Biological Weapons as Means of Attack

Biological weapons fall into five main categories: Bacterial agents (anthrax, plague, brucellosis, typhoid fever); rickettsial agents (typhus, Rocky Mountain spotted fever, Q-fever); viral agents (smallpox, influenza, yellow fever, encephalitis, dengue fever, chikungunga, Rift Valley Fever, and hemorrhagic fevers like Ebola, Marburg and Lassa); toxins (botulinum, staphylococcus enterotoxin, shigella toxin, aflatoxin); and fungal (coccidiodomyocosis). There are other anti-plant and anti-animal weapons that are not used against humans.

Such weapons offer a means of attack that is potentially cheap, lethal, and hard to detect. An accidental release of an Anthrax agent in Sverdlovsk in Russia, in 1979, affected an area some three miles downwind from the factory and infected 80-200 Russians. It killed animals in villages as far as 30 miles downwind.45 There is little practical experience with biological weapons, and the lethality models involved are far more uncertain than those associated with conventional explosives and chemical weapons.46 Up unti11945, the development of biological weapons had only limited success. A recent history of biological weapons has found that every major power in World War II failed to develop highly effective weapons while its scientists either lied about their success or exaggerated their potential success, and their intelligence experts grossly exaggerated the potential threat from other states.47

The past, however, is unlikely to be a representative prolog of the future. As Table Nine shows, a wide range of powers developed effective biological weapons after World War II, and the development of biological weapons in the form of dry , storable micropowders dates back to the 1950s. Many, if not most of the key technologies involved are now commercialized for food processing and pharmaceutical purposes, and Table Ten shows that Iraq was found to have weaponized a wide range of agents after the Gulf War.

The former Soviet Union successfully weaponized some 37 agents before the end of the Cold War, including infectious agents designed to followed up a strategic nuclear attack on the

US with contagious diseases designed to decimate the population.48 According to some sources, it involved some 60,000 to 70,000 people.49 The agents Russia developed included germ agents such as anthrax, smallpox, Ebola, Venezuelan encephalitis and genetically engineered bugs for which there is no vaccine or prophylactic treatment.50 Ken Alibek, a Senior Russian official in the Soviet Union's Bioweapons Directorate program summarizes the effort as follows,51

When I came to the United States we had a lot of discussions on how for example one or another country would be developing biological weapons. And do you know what was interesting to me, it's a widely accepted idea in this country that biological weapons could be developed just in one case; if there is protection or treatment or prophylaxis against one another agent. In the United States, until this country terminated its program, there was a requirement; if there was no treatment or prophylaxis you cannot use a given agent for developing and manufacturing biological weapons. People were trying just to apply exactly the same mentality to other countries involved in developing biological weapons. For example, for the Soviet Union, the best biological weapons were biological weapons without any possible treatment and prophylaxis. Ebola was considered one of the best possible agents for biological weapons; Marburg, smallpox and huge number of attempts to genetically alter diseases like plague, anthrax, tularemia. In the late '80s the country was able to start developing new prototypes of bacterial biological weapons based on multi-resistant strains, meaning that all existing treatments available in the West wouldn't be possible to apply because these agents would overcome antibiotic treatments. We cannot ignore this situation. I'm 100% sure that some biological weapons and their killing capability are more effective than some forms of nuclear weapons

State Actor, Proxy, and Terrorist/Extremist Incidents to Date

As is the case with a great deal of the reporting on terrorism, the number of attempts is sometimes confused with the seriousness of the threat. There have, however, been serious terrorist and extremist efforts to use biological weapons. Germany's Red Army Faction, Italy's Red Brigades, and some Palestinian groups have at least discussed the manufacture and use of chemical and biological weapons. Chemical poisons have been used in ways that skate the definition of biological weapons. Palestinian terrorists once poisoned a shipment of Jaffa oranges from Israel, and a shipment of Chilean grapes shipped to the US was dusted in cyanide. In 1984, a member of the Baghwan Shree Rajneesh cult used salmonella gastroenteritis to poison the salad bars in a town in Oregon and 751 people became ill.52 In 1989, a cell of the German Baader-Meinhof gang was discovered with a culture of clostridium botulinum.

Aum Shinrikyo is the case in which a terrorist/extremist group had vast financial resources and actively attempted to used biological weapons. It is not clear, however, that it represents anything other than a fluke. Few religious extremist movements turn to radical terrorism of the kind that involves the potential use of weapons of mass destruction. Aum's vast financial resources, ability to buy modern equipment, and access to some scientists also do not mean that cult based on a lunatic view of the world sets the standard for effective planning and

work efforts.

There are also different views of its success. According to some sources, it attempted to acquire the Ebola virus in Zaire, and successfully manufactured and tried to use anthrax and botulinum in attacks in J apan in 1995.53 One report even talks about spraying Anthrax from the top of Aum's building in Tokyo for four days. Its efforts failed, but experts debate the extent to which this was the result of any inherent problems in manufacturing the agent or limitations in the method of attack.54 Still another source summarizes Aum's efforts as follows:55

The first experiment with this in April 1990 while most of the cult members were on a retreat at an island near Okinawa. One team was left behind expressly for the purposes of experimentally releasing botulin toxin from a car around the Japanese Parliament building, around the Diet. There were no reports of any casualties, any injuries associated with that release.

Three years later, having worked towards trying to perfect their technology, working out of a new laboratory now, the cult attempted once again to release botulin toxin. They had modified a truck or a car rather, as a spray vehicle, and this time they were intending to release their botulin toxin to coincide with the wedding of the Crown Prince. And to that end they drove around the Imperial Palace grounds as well as government buildings in Tokyo. At that time they also visited the US Naval base outside of Tokyo and attempted to release botulin toxin in that area as well. However, once again there were no health effects associated with that release, at least none that were reported.

In late June of '93, that same month, disappointed perhaps over the inability of their botulin toxin to effect any lasting effects, the cult attempted to release anthrax spores, or did release anthrax spores, from their office building laboratory in Tokyo itself. Now at the time there were reports of foul smells, brown steam spots on cars and the sidewalk, some pet deaths, plant deaths and what-have-you, but again, no reports of any human casualties associated with that release.

Another source directly contradicts all of these assertions. It denies that Aum actively sought Ebola or Q-Fever, produced botulinum toxin with any success, or made an effective attempt to use anthrax. In fact, it claims that Aum attempted to modify an animal vaccine culture.56 It denies that Aum had any success in genetic engineering and reports that Aum successfully used molecular engineering or reengineering e-coli to place a botulinum toxin inside it. The most interesting aspect of this view is that it indicates that Aum failed to be successful (a) because it never made many of the reported attempts, and (b) failed because it was so extreme it could not carry out complex efforts efficiently.

The y ugoslav Smallpox Incident

It is interesting to contrast the various views of the Aum experience with a natural outbreak

of disease in a developed country , which could just as easily have been the result of a biological attack: 57

...the only guidance we have on what to expect from a smallpox release comes from the experience of two natural outbreaks, one in Germany in 1970, which led to a total of 20 people being infected, and a far worse outbreak in Yugoslavia in 1972...When a pilgrim returned to the famous Kosovo province, he was seen by a number of different friends on return. These friends came from a number of different areas and about two weeks later, a group of cases occurred, eleven cases.

Yugoslavia had seen no smallpox since 1927, so this was 1972, 45 years since they'd had any smallpox. Yugoslavia, like most of Europe, was regularly vaccinating the population, so it was a moderately well vaccinated population. The physicians however, had had no experience in diagnosing smallpox and all of the eleven cases in the first generation were missed. One of the cases was a haemorrhagic case. Haemorrhagic smallpox is very uniformly fatal, within usually five to seven days. The individual normally puts out a great deal of virus, but the diagnosis is often missed. In this case it was a 30-year-old schoolteacher who came down with this disease, was given penicillin; his condition deteriorated, he was moved subsequently to another hospital, a district hospital, finally to the capital city , his blood pressure began to fall, he was evacuated to an intensive care unit, and at the intensive care unit he died. Only two days after his death was it recognized that smallpox was present in Yugoslavia.

That person, that one schoolteacher, infected some 35 others in hospital throughout his stay, including a number of physicians and nurses. And then by the time it was discovered, there were some 150 cases already present in Yugoslavia. The problem that the Yugoslav government was then faced with, as this was reported to other countries, they closed their borders, literally closed their borders -this would be Austria, Italy, Greece -and simply stopped all transport across the border, be it boat or train or plane, Yugoslavia was isolated.

They saw no option but to go ahead and vaccinate the entire country , which they did over a period of some 10 to 12 days, they vaccinated some 19-million people. They were faced with a number of contacts of cases; they wanted to isolate them, so that if they did come down with smallpox they would already be isolated and would not continue to spread the disease. And so they took over whole hotels, apartment blocks, and cordoned them off with barbed wire and police, and admitted the people in to this area for a two-week stay, and no-one left those once they were quarantined. And they did this for some 10,000 people.

Cases in the US

There have been a number of domestic extremist attempts to use such weapons in the US although many were little more than threats and none have been particularly successful. Some food poisoning efforts have succeeded in causing illness, but a few sick and dead scarcely compare with an average of 9,000 deaths from food poisoning a year in the US from natural causes. The FBI reports that: 58

.37 cases involving chemical and biological weapons were opened in 1996,

.There were 74 cases opened in 1997, 22 of which were related to biological agents, .There were 181 cases opened in 1998, 112 of which were biological-

.As of late May 1999, 123 cases had been opened in 1999, 100 of which were biological, .In 1998 and 1999 combined, over three-quarters of the cases opened threatened the

release of biological weapons. The most common threat was Anthrax.

Most of these cases can be dismissed as mere threats and extortion attempts, often by deeply disturbed “loners.” FBI sources do indicate, however, that some involves relatively well-equipped home labs, and that there were some successful efforts to produce Ricin, botulinum, and anthrax.

Lethality and Effectiveness

Modem biological weapons have never been used in combat, or in effective covert and terrorist attacks, but they have been stockpiled. For example, Britain produced over five million seed cakes of animal anthrax to be dropped by bombers during World War II. The US had stockpiles of seven weapons in 1969 at the time it renounced the use of biological weapons, and was testing biological warheads for the Polaris and Snark cruise missile.59 US intelligence exports estimate that as many as 15 countries now stockpile such weapons.

They offer many potential advantages. They employ living agents or toxins produced by natural or synthetic agents to kill or injure humans, domestic animals, and crqps. As Table Eight shows, there are a wide range of agents with many different and effects and they offer a wide range of ways to attack American citizens, crops, and live stock.

Chart Six shows that biological weapons can be far more lethal than chemical weapons, but this depends on the weapon. Chart Seven and Table Eight show that biological weapons can be extremely lethal or merely incapacitating. They can be infectious or transmitted only by contact with a wet or dry delivery medium. They can be quick or slow to react, and can be chosen from weapons for which there are well known and proven cures or from weapons for which there is no present vaccine or effective treatment. It should be noted, however, that most of the estimates of the impact of attacks used in this study are drawn from military models where the threat was assumed to be weaponized

Anthrax, which is by no means the most lethal biological weapon. In contrast, many studies of the use of biological weapons in homeland defense assume that state actors will not be involved. This is an assumption which greatly complicates the problem of obtaining weapons for the attacker and often leads to the assumption that attacks will be limited in lethality and scale, greatly easing the problems for the US defenders and responders.

Many forms of biological attacks, and some chemical attacks as well, would present major problems in terms of effective medical treatment. A recent GAO study concludes that this would be true even if the biological agent was a relatively well known weapon like Anthrax: ro

Medical preventive measures and treatments are available for some but not all chemical and biological agents. Early treatment following exposure to chemical agents is critical. The availability of effective medical defenses from or treatments for a chemical or biological agent could be a risk factor and influence terrorists' choice of weapon. The lack of an effective vaccine or antibioticl antiviral treatment for biological agents or of an antidote for chemical agents would pose a potential public health challenge but also pose a significant risk for terrorists as well. In the absence of medical defenses, a chemical or biological agent if effectively acquired, processed, and disseminated could become a more desirable choice because it might result in greater casualties. However, processing, testing, and disseminating the agent could equally endanger terrorists because they, too, would have no effective protection against the agent.

Medical and biological warfare experts agree that anthrax when inhaled is an agent of concern due in large part to the difficulty of diagnosis and treatment once symptoms appear and its very high lethality. We recently testified on DOD's anthrax vaccination program, pointing out that

.the anthrax vaccine is effective for preventing anthrax infections through the skin such as those sometimes contracted by unprotected workers who handle wool and hides and

.the vaccine appears to be effective against inhalation anthrax in some animal species for some, but not all, strains.

However, due to the absence of known correlates of immunity, the results of the animal studies cannot be extrapolated with certainty to humans. DOD is in the process of vaccinating military personnel against anthrax. The efficacy of the vaccine for inhalation anthrax in humans has not been proven. According to CDC, supplies of the plague vaccine do not exist in the United States; however, small supplies of killed plague vaccine may exist in Australia and the United Kingdom. CDC does not consider a vaccine useful to control an outbreak nor protect a population against a terrorist incident.

Further, there are no vaccines for other potential biological agents such as Ebola and other hemorrhagic fevers, brucellosis, glanders, or staphylococcal enterotoxin B. Post- exposure treatment for inhalation anthrax consists of using the vaccine and the antibiotic ciproflaxin, but treatment must begin immediately after exposure and before the influenza- like symptoms appear...Because the symptoms mimic common influenza, proper diagnosis may come too late for effective treatment. ...DOD believes it is prudent to vaccinate U. S. military forces against anthrax exposure, even though efficacy for inhalation anthrax has been based on animal testing

Similarly, there are no specific antidotes for a number of chemical agents such as the toxic industrial chemicals chlorine and phosgene. Treatment for exposure to these chemical agents consists largely of decontamination, first aid, and respiratory support. An antidote kit comprised of amyl or sodium nitrite exists for hydrogen cyanide. Appendixes I and II contain information on medical treatments for chemical and biological agents, respectively.

Prevention and treatments are available for a number of other agents. For example, there is an effective vaccine for known strains of smallpox, and there are new investigative vaccines for several other possible biological agents, including botulinum, Q fever, Venezuelan equine encephalitis, and tularemia. Antidotes such as atropine, pralidoxime chloride, and diazepam can be used to counteract the effects of a number of chemical nerve agents. The treatment for some chemical and biological agents includes respiratory support with a ventilator. The types and quantities of vaccines, pharmaceuticals, and other items that should be available in the event of a chemical or biological attack can be determined through a methodologically sound threat and risk assessment.

Means of Delivery

Biological agents generally are compact and low in weight. They can be disseminated in a wide number of ways -such as insects, the contamination of water and food supplies, contact, spreading powers or liquids, and by aerosol. The Department of Defense reports that dissemination of infectious agents through aerosols, either as droplets from liquid suspensions or by small particles from dry powders, is by far the most efficient method.61 Tests the conducted during the 1950s and 1960s showed that an aerosol cloud of fine 2-5 micron particles behaves more like a gas than a suspension, and penetrates interior spaces as well as exterior spaces. The US found that release from ships, aircraft, and tall buildings could achieve some lethality over distances of 50-100 miles, although without anything approaching uniform density .62

The military means for delivering biological weapons include artillery , missiles, and aerial sprayers. There are two basic types of actual munition: point source bomblets and line source tanks. Within each category there can be multiple shapes and configurations. BW munitions and delivery systems are very interdependent; frequently the munition dictates the delivery system. With the evolution of sophisticated line source hardware, the agent, the munition, and delivery system must be carefully integrated. Like chemical weapons, the effectiveness of BW munitions is very dependent on meteorological conditions and many are also sensitive to exposure to daylight.

Covert attacks against the American homeland would probably involve different methods of delivery .These can include agents disseminating agents through contact, using the wind or spreading them from high buildings, crop sprayers, commercial aircraft, and helicopters. Arthropod vectors and the contamination of food and water supplies could also be significant modes of dissemination for BW agents. Contamination of food and water supplies or aerosol dissemination are possible. Because only relatively small quantities of relatively impure agent would be required for terrorist use, agent selection is almost unlimited

Such attacks could involve a mix of different biological weapons requiring radically different treatment. Because some weapons take so long before their effects are clear, multiple attacks could be carried out over days or weeks before their impact became clear, and attacks on agriculture or even humans could be masked as the natural outbreak of disease.

It is important to note in this regard that accidental attacks on American agriculture have consisted of importing the wrong pet and having it threaten the ecology , diseases brought in the form of a few infect animals or plants, and parasites that come in on birds, aircraft, cars, and ships. The potential lethality of such attacks is illustrated by the costs of “mad cow” disease in Britain, and the fact that one infected pig could destroy an entire swine industry in Taiwan. Such a form of delivery offers many advantages: It could be virtually undetectable, it could be unattributable and might never been seen as a deliberate attack, and the effects could be lasting and nation-wide.

The Department of Defense estimates that different factors are relevant for potential terrorist use of BW and for deliberate attacks against civilian populations in urban areas. The quantity of agent could be small (a single gram, possibly less), production and purification methods extremely simple, and the dissemination means simple-to-complex. It estimates that all of the elements of such a program might go undetected until use has occurred. Individual buildings are potential targets. Off-the-shelf aerosol generators could be used to disperse a BW agent into the air inlet ducts of the target structure. Especially in the case of toxins, much less toxic agents could be employed and/or quantities of agent required would be much less than for other targets.

Manufacturing Biological Weapons

The manufacture of highly effective biological weapons to use against humans currently presents significant problems, although attacks on agriculture would not necessarily require such sophistication. Obtaining such weapons will not be a problem for most governments, but the ease with which most domestic or foreign terrorists/extremists can obtain or manufacture such weapons has sometimes been exaggerated. A recent GAO analysis of the issue found that,63

According to experts in the many fields associated with the technical Biological Agents aspects of dealing with biological agents, including those formerly with state- sponsored offensive biological weapon programs, terrorists working outside a state- run laboratory infrastructure would have to overcome extraordinary technical and operational challenges to effectively and successfully weaponize and deliver a biological agent to cause mass casualties. Terrorists would require specialized knowledge from a wide range of scientific disciplines to successfully conduct biological terrorism and cause mass casualties. For example, biological agents have varying characteristics.

Information and technical data from these experts, intelligence, and authoritative documented sources indicate that some biological agents such as smallpox are difficult to obtain. In the case of other biological agents such as anthrax land tularemia (both of which are bacteria), it is difficult to obtain a virulent strain (one that causes disease and injury to humans). Other agents such as plague are difficult to produce. Biological toxins such as ricin require large quantities to cause mass casualties, thereby increasing the risk of arousing suspicion or detection prior to dissemination. Furthermore, some agents such as Q fever incapacitate rather than cause death. Finally, many agents are relatively easy to grow, but are difficult to process into a form for a weapon. Appendix n describes some biological agents' key characteristics we developed from technical documents and reviews with experts.

According to experts from former biological warfare programs, to survive and be effective, a virulent biological agent must be grown, handled, and stored properly. This stage requires time and effort for research and development. After cultivation, the agent is wet. Terrorists would need the means to sterilize the growth medium and dispose of hazardous biological wastes. Processing the biological agent into a weaponized form requires even more specialized knowledge.

According to a wide range of experts in science, health, intelligence, and biological warfare and the technical report we reviewed, the most effective way to disseminate a biological agent is by aerosol. This method allows the simultaneous respiratory infection of a large number of people. Microscopic particles that are dispersed must remain airborne for long periods and may be transported by the wind over long distances. The particles are small enough to reach the tiny air sacs of the lungs (alveoli) and bypass the body's natural filtering and defense mechanisms.

According to experts, if larger particles are dispersed, they may fall to the ground, causing no injury , or become trapped in the upper respiratory tract, possibly causing infections but not necessarily death. From an engineering standpoint, it is easier to produce and disseminate the larger particles than the microscopic particles. Other critical technical hurdles include obtaining the proper size equipment to generate proper size aerosols, calculating the correct output rate (speed at which the equipment operates), and having the correct liquid composition.

According to key experts with experience in biological warfare, biological agents can be processed into liquid or dry forms for dissemination. Both 14 Anthrax is the disease caused by the biological agent Bacillus anthracis. Throughout the report we use the related disease term when referring to biological agents. We found that the disease term is used synonymously with the biological agent in discussions with the many experts we interviewed and documentation we reviewed.

They pose difficult technical challenges for terrorists to effectively cause mass casualties. These experts told us that liquid agents are easy to produce. However, it is difficult to effectively disseminate aerosolized liquid agents with the right particle size without reducing the strength of the mixture. Further, the liquid agent requires larger quantities and dissemination vehicles that can increase the possibility of raising suspicion and detection. In addition, experts told us that in contrast, dry biological agents are more difficult to produce than liquid agents, but dry agents are easier to disseminate.

Dry biological agents could be easily destroyed when processed, rendering the agent ineffective for causing mass casualties. A leading expert told us that the whole process entails risks. For example, powders easily adhere to rubber gloves and pose a handling problem. Effectively disseminating both forms of agent can pose technical challenges in that the proper equipment and energy sources are needed. A less sophisticated product and dissemination method can produce some illness and/ or deaths. DOD classified further details on technical challenges of effectively processing and disseminating biological agents.

According to the experts we spoke with, exterior dissemination of biological agents can be disrupted by environmental (e. g., pollution) and meteorological (e. g., sun, rain, mist, and wind) conditions. Once released, an aerosol cloud gradually decays and dies as a result of exposure to oxygen, pollutants, and ultraviolet rays. If wind is too erratic or strong, the agent might be dissipated too rapidly or fail to reach the desired area. Interior dissemination of a biological agent through a heating and air conditioning ventilation system could cause casualties. But this method also has risks. Security countermeasures could intercept the perpetrators or apprehend them after the attack. Successful interior dissemination also requires knowledge of aerodynamics. For example, the air exchange rate in a building could affect the dissemination of a biological agent. Regardless of whether a liquid or dry agent is used in interior or exterior environments, experts believe that testing should be done to determine if the agent is virulent and disseminates properly. The numerous steps in the process of developing a biological weapon increase the chances of a terrorist being detected by authorities.

The Advisory Panel to Assess Domestic Response Capabilities for Terrorism Involving Weapons of Mass Destruction drew somewhat similar conclusions:64

...the situation now facing a terrorist, who may seek to use a CBRN weapon to achieve mass effects, could

change dramatically because of new discoveries, further advances in technology, or other material factors. This is particularly true with respect to potential improvements in aerosolization techniques and processes; advances in the isolation, purification, stability, and quality of certain biological strains; or enhancements to delivery devices, such as nozzles or other sprayers. Future progress in any two or more areas would be especially troubling..

...There are at least four primary acquisition routes that terrorists could conceivably pursue in acquiring a biological warfare capability. They are purchasing a biological agent from one of the world's 1,500 germ banks, as Larry Wayne Harris did; theft from a research laboratory, hospital, or public health service laboratory , where agents are cultivated for diagnostic purposes; isolation and culturing of a desired agent from natural sources; or obtaining biological agents from a rogue state, a disgruntled government scientist, or a state sponsor.

The principal obstacle is less the development of a biological agent than the development of a genuinely lethal strain of the agent in sufficient quantities to cause mass casualties-precisely as Aum's experience indicates. Acquiring the "most infectious and virulent culture for the seed stock is the greatest hurdle," a former senior official in the U.S. military's biological warfare program maintains.

As Aum clearly demonstrated, this is not an easily surmountable obstacle. The most obvious route would be by attempting to acquire the strain from nature, e.g., obtaining potentially lethal anthrax spores from soil and then culturing sufficient quantities to produce mass casualties. While theoretically conceivable, this is nonetheless difficult in practice and doubtless well beyond the capabilities of most terrorist groups.

Acquiring a biological agent of sufficient virulence is only one of the prerequisites for conducting biological terrorism on a mass scale. As Ken Alibek, one of the former Soviet Union's leading biological weapons scientists has argued, the "most virulent culture in a test tube is useless as an offensive weapon until it has been put through a less a matter of having intelligence, than being able to recognize its significance and being prepared to act decisively based on such information -process that gives it stability and predictability .The manufacturing technique is, in a sense, the real weapon, and it is harder to develop than individual agents."

...Airborne viral agents, in particular, are extraordinarily difficult to work with, since the mass production, packaging, and storage of viruses are by themselves difficult and complicated tasks, demanding advanced biotechnical skills, in addition to the attendant risks to personnel involved in the process. In the specific case of botulinum toxins, there are difficulties in purifying these agents, which then will likely become unstable once they are purified. According to one biological warfare authority, "maintaining the high toxicity in the culture and the properties of the toxin as you purify it are what you have to have a lot of years [of experience] to know how to do."

The same problem of maintaining toxicity during the purification process hampered U.S. government researchers during the Cold War. They discovered that attempting to achieve 95 percent purity of a biological agent-the level needed to render it effective as a weapon-in turn reduced the bulk amount of the toxin by 70-80 percent.

Producing other types of bioterrorism agents similarly requires training, advanced techniques, and specialized equipment. In the case of B. anthracis, for example, transforming the bacterium into spore form suitable for use in a wide-scale terrorist attack necessitates a combination of skill and extreme care during a production technique that involves the application of heat or chemical shock. During all stages of the process, B. anthracis, like all other biological agents, must also be continuously tested to ensure its purity and lethality and thus its utility for weapons purposes. Although small-scale laboratory testing might be concealed, any larger-scale tests will likely invite the attention of law enforcement or intelligence agencies.

Indeed, any group aiming at developing a weapon capable of inflicting mass casualties would almost certainly require sophisticated, though not exotic, laboratory equipment. According to the Central Intelligence Agency, this would include “fermenters, large-scale lyophilizers or freeze dryers, class II or ill safety hoods, High-Efficiency Particulate Air (HEPA) filters, and centrifuges.”

Estimates for the cost of equipping a facility for the production of biological agents for mass-casualty terrorist operations vary widely but would likely seem to fall anywhere in the $200,000 to $2 million range-certainly not trivial sums. Although there remains a widespread public perception that it is easy to acquire and use highly lethal biological agents, there is no clear consensus among analysts about how much scientific and technological expertise and prior training are needed. Some authorities maintain that having an “experimental microbiologist and a pathologist, or someone who combines these capabilities, would be crucial [s]upplemented with a little help and advice from an aerosol physicist and a meteorologist.”

Other experts are even more conservative in their assessments. In their view, the creation of a mass- casualty biological weapon would entail scientific teams composed of persons highly trained in “microbiology, pathology, aerosol physics, aerobiology, and even meteorology.”

The acquisition of dedicated staff with the appropriate scientific and engineering knowledge and credentials may, therefore, be the greatest hurdle to developing an effective biological terrorism capability .Finding trained and skilled personnel, who could also overcome obstacles of perhaps working in less-than-ideal environments and who are willing to participate in mass murder, is a profound organizational roadblock, inherent to terrorist development of biological weapons, that is perhaps too readily discounted.

In addition, the paranoid, stressful, and fantasy-prone atmosphere almost certain to be present in a terrorist organization most likely to seek to acquire biological weapons would make it difficult for personnel to perform efficiently the careful and demanding work required for a successful program. In the case of Aum, the atmosphere within the cult, characterized by extreme paranoia, intense stress, and widespread delusion, likely contributed to its failure to develop an effective biological weapons capability .That atmosphere could exist in any number of potential terrorist organizations with similar intentions or motivations.

Finally, terrorists intent on inflicting hundreds of thousands of casualties with biological agents would have to create an aerosol cloud to disseminate the toxin. Aerosol clouds can be created from biological agents in either a mud-like liquid (“slurry”) form or in a dried, talcum powder-like form. The latter is far more difficult. In the case of B. anthracis, turning the spores into a powder requires the use of large and expensive centrifuges and drying apparatus. Powder, moreover, clings to surfaces, making it both difficult to handle and more probable that those handling it will accidentally infect themselves.

In addition, the drying process needed to create a pathogenic powder tends to kill inordinate amounts of the organisms. The use of slurry , on the other hand, while less technically challenging, still presents significant problems. For example, the slurry must be continuously refrigerated until it is used, and unless it is extremely pure, material is likely to settle at the bottom of a container and clog the sprayer or aerosol dissemination device. As is detailed below, this is precisely what happened when Aum Shinrikyo members sprayed what they believed to be a lethal strain of B. anthracis from the roof of a Tokyo building in 1993. A slurry concoction is also tricky to disseminate as an aerosol of particles of an optimal size-in other words, that will readily be inhaled into the victims’ lungs. Disseminating particles of the proper size (1-5 microns) is critical to the success of any large-scale attack. Building a disseminator capable {)f dispersing 1- to 5- micron particles in dry form would, however, be a major technical hurdle for any prospective biological terrorist.

That being said, the dissemination itself could conceivably be physically accomplished in any number of different ways: from low-flying airplanes, crop dusters, trucks equipped with sprayers, or with an aerosol canister situated in one place and activated by a remote timing device.

Even if a terrorist group succeeded in producing a virulent biological agent, even if it conducted rigorous tests to ensure that virulence was maintained, and even if it prepared the agent properly for aerosolization and acquired the proper equipment with which to disseminate it, at least one major hurdle would remain. As bioagents are aerosolized and become airborne, they decay rapidly. It is estimated, for example, that 90 percent of the microorganisms in a slurry are likely to die during the process of aerosolization.

Environmental conditions are likely to reduce the effectiveness of biological agents still further. Sunlight, smog, humidity , and temperature changes reduce the ability of pathogens to survive and multiply, although biological agents dispersed in a subway station or other enclosed area may not be subjected to conditions as adverse as those in open areas. Potential users of biological weapons must, therefore, take into account other disruptive meteorological conditions as well. Rain will wash most aerosol particles out of the air, and high local wind speed will disrupt an aerosol cloud.

In sum, while the technical challenges in producing an effective biological weapon are not insurmountable, they are neither as straightforward nor as simple as has often been claimed and presented publicly. The latter view, based on the limited information previously available, has heretofore primarily served as the basis for the public and for many decision makers to draw conclusions about the direction of related public policy. The level of difficulty was in fact what Aum discovered for itself and why it elected to pursue, in tandem with its continuing biological weapons R&D program, a concerted and even more expensive effort to produce chemical weapons.

Moreover, as previously mentioned, the requirements to amass personnel, money, facilities, equipment; to conduct testing; and to execute related logistics tasks, will materially increase the risk of exposure to detection by intelligence and law enforcement agencies.

Changes in Technology and the Difficulty of Manufacture

Once again, however, these comments on the difficulties in manufacturing biological weapons apply largely to attacks on human beings by either individuals or terrorist and extremist groups working without the aid of a state.

They also apply to the current state of the art in biotechnology. The steady dissemination of the required technology and equipment is reducing such problems, and they would not apply to any attack carried out with the support of a hostile state. For example, a recent survey of 1400 US academic institutions found the 16% possessed human, animal, or plant pathogens that appear of the draft Biological Weapons Convention’ s list of biological agents. Another 11% have high level containment facilities, 7% conduct research on vaccines, 5% perform research for the military or Department of Energy to develop defenses against biological weapons, and 3% have high volume bioreactors.65

In the 25 years that have followed the development of recombinant DNA technologies, over 2,000 flrlns have been founded in the US alone. More generally, there are roughly 1,308 US companies now actively commercializing biotechnology. They employ 108,00-116,000 people, and the market for such products is estimated to grow from $7.6 billion in 1996 to $24 billion in 2006. These figures do not include the growth of agriculture biotechnology -which may be as much of a source of threats as the technology tailored to deal with humans, and which is expected to grow from $295 million in 1996 to $1,74 billion in 2006. Unlike most companies, such firms also train a large number of individuals in research and development. Biotech firms spent $69,000 per employee on R&D in 1995, versus a US corporate average of $7,651.66 While there are no precise figures, much of this activity involves foreign scientists and technical personnel.

Other regions are not advanced. For example, Japan is estimated to lag roughly 10 years behind the UD in biotechnology (a factor to be considered in assessing Aum Shinrikyo), but the volume is growing. Japan's pharmaceutical market is now worth about $37 billion. Europe is also experiencing significant growth. The number of biotechnology firms grew from 486 in 1994 to 584 in 1995, and the number of employees grew from 16,100 to 17,200. What is more significant is that spending on R&D increased by 21% in one year, to $795 million. 67

Technology transfer from the former Soviet Union (FSU) is a very serious potential problem. The Cold War effort involved some 60,000 to 70,000 people.68 There is no meaningful current accounting of their whereabouts. It is clear, however, that at least 75,000 Russian scientific workers emigrated between 1989-1992, and many have left since. There are also repeated unconfirmed reports that some of these scientists are working in Iran and North Korea.

The Department of Defense has warned that foreign production and development of such weapons might not be detected.69

...A state might elect to build large-scale facilities unique to this function, as was done in the United States prior to 1969. Such facilities would be, in principle, more susceptible to detection. However, there is no requirement to do this. The lower cost (by a considerable margin) and less readily observable approach would be to employ an in-place civilian facility as the site for agent production.

Production equipment will vary , depending on the quantity of material desired, the methods selected for production, and the agent selected. Unlike CW agents, where production is measured in the tons, BW agent production is measured in the kilograms to tens of kilograms. Assessments of BW verification sometimes assume that the problem is to detect production of as little as 10 kilograms of BW agent.

There is nothing unique about the types of equipment (or technology) that might be employed in a BW program. For example, biological safety cabinets have been adopted universally for biomedical research as well as commercial production of infectious disease products, reagents, and so forth. Fermenters, centrifuges, purification, and other laboratory equipment are used not only by the biomedical community, but have other academic and commercial applications as well, such as wineries, milk plants, pharmaceutical houses, and agricultural products. Production of beer, antibodies, enzymes, and other therapeutic products, such as insulin and growth hormone, involves the use of fermenters ranging in size from 10,000 to 1 million liters; such fermenters could produce significant quantities of BW agent. Key technologies have an intrinsic dual-use character.

Similarly, neither states nor independent groups necessary have to adopt the safety procedures used by the US. Department of Defense reporting also notes that while the US developed elaborate containment facilities for conducting infectious disease research at facilities like the. Fort Detrick Biological Warfare Research and Development Laboratories during the Cold War, “Other countries do not necessarily share these safety concems.”70 Iraq certainly did not follow such procedures, and during the Gulf War it did not even provide all of its biological weapons with guards or special security storage arrangements.

The Growing Lethality of Biological Weapons and Growing Ease of Manufacture

Genetic engineering and other new technologies now can be employed to overcome product deficiencies in the classic agents and toxins normally addressed in such discussions. Moreover, toxins that exist in nature in small amounts were once considered not to be potential threat agents because of their limited availability .Today, the Department of Defense estimates that a number of natural toxins could be produced through genetic engineering techniques in sufficient quantities for an adversary to consider producing them as an offensive weapon. There are many microorganisms, or their metabolic byproducts (toxins) that meet all of the criteria for effective BW agents.71

Studies like those of the Jason project indicate that this situation could become much worse in the future. Genetically engineered pathogens can be designed to have any or all of the

services for chemical and biological as well as nuclear incidents. And the Public Health Service is in the process of establishing 25 Metropolitan Medical Strike Teams throughout the country in addition to 3 deployable “national asset” National Medical Response Teams and existing Disaster Medical Assistance Teams. There are many more examples of new players in the terrorism arena.

The Defense Against Weapons of Mass Destruction Act, contained in the National Defense Authorization Act for Fiscal Year 1997 (title XIV of P.L. 104-201, Sept. 23, 1996), established the Nunn-Lugar-Domenici Domestic Preparedness Program. The Department of Defense is the lead federal agency for implementing the program, and is to work in cooperation with the FBI, the Department of Energy, the Environmental Protection Agency, the Department of Health and Human Services, and the Federal Emergency Management Agency .89

On June 8, 1998, the President forwarded to Congress a fiscal year 1999 budget amendment that included a proposal to (1) build for the first timea civilian stockpile of antidotes and vaccines torespond to a large-scale biological or chemical attack, (2) improve the public health surveillance system to detect biological or chemical agents rapidly and analyze resulting disease outbreaks, (3) provide specialized equipment and training to states and localities for responding to a biological or chemical incident, and (4) expand the National Institutes of Health's research into vaccines and therapies. The Omnibus Consolidated and Emergency Supplemental Appropriations Act (P .L. 105- 277) included $51 million for the Centers for Disease Control and Prevention to begin developing a pharmaceutical and vaccine stockpile for civilian populations.

The act also required that HHS submit an operating plan to the House and Senate Committees on Appropriations before obligating the funds. The fiscal year 2000 request for HHS' bioterrorism initiative is $230 million, including $52 million for the Centers for Disease Control and Prevention to continue procurement of a national stockpile.

.What means now exist to effectively protect against these threats?

.What plans and programs are now underway or in fonnation? .What are the current and planned budgets?

.Are projected resources & budget priorities adequate for effective U.S. responses? .How will responses challenge existing legal and organizational parameters? .What sort of preventive strategies can the u.s. employ to pre-empt attacks? .What fonns of deterrence can work against various threats?

.How does u.s. military doctrine and planning support or inhibit Homeland Defense

against foreign and domestic threats?

.What are current programs and budgets?

.What programs deal with Homeland defense in tenns of overseas intelligence and

defense activities and what programs operate within us territory?

.Do the systems being acquired by the military have utility for Homeland Defense against both domestic and foreign threats?

.What aspects of counterproliferation and counterterrorism programs overseas will aid in activities inside us territory?

.What organization is need within the Department of Defense and the Office of the Secretary of Defense to ensure suitable support for Homeland Defense?

.How might allies help or hinder the U.S. in constructing an effective defense? .What new strategies might the U.S. adopt to improve Homeland Defense?

Current Federal Programs and Budget

Federal reporting on the key programs contributing to homeland defense is a definitional and statistical nightmare filled with conflicting bureaucratic rivalries and priorities. There is no unclassified CBO reporting available on the subject, and the GAO reporting is dated.

The 0MB did report to the Congress on enacted and requested terrorism-related funding for fiscal years 1998 and 1999, and stated that that more than 17 agencies had classified and unclassified programs that were authorized a total of $6.5 billion for fiscal year 1998, and $6.7 billion for fiscal year 1999. OMB's figures are lower than the GAO's were for fiscal year 1997, but different definitions and interpretations of how to attribute terrorism-related spending in broader accounts could cause a difference of billions of dollars.w

The White House has issued what seem to be "guesstimates" of the more recent trends in federal spending.91

.*Funding for Domestic Preparedness and Critical Infrastructure Protection:* The President's Fiscal Year 2000 budget includes requests for $2.849 billion for critical infrastructure protection, computer security , and domestic preparedness against a weapons of mass destruction attack. The budget request also proposed $7.162 billion for conventional counter-terrorism security programs.

.*Domestic Preparedness against Weapons of Mass Destruction:* In May 1999 the President proposed adding $300 million for a new weapons of mass destruction domestic preparedness program. As a result, the 1999 enacted level was $1.281 billion. The President's FY 2000 funding request for countering the threat of terrorist use of weapons of mass destruction continues and expands the program to $1.385 billion. The FY 2000 request included increases of $30 million above the previous level for research into new vaccines and medicines, an additional $15 million to fund Public Health Surveillance to detect an attack, and an additional $13 million to create new metropolitan medical response teams. Highlights of the FY 2000 budget included:

.$52 million to continue procurement of a national stockpile of specialized medicines to protect the civilian population.

.$611 million for training and equipping emergency personnel in U.S. cities, planning and exercising for weapons of mass destruction contingencies and strengthening public health infrastructure.

.$206 million to protect U.S. government facilities, $381 for research and development, including pathogen genome sequencing, vaccines, new therapies, detection and diagnosis, decontamination, and disposition of nuclear material-

.*Critical Infrastructure Protection and Computer Security:* The President's FY 2000 request included $1.464 billion for protection of critical infrastructure and computer security. This-represented a 40% increase in the two budget years since the President created the Critical Infrastructure Protection Commission. The highlights of this program included:

.Critical Infrastructure Applied Research Initiative ($500 million).

.Intrusion and Detection Systems: In addition to ongoing Department of Defense funding, $2 million will be spent to design and evaluate a similar system for other Federal agencies.

.Information Sharing and Analysis Centers (ISACs): As part of the public-private partnership, we will provide $8 million to support the initial establishment of ISACs.

.*Cyber Corps:* This program addresses the shortage of highly skilled computer science expertise in the government and enable agencies to recruit a cadre of experts to respond to attacks on computer networks. It will use existing personnel flexibilities, scholarship and financial assistance programs, and $3 million to examine new scholarship programs to retrain, retain and recruit computer science students.

.*Counter-terrorism Security:* In addition to the programs above, the President's FY 2000 budget request for all anti-terrorism and counter-terrorism programs was $8.547 billion, a 12% increase over the FY 1999 enacted level and an 18% increase over FY1998.

.The President also requested a supplemental appropriation in FY 1999 of $2.064 billion after the Africa bombings. This included $1.4 billion to provide additional security measures to diplomatic and consular facilities and rebuild the two embassies destroyed in Dar es Salaam and Nairobi.

The Department of Defense (DoD) Chemical and Biological Defense Program (CBDP) continues to implement congressional direction to improve jointness and reflects an integrated DoD developed program. The FY 1999-2000 program continues funding to support the highest priority counterproliferation initiatives. During the past year, the Department reviewed its capabilities to protect against the asymmetric threats from chemical and biological weapons. As a result of the review, funding was identified to enhance and accelerate high-payoff technologies and advanced CB defense systems. The FY2OO- 2001 President's Budget Submission includes $380 million in increased research and development funding for biological warfare defense and

vaccines over the FY 2000-05 Future Years Defense Program {FYDP), as well as additional FY 1999 Emergency Supplemental funding to procure CB defense equipment for the Guard and Reserves to support the Consequence Management mission.

Moreover, the Department continues to procure new CB defense equipment, due in large measure to the May 1997 Report of the Quadrennial Defense Review (QDR) recommendation to increase planned spending on counterproliferation by $1 billion over the FY 1999- 2003 program period, of which $732 million was allocated for chemical and biological defense efforts. The DoD CBDP invests in technologies to provide improved capabilities that have minimal adverse impact on warfighting potential.

Joint and Service unique programs provide capabilities to support the framework of the three commodity areas of CB defense: Contamination Avoidance (detection, identification, warning/reporting, reconnaissance), Protection (individual, collective, medical support), and Decontamination. All of these capabilities integrated together as a system-of -systems are essential to avoid contamination and to sustain operational tempo on an asymmetric battlefield. Moreover, sound Joint doctrine and realistic training remain fundamental to our defense against chemical and biological weapons..

.What plans and programs are now underway or in formation?

.What legal and organizational structures restrict the role of the various elements of the federal government in Homeland Defense?

.Are changes needed in the role and organization of Congress to deal properly with

Homeland Defense?

.How will responses challenge existing legal and organizational parameters?

.What is the role of the Department of Defense? Is posse comitatus a valid issue and

limitation ?

.What are the current and planned budgets? -

.What plans and programs are now underway or in formation ? .What are the current and planned budgets?

.Are projected resources & budget priorities adequate for effective U.S. responses? .What is the role Federal research and development can and should perform in creating

new Homeland Defense capabilities?

Current and Planned Federal, State, Local, and Private Roles in Homeland Defense

.How are the levels of government and the private sector organized to address these challenges?

.What are the relevant programs and budgets?

.How will responses challenge existing legal and organizational parameters? .How might state-controlled National Guard participate? Or lead? .How might state, city , and county police participate?

.How will other "first responders" and local agencies come into play?

.What role should there be for private enterprises? How will they be coordinated?

What should be regulated, voluntary , and a matter of private sector decision and acceptance of risk?

How Other N ations Deal With These Threats .Israel

.Britain .Japan

.Others

.Have other nations with military engaged abroad instituted comprehensive policies at

home?

.Is there a role for alliances in Homeland Defense?

.How might allies help or hinder the U.S. in constructing an effective defense?

.How can responses to foreign and domestic threats differ and how can they best be

integrated?

Recommended program

Development of a proposed organizational hierarchy Development of a proposed program budget.

Identification of possible tradeoffs of current government

options.

Recommended Cooperation with Allies

I

I See 22 U.S.C. Sec. 2656f(d). The term noncombatant includes military personnel who at the time of the incident are unarmed and/or not on duty. This legislation also requires the State Department to submit annual reports to Congress on international terrorism.

2 GAO/NSIAD-97-254, "Combating Terrorism," Page 16. 3 www .fema.gov/libra~/terror .htm

4 GAO/NSIAD-97-254 Combating Terrorism Page 16; First Annual Report of the Advisory Panel to Assess Domestic Response Capabilities for Terrorism Involving Weapons of Mass Destruction, L Assessing the Threat, December 15, 1999, p. iii, www.rand.org/organisation/nsrd/terpanel.

5 Bruce Hoffman, Responding to Terrorism Across the Technological Spectrum, Santa Monica, Rand Corporation, 1993, p. 3.

6 The State Department does not distinguish the type of terrorist responsible for attacks.

7 General Accounting Office, "Combating Terrorism: Federal Agencies' Efforts to Implement National Policy and Strategy," Report, 09/26/97, GAO/NSIAD-97-254).

8 General Accounting Office, "Combating Terrorism: Federal Agencies' Efforts to Implement National Policy and Strategy," Report, 09/26/97, GAO/NSIAD-97-254).

9 Adapted from US State Department, Patterns of Global Terrorism.. 1998, Department of State Publication 10610, Office of the Secretary of State, Office of the Coordinator for Counterterrorism, Released April 1999, www .state.gov/www / global/terrorisrn/ 1998Report/sponsor .html

10 Combating Terrorism: Opportunities to Improve Domestic Preparedness, Program Focus and Efficiency, (GAO/NSIAD-99-3, November 12, 1998); Combating Terrorism: Observations on the Nunn-Lugar-Domenici Domestic Preparedness Program (GAO-T-NSIAD-99-16, October 2, 1998); Combating Terrorism: Need for Comprehensive Threat and Risk Assessments of Chemical and Biological Attacks (GAO- T -NSIAD-99-163, September 1999).

II Combating Terrorism: Opportunities to Improve Domestic Preparedness, Program Focus and Efficiency, (GAO/NSIAD-99-3, November 12, 1998); Combating Terrorism: Observations on the Nunn-Lugar-Domenici Domestic Preparedness Program (GAO-T-NSIAD-99-16, October 2, 1998); Combating Terrorism: Need for Comprehensive Threat and Risk Assessments of Chemical and Biological Attacks (GAO-T-NSIAD-99-163, September 1999).

12 Statement for the Record of Louis J. Freeh, Director Federal Bureau of Investigation on "Threats to U. S. National Security ," Before the Senate Select Committee on Intelligence, January 28, 1998, www .fui .goy /pressrrn/congress/con ~ess98/threats.html :

13 Statement for the Record of Mrs. Barbara Y. Martinez Deputy Director, National Domestic Preparedness Office Federal Bureau of Investigation on Preparedness for Terrorism Response- Before the United States House of Representatives Transportation and Infrastructure Committee, Subcommittee on Oversight, Investigations, and Emergency Management, June 9, 1999, www .fui.goy/pressrrn/congress/con~ess99/comterr .htm

14 Statement by Director of Central Intelligence, George J. Tenet, before the Senate Foreign Relations Committee on "The Worldwide Threat in 2000: Global Realities of Our National Security," as prepared for delivery, 21 March 2000

15 National Intelligence Council, "The Global Infectious Disease Threat and Its Implications for the United States, CIA NIE-99-17D, January 2000. htt :/Iwww .cia. ovl ia/ u licationslnielre o nie -17 .htm. 16 FBI, Uniform Crime Re~orts, January-June 1999, November 21, 1999. Table 4.

17 Adapted from US State Department, Patterns of Global Terrorism.. 1998, Department of State Publication 10610,

Office of the Secretary of State, Office of the Coordinator for Counterterrorism, Released April 1999, www .state.govlwwwlglobal/terrorism/1998Report/sponsor .html

!8 Department of Defense. Chemical and Biolo&ical Defense Pro&ram. Annual Re~ort to the Con&ress, Washington, Department of Defense, March., 2000, pp. 6-10

19 Adapted from US State Department, Patterns of Global Terrorism.. 1998, Department of State Publication 10610, Office of the Secretary of State, Office of the Coordinator for Counterterrorism, Released April 1999, www .state.govlwww/global/terrorism/1998Report/sponsor .html

20 www .fbi.govlpressrm/congresslcongress99Ifreehct2.htm.

21 Adapted from US State Department, Patterns of Global Terrorism.. 1998, Department of State Publication 10610, Office of the Secretary of State, Office of the Coordinator for Counterterrorism, Released April 1999, www .state.govlwwwlgloballterrorism/1998Report/sponsor .html

22 The State Department list includes groups that were designated foreign terrorist organizations on 8 October 1997

pursuant to the Antiterrorism and Effective Death Penalty Act of 1996 (denoted by an asterisk) but also includes other major groups that were active in 1998. Terrorist groups whose activities were limited in scope in 1998 are not included.

23 www .fbi.govlpressrm/congresslcongress99Ifreehct2.htm. 24 See the series in the New York Times, April 8-12, 2000. 25 www .fema.govllibrarylterror .htm.

26 Estimates of membership as high as 12 million have been made but seem absurd. For a partial list see "The Militia

Watchdog Links Page, www.militia.watchdog.org/ml.htm.

27 United States General Accounting Office, GAO Report to Congressional Requesters, "Combating Terrorism, Federal Agencies' Efforts to Implement National Policy and Strategy," GAO/NSIAD-97-254, September 1997, p. 15.

28 GAO/NSIAD-99-163, Combating Terrorism: Need for Comprehensive Threat and Risk Assessments of Chemical and Biological Attacks," pp. 18-17

29 First Annual Report of the Advisory Panel to Assess Domestic Response Capabilities for Terrorism Involving the

Use of Weapons of Mass Destruction, I. Assessin& the Threat, December 15, 1999, www .rand. or &1 organizati onlnsrd/te!Il2anel/

30 GAO/T-NSIAD-98-164, "Combating Terrorism," Apri123, 1998, Page 8. 31 GAO/T-NSIAD-98-164, "Combating Terrorism," Apri123, 1998, Page 1.

32 Robert M. Burnham, Chief, Domestic Terrorism Section, FBI, before the United States Senate Subcommittee on

Clean Air, Wetlands, Private Property, and Nuclear Safety, March 16, 1999.

33 The US Department of Defense defines the technical risk posed by chemical weapons as:

Chemical weapons (CW) are compounds used in military operations or as terrorist weapons to kill, incapacitate, or

seriously injure personnel through their chemical properties. Most CW agents useful as military weapons are not ~ses, a)!!19Lu~QiS9.qlgas~~ a term co~only used. While chlorine gas was used in World War I, most agents are tr'cfli(fl,~h-~t~ li\~it~ot~~b~ffl~ and contribute to stability in storage and transportation. When employed, these liquids are dispersed as droplets. These droplets can either penetrate the skin or vaporize and become a respiration hazard.

Chemical agents are either persistent or nonpersistent. Persistent agents may last from hours to days. Nonpersistent agents last minutes to hours. Agents can be lethal or non-lethal. The effects induced can include blistering, choking, blocking the ability of body tissue to absorb oxygen, convulsions, and paralysis. Reports indicate that the 1995 Japanese subway incident involved Sarin, an agent that attacks the nervous system.

The precursor chemicals and intermediate stages in the production process for two classical CW agents, nerve and blister agents, have both agricultural and industrial uses. For example, Thiodiglycol, which has been used to produce ball-point pen ink, can be converted to mustard agent by a simple (single) chlorination step. The technology and most of the production equipment, moreover, even the military hardware necessary for delivery and dissemination, are dual-use. Detection and discrimination between legitimate and illegal production are difficult. Facilities producing pesticides, insecticides, and fire retardant chemicals could be converted to CW production. There are strong external similarities between civilian and military facilities, although the latter may have observable security measures such as restricted access areas and fences, and possibly storage areas used for chemical munitions. Knowledgeable personnel are readily available; a relatively small number of chemical engineers and technicians are needed for production of chemical weapons.

CW THREATS DURING THE GULF W AR

“While the defensive capabilities of U.S. and other Coalition forces improved rapidly, CW/BW defensive readiness at the outset of the crisis was quite low. Coalition forces embarked on extraordinary measures to correct these weaknesses, largely by building up the preparedness of individuals to protect themselves in the event of CW /BW attack. On balance, these gains did lead to a significant potential for U.S. forces to operate on a contaminated battlefield. While the outcome would have been unaffected, the tempo of the Operation Desert Storm campaign could have been hindered had U.S. troops been forced to remain fully protected by masks and suits. Temperatures during Operation Desert Storm were comparatively cool; data indicate that risks of heat exhaustion would have been sharply higher in the summer, making protracted use of personal protective gear impractical. Studies have also shown that protective equipment dramatically impedes crew performance. The masks hinder communications, and the suits impair the ability to operate equipment. High-speed combat requiring close coordination between crews manning complex systems becomes quite difficult.

THE IRAQI THREAT. Iraq had developed a substantial CW capability including research and development facilities; stockpiles of CW munitions; a variety of delivery systems; and the doctrine and training to employ integrated CW and conventional fIfe effectively on the battlefield. Iraq was the fIrSt nation to use nerve agents on the battlefield—attacking unprepared Iranian troops in 1984. By 1990, Iraq had the largest CW agent production capability in the Third World, annually producing thousands of tons of blister and nerve agents...”

Source: Conduct of the Persian Gulf War, p. 640.

CW-suitable dual-use delivery systems are readily available ranging from SCUD missiles and unmanned aerial vehicles to sophisticated cruise and ballistic missiles. If need be, crop duster aircraft and simple spray generators can be readily adapted for delivery of a variety of agents. The quantities of chemical agent required are relatively small when compared to industrial production of similar commercial chemicals, which poses significant problems for detection. The low technology required lends itself to proliferation and even potential terrorist use. Terrorists could employ CW agents in a variety of means utilizing simple containers such as glass bottles, commercial compressed gas bottles, or propane tanks.

Military Significance

Chemical weapons are the only NBC munitions that have been used in post-World War IIlarge-scale conflicts, most recently during the Iran-Iraq war. Consequently, there is cause for concern that proliferators may perceive that international responses (ranging from sanctions to military action) are less likely, given the use of CW.

CW impacts military operations in a number of ways. Large numbers of people (combatants and civilians) can be killed if suitable protective equipment or shelters are not available and properly utilized. There may be large numbers of nonfatal casualties. This was the characteristic experience when CW was employed during World War I. The volume of injured personnel can overwhelm the military medical evacuation and treatment system, impacting operations.

If CW employment is anticipated, forces are required to operate in protective ensembles that degrade operational performance, especially under adverse climatic conditions. Even though forces using appropriate protective equipment may be immune to CW effects, their ability to accomplish tasks is greatly reduced. Furthermore, equipment, facilities, and territory are contaminated. This impacts the ability of forces to maneuver. It also can have a major effect on ports, airfields, and other essential facilities that support operations.

Once CW use occurs, decontamination operations are required. These operations can be time-consuming. They may require forces to be diverted from other missions. In some instances, current technology decontamination equipment damages equipment. Perhaps most significantly, psychological effects impacting the ability of personnel to perform their missions can occur.

CW employment involves a number of factors, including agent type; the dissemination method (and its dispersion efficiency); droplet size; and meteorological conditions, including temperature, wind speed and direction, and inversion conditions. Agent dispersion can be very dependent on environmental factors, such as wind direction and speed.

Chemical agents can be used as limited area effects (battlefield) or large area effects weapons, to include areas with civilian populations. Unlike nuclear or biological weapons (BW), effective chemical agent attacks sometimes require significant numbers of munitions to achieve large area coverage. This can be an advantage in some situations since it means that the consequences of CW use are more predictable and hence more readily integrated into war plans. (http://www .defen!\elink.mil/puh!\/prolif/access tech.html)

34 See Center for Counterproliferation Research, "The Effects of Chemical and Biological Weapons on Operations, What We Know and Don't Know," National Defense University, February 1997; p2NBC2 Report No.90-1, Physiological and Psychological Effects of NBC Environment and Sustained Operations on Systems in Combat, P2NBC2 Te!\t Report!\, «Technical Papers and Bibliographies," US Army Chemical School, Ft. McClellan, Alabama, January 4, 1990, CB -013725.0; p2NBC2 Report No.90-2, Physiological and Psychological Effects of NBC

Environment and Sustained Operations on Systems in Combat, p2NBC2Test Report!\, «Program Overview," US Army Chemical School, Ft. McClellan, Alabama, January 4, 1990, CB -013726; p2NBC2., Physiological and Psychological Effects of NBC Environment and Sustained Operations on Systems in Combat, p2NBC2 Te!\t Reports, "Program Wrap-Up, Annotated List of Findings," US Army Chemical School, Ft. McClellan, Alabama, January 1995, EAI Report 69-2/95/002F; John A Mojecki, "Combined Arms in a Nuclear/Chemical Environment (CANE), Phase IIA; Summary Evaluation," ORI, Inc. for Commandant, ," US Army Chemical School, Ft. McClellan, Alabama, May 31, 1987.

35 For a good technical summary of the issues involved in making such weapons, see Office of Technology Assessment, «Background Paper: Technologies Underlying Weapons of Mass Destruction," Washington, US Congress, OTA-BP-ISC-115, December 1993.

36 GAO/NSIAD-99-163, Combating Terrorism: Need for Comprehensive Threat and Risk Assessments of Chemical and Biological Attacks," p. 12.

37 Brad Roberts, ed., H~~ of Realitv? The “New Terrorism” and Mass Casualt~ Attacks, Alexandria, Chemical and

Biological Arms Control Institute, 2000, p. 216.

38 Rand reports that in 1984, a disgruntled employee at a pesticide plant in Bhopal, India sabotaged the plant in ways that led to an explosion in one of the storage tanks by simply adding water to its contents. This led to a massive release of methylisocyanate and the noxious fumes affected thousands of people near the plant. Four

months later, some 1,430 persons were reported to have died-a figure that increased to 3,800 in a report issued seven years later. A total of 11,000 persons were listed as having been disabled or harmed from exposure to the gas.

39 Aum Shinriyo carried out an expensive research and development effort, which the Rand Corporation indicates has cost estimates as high as $30 million. The program had 80-men program in state-of-the-art facilities, and was led by a Ph.D.-Ievel scientist. Nevertheless, it took at least a year between the time of conception and the initial production of sarin. And the Tokyo subway attack, and an earlier sarin attack in Matsumoto, succeeded in killing only a dozen people, although several thousand were affected.

40 Chris Bullock, "Biological Terrorism," Transcript of a program on biological warfare chaired by Professor D. A. Henderson, Director of the Johns Hopkins Center for Biodefense Studies, August 29, 1999, http://www.infowar.comlwmd/99/wmd 091699a j.shtml, September 16,1999,

41 Rand reports that in 1984, a disgruntled employee at a pesticide plant in Bhopal, India sabotaged the plant in ways that led to an explosion in one of the storage tanks by simply adding water to its contents. This led to a massive release of methylisocyanate and the noxious fumes affected thousands of people near the plant. Four months later, some 1,430 persons were reported to have died-a figure that increased to 3,800 in a report issued seven years later. A total of 11,000 persons were listed as having been disabled or harmed from exposure to the gas.

42 First Annual Report of the Advisory Panel to Assess Domestic Response Capabilities for Terrorism Involving Weapons of Mass Destruction, "Assessing the Threat," December 15, 1999, www .rand.orgLorganization/nsrd/terrpanel, pp. 91-94.

43 Wayman C. Mullins, "An Overview and Analysis of Nuclear, Biological, and Chemical Terrorism: The Weapons, Strategies and Solutions to a Growing Problem," American Journal of Criminal Justice, Vol. 16, No.2 (1992), pp. 108-109.The model, known as VLSTRACK 3.0, was developed by the Dahlgren Division, Naval Surface Warfare Center, Dahlgren, Virginia.

44 GAO, "Combating Terrorism: Need for Comprehensive Threat and Risk Assessments of Chemical and Biological Attacks," GAO/NSIAD-99-163, September 1999; GAO, "Combating Terrorism: Observations on the Threat of Chemical and Biological Terrorism," GAO/NSIAD-00-50, October 20,1999.

45 Chris Bullock, "Biological Terrorism," Transcript of a program on biological warfare chaired by Professor D. A. Henderson, Director of the Johns Hopkins Center for Biodefense Studies, August 29, 1999, htt ://www.infowar.comlwm 9/wm I 9a ..shtml, September 16,1999,

46 See Center for Counterproliferation Research, "The Effects of Chemical and Biological Weapons on Operations, What We Know and Don't Know," National Defense University, February 1997; p2NBC2 Report No.90-1, Physiological and Psychological Effects of NBC Environment and Sustained Operations on Systems in Combat, P2NBC2 Test Reports, "Technical Papers and Bibliographies," US Army Chemical School, Ft. McClellan, Alabama, January 4, 1990, CB -013725.0; p2NBC2 Report No.90-2, Physiological and Psychological Effects of NBC Environment and Sustained Operations on Systems in Combat, p2NBC2 Test Reports, "Program Overview ," US Army Chemical School, Ft. McClellan, Alabama, January 4, 1990, CB -013726; p2NBC2., Physiological and Psychological Effects of NBC Environment and Sustained Operations on Systems in Combat, p2NBC2 Test Reports, "Program Wrap-Up, Annotated List of Findings," US Army Chemical School, Ft. McClellan, Alabama, January 1995, EAI Report 69-2/95/002F; John A Mojecki, "Combined Arms in a Nuclear/Chemical Environment (CANE), Phase IIA; Summary Evaluation," ORI, Inc. for Commandant, ," US Army Chemical School, Ft. McClellan, Alabama, May 31,1987.

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was called “Biopreparat”, and was extremely secret. Russia developed the capability to produce extremely amounts of agent and some estimates indicate capacities in the end, of the order of hundreds, even thousands of tons in facilities distributed throughout the FSU. Mobilization plans to be able to take all this production from zero to weapons in a relatively short period of time. The current status of this program, and the location of its scientists, equipment, agents, and stockpiles is unknown.

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