
Chemical Terrorism Fact Sheet

Vesicants/Blistering Agents – Halogenated Oxime Agents: Phosgene Oxime

Protective Equipment/Detection

Ordinary clothing and surgical gear offer little or no protection against phosgene oxime, so special equipment including a respirator, NBC suit, gloves and overboots are required. It penetrates rubber faster than the mustards, so frequent changes of NBC gear are required.

There are no automatic detectors available for use in the field.

Decontamination

Decontamination of the Skin - is based on physical adsorption or on the combination of physical adsorption and chemical inactivation. Physical adsorption is achieved by adsorbing powders (talcum powder, flour, Fullers earth), while chemical inactivation is achieved with alkaline agents. Chlorinated agents such as household bleach do not work on **phosgene oxime**. Vesicants should not be decontaminated with water, except for the eyes, as this may spread the agent. Skin decontamination must take place immediately, as full absorption by the skin occurs within minutes.

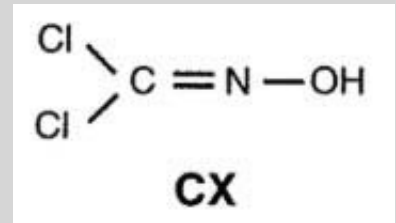
Decontamination of the Eyes - The substances used for skin decontamination are too irritating for use on the eyes. In this case the eyes should be flushed immediately with copious amounts of water or isotonic sodium bicarbonate (1.26%).

Additional Information: Clothing contaminated by liquid agent poses an immediate danger, and must be removed and double bagged to prevent exposure to off-gassing vapors.

Signs and Symptoms

Phosgene oxime in concentrations less than 8% causes little biologic damage. In higher concentrations, however, it causes more severe damage than any other vesicant. Its pain is instantaneous and severe enough that victims are likely to remove protective gear in an effort to relieve the pain. Tissue necrosis rapidly follows the pain after exposure.

Eyes: Although the immediate pain of contact to **phosgene oxime** leads to the rapid use of protective gear and decontamination, the eyes can be severely damaged with marked corneal damage and blindness. As with the other vesicants, the immediate symptoms are those of conjunctivitis, blepharospasm, blepharitis, lacrimation, and keratitis.



Phosgene Oxime Chemical Structure.
Photo courtesy of the U.S. Army Medical
Research Institute of Chemical Defense

Chemical Overview

The **halogenated oximes**, diiodoformoxime, dibromoformoxime, monochloroformoxime and dichloroformoxime, were first synthesized in the late 1920's. Dichloroformoxime is the most irritating and is commonly known as **phosgene oxime (CX)**, which must be distinguished from the pulmonary irritant phosgene (CG). It is one of the least studied chemical warfare agents, so specific information is limited.

Although classified with the blistering agents, **phosgene oxime** does not cause vesicles and is an urticant or nettle agent, rather than a true vesicant. It has also been called a corrosive agent because of the extreme damage it can do. It is categorized with these agents because it produces eye, lung, and skin damage similar to the other vesicant agents.

Phosgene oxime is a white crystalline powder that can be liquefied at room temperature. It is soluble in water and organic solvents, but hydrolyses fairly rapidly, especially in the presence of alkali. It has a high vapor pressure and can vaporize at ambient temperatures. Its odor is very unpleasant and irritating. It can be mixed with other agents, such as nerve agents, and its rapid skin damage makes the victim more susceptible to the second agent.

Prophylaxis

The only practical prophylactic method is the physical protection of a protective respirator and special clothing.

Signs and Symptoms (Continued)

Skin: Skin irritation is immediate from **phosgene oxime** exposure, and resembles stinging nettle. Contact with just a few milligrams produces an intense pain and itching, which radiates from the point of application. Within a minute the exposed area turns white and is surrounded by a circular zone of erythema to resemble a target. By this time the **phosgene oxime** is fully absorbed by the skin. Within an hour the area becomes edematous, and within 24 hours the edema resolves, the lesion becomes darkly pigmented, and severe necrosis develops. Desquamation with necrosis of the skin followed by eschar formation and a purulent discharge develops over the next 7 – 10 days. The necrotic lesion will extend into the underlying panniculus and muscle, and is surrounded by intense inflammation. The LD₅₀ for skin exposure is estimated at 25 mg/kg.

Respiratory Tract: Inhalation exposure causes immediate irritation to the respiratory tract and leads to pulmonary edema. A necrotizing bronchiolitis and pulmonary venule thrombosis may accompany the pulmonary edema. Severe skin exposures may also produce pulmonary edema and thromboses, although with a several hour delay. Irritation to exposure occurs at 0.2 mg min/m³ and becomes unbearable at 3 mg min/m³. The estimated LC_{t50} is 1500 – 2000 mg min/m³.

Systemic Action: Systemic toxicity from parenteral absorption has been described, including hepatic and vascular necrosis. While the exact mode of action is not known, the effects are believed to be the result of **phosgene oxime** reacting with SH and H₂N groups

Treatment

There is no specific treatment available for these injuries. The aim of therapy is to relieve symptoms, prevent infections, and promote healing. Necrotic skin lesions must be treated surgically, and pulmonary edema should be handled appropriately. Recovery typically takes from 1 to 3 months, but some burns can take more than 6 months to heal.

Caveats:

Eyes: Do not use topical anesthetics for pain relief, as they may increase corneal damage. Use systemic, narcotic analgesics when needed. Similarly, do not bandage the eyes; use dark, protective goggles.

GI: Data on the ingestion of phosgene oxime is scant, but do not induce emesis. If the victim is able, give 4-8 ounces of milk or water. There is no data on the use of activated charcoal.

Long-term Medical Sequelae

The long-term medical sequelae are unknown but believed to be related to the initial acute injuries. Its carcinogenicity and reproductive effects are unknown.

Environmental Sequelae

Phosgene oxime is highly reactive and volatile, and is considered a nonpersistent agent that is unlikely to produce environmental hazards.

Additional information and references available at <http://www.bioterrorism.slu.edu>

Disclaimer

Information contained in this fact sheet was current as of August 2002, and was designed for educational purposes only. Medication information should always be researched and verified before initiation of patient treatment.