# Standard Operating Procedure

**Chemical name and concentration:** Click here to enter text.

*This is an SOP template. It is not complete until:*

1. *Lab specific information is entered into the box below.*
2. *Lab specific protocol and procedure is added to the protocol and procedure section.*
3. *SOP has been signed and dated by the PI and relevant lab personnel.*
4. *All italicized/red text has been removed/replaced with information specific to the chemical.*

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

|  |  |  |  |
| --- | --- | --- | --- |
| **School and department:** | Click here to enter text. | | |
| **SOP preparation date:** | Click here to enter a date. | **SOP approval date:** | Click here to enter a date. |
| **Principal investigator:** | Click here to enter text. | | |
| **Lab manager name:** | Click here to enter text. | | |
| **Laboratory phone:** | Click here to enter text. | **Office phone:** | Click here to enter text. |
| **Emergency contact:** | Click here to enter text. | **Contact phone:** | Click here to enter text. |
|  |  |  |  |
| **Laboratory locations covered by this SOP – building and room number** | | | |
| Click here to enter text. | | | |

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| --- | --- | --- | --- | --- | --- | --- |
| **Type of SOP** |  | Process |  | Hazardous chemical |  | Hazardous class |

# Hazards Identification

## **GHS Classification**

*Copy chemical-specific information from the SDS section 2.*

## **GHS Label Information**

*Copy chemical-specific information from the SDS section 2.*

### **Pictogram**

*Select as needed from the following:*

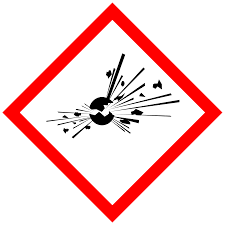
****Icon

Description automatically generatedLogo, icon

Description automatically generatedIcon

Description automatically generatedA picture containing text, sign, vector graphics

Description automatically generatedA picture containing text, clipart

Description automatically generated

### **Signal Word**

### **Hazard Statement(s)**

*Copy chemical-specific information from the SDS section 2.*

### **Precautionary Statement(s)**

*Some of these statements belong under “First Aid Procedures” below. Place them according to relevance (i.e., put “If on skin” instructions below “In case of skin contact.”*

# Physical and Chemical Properties

Stench chemicals have an extremely foul smell that is detectable by the human nose in amounts as little as 1.4×10-4 ppb,1 depending on the compound. While the stench may not be known to have toxic effects, it can still negatively impact laboratory workers and people outside the laboratory (even outside the building) by inducing nausea and/or vomiting, and causing reports of gas leaks or sewage problems. The odors have even been responsible for building evacuations at ASU. Therefore, handling and disposal of stench compounds should be carefully controlled in order to minimize the release of odors.

Stench chemicals include (where “R” can include any organic chains or structures):

* thiols (mercaptans)

Chart, line chart

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* sulfides
* Chart, line chart

  Description automatically generatedselenides
* Chart

  Description automatically generatedamines
* Chart

  Description automatically generatedphosphines

Diagram

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* carboxylic acids with short aliphatic hydrocarbon chains, such as butyric and valeric acid

*Get these from the SDS sections 1 & 9.*

|  |  |  |  |
| --- | --- | --- | --- |
| CAS | Click here to enter text. | Melting Point/Range | Click here to enter text. |
| Molecular Formula | Click here to enter text. | Boiling Point/Range | Click here to enter text. |
| Molecular Weight |  | Flash Point |  |
| Physical State, Color | Click here to enter text. | Upper flammability/ explosion limit | Click here to enter text. |
| Odor | Click here to enter text. | Lower flammability/ explosion limit | Click here to enter text. |
| Odor Threshold | Click here to enter text. | Autoignition Temp. | Click here to enter text. |
| Evaporation Rate | Click here to enter text. | Decomposition Temp | Click here to enter text. |

# First Aid Procedures

*Get chemical-specific info from the SDS sections 2 and 4.*

**If inhaled,** move to fresh air. If the person is not breathing, give artificial respiration. Avoid mouth to mouth contact. Call 911. Then call EHS at 480-965-1823.

**In case of skin contact,** immediately remove all contaminated clothing and flush affected area for 15 minutes. Call 911. Then call EHS at 480-965-1823.

**In case of eye contact,** use nearest emergency eyewash immediately. Remove any contact lenses. Call 911. Then call EHS at 480-965-1823.

**If swallowed,** do not induce vomiting. Never give anything by mouth to an unconscious person. Call 911. Then call EHS at 480-965-1823.

*Preceding information may change based on specific guidance for the hazardous material.*

# Spill and Accident Procedure

## **Personal precautions**

* Avoid breathing vapors, mist or dust.
* If the spill happened outside of a fume hood and poses a respiratory threat, evacuate the lab and call EHS (480-965-1823).
* Do not attempt clean-up without the required PPE (see below).

## **Environmental precautions**

Prevent further leakage or spillage – if safe to do so. Do not allow product to enter drains.

## **Methods and materials for containment and clean-up**

* Consider material compatibility prior to clean-up. Verify the spill is not releasing hazardous fumes outside of a fume hood. Verify spill kit is available. Verify correct PPE is being worn.
* Immediately assess amount spilled, follow posted ASU Emergency Response Guide procedures for hazardous materials incidents.
* If a chemical exposure has occurred, follow First Aid Procedures above. A fellow lab worker shall call 9-1-1 and seek immediate medical attention. Then call EHS at (480) 965-1823.
* Secure / restrict access to the area of the spill to prevent spread of the chemical.
* Use the available spill kit to stop and contain the spill. Bag the collected material.
* Wipe down affected areas with a compatible oxidant. For spills outside the fume hood, use only oxidants that do not require the use of a fume hood, such as 15% bleach (aq) or 3% H2O2 with NaHCO3. Bag the wipes separately from the collected material.
* Label and tag as hazardous waste and submit a pick-up request to EH&S using EHS Assistant. <https://ehsaweb.asu.edu/>

*Preceding information may change based on specific guidance for the hazardous material.*

# Personal protective equipment (PPE) & Engineering Controls

## **Respiratory protection**

All operations involving stench chemicals and dilutions should be carried out in a ventilated enclosure fume hood to keep airborne concentrations below recommended exposure limits.

* Chemical fume hoods used as containment areas for particularly hazardous chemicals must have a face velocity of 100 cfm, averaged over the face of the hood and must be certified annually.
* The fume hood sash should be kept as low as possible.
* Laboratory rooms must be at negative pressure with respect to the corridors and external environment.
* The laboratory/room door must be kept closed at all times.

## **Hand protection**

*Specify the type of gloves along with their thickness. Glove type may be indicated in the SDS section 8. Check with glove manufacturer and independent testing charts to ensure that the gloves you plan on using are compatible with your chemical(s).*

*Here are a few manufacturer testing charts:*

<https://cdn.mscdirect.com/global/media/pdf/search/ansell/ansell-chemical-glove-resistance-guide.pdf>

*Keep in mind that permeation time is dependent on material (nitrile vs. others) and thickness (disposable 4 mil vs. heavy-duty 11 or 20+ mil).*

*Consult FSE Safety if your chemical/concentration is not listed on the charts, or if you’re considering using disposable nitriles when the charts only tested heavy-duty nitriles, or if there is any uncertainty about the type of glove needed.*

## **Eye protection**

* Wear chemical splash goggles to protect from splash hazards and chemical vapors.
  + Chemical splash goggles must meet ANSI Z87.1 D3 certification. Goggles must be properly-fitted to the face to provide an adequate seal against splashes.
* Goggles must be worn at all times by all lab personnel within splash range of the work performed if the work involves any liquids that are not plain water.

*If light/radiation is produced, consult FSE Safety for further guidance.*

## **Skin and body protection**

* Lab coat
  + *An FR-rated lab coat (usually Nomex or fire-retardant-treated cotton) is* required *for work with pyrophorics. FR-rated lab coats are strongly recommended for work with flammable chemicals.*
  + *Lab Coats must be worn at all times by all lab personnel who are within splash range of the work performed* ***if*** *the work involves anything that is hazardous by skin contact*
  + *Do not wear a lab coat or other loose-fitting clothing near machine shop tools/equipment – consult FSE Safety with any questions/concerns*
* Full-length pants
* Fully-enclosed rubber or leather shoes

*Preceding information may change based on specific guidance for the hazardous material.*

## **Hygiene measures**

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

*Preceding information may change based on specific guidance for the hazardous material.*

# Storage

*Get these from the SDS sections 7 and 10.*

* Ensure the container is tightly closed at all times with a lid that will not come loose in the event that the container tips over (parafilm is not a substitute).
* The neck of the stench chemical container must be wrapped with parafilm, Teflon tape, electrical tape, or other compatible sealing tape.
* The outside of containers must be wiped down with bleach (or other compatible oxidant) after each use.
* If the stench chemical container still emits an odor after being wiped down and having its neck wrapped, then it must be placed inside a secondary container (such as a large jar with a lid) and the neck of the secondary container must be sealed with a compatible tape. If the secondary container is not transparent (colorless glass), then it must be properly labeled.
* *List any chemical compatibilities (i.e., do not store with oxidizers) here – see SDS sections 7 & 10*
* *If the material is capable of building up gas inside the container, include a protocol for vented caps or periodic opening of the bottle. Consult FSE Safety for details.*

# Handling Requirements

*Get these from the SDS section 7, and add any additional precautions recommended by your PI, Lab Manager, or Safety Staff (recommendations may be based on the SDS sections 2, 10, & 11).*

* The lab where the material is being handled must have an approved / certified emergency eyewash and safety shower. *Consult FSE Safety if your lab is missing either the shower or the eyewash.*
* Ensure you are wearing the required PPE and using appropriate engineering controls as stated above.
* Lab emergency contact information must be readily posted. Easy access to a cellular phone or land line is readily available.
* Any equipment needed for the use of the stench chemical (pipettes, extra gloves, etc.) must be placed inside the fume hood so that it can be reached without removing contaminated gloves from the fume hood area.
* Great care must be taken to reduce the spread of stench chemicals during the process. From the moment that the stench chemical bottle is picked up, avoid touching any handles, valves, or surfaces unnecessarily. Adjust gas lines and fume hood sash height prior to the process.
* Any item that was *touched or used at* ***any*** *point* during the process (including gloves, paper towels, weighing paper, equipment handles, the fume hood sash, etc.) must be considered to be contaminated with the stench chemical, and should be cleaned or disposed of accordingly.
* All items, including sealed containers, must be decontaminated with bleach (or another compatible oxidant) before they may be removed from the fume hood.
* *Specify any additional handling concerns (i.e. no metal tools, no ground-glass joints in the glassware, special plastic vs. glass vessels, etc.)*

*Preceding information may change based on specific guidance for the hazardous material.*

If the stench chemical is a solid, it must be weighed and used entirely inside the fume hood. After use, the scale and its glass covering, handles, and buttons should be wiped down with bleach (aqueous sodium hypochlorite, or NaClO) or other compatible oxidant (i.e. the oxidant should not have any violent reaction with the stench chemical). Gloves should be replaced before carrying the scale out of the fume hood.

If the stench chemical is a liquid, all transfers should be performed using a syringe or cannula. Use the volume markings on the syringe and the liquid’s density to determine the amount; do not weigh it on a scale. Never pour or pipette these liquids or their dilutions. Any re-usable cannulas, needles, or syringes should be cleaned with bleach or another compatible oxidant prior to re-use.

Avoid using excess amounts of stench chemicals. The reaction mixture must be handled as a stench chemical until all unreacted stench chemical is thoroughly removed from the mixture.

Depending on the potency of the stench chemical in question, a cold finger trap or bleach trap (examples illustrated below, Figures 1 & 2) must be used to prevent stench chemical fumes from being released into the fume hood. The process must be evaluated by the PI or other responsible party first to ensure that none of the components in the experimental setup are incompatible with bleach.

Bleach (aqueous sodium hypochlorite, or NaClO) is capable of oxidizing thiols, sulfides, selenides, phosphines, and some amines to their less-smelly counterparts (such as sulfoxides, sulfones, phosphine oxides, etc.).2,3 Bleach can also oxidize carboxylic acids through decarboxylation.4

Diagram

Description automatically generated

**Figure 1.2** Exhaust from a system that contains stench chemical fumes is passed through bleach. The hydrochloric acid (HCl) vapor that is generated as a by-product of oxidation is neutralized by passing through a strong base solution (0.01 M should be sufficient).

Both the oxidation and neutralization reactions are exothermic and will generate heat.2 Depending on the amount of stench chemicals passing through the flasks, ice baths may be required in order to control the temperature.

Clorox brand bleach is typically 5-10% sodium hypochlorite by weight.6 Other brands may have lower concentrations and therefore may be less effective in bleach traps.7 Consult the brand’s MSDS/SDS for concentration prior to use. Do not attempt to acidify the bleach solution; dropping the pH of the bleach solution will cause off-gassing of toxic Cl2 gas.7

Diagram

Description automatically generated

**Figure 2.5** Exhaust from a system that contains stench chemical fumes is passed through a cold finger chamber surrounded by a dewar, which should be cooled to at least -78°C (it can be filled with dry ice in acetone, or liquid nitrogen). The vacuum gauge is optional, and the air exiting the cold finger may be exhausted into the fume hood if vacuum is not needed.

The cold finger setup is ideal in cases where an experimental component may be incompatible with bleach. The portion where the stench chemicals are trapped must be emptied into a stench waste container and rinsed out with a compatible oxidant. Rinsings should also go into a stench waste container, although not necessarily into the same container as the pure stench chemical; be cautious of exothermic reactions between the oxidant and the stench chemical.

If any mixture containing a stench chemical is to be concentrated under reduced pressure (by use of a rotovap, for example), the cold finger trap must be used in between the vacuum pump and the vacuum take-off of the evaporative device. This cold finger is *in addition to* the normal condenser, and does not replace it. The entire apparatus must be located inside the fume hood, and cleaned with a compatible oxidant after use.

# Protocol and procedure

## ***Laboratory-specific procedures***

*Add your lab’s specific procedures in this section. Write out separate steps in a list format for easy reading. Please include photos whenever possible. Be descriptive – future generations of researchers in your lab may need to learn the procedure from this document.*

Click here to enter text.

**Important note:** Any deviation from this SOP requires advance PI approval.

# Cleanup and Waste Disposal Procedure

### **Label waste**

* Attach a completed ASU Hazardous Waste tag to all waste containers as soon as the first drop of waste is added to the container.
* In the “Category” section on the Hazardous Waste tag, be sure to include “Stench” as a hazard.

### **Store waste**

* All waste that was exposed to or contains stench chemicals, (including gloves, weighing paper, paper towels, etc.) must be placed in containers that are separate from other waste.
* All waste exposed to or containing stench chemicals (including sharps) must be put in air-tight containers. Containers cannot leave the fume hood until they are tightly closed.
* Store hazardous waste in closed containers, in secondary containment and in a designated location.
  + Do not store waste inside a fume hood. Clutter inside a fume hood will block the air flow and prevent the fume hood from working properly.
* Separate waste from any incompatible materials.
* Double-bag dry waste (kimwipes, gloves, etc.) using sealable transparent bags.
* Any waste objects that can penetrate bags (pipettes, swabs, razor blades, or syringes) must be placed inside a leak-proof container made out of a material that will resist cuts or punctures from those objects.
* If the chemical gives off hazardous vapors, the waste container must be brought inside the fume hood whenever waste is being added to it.
* Waste must be under the control of the person generating and disposing of it.

### **Dispose of waste**

* Dispose of regularly generated chemical waste within 90 days or less (even if the container is not full).
* Use EHS Assistant online hazardous waste pick-up request system: <https://ehsaweb.asu.edu/>
* Contact ASU EH&S at (480) 965-1823 with questions.

*Preceding information may change based on specific guidance for the hazardous material.*

# Documentation of training

* Prior to conducting any work with this material, Principal Investigator or designee must provide to his or 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 a copy of the Safety Data Sheet or SDS provided by the manufacturer.
* The Principal Investigator must ensure that his/her laboratory personnel have attended appropriate/required laboratory safety training or refresher training within the last one year.

**I have read and understand the content of this SOP.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Employee name** | **ASU affiliate no.** | **Signature** | **Date** |
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# References

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