Chemoterrorism Introduction
September 2003

Introduction

Hello, my name is Braxton DeGarmo and I am the Emergency Medicine and Primary Care consultant to St. Louis University's Center for the Study of Bioterrorism. In our effort to broaden the scope of our educational materials for physicians and other healthcare workers, we have produced this informational CD-ROM on chemical weapons, their potential use by terrorists, and the medical management of such casualties. The chemical agents that we discuss here are those that have been selected by the Federal Bureau of Investigation as being most likely to be used by terrorists.

Chemicals as Weapons

The annals of chemical warfare date back into early history with attempts to poison enemy foodstuffs and water. Casualties were minimal and, outside of the occasionally successful poisoning of a king or other leader, rarely affected the society at large. In the last century, however, chemical warfare gained the potential of causing mass death. Technology had advanced to allow the mass production of chemicals, as well as the development of highly lethal agents. In addition, new methods of delivering these agents made it possible for combatants to utilize these chemicals on distant targets, while remaining safely away from their deadly effects.

Chemicals as Weapons of Mass Destruction

Although now listed as potential weapons of mass destruction, chemicals do not really cause mass destruction, rather they inflict mass death and disability. Chemical agents made their debut as such weapons in World War I. Chlorine and mustard gas were the primary agents used, but their use was intended not so much to kill as it was to harass and disable enemy troops, and to force them to leave the protection of their trenches and bunkers and draw them into the line of fire for conventional weapons.

By the end of World War II, however, the potential scope of chemical weapons had increased logarithmically. New, highly lethal agents, the organophosphate nerve gases, Tabun, Sarin, and Soman, had been developed by IG Farben of Germany. Fortunately, they were not used in the war. And in a game of catch-up, Great Britain developed VX in the early 1950's. Another technological advance, rocketry, made it possible to deliver these agents at great distances. For the first time in history, the specter of mass death raining down from the skies horrified the world community and the public outcry against these weapons led to worldwide chemical weapons treaties and a general aversion to using such weapons.

Chemicals as Weapons of Mass Destruction

Today, there are tens of thousands of chemicals which hold the potential for use as weapons of mass death. In the class of organophosphates alone there are 50,000 known chemicals, all of which can possibly be used to harm or kill. The information necessary for manufacturing these chemicals is readily available in the technical literature or on the Internet, and with a modicum of chemistry training and a minimal investment, begin production of these lethal chemicals. Also of concern is the fact that the formulae and processes for the military grade nerve agents were made public as a result of the anti-war movement of the 1960's and early 1970's.

Besides the organophosphates, a wide variety of other chemicals also pose a risk for use as weapons by terrorists. Among the other insecticides, nicotine sulfate can be readily obtained and used as a lethal aerosol. There are also cyanides, pulmonary choking agents such as chlorine and phosgene, the vesicants or blistering agents -- also called mustard agents due to their distinctive odor -- and a wide variety of other agents. Many of these latter chemicals are not highly lethal, but quite disabling and could be used to disrupt or psychologically terrorize a community. The effects of widespread use of a psychoactive drug, such as LSD, could produce significant societal and national security problems. However, most experts believe that today's terrorist groups are likely to use the most lethal agents available and the organophosphate nerve agents are the probable agents of choice.

CW: Not Just for Armies Anymore

Unfortunately, the moral aversion to chemical warfare that deterred their use in World War II, has waned as time goes on. Beginning in the early 1970's various activist groups, mainly political and environmental, used the fear of chemical agents to promote their causes. In the 1970's, groups like the Weathermen made threats against attendees at the Democratic National Convention in Chicago and against New York City's Kensico Reservoir. Most, like the Animal Liberation Front's 1984 claim to have contaminated Mars candy bars with rat poison in the

United Kingdom, were discovered to be hoaxes. But not until millions of candy bars were recalled at significant cost to the manufacturer. Others, like a neo-Nazi "skinhead" plot to pump hydrogen cyanide gas into a West German synagogue in 1992, were thwarted by authorities.

However, over the last two decades the number of these events has shown a disturbing upward trend and the risks have become more serious. In 1986, the FBI moved against a heavily armed extremist group called the "Covenant, Sword, and Arm of the Lord" and found large quantities of potassium cyanide in their possession which their leader stated was to be used to poison the water supplies of several large cities. In another example, it had been rumored that in the 1970's various Palestinian groups began stockpiling nerve agents. The rumors became reality in 1989 when Israeli security forces raided a Palestinian safe house in Tel Aviv and found canisters of "a deadly poison." The actual contents were not publicly disclosed. And, of course, by 1990 the world community had confirmation of Iraq's use of chemicals against Iran and its own Kurdish population. In the 1990's, reports began increasing about actual attacks with various agents -- some against military targets, others against civilians. Some of these attacks were discovered before anyone was harmed, but some succeeded. The 1995 sarin attack by the Aum Shinrikyo sect using Sarin against civilians in the Tokyo subway is probably the best known.

CW: The Terrorist Risk

Another way of looking at the potential terrorist threat is to categorize the risk. The lowest risk situation is that of threats by a group that has no real capability to use these agents. Although they pose no harm to life, such hoaxes by these groups can still cause significant financial loss and tie up police and other agencies' which must prove or disprove claims. The next level involves groups that may have the capabilities to use chemical weapons but have been unsuccessful in obtaining them. A greater risk is posed by those groups that have obtained chemical agents. Hopefully, such material, and those who would try to use them, will be found before they can be used. The highest risk, then, is seen with the actual use of chemical weapons, with failed attempts falling just below their successful use. Unfortunately, since the late 1960's we have seen this progression from lower risk to high risk. Ten years ago most experts believed that with increased access to these agents, we would see more attempts at using them.

But so far, that has not been the case, and we can only speculate as to why. Some possible reasons include the fear of a severe backlash against those who would use chemical agents. This is a particularly good deterrent to those groups seeking political or social legitimacy. Another likely explanation is that explosives make for good news coverage, as they have immediate shock value and cause greater carnage. However, the more likely reason is that the use of chemical agents entails a certain degree of uncertainty, and terrorists dislike uncertainty. With a chemical attack, the outcome is less sure and environmental factors can

potentially negate the entire attack. There is also a greater chance of discovery since a successful attack with a goal of mass casualties, requires large amounts of the chemical agent. The more material that must be obtained, the greater the risk of exposure.

CW: Advantages

So, if uncertainty is the major deterrent to terrorist use of chemical weapons, what are their advantages? Why is it still believed that we will see the increasing use of chemicals, both militarily and against civilians? First and foremost, they are very inexpensive. Excluding a salary or living expenses for technicians, the investment of just $10,000 can equip and operate a chemical lab capable of producing tens of kilograms of agent each year, with the technicians working a leisurely 40-hour work week. This makes many of these agents easily available, as will be discussed in the following slide. Another factor is that many of these agents have a long shelf life, enabling a determined group enough time to obtain the quantities necessary for a successful large scale attack.

Also outweighing the uncertainty factor is the reality that these agents have a high level of control and containment. They can be precisely delivered to a target, -- a target which may be small or large, the effect is immediate, and the area surrounding the target can be decontaminated for reuse. In comparison, biological weapons, while also inexpensive and deadly, are not easy to control – they can spread beyond the target area and even back to the terrorists' unprotected homelands – and their effect can be delayed for weeks and continue for months. As for nuclear weapons, they can destroy the target area's infrastructure and can make the vicinity uninhabitable for a long time.

While large quantities of chemical agent increase the risk of discovery, chemicals actually pose less risk of detection and give greater anonymity than other weapons of mass destruction. They can be easily shipped and transported like many other commercially available chemicals. And there are no wide-area chemical detectors to "spot" illegal shipments, unlike the detectors in use at many ports and airports to sense radioactive materials. In addition, if manufactured, they hold no chemical tags or radioisotope "signature" that exposes their point of origin.

CW: Availability

As mentioned on the previous slide, most of the chemical agents that pose a risk for terrorist use are readily available. Nerve agents are considered the chemical weapon of choice for most terrorist groups because of their deadliness. The formula and chemical process for making nerve agents was declassified by both the U.S. and Britain in the early 1970's and both are easily found in the technical literature, and in all probability, on the Internet. These agents can be easily manufactured from materials openly available in the commercial marketplace. In fact, it would surprise most people that something as common as ball-point pen

ink is only one chemical step away from Sarin: a case of the pen really being mightier than the sword.

Should a terrorist group seek to use a chemical other than a military-grade nerve agent, such material is readily available on the open and black markets. Organophosphate pesticides, which can be just as deadly as their military counterparts, can be purchased in bulk in this country with just an exterminator's license. Other agents, whether used by police or military units, or commercially, are often under lax security and can be stolen. This was the case in 1975 when the Baader-Meinhof gang stole 53 canisters of mustard gas from a U.S. ammunition bunker in West Germany. While the military has certainly tightened security over such agents, most police and industrial storage sites do not have adequate protection.

Of greatest concern today, however, are state-sponsored labs in countries such as Libya, Iraq, Iran, Russia and other former Soviet states, Syria, North Korea, and Cuba are manufacturing chemical agents. The products from these labs are being made available not only to their military units, but also to terrorist groups throughout the world.

CW: Toxicity

The efficacy or lethality of chemical agents used in terms of weapons of mass destruction falls between that of conventional weapons and the more devastating nuclear and biological weapons. We will see an example of that on the next slide.

Toxicity is also greatly affected by the environment. Weather conditions must be "just right" for the successful deployment of a chemical weapon. Rain or high humidity can neutralize some agents and dilute almost all of them, making them ineffective. Likewise, high winds would make it unlikely that an aerosolized agent reached its target. Because of these factors, the chance of success for an outside attack is low. This means that indoor targets are very appropriate for chemical agents.

One other comment should be made about the lethality or toxicity of these agents. If a terrorist's goal is the death of his or her targets, a highly lethal agent like VX or Sarin will be the probable weapon of choice. We must remember, though, that terror can also be achieved through harassment and fear, and to this end, many chemicals in which high toxicity is not the most important factor affecting choice, could be employed.

CW: Toxicity

As you can see from the slide, where 320 million grams of conventional fuel-air explosives are required to produce heavy casualties within a square-mile area, it only takes 800,000 grams of Sarin, and 8 grams of anthrax spores.

CW: Toxicity

In another commonly-cited scenario, an attack on a municipal water supply, 18,000 grams of potassium cyanide is required in order to have the same effect as 100 grams of the nerve agent VX or 1 gram of typhoid. These numbers reveal only the level of toxicity of these agents in relations to each other and not imply that such amounts could constitute a serious attack. Much more than these amounts would be required for a significant attack, as we'll see in the next slide.

CW: Delivery

Fortunately, while chemical agents are readily available and obtained, delivery then to a target is more difficult. As noted, environmental factors play a key role in delivering a chemical weapon to an outdoor target. For an outdoor attack under ideal conditions, it is estimated that you would have to multiply the desired casualty number by one million to get the number of LD_{50} doses that would have to be dispersed. This unavoidable dispersion that occurs in the outdoors makes indoor targets more likely for a terrorist group using chemical agents. Indoor targets have their own set of problems. It is one thing to target a small gathering and quite another to strike a large crowd for instance, in a domed stadium. The logistics, dissemination, and potential problems of a chemical attack increase logarithmically with the increasing size of the target.

Although the previous comments pertain to an aerosolized, airborne attack, a strike against a municipal water system is even more difficult. This slide shows one such example. Assuming a four billion gallon reservoir serving a community of 20,000, with <u>all</u> the water being used for consumption only, and that each person would consume 16 ounces of contaminated water, over 14 billion lethal doses would have to be dumped into the water to deliver one lethal dose to each resident. If a fluoroacetate was the chemical chosen for such an attack, over 600 metric tons would be required.

CW: Delivery

Taking into account, the difficulties in disseminating a chemical agent, what are the most likely methods of delivery a terrorist group might use? Perhaps the easiest is the covert poisoning of selected foods or beverages. Contaminating one 10-pound sack of ground coffee at a military mess hall or large company cafeteria could kill up to 800 people. Such an attack through a soft drink bottling plant could kill thousands.

Another means of delivery is the covert generation of a volatile agent within an enclosed space. This is precisely what the Aum Shinrikyo sect did with Sarin in the Tokyo subway. Although the death toll was relatively small, hundreds of people were injured by the attack. Likewise, the covert dissemination of a non-volatile agent like VX in an enclosed space such as a sports arena might kill hundreds while injuring thousands.

A fourth likely scenario is an open, or overt, attack on an outdoor target using "bursting" munitions or thermogenerators to disseminate the agent. As shown in the example on the slide, six pounds of Sarin dispersed by a three-pound burst charge at a height of fifteen feet, will deliver a median lethal dose to everyone within a 70,000 square foot area in one minute. What a Super Bowl half-time show that could produce.

CW: Current Trends

Despite potential problems in delivering chemical agents to a target, most experts still agree that we are likely to see a chemical attack in this country in the near future. The moral aversion to using such weapons has largely evaporated in many regions of the world and terrorists are willing to use anything and everything in their arsenal to accomplish their goals. The FBI has determined that various Palestinian and Islamic groups, as well as a handful of extremist groups within the US and Europe are most likely to utilize these weapons; while revolutionary groups in South America and Western Europe are unlikely candidates for their use. And despite certain obstacles in using chemical agents, their advantages are seen to outweigh those difficulties. With the understanding of their pros and cons, it is acknowledged that there is a higher probability that such an attack will be against a small, well-defined and easily accessible target or series of such targets rather than against a large gathering.

CW: Defense

Can we defend ourselves? Unfortunately, with small select targets being high on the list for strikes with chemical agents, our defenses are limited. We can tighten security at airports and stadiums, but it is impractical, if not impossible, to do so at thousands of factories, businesses, and entertainment venues that might become targets. Likewise, attempts to tighten access to these chemicals are unfeasible in an open society which affords easy access to such chemicals for industrial and commercial use. Currently, our ability to defend against such an attack is dependent upon an advanced warning of the threat.

That said, limiting the availability of these agents remains the single best way to keep them from the hands of terrorists and extremist groups. Can our society find

a way to successfully block access to unauthorized individuals while balancing such security against the freedoms of our open society? The terrorists are betting that we can't, so it is imperative that healthcare providers be prepared to handle these emergencies. The following presentations will help prepare you for managing the medical care of victims of the most likely chemical agents we might encounter. We hope that you find them informative and useful, and as always, we appreciate any and all feedback on these materials.

References:

CHEMICAL AND BIOLOGICAL TERRORISM: THE THREAT ACCORDING TO THE OPEN LITERATURE, Ron Purver, Strategic Analyst, Canadian Security Intelligence Service, June 1995

Primary citations for the material I used from the above CSIS Report:

Alexander, Yonah, 1983. "Terrorism and High-Technology Weapons," in: Freedman and Alexander (eds.), 1983, pp. 225-240.

Berkowitz, B.J., et al., 1972. Superviolence: The Civil Threat of Mass Destruction Weapons. Santa Barbara, CA: ADCON (Advanced Concepts Research) Corporation, Report A72-034-10, 29 September.

Bremer, L. Paul, III, 1988. "Testimony...on High Technology Terrorism before the Subcommittee on Technology and the Law of the Committee on the Judiciary, May 19, 1988," in: U.S. Department of Justice 1988.

Clark, Richard Charles, 1980. Technological Terrorism. Old Greenwich, CT: Devin-Adair.

Douglass, Joseph D., Jr., and Neil C. Livingstone, 1987. America the Vulnerable: The Threat of Chemical and Biological Warfare. Lexington, MA: Lexington Books.

Hurwitz, Elliott, 1982. "Terrorists and Chemical/Biological Weapons." Naval War College Review 35:3 (May-June), pp. 36-40.

Jenkins, Brian M., and Alfred P. Rubin, 1978. "New Vulnerabilities and the Acquisition of New Weapons by Nongovernment Groups," in: Evans and Murphy 1978, pp. 221-276.

Joyner, Christopher C., 1990. "Chemoterrorism: Rethinking the Reality of the Threat," in: Alexander and Foxman (eds.) 1990, pp. 135-144.

Kellett, Anthony, 1988. Contemporary International Terrorism and Its Impact on Canada. Ottawa: Department of National Defence, Operational Research and Analysis Establishment Report No. R100, February.

Ketcham, Christine C., and Harvey J. McGeorge, II, 1986. "Terrorist Violence: Its Mechanics and Countermeasures," in: Livingstone and Arnold (eds.) 1986.

Kupperman, Robert H. and Kamen, Jeff, 1989. Final Warning: Averting Disaster in the New Age of Terrorism. New York: Doubleday.

Kupperman, Robert H. and Trent, Darrell M., 1979. Terrorism: Threat, Reality, Response. Stanford, CA: Hoover Institution Press.

Kupperman, Robert H., and R. James Woolsey, 1988. "Techno-Terrorism: Testimony before the Technology and Law Subcommittee of the Judiciary Committee...May 19, 1988," in: U.S. Department of Justice 1988.

Livingstone, Neil C., 1982. The War Against Terrorism. Lexington and Toronto: Lexington Books.

Marshall, Patrick G., 1990. "Obstacles to Bio-Chemical Disarmament." Editorial Research Reports 1:24 (29 June), pp. 366- 378.

McGeorge, Harvey J., II, 1986. "The Deadly Mixture: Bugs, Gas, and Terrorists." NBC Defense & Technology International 1:2 (May), pp. 56-61.

Mengel, R.W., 1976. "Terrorism and New Technologies of Destruction: An Overview of the Potential Risk," Appendix 2 in: Disorders and Terrorism, supra, pp. 443-473.

Mullen, Robert K., 1978. "Mass Destruction and Terrorism." Journal of International Affairs 32:1 (Spring-Summer 1978), pp. 62-89.

Mullins, Wayman C., 1992. "An Overview and Analysis of Nuclear, Biological, and Chemical Terrorism: The Weapons, Strategies and Solutions to a Growing Problem." American Journal of Criminal Justice 16:2, pp. 95-119.

Robinson, J.P., 1967. "Chemical Warfare." Science Journal (London), vol. 3 no.4.

Smith, G.D., 1992. Militant Activism and the Issue of Animal Rights. Ottawa: Canadian Security Intelligence Service, Commentary No.21 (April).

United States Congress, Office of Technology Assessment, 1991. Technology Against Terrorism: The Federal Effort. Washington, DC: U.S. Government Printing Office, July.

United States Congress, Office of Technology Assessment, 1992. Technology Against Terrorism: Structuring Security. Washington, DC: U.S. Government Printing Office.

Wiener, Stanley L., 1991b. "Chemical and Biological Weapons and Terrorism," in: Flood (ed.) 1991.