
Information and recommendations for first responders

- Before approaching the patient, the first responder must make sure that he does not risk exposing himself to chloroformates.
 - Patients exposed only to chloroformates gas do not pose a significant risk of secondary contamination. Patients whose clothing or skin is contaminated with liquid chloroformates or solvents containing chloroformates can secondarily contaminate rescue and medical personnel by direct contact or through off-gassing chloroformates.
 - Chloroformates irritate lungs severely. Because of its slow hydrolysis in the alveoli, serious lung effects and, therefore, symptoms of toxicity may be delayed up to 24 hours. Signs of accumulation of fluid in the lungs (shortness of breath, cyanosis, expectoration, cough) do not usually appear for hours after even severely toxic exposures.
 - There is no antidote to be administered to counteract the effects of chloroformates. Treatment consists of supportive measures.
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1. Substance information

Methyl chloroformate (CH₃-OCOCI), CAS 79-22-1

Synonyms: chloroformic acid methyl ester, methoxycarbonyl chloride

Methyl chloroformate is a colorless-yellow clear liquid at room temperature with a melting point of -61 °C and a boiling point of 71°C.

Ethyl chloroformate (C₂H₅-OCOCI), CAS 541-41-3

Synonyms chloroformic acid ethyl ester, ethoxycarbonyl chloride

Ethyl chloroformate is a colorless-yellow clear liquid at room temperature with a melting point of -80°C and a boiling point of 93°C.

2-Ethylhexyl chloroformate (C₈H₁₇-OCOCI), CAS 24468-13-1

Synonyms: chloroformic acid 2-ethylhexyl ester, 2-ethoxyhexylcarbonyl chloride

2-Ethylhexyl chloroformate is a colorless-yellow clear liquid at room temperature with a melting point of -55 °C and a boiling point of 100 °C.

Isopropyl chloroformate (C₃H₇-OCOCI), CAS 108-23-6

Synonyms chloroformic acid isopropyl ester, isopropoxycarbonyl chloride

Isopropyl chloroformate is a colorless-yellow clear liquid at room temperature with a melting point of -70°C and a boiling point of 34°C.

Butyl chloroformate (C₄H₉-OCOCI), CAS 592-34-7

Synonyms: chloroformic acid butyl ester, butoxycarbonyl chloride

Butyl chloroformate is a colorless-yellow clear liquid at room temperature with a melting point of -70°C and a boiling point of 138°C.

Methyl chloroformate is the methyl ester of chloroformic acid, a phosgene derivative. Methyl chloroformate should not be confused with methyl chloroform (1,1,1-trichloroethane).

Often chloroformates are used as a solution in organic solvents. Their odor is pungent and can be sharp and suffocating. Chloroformates are hydrolyzed slowly by moisture to form hydrochloric acid.

Chloroformates are used as an intermediate in the manufacture of many chemicals including isocyanates, polyurethane, polycarbonates, dyes, crop protection products, and pharmaceuticals.

2. Routes of exposure

Inhalation

Most exposures occur by inhalation or by skin/eye contact.

Chloroformates' odor may provide insufficient warning of hazardous exposure that can occur even at low concentrations. Its irritating quality can be mild and delayed, which may allow persons to be exposed for prolonged intervals. Chloroformates are heavier than air and may travel along the ground.

Skin/eye contact

Chloroformates can cause irritation and burns of wet or moist skin and the eyes. Dermal absorption may occur.

Ingestion

Accidental ingestion of chloroformates may occur and may cause irritation of the mouth, throat and stomach.

3. Acute health effects

Chloroformates exposure usually causes eye, nose, throat, and lung irritation. **Irritating effects immediately after exposure might be mild, but severe delayed lung damage can occur as late as 24 hours after exposure.** Chloroformates poisoning may cause respiratory and cardiovascular failure.

If the skin is wet or moist, contact with chloroformates can cause irritation and redness of the skin.

High gas concentrations may cause tearing and redness of the eye. Eye contact with liquid chloroformates may result in clouding of the eye surface and delayed perforation.

4. Actions

Rescuer self-protection

If the zone which has to be entered by the rescuer is suspected of containing chloroformates, pressure-demand, self-contained breathing apparatus and chemical-protective clothing shall be worn; do not use equipment that is contaminated itself.

Patients exposed only to chloroformates gas do not pose a significant risk of secondary contamination. Patients whose clothing or skin is contaminated with liquid chloroformates or solvents containing chloroformates can secondarily contaminate other people by direct contact or through off-gassing chloroformates.

Patient recovery

Patients should be removed from the contaminated zone immediately. Patients who are unable to walk may be removed on backboards or stretchers; if these are not available, carefully remove/transport patients with appropriate action to a safe zone, taking into account your self-protection.

Immediate priorities must follow the "A, B, C's" of resuscitation:

- A) Airway** (make sure the airway is not blocked by the tongue or by a foreign body)
- B) Breathing** (check to see if the patient is breathing, provide ventilations with use of appropriate barrier devices, e.g. with a pocket face mask, if breathing is absent)
- C) Circulation** (start CPR in any unresponsive person with absent or abnormal breathing)

Decontamination

Patients exposed only to chloroformates gas who have no evidence of skin or eye irritation do not need decontamination. All others require decontamination.

Patients who are able and cooperative may assist with their own decontamination. If the exposure involved liquid chloroformates or solvents containing chloroformates and if clothing is contaminated, remove and double-bag the clothing.

Flush exposed skin and hair with plain water for at least 15 minutes. Protect eyes during flushing of skin and hair. Continue other basic care during flushing.

Irrigate exposed or irritated eyes with plain water or saline for at least 15 minutes. Remove contact lenses if present and easily removable without additional trauma to the eye. Continue other basic care during flushing.

Further actions

Each potentially exposed person should seek immediate medical advice and treatment.

In this document BASF has made a diligent effort to ensure the accuracy and currency of the information presented but makes no claim that the document comprehensively addresses all possible situations related to this topic. This document is intended as an additional resource for first responders in assessing the condition and managing the treatment of patients exposed to Chloroformate. It is not, however, a substitute for the judgement of a first responder and must be interpreted in the light of specific information regarding the patient available to such a first responder and in conjunction with other sources of authority.

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