Standard Operating Procedure

**Tetramethylammonium hydroxide (TMAH)**

*This is an SOP template and is not complete until: 1) lab specific information is entered into the box below 2) lab specific protocol/procedure is added to the protocol/procedure section and
3) SOP has been signed and dated by the PI and relevant lab personnel.*

 Print a copy and insert into your
*Laboratory Safety Manual* and *Chemical Hygiene Plan*.
Refer to instructions for assistance.

|  |  |
| --- | --- |
| **Department:** | Click here to enter text. |
| **Date SOP was written:** | Click here to enter a date. |
| **Date SOP was approved by PI/lab supervisor:** | Click here to enter a date. |
| **Principal Investigator:** | Click here to enter text. |
| **Internal Lab Safety Coordinator/Lab Manager:** | Click here to enter text. |
| **Lab Phone:** | Click here to enter text. |
| **Office Phone:** | Click here to enter text. |
| **Emergency Contact:** | Click here to enter text. |
| *(Name and Phone Number)* |
| **Location(s) covered by this SOP:** | Click here to enter text. |
| *(Building/Room Number)* |

**Type of SOP:** [ ]  Process [x] Hazardous Chemical [ ]  Hazardous Class

**Purpose**

Tetramethylammonium hydroxide (TMAH) is a corrosive and highly toxic chemical. If not stored and handled properly, this can pose a serious threat to the health and safety of laboratory personnel, emergency responders and chemical waste handlers. Hence, it is important to follow safety protocols to handle this chemical.

Tetramethylammonium hydroxide is a quaternary ammonium salt. It is used as an anisotropic etchant of silicon. It is also used as a basic solvent in the development of acidic photoresist in the photolithography process. Since it is a phase transfer catalyst, it is highly effective in stripping photoresist. It is also used as a surfactant in the synthesis of ferrofluid, to prevent agglomeration.

Also known as Tetramethylammonium hydroxide 20% in methanol; TMAH 25%; Methanaminium; Ammonium tetramethyl hydroxide.

**Physical & Chemical Properties/Definition of Chemical Group**

CAS#: 75-59-2

Class: Poison

Molecular Formula: (CH3)4NOH

Form (physical state): Liquid

Color: Colorless or straw-colored

Boiling point: 60-65° C

**Potential Hazards/Toxicity**

**Inhalation:** Extremely destructive to tissues of the mucous membranes and upper respiratory tract. May produce upper airway edema, respiratory failure, pulmonary edema and pnemonitis. Symptoms may include burning, wheezing, laryngitis, shortness of breath. Toxic effects from the Methanol component are exerted upon nervous system, particularly the optic nerve. Once absorbed into the body, it is very slowly eliminated. Symptoms of overexposure may include headache, drowsiness, nausea, vomiting, blurred vision, blindness, coma, and death. A person may get better but then worse again up to 30 hours later.

**Ingestion:** Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach. Can cause sore throat, vomiting and diarrhea. Methanol component is Toxic. Symptoms parallel inhalation. Can intoxicate and cause blindness.

**Skin Contact:** Corrosive. Symptoms of redness, pain, and severe burn can occur. Methanol component is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure.

**Eye Contact:** Corrosive. Contact can cause blurred vision, redness, pain and severe tissue burns.

**Chronic Exposure:** Marked impairment of vision has been reported. Repeated or prolonged exposure may cause skin irritation.

**Aggravation of Pre-existing Conditions:** Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance.

**Personal Protective Equipment (PPE)**

**Respiratory Protection**

If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, air-lined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134).

Respirators should be used only under any of the following circumstances:

* As a last line of defense (i.e., after engineering and administrative controls have been exhausted).
* When Permissible Exposure Limit (PEL) has exceeded or when there is a possibility that PEL will be exceeded.
* Regulations require the use of a respirator.
* An employer requires the use of a respirator.
* There is potential for harmful exposure due to an atmospheric contaminant (in the absence of PEL).
* As PPE in the event of a chemical spill clean-up process.

Lab personnel intending to use/wear a respirator mask must be trained and fit-tested by ORS and should contact occhealt@uga.edu. This is a UGA requirement described in more detail in the [UGA Respiratory Protection Plan](https://esd.uga.edu/sites/default/files/respiratoryprotection.pdf) and supported by the [Office of Research Occupational Health and Safety Program](https://research.uga.edu/ohsp/).

**Hand Protection**

Disposable nitrile gloves may only provide brief protection and must be replaced if they become wetted. More protective gloves are the Stansolv or Tri-Ionic glove models sold by MAPA. Tri-Ionic clean room gloves provide excellent protection from TMAH exposure.

NOTE: Consult with your preferred glove manufacturer to ensure that the gloves you plan on using are compatible with tetramethylammonium hydroxide (TMAH).

Refer to glove selection chart from the links below:

<http://www.ansellpro.com/download/Ansell_8thEditionChemicalResistanceGuide.pdf>

OR

<http://www.allsafetyproducts.biz/page/74172>

OR

<http://www.showabestglove.com/site/default.aspx>

OR

<http://www.mapaglove.com/>

**Eye Protection**

Wear safety goggles (not glasses).

**Skin and Body Protection**

Wear a buttoned lab coat, full-length pants, and closed-toe shoes.

**Hygiene Measures**

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

**Engineering Controls**

Tetramethylammonium hydroxide (TMAH)must be handled under a certified chemical fume hood.

**First Aid Procedures**

**If inhaled**

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

**In case of skin contact**

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.

**In case of eye contact**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

**If swallowed**

If swallowed, Do NOT induce vomiting. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

**Special Handling and Storage Requirements**

**Stability:** Stable under ordinary conditions of use and storage. Readily absorbs CO2 from the air.
**Hazardous Decomposition Products:** Carbon oxides, nitrogen oxides and formaldehyde gas form when heated to decomposition.
**Incompatibilities:** Strong acids and oxidizing agents; attacks many plastics and rubber. May react with metallic aluminum and generate hydrogen gas.
**Conditions to Avoid:** Heat, flames, ignition sources and incompatibles.

**NOTE:** You should NOT handle TMAH containing materials when working alone. Have lab buddy system in place.

**Spill and Accident Procedure**

**Chemical Spill Dial 911**

**24-7 On-Call Response to Research, Environment, Health or Safety Concerns Dial 2-5561 from a campus phone or 706-542-5561 from a non-campus line.**

**Spill** – Follow the procedures set out in the [UGA Chemical and Laboratory Safety Manual.](http://research.uga.edu/docs/units/safety/manuals/Chemical-Laboratory-Safety-Manual.pdf)

[If there are any chemical-specific protocols for responding to a spill, insert them here or mark “none”:]

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# **Medical Emergency Dial 911**

**Life Threatening Emergency, After Hours, Weekends And Holidays** – Dial **911** or the emergency phone numbers listed at the beginning of the UGA Chemical and Laboratory Safety Manual

*Note: All incidents that result in an injury or property damage must be reported to ORS / ESD using a University Incident/Accident Report.*

**Non-Life Threatening Emergency** – Follow the instructions in the UGA Chemical and Laboratory Safety Manual.

*Note: All incidents that result in an injury or property damage must be reported to ORS / ESD using a University Incident/Accident Report.*

**Decontamination/Waste Disposal Procedure**

**For general hazardous waste disposal procedures, see Appendix H of the UGA Chemical and Laboratory Safety Manual.**

**Chemical Specific Procedures: [to be inserted or marked as “none”]**

* Store the Tetramethylammonium hydroxide (TMAH) container away (segregate) from acids, acid waste and oxidizing chemicals/agents.
* Use secondary containment (Nalgene or polypropylene tray/tub) when storing the waste.
* Add the TMAH waste into the container inside the fume hood by using a funnel.
* Close the container immediately after adding waste.
* Use appropriate PPE when handling TMAH waste, as recommended in the PPE section of this SOP.

**Safety Data Sheet (SDS) Location**

UGA personnel can access Online SDS through a link in the upper left corner of the ESD home page (<https://esd.uga.edu>) and logging in by using their UGA email user name and password.

**Protocol/Procedure (Add lab specific Protocol/Procedure here)**

Click here to enter text.

**NOTE**

Any deviation from this SOP requires approval from PI.

**Documentation of Training** (signature of all users is required)

* Prior to conducting any work with Tetramethylammonium hydroxide (TMAH), designated personnel must provide training to his/her laboratory personnel specific to the hazards involved in working with this substance, work area decontamination, and emergency procedures.
* The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and access to the SDS provided by the manufacturer.
* The Principal Investigator must ensure that his/her laboratory personnel have attended appropriate laboratory safety training or refresher training within the last 12 months.

**Principal Investigator SOP Approval**

Print name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Signature\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Approval Date:

I have read and understand the content of this SOP:

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| --- | --- | --- |
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