From the Toxipedia website in original form. Last updated by Toxipedia in 2014.
Dr. Steve Gilbert, author.

Chemical Weapons

Overview

The modern era of chemical weaponry began in the First World War and advances in synthetic chemistry led to the development of increasingly potent compounds such as Nerve Agents and VX. Chemical weaponry stockpiling was an integral part of the arms race throughout the Cold War and they were used during that time by Egypt, Iraq, and Iran. The Chemical Weapons Convention of 1993 outlaws the production, stockpiling, and use of chemical weapons for all signatories (all but 8 nations have signed).

History

Chemical Weaponry in Ancient, Medieval, and Pre-World War I

The use of chemical compounds (as well as biological materials) dates back to biblical times. Greek historian Thucydides recorded use of Arsenic smoke by the Spartans against the Athenian city of Delium during the Peloponnesian War in 425 A.D. (#Tucker, 2006). Similar smoke was used during the Sung Dynasty by the Imperial forces in China. The Germans burned a mixture of bones coated in resin to produce a foul stench that would keep invaders at bay (#Hutchinson, 2003).
The use of poisons fell out of favor in the 18th and 19th century. The British in the Crimean War rejected use of cacodyl Cyanide shells, dismissing them "as bad a mode of warfare as poisoning the wells of the enemy" (#Scott, 1997).

In 1862 New York schoolteacher John W. Doughty wrote to the US Secretary of War suggesting methods of poison gas. This was dismissed and subsequently followed by a War Department General Order signed by President Abraham Lincoln stating that the use of poison should be "wholly excluded from modern warfare" (#Hutchinson, 2003).

Chemical Weapons in World War I

At the beginning of World War I, the use of chemical weapons was still very much taboo. Not only did mankind have a universal aversion to the use of poison but there was also the 1899 Hague Convention

Respecting the Laws and Customs of War on Land that prohibited "poison or poisoned weapons" as permissible in war (#Tucker, 2006).

As the war progressed and trench warfare led to virtual stalemates throughout the theater, the aversion to chemical weapons and the legal ramifications were subordinated to the military necessity of the gases (or at least the military necessity as judged by the German High Command). The Germans were especially well suited to chemical warfare because there chemical industry was by far the most advanced in the world at the time. The first in long line of German scientists that advanced the use of chemical weapons, a title that most would rather not bear, was Fritz Haber of the chemical giant IG Faber.

The first use of chemical weapons in modern warfare was by the Germans. They fired nearly 18,000 shells filled with Xylyl Bromide accompanied with an explosive charge at Russian positions near Bolimow in January 1915. These were entirely ineffective because the freezing temperatures did not allow vaporization of the liquid thus rendering it ineffective (#Tucker, 2006).
Around the time of the failed attack on Bolimow, Haber developed the idea of using Chlorine released from cylinders and using the wind to carry the toxic gas toward enemy positions. The German high command agreed to the plan and the first successful use of chemical weapons occurred in April 22, 1915 at Ypres Salient in Belgium. German troops released 168 tons of gas which traveled across the open field toward French and Algerian troops. Company roll calls claim that more than 5,000 died, though this number is likely elevated for propaganda purposes because many still held the belief that chemical warfare was immoral. The Germans attacked Canadians the next day though unfavorable wind conditions severely lessened the effect of the Chlorine (#Hutchinson, 2003). It is important to note that the Germans felt that this use of chemical weapons was not prohibited by law because they were not disseminated through use of shells.

Less than 24 hours later the English had declared they planned on retaliating in similar fashion with chemical weapons. They used Chlorine released from cylinders on September 25, 1915 at the Battle of Loos with no effect. This use spawned a technological competition between the Allies and Germans revolving around offensive and defensive (protective masks and antidotes) possibilities of chemicals. The newly created chemical weapons division in Britain, Porton Down, developed a gas helmet which severely mitigated certain chemicals' effects. However, they were cumbersome, the gases were hard to detect, and there were malfunctions so large scale casualties were still common. Phosgene for instance had no effects for hours after exposure and victims would not know they were exposed. One attack on February 21, 1916 against French and British soldiers with Phosgene resulted in 750,000 casualties (#Hutchinson, 2003). Additionally, certain chemicals could not be detected easily.

New gases continued to be developed and used. France and Britain produced blood agents which attempted to inhibit the victims ability to absorb oxygen into the blood. These gases were not terribly effective in battle. The most devastating new gas was Mustard Gas. This was developed as to circumvent the newly invented gas helmet and affect exposed skin (#Tucker, 2006). It was first used July 12-13, 1917 at Ypres Salient by the Germans. In the next six weeks the British suffered 9,000 casualties as a result of Mustard Gas (#Hutchinson, 2003).

The United States began producing chemical weapons late in the conflict. they established theChemical Warfare Service (CWS) and first participated in a chemical weapons attack with the British October 13, 1918. One of the casualties of that attack was a young infantryman named Adolf Hitler. The gas inflicted such pain that Hitler had to be evacuated to Germany. The attack may have saved countless lives because it cemented in Hitler a lifelong hate of chemical weapons which influenced many policies in the second World War.

At War's end, more than 124,000 metric tons of 39 different toxins. There were 90,000 deaths and roughly 900,000 more wounded (#Tucker, 2006).

World War I Implications

The international community attempted to ban the use of chemical weapons. The 1919 Treaty of Versailles severely hindered Germany's ability to continue to develop chemical weapons. The Germans were prohibited from using weapons in war and from manufacturing or importing such gases or liquids. The five allied powers (US, Britain, France, Italy, and Japan) met in Washington, DC in 1921-22 for the Conference on Limitation of Armament and negotiated the "Treaty Relating to the Use of Submarines and Noxious Gases in Warfare" which outlawed "the use in war of asphyxiating, poisonous and other gases and all analogous liquids, materials, or devices." This treaty was ratified but never entered force due to French objections over some of the provisions concerning submarines (#Tucker, 2006).

By far the most wide reaching implications for chemical weapon use was the 1925 Geneva Protocol. This had similar provisions regarding chemical weaponry as the previous treaty, outlawing poisonous and asphyxiating gases and liquids in warfare. This was supported by the White House but a large movement made by some in the military, chemical manufacturers, and the American Chemical Societysuccessfully lobbied the Senate to leave it bottled up in the Foreign Relations Committee until 1974, when it was finally ratified.

Interwar Years

The beginning of modern chemical warfare unequivocally begins in the German search for new Pesticides in the 1920s and 1930s. With the loss of territory after World War I and Germany's desire to lessen its reliance on food importation, the German leadership emphasized the need for new Insecticides to increase production. Chemist Gerhard Schrader was tasked with finding new non-flammable, non-harmful Insecticides to elimante the treat from the bool weavil (#Tucker, 2006). Schrader synthesized a series of "organophosphates" - organic molecules with a central Phosphorousatom and four atoms extending off of it. Schrader made the [organophosphates more potent by adding Cyanide. These molecules had undesirable side effects on the chemist including blurred vision, dilated pupils, and eventually became sever enough to warrant hospitalization (#Tucker, 2006).

As Schrader continued work on this Cyanide-containing compound, the unpleasant side effects continued to manifest themselves at the slightest whiff of the vapor. Further toxicological testing on mice, guinea pigs, rabbits, apes, and others reveled a frighteningly high level of toxicity to this new insecticide tentatively named Le-100 (Le as an abbreviation for Leverkusen, the German city where it was synthesized). Very small amounts led to vomiting, bronchial tube constriction, diarrhea, paralysis of

breathing muscles, and eventual death. This made Le-100 far too toxic to use as a commercial insecticide, but the findings were passed on to the German government's War Office.

A good number of people in the War Department felt that chemical weapons were a viable military weapon. Gas had recently been used with good results by the Italians in their march on Ethiopia and its Emperor Haile Selassie (#Tucker, 2006). The German government took over production of Le-100, renaming it Tabun, an invented word with no particular meaning. The field testing of Tabun were successful and it was shortly declared the German chemical weapon of choice. The German authorities designated the somewhat reluctant IG Faber to build a plant capable of producing 1,000-2,000 metric tons of Tabun per month (#Tucker, 2006).

As Tabun was entering widescale production, Schrader had returned to his laboratory at the German Army's Gas Protection Lab (he had been moved from Leverkusen here after he synthesized Tabun) and was working on a new set of Insecticides using flourine rather than Cyanide. During the latter part of 1938, Schrader synthesized a compound that proved to be 5-10 times more lethal than Tabun and would name it Sarin, which was an acronym for the four scientists most closely associated with the compound - Schrader, Ambrose, Rudiger, and LIN de (#Tucker, 2006).

World War II

Hitler's aversion to chemical weapons continued throughout the second World War. Against the wishes of many of his high commanders, Hitler wanted to use chemical weapons only in retaliation against a similar attack. However, he continued to push the German military to produce and stockpile weapons to ensure German superiority should the Allies commence chemical warfare (#Tucker, 2006).
The Germans had a large head start on production, though they were not entirely convinced of this. Otto Ambros, a leading German chemist who had been instrumental in synthesizing Sarin, believed that the Allies had independently discovered some sort of nerve agent because of similar insecticidal research they were conducting prior to the war. Even if the Allies did not have it, Ambros felt that "in the event that Germany were to use this special gas, other countries would not only be able to imitate it quickly but could produce it in considerably larger quantities" (#Tucker, 2006). The immense production capabilities of the Allies and the fact that they had immense stockpiles of artillery and bombs with mustard and Phosgene in which to retaliate with provided a sufficient deterrent to the German use of chemical weapons.

The Allies did not in fact have anything near the lethality of Tabun or Sarin. The closest compound the Allies could produce was DFP which could, at high doses, produce unconsciousness. The US Office of Scientific Research and Development and universities throughout the States synthesized over 200Organophosphates including many with flourine yet none approached the toxicity of Tabun or Sarin(#Tucker, 2006). The British scientists at Porton Down discovered Tabun in 1944 after the army raided a building holding German munitions. They extracted the liquid, analyzed it, and tested it on laboratory rabbits amazed at its lethality.

The only deliberate use of gas in World War II was extensive Mustard Gas use by the Japanese during their 1937 invasion of Manchuria. Some studies have claimed that more than 2,000 separate incidences of poison gas use in that campaign, though that number very well could be inflated (#Hutchinson, 2006).

Numerous instances are recorded that either side in the European theater, the Allies or the Axis, were on the verge of using gas at some point but retreated.

Chemical weapons were however used ubiquitously by the Nazis in concentration camps to kill Jews that were interned. Zyklon-B was developed by Haber as an insecticide to kill vermin but would later be used to kill Haber's own family members. It was first used at Auschwitz in the summer of 1941 where SS officers conducted experiments testing its lethality. In the upcoming years Zyklon-B would become the primary agent used in gas chambers at Auschwitz (#Tucker, 2006).

Chemical Weapons in the Cold War

Following World War II, there was a mad dash between the Allies and the Russians for German chemical warfare resources. The United States and Britain began Operation Dustbin in May of 1945.Dustbin arrested, interned, and interrogated leading German scientists including Schrader, Ambros, and Werner von Braun. The Allies married their interrogations with collection and testing of large caches of German stockpiled weapons and a discovery of the Tabun and Sarin production process with help from the German scientists (#Tucker, 2006).

Russian advancement from the east brought them very close, and even past, the main German chemical weapons processing plants. The Russians captured the nerve agent factory at Dyernfurth intact, vast raw materials for nerve agent's production process, a partially complete Sarin plant, and, hidden in a mine shaft, a plethora of documents including those highlighting the production process ofSarin (#Tucker, 2006). The Soviets were able to disassemble the plants, and with the help of the documents and some German technicians, reassemble and begin producing Tabun in 1948 Tabun was easier to produce than Sarin so the Soviets concentrated on it initially).

The Soviets tested their atomic bomb in 1949, thus destroying the United States hegemony over nuclear warfare and making US policymakers rethink their reliance on nuclear deterrence. A CIA report in December of 1950 that estimated the Soviets would have a large enough nerve agent stockpile to conduct a "sustained" campaign which, along with the Korean War, led the US to quickly moved to obtain a stockpile of Sarin, which was crowned the weapon of choice, for "retaliation-only" purposes. The Vitro Corporation was contracted to build two plants for commercial Sarin production. Site A was at Muscle Shoals in Northwest Alabama and Site B was at The Rocky Mountain Arsenal near Denver, CO (#Tucker, 2006). The plants were operational by the end of 1952, though they cost over $100 million, $70 million more than expected.

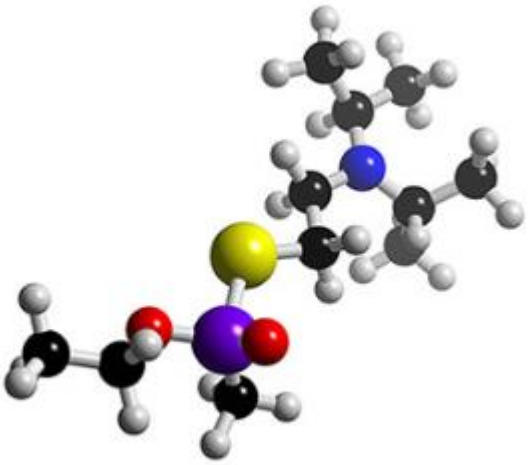
V-Class Agents

The discovery of DDT resistant lice led to intensified research in new organophosphate Insecticides. From this research, the V-Agents, were born, the most common of these being VX.

In 1952 Dr. Ranajit Ghosh synthesized a compound containing sulfer and Nitrogen. This compound, marketed Amiton, was commercially available for a short time before its toxicity became apparent and its producer, Britain's Imperial Chemical Industries (ICI), was forced to cease sales (#Tucker, 2006). The same pernicious properties that made it commercially inviable, made it militarily advantageous and scientists at Porton Down continued testing and development (NOTE: this occurred even though Britain

had abandoned production of Sarin and renounced plans to stockpile chemical weapons. This was done because they felt their new nuclear stockpile acted as a deterrent to every threat and they could not justify the funds needed to develop large chemical weapons stockpiles (#Tucker, 2006) (the British reversed the position and began stockpiling again in May 1963.)

VX Structure



The US went on to synthesize fifty V-Agents and selected VX as the agent to pursue. One liter of VXcould theoretically kill one million people and it persistence makes it deadly for up to three weeks. Widescale production of VX began at Wabash River Ordnance Works around Newport, Indiana. The production of VX began in 1961 and quickly accelerated as the use of nerve gas was viewed by the civilian and military leaders of the Kennedy Administration as a the lesser of two evils when compared to the possibility of all out nuclear war (#Tucker, 2006). This line of thinking continued up until the Vietnam War, when VX production was ceased because of a dearth of munitions available to store the agent.

Chemical Weapons in Yemen

Egypt, a signatory of the 1925 Geneva Protocal, began producing chemical weapons in 1973 focusing on Mustard Gas and Phosgene (#Hutchinson, 2003). One year before this plant opened the Islamic state Yemen became embroiled in a civil war. The war quickly escalated into a semi-regional conflict with Egypt entering the war siding with the republicans - trying to overthrow the monarchy - and states such as Jordon and Saudi Arabia, both monarchies themselves, fighting with the Yemini royalists (#Tucker, 2006).

Egypt began using chemical weapons dispersed from Soviet-made bombers against the Yemeni guerrillas. Initial attacks employed tear gas, but as the chemical attacks continued they began to usePhosgene and Mustard Gas. In the spring of 1967 chemical attacks were common throughout North Yemen and Red Cross doctors confirmed the use of chemical weapons. despite Egypt's flagrant violation of the Geneva Protocol, the international community did little (#Tucker, 2006).

Chemical Weapons in Iraq/Iran War

The Iraq Chemical Weapons Program was initiated in 1971, but its products were not unleashed until a decade later. After a series of military setbacks in the war with its neighbor Iran, Iraq, a signatory of the 1925 Geneva Protocol began to employ chemical weapons. Iran started filing grievances with the United Nations in the Summer of 1983, which suggests the first use of the agents was sometime in the spring. In Spring of 1984, Iraq employed Nerve Agents on entrenched Iranian soldiers at the strategically important oil fields of the Majnoon Islands. The strike killed 50-100 men nearly instantaneously and

more fell to heat stroke and dehydration in the upcoming days because the Nerve Agents dry out the skin and body (#Tucker, 2006).

Iraqi scientists synthesized and stockpiled 60 tons of low-grade Tabun in 1984 (#Tucker 2006). Two years later, their production capabilities had improved to the point where they could stop Tabunproduction and concentrate exclusively on Sarin, though it too was low-grade. As their production capabilities increased so too did their use.

In December 1986, Hussein authorized the field commanders to use chemical weapons without his explicit approval and commanders "took full advantage" of these orders using chemical weapons routinely (#Tucker, 2006). Iraq also acquired and produced poor quality VX gas in late 1987, however, they never used it. Up to 100,000 chemical munitions were used during the war (#Hutchinson, 203). Iran, after receiving much vocal support but little practical action, began producing their own chemical agents in 1984, but their attacks were never successful (#Tucker, 2006).

The United States condemned the use of chemical weapons by Iraq though failed to take any action on the matter. This dubious stance was due to the Reagan Administration support of Saddam Hussein which stemmed not only from Iran's kidnapping of 66 U.S. citizens and diplomats for 444 days in 1979, the virulent hatred being directed at the U.S. from Iran's Grand Leader Ayatollah Khomeini, and the Reagan Administration's belief that a secular Muslim state was a adequate check on the religious fervor and zealotry arising from Iran (#Tucker, 2006).

This support was not just tacit but rather material. Even as Iraq was increasing its use of chemical weapons through 1986-1987, the U.S. restored diplomatic ties and provided loans and intelligence to the Hussein regime.

The Anful Campaign

The Anful Campaign was a devastating military campaign targeting the Kurdish ethnic group in Northern Iraq who formed a loose alliance with Iran during their war with Iraq hoping to obtain an autonomous state should Iran prevail. Ali Hassan al-Majid or "chemical ali", as he has become known, was the Iraqi leader in charge of the chemical attacks on the Kurds.

On March 9, 1988, Iraq dropped mustard and hydrogen cyanide bombs on the town of Halbja killing between 3,200 and 5,000 Kurds and injuring 10,000 more(#Hutchinson, 2003). The Iraqis also dropped Sarin on the village of Birjinni (#Tucker, 2006).

Post Cold War Developments

The Soviet Union acquired the chemical formula of VX in the late 1950s through espionage.
The created R-33, later named Novichok, as a binary agent - a weapon that contains two chemical agents that only becomes harmful when the munition is fired and the chemicals mix - throughout the 1980s. Chemicals used in both synthesizations for both agents are common, thus allowing the agent to be constructed with little no overview from the West. Novichok agents are even more toxic than VX.
In April 1987, Soviet President Mikhail Gorbachev declared his country was ending its chemical weapons program. Despite this declaration, the Soviets continued working on the Novichok binary agents. The

would later go on to sign the Wyoming MOU with the United States forcing each country to declare their chemical weapon stockpile to the other. Not until Soviet scientist Vil Mirzayanov went public about his concerns with the secret Soviet Nerve Agents program, most notably the Soviets utter disregard for employees' health, did the Soviets declare their true stockpiles (#Tucker, 2006).
In 1993 the Chemical Weapons Convention (CWC) was signed forcing all signatories to halt production, stockpiling, and use of chemical weaponry. Numerous countries with known stockpiles have begun destroying them.

The most recent attack employing chemical weapon were in Japan where followers of the Aum Shinrikyo cult twice released Sarin at the civilian population. In June of 1994, followers vaporized theSarin in a van then directed it at homes and buildings in Matsumoto, Japan. This attack killed seven and injured 193 (#Tucker, 2006). The second attack was infinitely more devastating because they targeted the crowded Tokyo subway system. during morning rush hour on March 20, 1994, the followers released Sarin throughout the subway killing 12 and injuring more than 5,000 others (#Hutchinson, 2003).

Modes of Dissemination

Throughout the infancy of chemical weaponry, the only form of dissemination used was wind dispersion. Throughout World War I, the wind would blow the chemical agent into the enemy's trenches engulfing them in clouds of smoke (#Tucker, 2006). Attempts to deploy the agents via artillery were unsuccessful because they were unable for many reasons, produce a vapor cloud. The first attempt was when Germany fired 3,000 shells that destroyed the chemical agent upon detonation (#Smart, 1999). The M34 Cluster Bomb was one of the first munitions specifically designed for delivering chemical weapons. Designed starting in 1950, the M34 Bomb was a metal cylinder with 76 Sarin packets embedded that would disperse at detonation covering a huge swath of land.

The M55 rocket was commissioned as the delivery method of choice for Sarin by the U.S. Army in 1960. About 478,000 rockets were manufactured each weighing 55 pounds packed into a mobile launcher that carried 45 rockets. Its performance however was "erratic and unreliable" and eventually the Sarin-filled rounds leaked making the rockets useless (#Tucker, 2006).

Binary Weaponry were a goal of every major chemical weapon producing nation since the 1960s through the early 1990s. The weapons were composed of two benign chemicals, but when launched would combine to form the desired agent. This was advantageous because it allowed for safe storage and transport of the weapons (#Tucker, 2006).

Current Events

March 27, 2007
Britain has completed the destruction of the entirety of its chemical weapons holdings and presented a deactivated munitions shell to a museum to symbolize the ending of their chemical weapons era. See full article from US Fed News

March 5, 2007
The United States has completed the destruction of 50% of its chemical weapon stackpile. See the full article from US Fed News
December 6, 2006
China has reaffirmed its commitment and urged other countries to destroy all chemical stockpiles by 2012. See full article from *BBC*.
November 21, 2006
The United States has pushed back the date for complete destruction of its chemical weapons stockpile until 2023, 11 years after the deadline that was previously set. See the full *USA Today* article.
September 8, 2006
Russia has opened another plant to hasten destruction of its immense stockpile of chemical weapons. The plant, Russia's third destruction facility, is charged with destroying 17% of the country's stockpile and will focus its efforts on neutralizing nerve agents stored in bombs and warheads. See the full text from the *Associated Press Worldstream*.
July 7, 2006
The United States has requested an extension to the Chemical Weapons Convention's deadline to destroy its stockpile by 2012. Analysts estimate the US will not be able to destroy its stockpiles until around 2020. See full article from *State Department Documents and Publication*.

Regulation

Chronology of Regulation

- 1675: An agreement between the British and the French that banned the use of poison bullets
- 1863: **U.S. General Army Order No. 100**
  Issued during American Civil War, the order stated, "The use of poison in any manner, be it poison wells, or food, or arms, is wholly excluded from modern warfare" (#Smart, 1999).
- 1899: **International Declaration on the Laws and Customs of War**
  Article 23 of the declaration prohibited the use of projectiles disseminating "asphyxiating or deleterious gases" (#Hutchinson, 2003). This was unenforceable by the international community.
- 1925: **Geneva Protocol**
  The Geneva Protocol would outlaw the use in war of chemical and biological weapons, but not their production or stockpiling. The United States, under pressure from some military parties and chemical companies, did not ratify the protocol until 1974 (#Tucker, 2004).
- 1993: Chemical Weapons Convention

Disposal

The first methods of disposal were burial at sea. The British buried many tons of German gas collected after World War II in the Baltic Sea. The United States conducted Operation Davey Jones' Locker from 1946-1948 in which German ships were filled with chemical munitions and scuttled in the North Sea and Skaggerak Straight between Norway and Denmark (#Tucker, 2006).

The U.S. later conducted the CHASE Program - CHASE as an acronym for "cut holes and sink em." TheCHASE Program involved loading unwanted munition into aging ships and scuttling them at sea. Most disposals were or conventional weapons but four operations included chemical weapons (#Smart):

1. **CHASE 8** - 1967 - Disposed of mustard agents and Sarin filled M55 rockets.
2. **CHASE 11** - June 1968 - Disposed of Sarin and VX.
3. **CHASE 12** - August 1968 - Disposed of mustard.
4. **CHASE 10** - August 1970 - Disposed of about 3,000 tons of nerve agent rockets encased in concrete vaults.

Environmental concern over the sea dumping of chemical weapons led to a public law prohibiting further such missions (#Smart).

Chemical Weapons Accidents

- Okinawa Sarin Leak - More than twenty Americans were exposed to Sarin after a leak developed inside a munitions bunker on Okinawa. The munitions stockpile was transferred to Okinawa without permission of the Japanese government and they demanded the removal after the leak became public.
- Skull Valley - Malfunction during a test of Nerve Agents resulted in thousands of sheep deaths and contaminated soil throughout Northwest Utah.

Chemical Weapons Storage Sites

- Johnston Atoll in the Pacific Ocean
- Edgewood, Maryland
- Anniston, Alabama
- Blue Grass, Kentucky
- Newport, Indiana
- Pine Bluff, Arkansas
- Pueblo, Colorado
- Tooele, Utah
- Umatilla, Oregon.

Chemical Weapons Timeline

The below chronology is taken from #Hurley, 1999.

1907
The Hague Convention outlaws chemical weapons. The US does not sign the treaty.

1925
The Geneva Protocol, an international treaty banning biological warfare, is signed.

1935
Italy uses Mustard Gas in its conquest of Abyssinia (Ethiopia).

1936
Japan uses chemical weapons during its invasion of China. German chemical laboratories produce the first nerve agent, Tabun.

1945
Germans use Zyklon-B in the extermination of the Jews.

1947
President Harry Truman withdraws the Geneva Protocol from Senate consideration.

1961
The Kennedy Administration increases the funding of of US chemical weapons programs.

1962
Chemical weapons are loaded on US planes during the Cuban missile crisis.

1982
Iraq-Iran War ends. Evidence emerged that Iraq used chemical weapons on Iranian soldiers and civilians, as well as on members of the Kurdish ethnic minority within its own borders.

1990
The United States and the former Soviet Union pledge to reduce chemical weapons stockpiles by 2002. Iraq threatens to use chemical weapons on Israel.

1992
Gulf War veterans report development of post-war health problems with symptoms similiar to organophosphate poisoning. Some believe that exposure to chemical weapons was the cause. In Germany, police thwart a neo-Nazi attempt to release cyanide in a synagogue.

1993
President Bill Clinton continues to bomb Iraq'a chemical and biological facilities as UN Inspectors begin a program to dismantle the weapons. The U.S. signs theChemical Weapons Convention, a treaty barring the use, production, and transfer of chemical weapon for any purpose; treaty members pledge to destroy their stockpiles by 2007.

1994
Apocalyptic cult Aum Shinrikyo releases the nerve agent Sarin in Matsumoto, Japan.; 8 people die and 200 are hospitalized.

1995

Aum Shinrikyo launches a Sarin gas attack on the Tokyo subway system; 12 eople die and 5,500 are affected.

1995
FBI thwarts a possible Sarin gas attack on Disneyland.

1997
Two Chlorine bombs are activated in crowded shopping malls in Australia. The U.S. ratifies the Chemical Weapons Convention.

Controversy and Opinion

January 10, 2006
I believe that the history of the development and stockpiling of chemical weapons in the 20th century is great mirror into the Cold War itself. First, between Russia and the United States directly, no weapons were used. However, each country did pass technology and weapons on to states across the world in an attempt to gain an upper hand. The U.S. passed weapons to France, continually in threat of "falling" to the communists, and Iraq (a US company provided chemicals for a short while and the US supported his military regime) while Russia shipped arms to North Korea, Egypt and others to gain influence.

Mistrust was rampant. The Soviets failed to disclose the foliant agents, neither side had any idea about the other's capabilities for long stretches, and when chaos is present fear rules. It is still unclear, even after the CWC, who really has weapons. No country knows this better than the United States who hung their hat on Iraq's stockpile of chemical and biological agents only to invade and discover that he may have destroyed them as he was instructed.

More than anything, there was wasted money. Especially for the Soviets who had little money to begin with. One of the major assumptions, that turned out to be correct, was that if the U.S. could contain the Soviet imperialist advances, then the Soviet Union will, as George Kennen stated at the time, "remain economically a vulnerable and in some sense an impotent nation" (Anatol Lieven and John Hulsman, Ethical Realism: A vision for America's Role in the World, Pantheon Books, 2006). Although I do not have exact data, let it suffice to say that it is very expensive to research, build plants, buy input chemicals, produce, and build bombs and other dissemination devices to make the weapons viable. The United States was able to internalize and absorb such awesome costs because the economy was growing as were the tax revenues. One must wonder then, if such a gradual increase of costs associated with chemical weapons was advised as a means to, apart from obvious defense purposes, further injure the Soviet economy and exacerbate its decline. No study of this mindset, to my knowledge, has been conducted.

January 11, 2006
The Army has deliberately mislead the public by not disclosing the real threat to communties surrounding incineration sites in the US. Chemical Weapons Working Groups claim that the Army is doing this because they are obsessed with the idea of building incinerators and have neglected the true danger to the surrounding communities. Please feel free to read it at the Chemical Weapons Working Group.

External Links

- Federation of American Scientists - Great Page
- Organization for the Prohibition of Chemical Weapons
- CDC Information on VX
- Reaching Critical Will. Good non-proliferation site.
- Organization for the Prohibition of Chemical Weapons.
- Medline Plus on Chemical Weapons.
- Center for Nonproliferation Studies (CNS).
- The US CWC Convention Website.
- The Henry Stimson Center for Nonproliferation and Response.
- World Health Organization (WHO) site on Chemical and Biological Weapons.
- CDC Site. Site has information sbout US stockpile destruction.
- CNN Site on Chemical and Biological Weapons
- Arms Control Association

References

- Tucker, Johnathon B. War of Nerves: Chemical Warfare from World War I to Al-Qaeda. Pantheon Books, 2006.
- Hurley, Jennifer. ed. Weapons of Mass Destruction: Opposing Viewpoints. Greenhaven Press, Inc., 1999.
- Hutchinson, Robert. Weapons of Mass Destruction: The No-nonsense Guide to Nuclear, Chemical and Biological Weapons Today. Widenfield and Nicholson, 2003.
- Price, Richard. "A Genealogy of the Chemical Weapons Taboo". *International Organization 49*, 1995.
- Shalom, Steven R. "The United States and the Gulf War". *Z Magazine*, 1990.
- Shalom, Steven R. "The United States and the Gulf War". *Z Magazine*, 1990.
- Smart, Jeff. "History of 22nd Chemical Battalion". Retrieved on 1-11-07.
- Smart, Jeffery K., M.A. (1997). "History of Biological and Chemical Warfare". Textbook of Military Medicine: Medical Aspects of Chemical and Biological Warfare. Retrieved Jan. 5, 2006 from Center for Diaster and Humanitarian Assistance Medicine (CDHAM).
- Emedicine.com. Retreived Jan. 5, 2004.
- **Picture References**
  Header Picture was retrieved from Coastal Community College .
- Picture retreived from UN Peacekeeping Site. Accessed on 1-25-07.
- M55 picture was retrieved from US Army Chemical Materials Agency
- M34 picture retrieved from HISTORY OF CHEMICAL AND BIOLOGICAL WARFARE: AN AMERICAN PERSPECTIVE. Smart, Jeffrey.
- VX structure was retrieved from CNN. Accessed on 1-26-07.