ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

Working together for a world free of chemical weapons

FACT SHEET 4

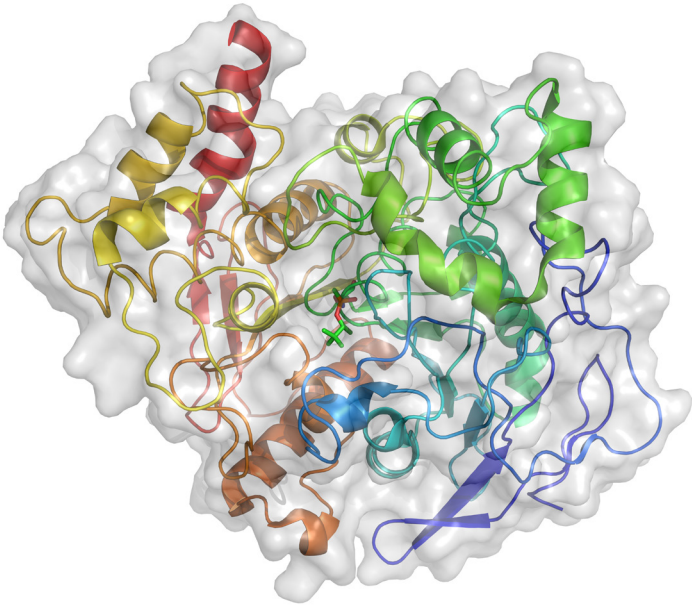
What is a Chemical Weapon?

All States Parties to the Chemical Weapons Convention (CWC) commit to a world free of chemical weapons. Key to this commitment and the implementation of the Convention is the way in which chemical weapons are defined. In order to be as compehensve as possible, this definition encompasses fully developed chemical weapons, the components of such weapons when stored separately (e.g. binary munitions), chemicals used to produce chemical weapons (precursors), and, under the general purpose criterion, items with a civilian use when intended for chemical weapons (dual-use items). The definition also includes munitions and devices intended for the delivery of toxic chemicals and equipment directly in connection with those munitions and devices.

Chemical Weapons under the CWC

A common conception of a chemical weapon is of a toxic chemical contained in a delivery system such as a bomb or artillery shell. While technically correct, a definition based on this conception would only cover a small portion of the range of things the CWC prohibits as 'chemical weapons'. For one thing, CW components—a toxic chemical and delivery system, for example—may be stored separately, each in and of itself less than a fully developed weapon. In the case of binary munitions, a non-lethal chemical may actually be stored within a munition, only to be mixed with a second chemical inserted into the munition shortly before firing, and the toxic product disseminated upon arrival at the target.

The complexity of the chemical weapon definition needed to meet the objectives of the Convention can be seen when considering 'dual use' items and technologies. Dual-use chemicals are those that can be used for peaceful and commercial purposes and can also be used as, or applied to the creation of, chemical weapons. To address the potential threat posed by these chemicals, the CWC definition of a chemical weapon had to be as comprehensive as possible.



Depiction of the soman conjugate of acetylcholinesterase. Nerve agents like soman inhibit the normal actions of acetylcholinesterase, an enzyme crucial to nervous systems (Protein Data Bank Structure 2WFZ)

At the same time, however, care had to be taken not to define chemical weapons in a way that unnecessarily hindered legitimate uses of chemicals and the economic and technological development to which such uses may lead. While providing for the prevention of production or stockpiling of chemical weapons, the definition could not result in restrictions of any State Party's right to to produce and use chemicals for peaceful purposes or to acquire and retain conventional weapons and their associated delivery systems. The definition eventually adopted allowed for a balanced approach under which the Convention's objectives can be met while the rights of States Parties are retained.

To preclude contravention of the treaty's intent by separation of chemical weapons into component parts, the Convention defines each component of a chemical weapon (CW) as a **chemical weapon**—whether assembled or not, stored together or separately. Anything specifically designed or intended for use in direct connection with the release of a chemical agent to cause death or harm is itself a chemical weapon. Specifically, the definition is divided into three parts: toxic chemicals and their precursors, munitions or devices and equipment 'directly in connection' with munitions and devices.

Types of Chemical Weapons

The first part of the definition states that all toxic chemicals and their precursors, except when used for purposes permitted by the CWC in specified quantities, are chemical weapons. **Toxic chemicals** are defined as 'any chemical which through its chemical action on life processes can cause death, temporary incapacitation or permanent harm to humans or animals'. **Precursors** are chemicals involved in production stages for toxic chemicals. Except for very limited application for protection programmes, medical research or other permitted purposes, the production of some toxic chemicals with virtually no legitimate peaceful uses, such as sarin (GB), is banned. Determining whether genuinely dual-use chemicals are chemical weapons is more difficult. For example, chemicals such as chlorine, phosgene and hydrogen cyanide (AC)—all of which were used during World War I as chemical weapons—are also key ingredients in numerous commercial products. To make the determination, toxic dual-use chemicals are subjected to the so-called general purpose criterion.

According to the **general purpose criterion**, a toxic or precursor chemical may be defined as a chemical weapon depending on its intended purpose. Put simply, a toxic or precursor chemical is defined as a chemical weapon unless it has been developed, produced, stockpiled or used for purposes not prohibited by the Convention. The definition thus includes any chemical intended for chemical weapons purposes, regardless of whether it is specifically listed in the Convention, its Annexes or the three schedules of chemicals (see Fact Sheet 7). The CWC does not, however, expressly state what 'chemical weapons purposes' are. Instead, it lists those purposes that are not prohibited by the Convention. Hence, chemicals intended for purposes other than these are considered chemical weapons.

A basic component of the general purpose criterion is the **principle of consistency**. A toxic chemical held by a State Party and in agreement with this principle will not only be produced, stockpiled or used for a legitimate purpose, but also will be of a type and quantity appropriate for that purpose.

The second part of the Convention's definition of a chemical weapon includes any **munitions** or **devices** specifically designed to inflict harm or cause death through the release of toxic chemicals. Among these could be mortars, artillery shells, missiles, bombs, mines or spray tanks. In order to be defined as a chemical weapon, however, the items in question would have had to have been designed and built with the intent to release any of the toxic chemicals in the first part of the definition.

Thirdly and lastly, any **equipment** specifically designed for use 'directly in connection' with employment of the munitions and devices of the second part of the definition are identified as chemical weapons. As with the second part, the principle of specificity applies. Thus, only that equipment specifically designed to be used with munitions and devices or toxic chemicals and their precursors falls under the chemical weapons definition

One other definition of relevance is that of riot control agents (RCAs), the use of which as a method of warfare is prohibited by the CWC. A riot control agent is defined as 'any chemical not listed in a schedule which can produce rapidly in humans sensory irritation or disabling physical effects which disappear within a short time following termination or exposure'. Regarding herbicides, the prohibition of their use as a method of warfare is recognised in the CWC Preamble. However, herbicides are not defined specifically in the Convention and there are no specific declaration or destruction requirements related to them. Neither does the Convention define or use the term incapacitating chemical agents (ICAs). The Convention refers to toxic chemicals that can cause, inter alia, 'temporary incapacitation'. This does not preclude application of the general purpose criterion to chemicals considered as herbicides or ICAs, to the extent that they meet the definition of toxic chemicals. In other words, if the intended purpose of a toxic chemical is prohibited by the CWC, the chemical shall be considered a chemical weapon.

Also deserving of mention are toxins – toxic chemicals produced by living organisms. Although also considered to be biological weapons, toxins are addressed by the CWC. The development, production and stockpiling of toxins for purposes of warfare are prohibited under the Biological Weapons Convention (BWC). Parties to that treaty that possess toxin weapons agree to destroy them. However, inasmuch as toxins are chemicals themselves and can have chemical weapons applications, they are automatically covered by the definitions listed above for chemical weapons and toxic chemicals. (Two toxins, ricin and saxitoxin, are in fact explicitly listed in Schedule 1.) This is due to the fact that a large number

Old chemical munitions (Pierre Bogaert, SID, Belgium)

of toxins can be synthesised in laboratories without the organisms that produce them in nature. Moreover, a number of toxins are also synthetic dual-use chemicals, meaning that under the CWC, at least, amounts needed for legitimate activities are permitted.

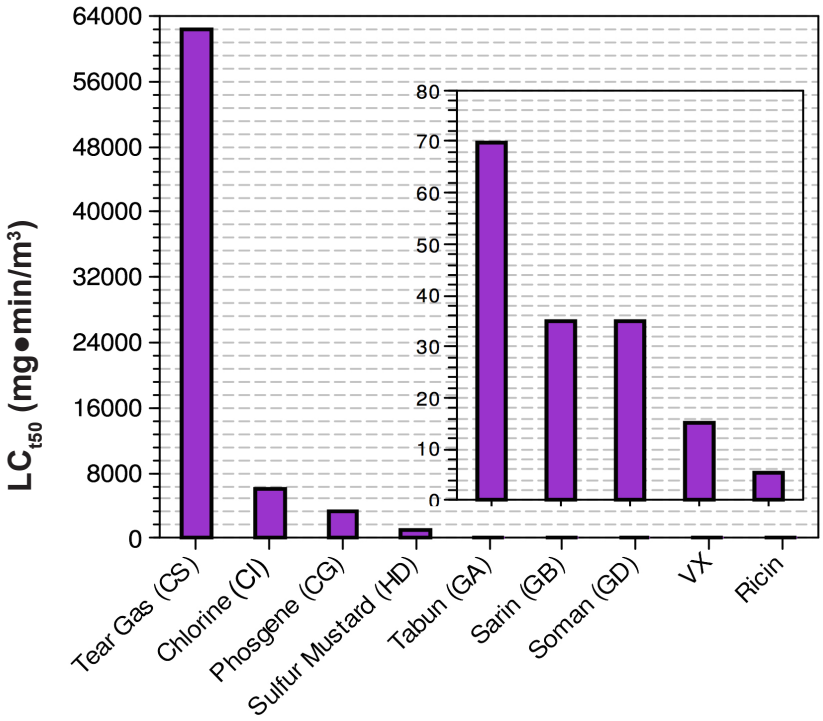
Several unresolved issues remain regarding the definition of chemical weapons. One has to do with the status of old chemical weapons. Old chemical weapons fall into two categories: 1) chemical weapons produced before 1925 and 2) chemical weapons produced between 1925 and 1946 'that have deteriorated to such an extent that they can no longer be used as chemical weapons'. Old chemical weapons of the first category may be 'destroyed or disposed of' as toxic waste in accordance with the relevant State Party's national laws after the OPCW Secretariat has confirmed that they were indeed produced before 1925. Those weapons that fall into the second category of old chemical weapons are to be destroyed in accordance with the same conditions as other chemical weapons, though the time limits and the order of destruction can be changed, subject to approval by the Executive Council. Guidelines for determining whether weapons in this category have deteriorated enough to be unusable, however, have yet to be decided, though efforts to do so are ongoing. Categorisation of such weapons therefore remains problematic.

Types of Chemical Agents

The toxic component of a chemical weapon is called its 'chemical agent'. Based on their mode of action (i.e. the route of penetration and their effect on the human body), chemical agents are commonly divided into several categories: choking, blister, blood, nerve and riot control agents.

Choking agents inflict injury mainly on the respiratory tract—that is, they irritate the nose, throat, and especially the lungs. Victims typically inhale these agents, which cause the alveoli to secrete a constant flow of fluid into the lungs, essentially drowning the victim. Examples of choking agents include: chlorine (Cl), phosgene (CG), diphosgene (DP) and chloropicrin (PS). Choking agents were among the first agents produced in large quantities. During World War I both sides used them extensively. Because they sink into and fill depressions, they were well suited to trench warfare. Their successful use on the battlefield led to research and development programmes to create even more toxic and effective chemical weapons.

Toxicity of Selected Chemical Agents



Median lethal dose, expressed as a concentration and exposure time (LC_{t50}), for selected chemical agents. LC_{t50} values represent the dose that would kill half the members of a population after a specified duration – these values should not be taken to indicate the actual dose that would kill a given individual. For purposes of comparison, the lower the value, the more toxic the agent. Values for sulfur mustard, VX and ricin are for aerosilized agent.

Blister agents, or vesicants, are one of the most common CW agents. These oily substances act via inhalation and contact with skin. They affect the eyes, respiratory tract, and skin, first as an irritant and then as a cell poison. As the name suggests, blister agents cause large and often life-threatening skin blisters which resemble severe burns. Examples include sulfur mustard (H, HD), nitrogen mustard (HN), lewisite (L) and phosgene oxime (CX). Mustard agents and lewisite are the best known. Blister agents were first tested in combat in 1917 by Germany and have been used in several conflicts since, notably in the Iran-Iraq War (1980–88). They are primarily dispersed in liquid or vapour (aerosol) form and may persist for days. Like phosgene, mustard agents have a delayed effect. Deaths typically represent only a small percentage of the casualties they cause. Exposure to blister agents often results in blindness and permanent damage to the respiratory system.

The name **blood agent**, like those of other groups of agents, derives from its effect on victims. Blood agents are distributed via the blood and generally enter the body via inhalation. They inhibit the ability of blood cells

Characteristics of Chemical Agents					
Agent	Persistency	Rate of Action	Mode of Action	Physiological Effect	Dispersal
Choking Agents • Chlorine (Cl) • Phosgene (CG) • Diphosgene (DP) • Chloropicrin (PS)	• Low • Low • Low • Low	• Variable • Delayed • Delayed • Rapid	Absorption through lungs	Fluid builds up in lungs, choking victim	Gas
Blister Agents • Sulfur mustard (H, HD) • Nitrogen mustard (HN) • Phosgene oxime (CX) • Lewisite (L)	• Very high • High • Low • High	• Delayed • Delayed • Immediate • Rapid	Absorption through lungs, skin	Burns skin, mucous membranes and eyes; causes large blisters on exposed skin; blisters windpipe and lungs; large number of casualties, low percentage of deaths	Liquid, aerosol, vapour and dust
Blood Agents • Hydrogen cyanide (AC) • Cyanogen chloride (CK) • Arsine (SA)	• Low • Low • Low	• Rapid • Rapid • Delayed	Absorption through lungs	Cyanide destroys ability of blood tissues to utilise oxygen, causing them to 'starve' and strangling the heart	Gas
Nerve Agents • Tabun (GA) • Sarin (GB) • Soman (GD) • Cyclosarin (GF) • VX	• Low • Low • Moderate • Moderate • Very high	• Very rapid • Very rapid • Very rapid • Very rapid • Rapid	Absorption through lungs (G-Series); contact with skin (VX)	Causes seizures, loss of body control; paralyses muscles, including heart and diaphragm; lethal doses can cause death in five minutes	Liquid, aerosol, vapour and dust
Riot Control Agents • Tear Gas (CS) • Pepper Spray (OC)	• Low • Low	• Immediate • Immediate	Absorption through lungs, skin, eyes	Causes tears, coughing and irritation to eyes, nose, mouth and skin; constricts airway and shuts eyes (OC)	Liquid, aerosol

to utilise and transfer oxygen. Thus, blood agents are poisons that effectively cause the body to suffocate. Examples of blood agents include: hydrogen cyanide (AC), cyanogen chloride (CK) and arsine (SA).

Nerve agents work to block impulses between nerve cells or across synapses. They act primarily via absorption through the skin and lungs. Nerve agents are divided into two main groups: G-series agents and V-series agents, so called due to their military designations.

Nerve agents are the product of the search for improved chemical agents between the two World Wars. In the late 1930s German chemists synthesised the first nerve agents, tabun (GA) and sarin (GB), which were the first of the G-series agents. Soman (GD) and cyclosarin (GF) followed quickly thereafter. British chemists developed V-series agents, which tend to be more lethal, in the 1950s. VX is the best known agent.

Some G-agents, particularly tabun and sarin, persist in the environment for only short periods. Other agents, such as soman and cyclosarin, persist longer and present a greater threat to the skin. V-agents, in comparison, are extremely potent (only milligrams needed to cause death) and persist for long periods of time on the battlefield.

Riot control agents (RCAs) such as CS were the topic of long and heated debates during CWC negotiations. At issue were their inclusion in the treaty and the restrictions that would be imposed upon their use. In the end, a compromise was reached under which States Parties are to declare to the OPCW the RCAs they possess for law enforcement purposes. Though use is allowed for these purposes, it is prohibited as a method of warfare.

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