need to assess deterrence, preparedness, and response options for clear and present dangers. Reliable intelligence is crucial for designing and implementing an effective WMD counter terrorism strategy. The recent 9/11 Commission Report and the Commission on the Intelligence Capabilities of the United States Regarding Weapons of Mass Destruction Report offer graphic evidence of the need for good intelligence.

The best possible science also is essential. Selecting a path forward requires effective measures for the rapid detection of exposures, delineation of risks, and minimization of adverse outcomes. This underscores the need for credible basic and applied research that reduces the probability, fosters effective intervention capabilities, and lessens potential consequences of a terrorist attack on the Nation's civilian population and critical infrastructure.

One important need is delineating ways in which cyber-terrorism can facilitate a WMD attack or inhibit response. Although there has been a great deal of general discussion about a possible terrorist cyber-attack, usually as a centerpiece event in itself, there has been limited

research on how such an attack might occur and how the terrorists are most likely to use the readily available cyber-attack tools employed by hackers, identity thieves, and net criminals to augment a larger WMD attack by diverting attention, reducing situational awareness through spoofing and harassment, and by neutralizing protective response measures.

Another priority involves effective communications networks. Deterrence, preparedness, and response to any potential or real threat are dependent on the combination of available protocols and actions blended with a set of clear responsibilities and lines of authority. Responses must be based upon fundamentals that are predefined and practiced. Ad hoc response is an inadequate alternative to clear concise disciplined actions clearly and effectively implemented. Standards, behaviors, and tools are needed to be effective. Regular practice is essential for the response to be repeatable, timely, and reliable.

Community-wide and regional preparedness for WMD disasters is critical to homeland security.

Setting priorities and coordinating deterrence, preparedness, and response requires planning, leadership, and authority integrated into an effective command and control structure.

In order to reduce uncertainties about potential outcomes if deterrence fails, it also is important to have credible baseline information that supports preparedness and response actions. Community-wide and regional preparedness for WMD disasters is critical to homeland security. In part, the ability to deter terrorism is contingent on levels of preparedness, especially medical services given the potential for mass casualties. And, when terrorist incidents occur, how communities in the U.S. respond to disaster incidents will depend upon pre-event analyzes of existing emergency response systems, determinations of critical gaps and weaknesses, emergency medical sys-

tems improvements and eventually integration of "best practice" plans into our national standards and educational efforts.

Of all the actions other than nuclear terrorism that could be undertaken by terrorists, perhaps none has more potential for causing massive civilian casualties through asymmetric warfare than does bioterrorism. Attacks may occur with little warning, personal exposure may be uncertain, the onset of symptoms may be delayed, individuals may not be or feel safe with each other because of potential contagion, and the effects may be uncontained and enduring. There will be no familiar crime scene perimeter and no traditional rescue and recovery operation. Instead, individuals are likely to self-triage, potentially impeding treatment of those most in need. Public health measures such as vaccination and quarantine may go unheeded and infected individuals may flee an area spreading the contagious agent. The inability to predict outcomes generates decreased confidence in the health system and government. Fear of exposure may also decrease the willingness of responders, health care providers, and public health officials to respond. Anxiety is likely to be exacerbated by ongoing public and scientific debate about the dangers of terrorism and our readiness to address it. Such an incident could create a variety of impacts on human health from exposure to infectious diseases, especially for unvaccinated individuals, and extensive environmental contamination requiring remediation as well as the potential for social/psychological impacts of variable duration and intensity coupled with significant economic disruption. Unlike military populations that are relatively homogenous and composed of healthy individuals who are vaccinated against a number of biowarfare agents, the civilian population is extremely diverse. A bioterrorism incident would result in exposures to a largely unvaccinated public with substantial variation in immune system capabilities. Accelerating advances in the biosciences to develop novel therapeutics and vaccines will substantially deter bioterrorism.

Usable intelligence and usable science represent the twin cornerstones of an effective WMD counter terrorism strategy. Successful deterrence, preparedness, and response are unlikely without careful integration of intelligence and science into an integrated strategy to enhance homeland security.

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