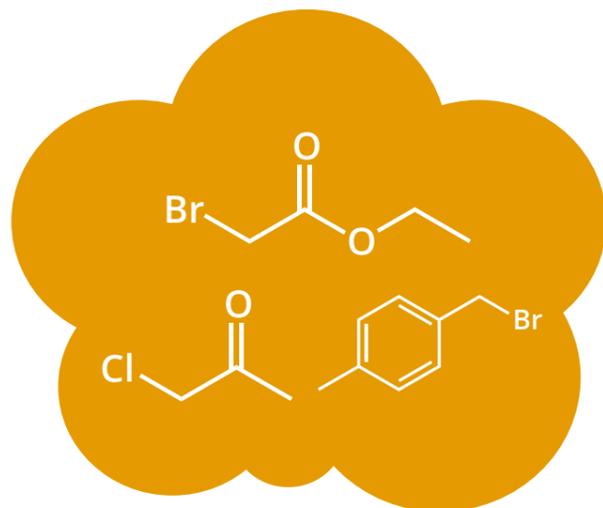




World War I saw the dawn of modern chemical warfare, with a variety of chemical agents used on a large scale. Each of these agents caused approximately 1,240,000 non-fatal casualties and 91,000 fatalities.



Tear gases

(ethyl bromoacetate, chloroacetone & xylol bromide)

Smell and appearance

Ethyl bromoacetate and chloroacetone are colourless to light yellow liquids with fruity, pungent odours. Xylol bromide is a colourless liquid with a pleasant, aromatic odour.

Effects

Tear gases are what is known as lachrymatory agents – they irritate the mucous membranes in the eyes, mouth, throat and lungs, causing crying, coughing, breathing difficulties, and temporary blindness.

First used

1914 In August 1914, the French forces used tear gas grenades against the German army, to little effect.

Estimated casualties

0 fatal These gases were used to incapacitate enemies rather than to kill. Symptoms commonly resolved within 30 minutes of leaving the affected area.



Chlorine

Smell and appearance

Chlorine is a yellow-green gas with a strong, bleach-like odour. Soldiers described its smell as "a distinct mix of pepper and pineapple".

Effects

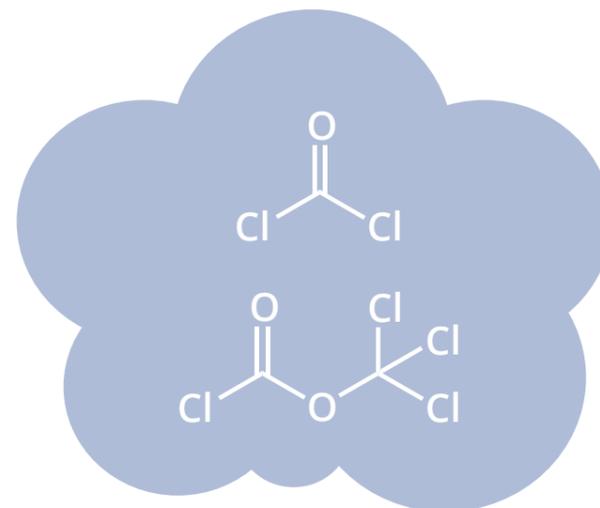
Chlorine reacts with the water in people's lungs to form hydrochloric acid. It causes coughing, vomiting, and irritation to the eyes at low concentrations, and rapid death at concentrations of 1000 parts per million.

First used

1915 Used by German forces at Ypres in April 1915. British forces used it for the first time at Loos in September 1915.

Estimated casualties

>1,100 number of fatalities in first use of chlorine at Ypres Chlorine was devastating as troops were initially unequipped to deal with it. Later, gas masks limited its effectiveness.



Phosgene and diphosgene

(carbonyl dichloride & trichloromethane chloroformate)

Smell and appearance

Phosgene is a colourless gas with a musty odour comparable to that of newly mown hay or grass. Diphosgene is a colourless, oily liquid.

Effects

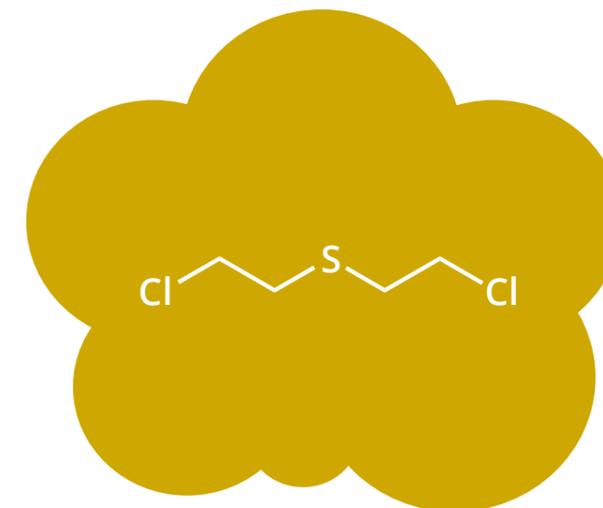
These agents react with proteins in lung alveoli. They cause coughing, difficulty breathing and irritation to the throat and eyes. Their delayed effects, not evident for 48 hours, including fluid in the lungs and death.

First used

1915 In December 1915, the German forces used phosgene against the British at Ypres.

Estimated casualties

85% of all gas-related fatalities in WWI It's estimated 85% of all gas-related fatalities in World War I resulted from phosgene and diphosgene, which were both used to fill artillery shells.



Mustard gas

(bis(2-chloroethyl) sulfide)

Smell and appearance

When pure, mustard gas is a colourless and odourless liquid, but it's used as a chemical agent in impure form. These forms are yellow-brown in colour and have an odour resembling garlic or horseradish.

Effects

Powerful irritant and vesicant (blistering agent) that can damage the eyes, skin, & respiratory tract. Causes chemical burns on contact with skin. Forms intermediates that react with DNA leading to cell death.

First used

1917 On 12th July 1917, German forces used mustard gas against the British at Ypres.

Estimated casualties

2-3% mortality rate of mustard gas casualties The mortality rate of mustard gas casualties was low, but its effects were highly debilitating, and patients required elaborate care.