
Information and recommendations for doctors at hospitals/emergency departments

- Patients exposed only to tetrahydrofuran vapor do not pose a significant risk of secondary contamination. Patients whose clothing or skin is contaminated with liquid tetrahydrofuran (boiling point 66°C, 150.8°F respectively) can secondarily contaminate rescue and medical personnel by direct contact or evaporation of tetrahydrofuran.
 - Tetrahydrofuran is irritating (defatting) when it comes in contact with the eyes, skin, and throat and causes headache, nausea, vertigo, dizziness, weakness, disorientation, and unconsciousness. Central and peripheral neuropathy has been noted.
 - There is no antidote to be administered to counteract the effects of tetrahydrofuran. Treatment consists of supportive measures.
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1. Substance information

Tetrahydrofuran (C₄H₈O), CAS 109-99-9

Synonymes: Cyclotetramethylene oxide, THF, tetramethylene oxide

Tetrahydrofuran is, at room temperature, a clear, colorless liquid with a boiling point of 66°C, 150.8°F, respectively. Both vapor and liquid are potential fire and explosion hazards. Tetrahydrofuran has an acetone or ether-like odor and an odor threshold of 2 – 7.4 ppm. It is miscible with water and common organic solvents. Tetrahydrofuran may decompose into explosive peroxides and carbon monoxide.

Tetrahydrofuran is an organic solvent for natural and synthetic polymers and resins. It is used in the manufacture of lacquers, glues, paint, and ink and wetting and dispersing agents in textile processing.

2. Routes of exposure

Inhalation

Most exposures occur by inhalation. Tetrahydrofuran is readily absorbed by the respiratory tract.

Skin/eye contact

It is absorbed through the skin causing systemic effects

Ingestion

Tetrahydrofuran is absorbed from the gastrointestinal tract. However, ingestion is uncommon in occupational settings, but may be aspirated.

3. Acute health effects

Systemic

Tetrahydrofuran causes headache, nausea, vertigo, dizziness, weakness, disorientation, and unconsciousness. Acute exposure to high concentrations may produce signs of upper respiratory irritation, followed by asphyxia, muscular weakness, cardiac arrhythmia, coma and death from respiratory paralysis. Central and peripheral neuropathy and alterations in liver enzymes have been noted after long-term exposure.

Respiratory

Tetrahydrofuran can irritate the upper respiratory tract.

Dermal

Irritation (defatting) of the skin may be caused by direct contact to liquid tetrahydrofuran.

Ocular

Eye contact to vapor or liquid tetrahydrofuran causes burning discomfort, spasmodic blinking or involuntary closing of the eyelids, redness, and tearing.

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Dose-effect relationships

Dose-effect relationships are as follows:

<u>Tetrahydrofuran concentration</u>	<u>Effect</u>
2 – 7.4 ppm	- Odor threshold
50 ppm	- Limit value 8 hours (European Union)
100 ppm	- Limit value short term (European Union)
200 ppm	- Limit value 8 hours (USA - NIOSH, OSHA)
250 ppm	- Limit value short term (USA - NIOSH)
2,000 ppm	- IDLH (NIOSH)
25,000 ppm	- anesthesia

Potential sequelae

If the patient survives the initial 48 hours after inhalation exposure, recovery is likely. After acute exposure, pulmonary function usually returns to normal in 7 to 14 days. Complete recovery is usual; however, symptoms and pulmonary deficits may persist. Pulmonary tissue destruction and scarring may lead to chronic dilation of the bronchi and increased susceptibility to infection. Central nervous system, liver and kidney impairment may occur in chronically exposed workers.

4. Actions

Decontamination

Patients exposed to tetrahydrofuran require decontamination. Patients who are able and cooperative may assist with their own decontamination. If clothing is contaminated, remove and double-bag the clothing.

Assure that exposed or irritated eyes have been irrigated with plain water or saline for at least 20 minutes. If not, continue eye irrigation during other basic care.

Remove contact lenses if present and easily removable without additional trauma to the eye.

Assure that exposed skin and hair have been flushed with plain water for at least 15 minutes. If not, continue flushing during other basic care. Protect eyes during flushing of skin and hair.

Assure that following ingestion mouth was rinsed with plenty of water and afterwards 200-300 ml of water has been administered. Emesis is not recommended due to the potential for esophageal irritation and aspiration.

Initial treatment

Therapy will be empiric; there is no specific antidote to counteract the effects of tetrahydrofuran.

If inhalational exposure exceeds 50-200 ppm (for 15 minutes or more), if symptoms, e. g. eye irritation or pulmonary symptoms have developed, or if no exposure concentration can be estimated but exposure has possibly occurred:

- **Administration of oxygen**
- **Administration of 8 puffs of beclomethasone (800 µg beclomethasone dipropionate) from a metered dose inhaler.**

Patients with severe clinical respiratory symptoms (e.g. bronchospasms, stridor) should be treated as follows:

a) Nebulization of adrenaline (epinephrine): 2 mg adrenaline (2 ml) with 3 ml NaCl 0.9% and inhale through a nebulizer mask.

b) Administration of a β 2-selective adrenoceptor agonist, e.g., four strokes of terbutaline or salbutamol or fenoterol (one stroke usually contains 0.25 mg of terbutaline sulfate; or 0.1 mg of salbutamol; or 0.2 mg of fenoterol); this may be repeated once after 10 minutes. Alternatively, 2.5 mg salbutamol and 0.5 mg atrovent may be administered by nebulizer mask.

If inhalation is not possible, administration of terbutaline sulfate (0.25 mg to 0.5 mg) subcutaneously or salbutamol (0.2 mg to 0.4 mg over 15 minutes) intravenously.

c) Intravenous administration of 250 mg methylprednisolone (or equivalent steroid dose).

Patients with clinical signs of a toxic lung edema (e.g. foamy sputum, wet crackles) should be treated as follows:

- a) Start CPAP-therapy (Continuous Positive Airway Pressure Ventilation).
- b) Intravenous administration of 1000 mg methylprednisolone (or an equivalent steroid dose) is recommended.

Intubation of the trachea or an alternative airway management should be considered in cases of respiratory compromise. When the patient's condition precludes this, consider cricothyrotomy if equipped and trained to do so.

Note: Efficacy of corticosteroid administration has not yet been proven in controlled clinical studies.

If tetrahydrofuran gas or liquid tetrahydrofuran has been in contact with the skin, irritations may result; treat as thermal burns.
After eye exposure, irritation may result; treat as thermal burns.
Immediately consult an ophthalmologist.

Laboratory tests

The diagnosis of acute tetrahydrofuran toxicity is primarily a clinical one, based on the irritation and CNS effects together with known or strongly suspected tetrahydrofuran exposure.

Further evaluation and treatment

Standard exposure history, physical examination, and vital signs, and spirometry should be obtained. Routine laboratory studies should include a complete blood count, blood glucose and electrolyte determinations.

Prophylactic antibiotics are not routinely recommended but may be used based on clinical signs of pneumonia.

Patient release/ follow-up instructions

Clinically asymptomatic patients exposed to a concentration of less than **100-250 ppm** (and less than 15 minutes) **as well as patients who have a normal clinical examination and no signs or symptoms of toxicity may be discharged after an appropriate observation period in the following circumstances:**

- a) The evaluating physician is experienced in the evaluation of individuals with tetrahydrofuran exposure.
- b) Information and recommendations for patients with follow-up instructions are provided verbally and in writing. Patients are advised to seek medical care promptly if symptoms develop or recur.
- c) The physician is comfortable that the patient understands the health effects of tetrahydrofuran.
- d) Site medical is notified, so that the patient may be contacted at regular intervals in the 24-hour period following release from the emergency department
- e) Drinking of alcoholic beverages should be forbidden for at least 72 hours.
- f) Heavy physical work should be precluded for 24 hours.
- g) Exposure to cigarette smoke should be avoided for 72 hours; the smoke may worsen the condition of the lungs.

Patients who have serious skin or eye injuries should be reexamined in 24 hours.

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 doctors at hospitals/emergency departments in assessing the condition and managing the treatment of patients exposed to Tetrahydrofuran. It is not, however, a substitute for the professional judgement of a doctor and must be interpreted in the light of specific information regarding the patient available to such a doctor and in conjunction with other sources of authority.

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