# University of Arizona

## Tetramethylammonium Hydroxide Standard Operating Procedure

*[This is a template. Fill in all necessary blanks and delete all highlighted areas when complete. Add any sections necessary for your laboratory. This will be appended to your Laboratory Chemical Hygiene Plan.]*

**Title:**  **Click here to enter the title of your SOP.**

**Approval Holder (AH):** Click here to enter text **Approval #:** Click here to enter text

**Approval Holder Phone Number(s):** Click here to enter text

**Approval Safety Coordinator (ASC):** Click here to enter text

**Approval Safety Coordinator Phone Number(s):** Click here to enter text

**Department:** Click here to enter text

1. **Purpose**

This standard operating procedure (SOP) is intended to provide guidance on how to safely store, handle, use, and dispose tetramethylammonium hydroxide (TMAH) in Enter AH’s name’s laboratory. Laboratory personnel should review this SOP, as well as the appropriate Safety Data Sheet(s) (SDSs), before Describe the procedure or process this SOP will address. If you have questions concerning the requirements within this SOP, contact your Approval Holder (AH) or Approval Safety Coordinator (ASC).

1. **Scope**

*[Describe when this SOP applies and to whom this SOP applies.]*

1. **Hazard Description**

*[Describe the hazards presented by the procedure or process this SOP addresses. What makes it hazardous? Provide an example, if applicable.]*



Tetramethylammonium hydroxide (TMAH) is a quaternary ammonium strong base commonly used for etching. It is a corrosive and acute toxicant. TMAH is available in solution and in the pentahydrate form as a white crystalline solid. The odor can be described as a strong, ammonia like smell. Although pure TMAH will have virtually no odor, solutions may give off a fishy smell. When heated to decomposition, TMAH emits toxic vapors of nitrogen oxides (NOx) and ammonia, which can both cause lung irritation, acutely (ammonia) and in a delayed reaction (NOx), and burns. TMAH solution is stable under ordinary conditions of use and storage. TMAH is incompatible with strong acids and oxidizers and will reacts vigorously. It will attack many plastics and rubbers. It may react with metallic aluminum and generate hydrogen gas, which is flammable.

Exposures can cause severe eye damage and/or skin burns. Dermal exposures to concentrations as low as 25% have resulted in death. If TMAH is inhaled, mild exposure may cause cough and bronchospasms while severe inhalation (greater than 4 hours) may cause upper airway edema, burns, stridor (high pitched sound wheezing sound caused by disrupted airflow), and rarely acute long injury. Ocular exposure can produce severe conjunctival irritation and chemosis, corneal epithelial defects, limbal ischemia, permanent visual loss and in severe causes perforation.

1. **Process & Hazard Controls**

*[Describe the steps needed to set up and complete the procedure or process in safe manner following the* [*hierarchy of controls*](https://www.cdc.gov/niosh/topics/hierarchy/default.html)*. Use as much detail as is necessary to ensure all laboratory workers can complete the procedure or experiment safely.]*

* 1. **Elimination/Substitution**

*[Describe any eliminations of hazardous chemicals or processes; alternatively, any substitutions with less hazardous alternatives that could be used to accomplish the task.]*

* When possible, substitute TMAH with KOH, Triton Surfactant or a similar etchant. TBAH and TPAH are alternatives that can be used for aqueous solutions.
  1. **Engineering Controls**

*[Describe any engineering controls (e.g. fume hoods, gas cabinets, local exhausts, blast shields, etc.) that are used to safely accomplish the task.]*

* All operations involving TMAH should be carried out in a certified chemical fume hood, under a local exhaust with adequate capture velocity, or another RLSS approved ventilated enclosure to keep airborne level below recommended exposure limits and prevent irritations or burns.
  + Contact RLSS for assistance in choosing the correct ventilated device for your specific application.
* Double containment with liquid leak detection
* Interlocks enclosures that terminate chemical delivery upon system breach
* Splash guard
  1. **Work Practices**

*[Describe any work practices (e.g. staggering schedules, additional cleaning measures for particulates, etc.) that are used to safely accomplish the task.]*

* Where possible, automatically pump liquid TMAH from storage containers to process containers.
* Do not work alone.
* Implement a buddy system, which may include in-person buddy and/or a live remote buddy.
  1. **Personal Protective Equipment**

*[Describe the personal protective equipment needed to adequately protect laboratory workers when performing the process or procedure addressed by this SOP. Ensure to specify any personal protective equipment beyond the minimum (i.e. safety glasses, lab coat, gloves, long pants and closed-toed shoes).]*

* **Hand and Arm Protection**: Elbow-length, acid resistant gloves should always be used when creating, working with, or cleaning up.
* **Face and Eye Protection**: Safety goggles are a minimum protection; the use of a face shield with eye protection is strongly recommended to protect both the eyes and face from splashes.
* **Body Protection**: A 100% cotton lab coat should be used and can be combined with an acid resistant apron to prevent exposure to the body.
* **Respiratory Protection**: All respiratory protection requires RLSS assessment and approval; for exposures that require respiratory protection, contact RLSS at [rlss-chem-support@arizona.edu](mailto:rlss-chem-support@arizona.edu).
  1. **Transportation and Storage**

*[Describe how to safely transport and/or store (e.g. ventilated cabinet, flammable cabinet, under inert blanket, etc.) the hazardous chemical(s) or processes.]*

* Store in secondary containment away from acids, oxidizing agents and any other materials that may be chemically incompatible.
* Each container’s label, both original and secondary or temporary, must be ocmpliant with GHS and include appropriate pictograms that identify the material as both acutely toxic and corrosive.
* Containers of TMAH must be stored in leak-proof secondary containment within a posted Designated Area.



* Also, if not plainly visible (e.g., through a cabinet window), labeling must be applied to storage locations where these are stored to avoid an inadvertent encounter.

1. **Spills, Cleanup & Disposal**

*[Describe how to safely end the procedure or process, clean up the process or spills, and/or dispose of any waste generated.]*

Spill response should always follow the [University Chemical Hygiene Plan](https://rgw.arizona.edu/sites/default/files/cs-univeristy_chemical_hygiene_plan.pdf) Section 8.2.

**Exposure Response**

|  |  |  |  |
| --- | --- | --- | --- |
| **Inhalation** | **Ingestion** | **Skin Contact** | **Eye Contact** |
| Remove to fresh air. If not breathing, give artificial respiration. Do not use mouth-to-mouth  method if victim ingested or inhaled the substance; give artificial respiration with the aid of a  pocket mask equipped with a one-way valve or other proper respiratory medical device.  Immediate medical attention is required. | Do NOT induce vomiting. Call a physician or poison control center immediately | Wash off immediately with plenty of water for at least 15 minutes. Immediate medical  attention is required. | Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician. |

1. **Enter Additional Section Title**

*[Add as many sections as necessary to adequately describe how to safely perform the procedure or process addressed by this SOP.]*

1. **References:**

* <https://ehrs.upenn.edu/health-safety/lab-safety/chemical-hygiene-plan/fact-sheets/fact-sheet-tmah-tetramethylammonium>
* <https://www.ehs.harvard.edu/sites/default/files/lab_safety_guideline_tmah.pdf>
* <https://nj.gov/health/eoh/rtkweb/documents/fs/1829.pdf>
* <https://www.concordia.ca/content/dam/concordia/services/safety/docs/EHS-DOC-020_TMAHGuidelines.pdf>