



COLUMBIA UNIVERSITY
ENVIRONMENTAL HEALTH AND SAFETY
Post Exposure **PRINT & GO** Sheet

Tetramethylammonium hydroxide (TMAH) post-exposure guidance

Created: 3/22/2024

Revised: / /

What are print and go sheets?

Following an occupational exposure to the agent identified above, this information sheet identifies the immediate “first aid” actions that should be taken. A medical evaluation should be sought immediately following the exposure. The guidance sheet provides information that medical personnel can reference but does not provide individualized medical care or treatment instructions. This sheet should be printed and taken to the medical provider. Also, display your Columbia University ID card while visiting the medical provider.

Agent: Tetramethylammonium hydroxide (TMAH) is a quaternary ammonium salt with molecular formula $N(CH_3)_4^+ OH^-$. It is commonly encountered in the form of concentrated solutions in water or methanol. TMAH in solid state and its aqueous solutions are all colorless but may be yellowish if impure. TMAH is most commonly in an aqueous solution, in concentrations from ~2–25%. Human fatalities have been reported for concentrations as low as 8%, and 25% could be fatal with ~4-9% body surface area exposure.

Routes of exposure: Inhalation, ingestion, absorption (eyes), dermal contact.

Mode of action: TMAH is a basic quaternary ammonium compound. The tetramethylammonium ion affects nerves and muscles, causing difficulties in breathing, muscular paralysis and possibly death. It is structurally related to acetylcholine, an important neurotransmitter at both the neuromuscular junction and autonomic ganglia. This structural similarity is reflected in its mechanism of toxicity – it binds to and activates the nicotinic acetylcholine receptors, although they may become desensitized in continued presence of the agonist. The action is most pronounced in autonomic ganglia, and so it is traditionally classified as a ganglion-stimulant drug.

Immediate actions to be taken in the event of exposure:

Dermal contact: Immediately flush skin with running water for at least 15 minutes, using a safety shower if available. Quickly remove all contaminated clothing.

Absorption(eyes): Immediately flush eye with running water for at least 15 minutes, using an eyewash if available. Remove contact lenses, if present and easy to do.

Inhalation: Remove person to fresh air and keep comfortable for breathing.

Ingestion: Rinse mouth. Do NOT induce vomiting. Swallow promptly a large quantity of milk, egg whites / gelatin solution. If not readily available, a slurry of activated charcoal may be useful.

In all exposures, self-transport to hospital with a buddy. If self-transport is not possible, call 911:

Morningside/Manhattanville Campus: Go to the Mount Sinai Morningside Hospital (212-523-3335) Emergency Room (ER).

CUIMC Campus: Go to the New York Presbyterian Hospital Emergency Room (ER).

1. U.S. National Library of Medicine. Tetramethylammonium hydroxide. National Center for Biotechnology Information. PubChem Compound Database.

<https://pubchem.ncbi.nlm.nih.gov/compound/Tetramethylammonium-hydroxide#section=Fire-Hazards>

2. Huang, C.-K., Hall, A. H., Wu, M.-L., Yang, C.-C., Hung, D.-Z., Mao, Y.-C., & Deng, J.-F. (2020a). Presentations of tetramethylammonium hydroxide dermal exposure and the valuable potential of diphoterine solution in decontamination: A retrospective observational study. BMC Pharmacology and Toxicology, 21(1). <https://doi.org/10.1186/s40360-020-00465-8>

3. ERG Guidebook. <https://www.phmsa.dot.gov/foia>

4. Tetramethylammonium Hydroxide Safety Data Sheet, accessed through ChemWatch: <https://ir.chemwatch.net/chemwatch/web/home>

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Information to be conveyed to the medical provider:

- Give this sheet to the physician so they understand that you have just been exposed to TMAH, and this is a medical emergency. A copy of the safety data sheet must also be provided.
- Indicate the concentration of TMAH exposure, area of exposure, duration of exposure, and first aid action taken.

Symptoms: Toxicity depends on concentration and body surface area exposure percentage.

- Based on exposure, skin burns, and eye damage can occur.
- At high concentrations, it may cause cough, wheezing, and fluid in the lungs¹.
- Systemic toxicity can also occur with symptoms such as weakness, excessive salivation, dyspnea, and cardiac arrest².
- Effects of exposure (inhalation, ingestion, or skin contact) to substance may be delayed³.

Counter measures/tests available to the physician:

- There is no known antidote for TMAH toxicity.
- Immediate decontamination is essential to prevent or reduce the effect of systemic toxicity.
- Ensure airway patency and supply supplemental oxygen and mechanical ventilation as soon as possible - this may be lifesaving in patients with TMAH poisoning².
- As reaction may be delayed up to 24 hours after exposure, affected individuals need complete rest and must be kept under medical observation even if no symptoms are (yet) manifested⁴.
- **If ingestion occurs:** Because of probable mucosal damage omit gastric lavage and emetic drugs. For dilute solutions (2% or less): If little or no emesis appears spontaneously, administer syrup of Ipecac or perform gastric lavage. If hypotension becomes severe, institute measures against circulatory shock. Persistent convulsions may be controlled by cautious intravenous injection of diazepam or short-acting barbiturate drugs⁴.

Documentation and reporting

Notify supervisor and EH&S of incident. All exposure incidents must be documented and warrant an accident investigation. Any loss of limb, eye, or admittance into hospital requires a notification to OSHA within 24 hours of incident.

Additional Resources

- Safety Data Sheet: <https://www.sigmaaldrich.com/US/en/sds/sigma/t7505>

Contact information: Environmental Health & Safety (EH&S) - Mon. - Fri: 9 am - 5 pm. Medical Center - (212) 305-6780, Morningside - (212) 854-5555, Manhattanville - (212) 853-3333
CUIMC Office of Workforce Health and Safety - (646)697-9470. Mon., Tues., Fri 7:30 am - 4:00 pm, Weds. 7:00 am - 6:45 pm, Thurs. 7:30 am - 11:30 am.
Public Safety can contact EH&S after business hours.

1. U.S. National Library of Medicine. Tetramethylammonium hydroxide. National Center for Biotechnology Information. PubChem Compound Database.

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3. ERG Guidebook. <https://www.phmsa.dot.gov/foia>

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