

The Chemical Terrorism Threat of G and V-type Nerve Gases

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PUBP 710-005: Global Terrorism and Public Health

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December 2, 2003

Purpose

The purpose of this research is to provide a basic overview of the four poisonous chemical G and V-type nerve gases. I also intend to explore the likelihood of a nerve gas attack in the United States as well as reexamine what transpired in the sarin nerve gas assault in Tokyo with the intention of analyzing how the Japanese responded to and the lessons learned since the incident.

Background

Chemical agents fall into four categories: choking agents, blood agents, blister agents and nerve agents with the final being the most powerful and able to inflict the most harm. Developed around World War II in Europe, these deadly toxins were originally intended for use as pesticides. Since their potency was discovered, they have been used in wars, to suppress internal uprisings in Iraq, and most recently, in terrorist attacks. William Augerson contends in his report, *A Review of the Scientific Literature as it Pertains to Gulf War Illness. Volume 5: Chemical and Biological Warfare Agents*, that radicals prefer nerve agents because they allow attackers many choices for dissemination, they “. . . can be delivered by free rockets, guided missiles, and mines, as well as mortars and artillery shells, aerial bombs and submunitions, and sprays tanks.” (Augerson, 2000) While nerve agents are ideal for use as weapons in warfare, it is an attack against innocent civilians that is of immediate concern.

Nerve Gas

For the purposes of this project, I will focus on the four main nerve gases: sarin, tabun, soman and VX, all speculated to have been manufactured at some point by various countries and/or terrorist groups in order to stage rogue attacks. Nerve gases belong to a

special group of chemicals called organophosphates whose purpose to block acetylcholinesterase, an enzyme necessary for function of the central nervous system. The gases, which may be released into the atmosphere via air, water or soil, are adsorbed through ingestion, inhalation or by dermal contact. Symptoms of exposure may include shortness of breath, runny nose, tightening of the chest, excessive salivating, vomiting, cramps, confusion and seizures. Breathing a dose of these chemicals is lethal within 15 minutes while a dose on the skin can kill in only a few minutes. Very small quantities of these toxins are necessary before a human would begin to show its affects; the table below demonstrates the miniscule amounts needed in order to incapacitate:

Estimates of Incapacitating Levels on Selected Nerve Agents:

Nerve Agent	Mg-min/m ³
Sarin	=25
Tabun	=50
Soman	=25
VX	10

(Source: Augerson, 2000)

At present, only two types of treatment drugs exist - atropine and pralidoxime; both must be administered within minutes of the onset of symptoms. Atropine works by blocking one type of acetylcholine receptor so that the acetylcholine that is already in the synapse cannot work. Pralidoxime blocks the binding of the nerve agent to the acetylcholine and acetylcholinesterase. Fortunately, the majority of doctors are familiar with these

antidotes and can dispense them rapidly once they are certain that a nerve gas attack has occurred.

Sarin

Sarin, also known as GB, was synthesized in 1938 by a German scientist. It is clear, colorless, odorless and tasteless in its most pure form. No more than 10 milligrams are necessary to kill and only a minute amount will make a person ill. Those who have been exposed to sarin can experience its effects for several years, suffering from eye problems, fatigue, headaches, depression and lack of concentration.

Sarin is highly susceptible to weather conditions; sun will evaporate it, rain will dilute it, and wind, proper humidity and temperature are necessary to carry it, thus making it extremely difficult to control once released. However, sarin is also fairly simple to manufacture, volatile and highly toxic, making it a weapon of choice for terrorists. It is ideal as only a small amount is necessary to harm and its effects will most likely be suffered for many years. The Japanese cult, Aum Shinrikyo, agreed with this assessment and released the deadly gas on a crowded subway in 1995. A case study of this attack appears below.

Tabun

Tabun, also known as GA, was originally developed in 1936. It is clear, colorless and tasteless with a fruity odor. Because tabun can easily mix with water, it can be used to contaminate a water or food supply. However, due to this volatility, it will not last long in the environment. It is the simplest of all of the nerve agents to produce and because of this, Germany began full production in 1942. Tabun can be used to cause behavioral effects such

as depression and fatigue, ideal for confusing enemy troops. Also, mixing tabun with mustard gas can increase its toxicity, making it a more desirable weapon.

Along with soman, Iraq is thought to have used tabun against the Iranians during the Iran/Iraq conflict in the 1980's. This is highly significant because, as demonstrated in previous assaults, Iraq had only deployed mustard gas against its enemies in the past. However, tabun has the ability to act more rapidly than mustard gas, capable of virtually halting infantry on the move. The implication of the tabun use by the Iraqis is dual. First, if the reports were correct, this may have been the first use of nerve gas in combat operations. Second, this may have led to Gulf War rebels plotting to introduce even deadlier nerve gases that offer still more potential for rapid mass-destruction: agents such as sarin, VX and, reportedly, soman stockpiled at that time by the U.S., France and Russia.

Soman

Soman, also known as GD, was discovered by a German chemist in 1944. It is clear and colorless with a slight camphor-like odor. Symptoms may appear within a few seconds if exposed to the vapor and a few minutes up to 18 hours if exposed to the liquid form. The treatment of soman can be somewhat difficult and as a result the Food and Drug Administration recently approved pyridostigmine bromide as a pretreatment. Evidence of the drug's effectiveness was obtained using test results on monkeys and guinea pigs illustrating that the administration of the drug before exposure to soman increased the survival rate. (Editor, 2003) There is a probability that the country of Iraq may have used soman against the Iranians during the Iran/Iraq.

VX

VX is clear, odorless and amber colored. While it is oily, it can be mixed with water, dissolves in all solvents and is the least volatile of all of the nerve gases. It was discovered in the 1950's by a British scientist, making it the only significant nerve agent created after World War II. (Council on Foreign Relations, 2003) The effects of the gas can be felt and death can occur within four to 18 hours of exposure. After their laboratories were raided, the Japanese cult Aum Shinrikyo was found to have synthesized small amounts of VX gas to use for assassinations. Besides Aum Shinrikyo, only the United States and Russia have admitted to possessing VX. While there is no evidence that the Al-Qaeda network has any, it is suspected that two other dangerous countries, Syria and Iraq, likely have quantities of the deadly poison.

Name	First Made (Year)	Designation	Characteristics
Sarin	1938	GB	clear, colorless, odorless and tasteless
Tabun	1936	GA	clear, colorless, tasteless with a fruity odor
Soman	1944	GD	clear, colorless and has a slight camphor-like odor
VX	1952	VX	clear, odorless, amber colored

Methodology

I studied the case of the sarin gas attack on the Tokyo subway by the Japanese cult Aum Shinrikyo in 1995. I wanted to glimpse what lessons could be learned from Japan's readiness and response to the incident and apply it to future possible attacks.

A Case Study: Sarin Gas in Tokyo

Cults, militias, and terrorist groups are loosely defined as communities of people who are brought together by certain religious beliefs and/or rituals. They are rarely perceived as menaces to society and harming innocent civilians is almost unheard of. Most are innocuous factions whose goal is to attain awareness and media exposure for their causes. “They claim to act on behalf of the people, they aspire to popular support, and clearly the use of arms of mass destruction would not add to their popularity.” (Laqueur, 1987) However, there is a new brand of terrorists and cults who are driven by religious zeal and hatred for the West that have become far more dangerous and unstable.

Before the attack by Aum Shinrikyo in 1995 on the Tokyo subway, terrorists were generally believed only to *threaten* the use of chemical weapons. The scientific make-up of chemical weapons is complex and most groups do not possess the capital, time, patience or expertise to follow through with the undertaking of such a complicated project. Moreover, many agreed with the observation made by terrorism expert Brian Michael Jenkins that “terrorists want a lot of people watching and a lot of people listening and not a lot of people dead.” (Jenkins, 1975)

Prior to 1995, Aum Shinrikyo may have been the most popular and successful, if not bizarre, religious sect in Japanese history. The group promoted a theology drawn from many sources including Buddhism, Christianity, Shamanism, Hinduism and New Age with worldwide membership theorized to be anywhere from 20,000 to 40,000. Through funds collected from followers and earned through seminars and training courses, the group’s estimated worth was a hearty \$1.5 billion. (Olson, 2000) Aum Shinrikyo also had a number of commercial enterprises including a computer factory and a chain of successful restaurants. On the more sinister side, the sect also manufactured drugs and cavorted with the Japanese

mafia. The group was led by Shoko Asahara, a charismatic leader who claimed to be the reincarnation of Jesus Christ and preached of the impending Armageddon.

After the cult unsuccessfully attempted to buy chemical munitions from Russia in 1993, Asahara insisted that the group begin their own aggressive chemical and biological weapons program. Laboratories were built and scientists were hired in the hopes of developing diseases such as anthrax and Ebola and nerve gases such as sarin and VX. The cult spared no expense, spending an estimated \$30 million on the project. (Smithson and Levy, 1999) Before the subway attack, the group is believed to have attempted almost a dozen smaller attacks, without the desired results. These attacks were assumed to have been unsuccessful because while the cult had a great deal of money, they were unable to recruit the highly educated scientists necessary to correctly synthesize the chemicals. The scientists that they were able to employ most likely overcooked the agents or simply did not know how to use them properly.

“Aum Shinrikyo’s next major act of violence would serve as wake-up call to the world regarding the prospects of weapons of mass destruction and terrorism.” (Olson, 2000) On March 20, 1995, the group put their highly coordinated plan into action and placed plastic bags wrapped in newspaper on the floors of five Tokyo subway cars. The bags were then punctured with the tips of umbrellas and the liquid inside was allowed to spill onto the floors. The liquid quickly evaporated into invisible deadly vapors as unsuspecting Japanese citizens went about their daily commute.

It only took moments for the effects of the sarin gas to be felt by the passengers of the subway cars. Choking, trouble with vision, and breathing problems were the first reported effects. Upon hearing of the disaster, Japanese officials dispatched 1,346 Emergency Medical Technicians (EMTs) and 132 ambulances. These rescue workers, along

with police and fire crew, were clad in routine work clothing; protective gear and gas masks were not issued until 40 minutes after the attack had occurred. At the scene, technicians attempted to triage the victims; no antidotes were administered and no decontamination occurred on-site.

The nearest hospital was in an equal state of confusion. The doctors were told to prepare for burn or perhaps poisoning victims. It was not until two hours after the attack had occurred that doctors confirmed that the victims were suffering from sarin gas exposure and given the correct antidote. The doctors and nurses also suffered secondary effects of the sarin gas themselves because of the hospital's weak ventilation systems and the failure to decontaminate. Ultimately, 15 subway stations were affected and 3,800 people were injured. Twelve people lost their lives in the attack.

When police raided the cult's facilities two days later, they found a large-scale chemical production factory, complete with first-rate equipment. There was also evidence that the group had experimented with botulin toxin, anthrax, cholera, Q fever, and Ebola. Two hundred members of Aum Shinrikyo were arrested and 120 remain in jail to this day. The group's leader, Asahara, has been on trial for many years with no end in sight. The Japanese government also stripped the group of their status as a religious organization. "Many printed publishing's available as of December 1998 support the notion that the government ordered the disbandment of Aum Shinrikyo in December 1995. However, a web site maintained by the Foreign Press Center of Japan discloses information to the contrary." (Reader, 1997)

The cult appears to be recovering from the attacks. In an effort to change its image, Aum Shinrikyo has changed its name to Aleph, which means "to start anew." The group is

now rebuilding, soliciting donations and recruiting members again; they also still maintain offices worldwide. (Sims, 2000)

The significance of the 1995 subway attack cannot be underscored. Not only was it the most serious terrorist attack in Japan's modern history, causing massive disruption and widespread fear in a society that is virtually free of crime but the attack also demonstrated to the world that the population at large is vulnerable to chemical terrorism and that the key to survival is to recognize the threat and prepare accordingly. Until the Tokyo incident, Americans were relatively confident that deliberate poisoning was only an occasional event perpetrated by a single, severely troubled person. While the notion of the rarity of such misapplications of poisons is comforting, the sarin gas attack puts us on notice of the fragility of that belief.

Results and Discussion

The first lesson learned is the simple realization that terrorist groups do have and will use chemical weapons. According to former Senator Sam Nunn “I think we are very fortunate in this country. We haven’t had the kinds of attacks they had in Tokyo. And I think it’s just a question of time before someone attempts that sort of thing.” (Nunn, 1995) After the tragic events of September 11, many agree that a chemical attack on American soil is a viable possibility.

Some theorize that another lesson learned may be that chemical weapons are easy to obtain. (Smithson and Levy, 1999) As shown in the case of Aum Shinrikyo, this is not necessarily the case. Not only are chemical weapons difficult to find and expensive, but once a group obtains them, they will need the expertise and know-how to use them correctly. Chemical weapons are extremely delicate and complicated; and it is unlikely that

anyone, with the exception of the highest-trained chemical expert, will be able to synthesize the gases correctly. Aum Shinrikyo, with all of its money and power, was unable to fully realize its goal of a massive nerve gas attack with thousands of fatalities. This does not, however, underscore the significance nor does it mean that a similar incident, this time more deadly, could not occur.

Hospitals and emergency officials can likely acquire the most knowledge from the Tokyo attack. The incident caught hospitals off-guard and demonstrated how ill-equipped they were for an attack of such a large scale. “The majority of medical professionals were unfamiliar with chemical casualty care and could have benefited greatly not only from prior instruction, but from medical treatment protocols to guide their actions.” (Smithson and Levy, 1999) Most doctors in U.S. hospitals, like their counterparts in Japan, are not properly trained to recognize symptoms of a gas attacks. Education is the key to quickly recognizing and treating exposure to nerve gas. Secondary decontamination also proved to be troublesome in Japan and the U.S. can develop procedures to protect their staff and decontaminate their facilities quickly if necessary.

Conclusion

All four nerve gases I have described - sarin, soman, tabun, and VX - are chemical terrorism threats. While sarin is the nerve agent of preference because of its relatively simple use and deadly results, the country of Iraq has shown that they are not afraid to experiment with the more complicated tabun and soman. Of course, VX, being the most deadly gas, would certainly cause the most harm if any group had success with the agent. The attack on the Japanese subway by Aum Shinrikyo was a warning that a nerve gas attack, although unlikely, is a real possibility. Knowledge gained from the oversight and chaos in Japan can

ameliorate the U.S. in assembling its own chemical protection procedures. In this post-September 11 world, it would be unwise not to prepare for all acts of potential terrorism as anything is possible. Indeed, many steps have taken to ensure that our homeland is secure and that first responders have the proper training for a chemical attack and, as always, much more can be done.

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