Standard Operating Procedure

Arsine

*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 ☒Hazardous Chemical ☐ Hazardous Class

**Purpose**

Arsine is a highly flammable, toxic gas and is considered a pyrophoric, spontaneously igniting when in contact with air. In order for an arsine ignition to occur, three conditions need to occur simultaneously: the concentration of arsine must be within its flammable limits, the presence of sufficient air or an alternate oxidizing source, and a source of ignition must exist. Arsine is used in the synthesis of semiconducting materials related to microelectronics and solid-state lasers. Related to phosphorus, Arsenic is an n-dopant for silicon and germanium. More importantly, Arsine is used to make the semiconductor GaAs by chemical vapor deposition (CVD) at 700–900 °C. Arsine is also well known in forensic science because it is a chemical intermediate in the detection of arsenic poisoning.

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

CAS#: 7784-42-1

Class: Pyrophoric and Carcinogen

Molecular Formula: AsH3

Form (physical state): Gas

Color: Colorless

Boiling point: -62.5°C

**Potential Hazards/Toxicity**

Spontaneously ignite with contact to air. Carcinogenic effects, damage to target organs include blood, kidneys, and the liver. May be fatal through inhalation. Contact with rapidly expanding gas may cause burns or frostbite. Signs of short-term exposure include weakness, fatigue, headache, drowsiness, confusion, shortness of breath, rapid breathing, nausea, and muscle cramps. Signs of long-term exposure include loss of consciousness, convulsions, paralysis, and respiratory failure leading to death. Arsine is strongly endothermic, and can be deprotonated by suitably powerful initiation. Arsine ignites in contact with chlorine at ambient temperature and oxidized explosively by fuming nitric acid.

**Personal Protective Equipment (PPE)**

**Respiratory Protection**

When the respirator is the sole means of protection, users should wear a full-faced Self-Contained Breathing Apparatus (SCBA) respirator mask operating in pressure-demand or other positive-pressure mode.

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**

When handling the chemical, neoprene, butyl rubber, PVC, polyethylene, or Teflon gloves are recommended.

NOTE: Consult with your preferred glove manufacturer to ensure that the gloves you plan on using are compatible with arsine.

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 a face shield to protect face from direct exposure to the gas.

**Skin and Body Protection**

Lab personnel working with the chemical need to wear full-length pants or its equivalent, closed-toe footwear with no skin being exposed, and a flame-resistant lab coat.

**Hygiene Measures**

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

**Engineering Controls**

Arsine is to be used in an explosion-proof, ventilated area at all times (i.e. no sparks created from ventilation fan, lighting, etc.). A closed system in a chemical fume hood or glove-box is recommended.

**First Aid Procedures**

**If inhaled**

Immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

**In case of skin contact**

Wash with soap and water for at least 15 minutes. If irritation persists, seek medical attention.

**In case of eye contact**

Flush eyes with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. If irritation persists, seek medical attention.

**Special Handling and Storage Requirements**

**Precautions for safe handling**

Use only with adequate ventilation. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Keep container closed. Keep away from heat, sparks and flame. To avoid fire, eliminate ignition sources. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

**Conditions for safe storage**

Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Segregate from oxidizing materials. Cylinders should not be stored within 20 feet of oxygen and other oxidizing gas cylinders. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

**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”]**

Arsine cylinders should be returned to the compressed gas distributor when emptied or no longer used.

**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 arsine., 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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