



## Mutagens and Reproductive Toxins

H340 H341 H360 H361 H362



**Areas with blue text indicate that information must be provided or modified by researcher prior to the SOP approval.**

**This SOP is not a substitute for hands-on training.**

Print a copy and insert into your laboratory SOP binder.

|   |  |
|---|--|
| Department:                                     | Chemistry  |
| Date SOP was written:                           | Monday, October 24, 2016   |
| Date SOP was approved by PI/lab supervisor:     |  |
| Principal Investigator:                         | Name: R. Sarpong<br>Signature: _____   |
| Internal Lab Safety Coordinator or Lab Manager: | Name: Melissa Hardy/Justin Jurczyk<br>Lab Phone: 406-696-1225/412-728-1952<br>Office Phone: 510-642-6312 |
| Emergency Contact:                              | Name: Melissa Hardy/Justin Jurczyk<br>Lab Phone: 406-696-1225/412-728-1952                               |
| Location(s) covered by this SOP:                | Latimer Hall<br>831,832,834,836,837,838,839,842,844,847,849  |

### 1. Purpose

This SOP covers the precautions and safe handling procedures for the use of Mutagens and Reproductive Toxins.

For a list of Mutagens and Reproductive Toxins covered by this SOP and their use(s), see the “List of Chemicals”. Procedures described in Section 12 apply to all materials covered in this SOP.

***If you have questions concerning the applicability of any recommendation or requirement listed in this procedure, contact the Principal Investigator/Laboratory Supervisor or the campus Chemical Hygiene Officer at [ucbcho@berkeley.edu](mailto:ucbcho@berkeley.edu).***

### 2. Physical & Chemical Properties/Definition of Chemical Group

**Germ Cell Mutagenicity** is a hazard class that is primarily concerned with chemicals that may cause mutations in the germ cell of humans that can be transmitted to the progeny.



A **mutation** is defined as a permanent change in the amount or structure of genetic material in a cell.

**Mutagens** are agents giving rise to an increased occurrence of mutations in populations of cells and/or organisms.

**Reproductive toxicity** includes adverse effects on sexual function and fertility in adult males and females, as well as developmental toxicity in the offspring.

These chemicals may present extreme risk potential to laboratory workers if not handled appropriately; therefore, these substances may require additional control measures when used.

### 3. Potential Hazards/Toxicity

**Mutagens** and **Reproductive Toxins** are chemicals that affect the reproductive capabilities including causing chromosomal damage (mutations) and adverse effects on fetal development (teratogenesis).

As defined by the Globally Harmonized System of Classification and Labeling of Chemicals (GHS), reproductive toxins are designated by one or more of the following H codes:

**H340** May cause genetic defects

**H341** Suspected of causing genetic defects

**H360** May damage fertility or the unborn child

**H361** Suspected of damaging fertility or the unborn child

**H362** May cause harm to breast-fed children

Additional requirements may apply, depending on the specific chemical. Examples include particularly hazardous substances that are also highly flammable and/or reactive. Safe use requires assessing all potential hazards.

It is the Principal Investigator's responsibility to ensure activity-specific laboratory procedures and/or processes are taken into account when using this Chemical Class SOP.

Please, review the SDS of any chemical before use (see Section 11 – SDS Location).

### 4. Engineering Controls

Use the engineering controls listed below unless other lab-specific information is included in Section 12 - Protocol/Procedure.

- Work with mutagens and reproductive toxins – the work must be conducted in a fume hood unless other controls are designated in the lab-specific Protocol/Procedure section. Sash height must be kept as low as possible to avoid escaping fumes and provide a physical barrier.
- Laboratories and rooms where Mutagens and Reproductive Toxins are used must have general room ventilation that is negative pressure with respect to the corridors and external environment. The laboratory/room door must be kept closed at all times.

### 5. Personal Protective Equipment

At a minimum, the following PPE must be worn at all times.

#### Eye and Face Protection

- A. ANSI Z87.1-compliant safety glasses with side shields, or chemical splash goggles.
  - Ordinary prescription glasses will NOT provide adequate protection unless they also meet ANSI standard and have compliant side shields.



- B. If the potential for explosion/splashing exists, and adequate coverage is not provided by the hood sash, a face shield must be worn.

### Skin and Body Protection

- A. Gloves are required when handling hazardous chemicals.
- Refer to specific chemical SDS for information on glove selection.
  - For additional information on glove selection, go to:  
<http://ehs.berkeley.edu/hs/63-laboratory-safety/94-glove-selection-and-usage.html>
- B. Lab coats are required when handling hazardous chemicals in the lab. Select the type of lab coat according to the hazards at the specific workplace.
- C. Long pants, closed-toe/closed-heel shoes, covered legs, and ankles.

### Respiratory Protection

Respiratory protection is normally not required for UC Berkeley laboratory activities. Any lab personnel considering the use of a respirator (e.g. N-95 respirator, dust mask) must contact EH&S for a workplace assessment.

## 6. First Aid Procedures and Medical Emergencies

*In the event of an injury, notify your supervisor immediately and EH&S within 8 hours.*



*Go to the Occupational Health Facility (Tang Health Center, on campus); if after hours, go to the nearest emergency room (Alta Bates, 2450 Ashby Ave in Berkeley); or*



*Call 911 (from a cell phone: 510-642-3333) if:*

- *it is a life threatening emergency; or*
- *you are not confident in your ability to fully assess the conditions of the environment and/or the condition of the contaminated/injured person, or you cannot be assured of your own safety; or*
- *the contaminated/injured person is not breathing or is unconscious.*

*Please remember to provide a copy of the appropriate manufacturer SDS (if available) to the emergency responders or physician. At a minimum, be ready to provide the identity/name of any hazardous materials involved.*

#### In case of skin contact

If skin contact occurs, and/or skin or clothing are on fire, immediately drench in the safety shower with copious amounts of water for no less than 15 minutes to remove any remaining contaminants. If possible to do so without further injury, remove any remaining jewelry or clothing.

#### In case of eye contact

Rinse thoroughly with plenty of water using an eyewash station for at least 15 minutes, occasionally lifting the upper and lower eyelids. Remove contact lenses if possible.

#### If swallowed

Do NOT induce vomiting unless directed otherwise by the SDS. Never give anything by mouth to an unconscious person. Rinse mouth with water.

#### If inhaled

Move into fresh air.

#### Needle stick/puncture exposure



Wash the affected area with antiseptic soap and warm water for 15 minutes.

## 7. Special Handling, Storage and Disposal Requirements

Lab-specific information on handling and storage may be included in Section 12 - Protocol/Procedure.

### Precautions for Safe Handling:

- Eliminate or substitute for a less hazardous material when possible.
- Design your experiment to use the least amount of material possible to achieve the desired result.
- Do not exceed the scale of procedures specified in Protocol/Procedure section without approval of the PI.
- Verify your experimental set-up and procedure prior to use.
- Know the location of the nearest eyewash, safety shower and fire extinguisher before beginning work.
- Upon leaving the work area, remove any personal protective equipment worn and wash hands.
- At the end of each project, thoroughly decontaminate the work area according to the material being handled.

### Conditions for Safe Storage

- Store non-flammable mutagens and reproductive toxins within secondary containment.
- Chemicals that require refrigeration must be stored appropriately.
- Store flammable mutagens and reproductive toxins within flammable storage cabinet.

### Disposal

- Waste materials generated must be treated as a hazardous waste.
- The empty container must be rinsed three times with a COMPATIBLE solvent; leave it open in the back of the hood overnight. Solvent rinses and water rinse must be disposed of as hazardous waste.
- As an alternative, unrinsed empty containers can be disposed of through EH&S as hazardous waste. The unrinsed empty containers must be capped.
- Do not mix with incompatible waste streams.

## 8. Chemical Spill

**Spill** – Assess the extent of danger; if necessary request help by calling **911** (from a cell phone: **510-642-3333**) for emergency assistance or 510-642-3073 for non-life threatening situations. If you cannot assess the conditions of the environment well enough to be sure of your own safety, do not enter the area. If possible help contaminated or injured persons. Evacuate the spill area. Avoid breathing vapors from spill. If possible, confine the spill to a small area using a spill kit or absorbent material. Keep others from entering contaminated area.

- **Minor Spill** – In the event of a minor spill, if there is no potential for hazardous chemical exposure, report the spill to 510-642-3073 and proceed to clean it, if you are trained. Use appropriate personal protective equipment and clean-up material for chemical spilled. Double bag spill waste in clear plastic bags, label and request pick-up.
- **Major Spill** – Any hazardous chemical spill that involves chemical exposure, any chemical spill that due to size and/or hazard requires capabilities beyond your training, or any chemical spill



that gives the perception (because of odor, for example) that there has been a hazardous release. Call **911** or 510-642-3073 for assistance.

## 9. Cleaning and Decontamination

Lab-specific information on decontamination may be included in Section 12 - Protocol/Procedure.

- Wearing proper PPE, laboratory work surfaces must be cleaned at the conclusion of each procedure and at the end of each work day.
- Decontaminate all equipment before removing from a designated area.

## 10. Hazardous Waste Disposal

Label Waste

- Label all waste containers. See the EH&S Fact Sheet, “Hazardous Waste Management” for general instructions on procedures for disposing of hazardous waste.

Dispose of Waste

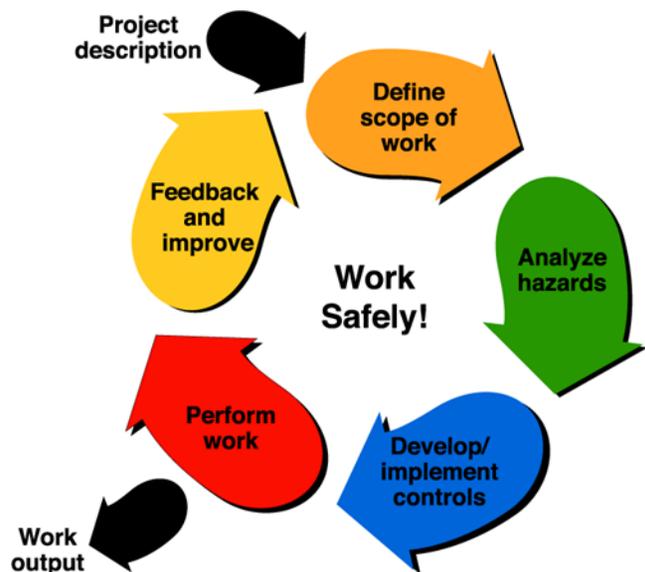
- Dispose of regularly generated chemical waste within 6 months.
- Contact EH&S at 642-3073 if you need assistance.

## 11. Safety Data Sheet (SDS) Location

SDS can be accessed online at <http://ucsdgs.com>



## -Take Ownership of Your Safety-



**Before starting any work, ask yourself:**

- 1- **What will I be doing?**
- 2- **Do I know what the hazards are?**
- 3- **Do I have everything I need to do the job safely?**
- 4- **Am I doing the job safely?**
- 5- **What can we do better?**



## 12. Protocol/Procedure – Mutagens and Reproductive Toxins

Section 12 must be customized to your specific needs. Delete any procedure that does not apply to your laboratory.

| Procedure/Use   | Scale   | Engineering Controls/Equipment  | PPE (eye, face, gloves, clothing)   | Procedure Steps and Precautions   |
|---|---|---|---|---|
| 1. Using Mutagens or Reproductive Toxins as reagents. | Up to 10 g or less as supplied in the reagent bottle.<br><br>Remember to obtain PI approval if higher scale is necessary. | All reactions using these materials must be performed in a properly operating fume hood with the sash as low as possible. Or in an inert atmosphere glovebox. | <p><b>Eye protection:</b> Wear ANSI Approved tight-fitting safety goggles or safety glasses with side shields.</p> <p><b>Face Protection:</b> Face shields are to be used when there is no protection from the hood sash.</p> <p><b>Hand Protection:</b> Confirm compatibility of glove material with chemical being used. General guidance (unless otherwise specified in the specific SDS): Nitrile gloves must be used to prevent incidental contact. For spill handling or for potential contact with larger quantities, use double nitrile or heavier gauge nitrile or neoprene gloves. Gloves must be inspected prior to use. Wash and dry hands after use.</p> <p><b>Clothing:</b> Wear lab coat; full length pants or equivalent; and close-toed, close-heeled shoes.</p> | <p>Avoid the formation of dusts with solids. Carefully weigh materials. Use enclosed balance or tared method with secondary containment. Immediately move to fume hood when weighing is complete.</p> <p>In a properly functioning fume hood, add reagent to the reaction vessel.</p> <p>If the reagent is a liquid, dispense and transfer to the reaction vessel using the appropriate technique (syringe, pipettor, or cannula method).</p> |
| Notes   | Any deviation from this SOP requires approval from PI.  |   |   |   |



| Procedure/Use  | Scale   | Engineering Controls/Equipment   | PPE (eye, face, gloves, clothing)   | Procedure Steps and Precautions   |
|--|---|--|---|---|
| <p>2. Using Mutagens or Reproductive Toxins as solvents in reactions, for extractions or cleaning glassware.  </p> | <p>Up to 100 mL (as supplied in the reagent bottle) when used as a reaction solvent</p> <p>No more than 500 mL (as supplied in the reagent bottle) when using to clean glassware</p> <p>No more than 500 mL (as supplied in the reagent bottle) when using for extractions.</p> <p style="color: red;">Remember to obtain PI approval if higher scale is necessary.</p> | <p>All reactions using these materials must be performed in a properly operating fume hood with the sash as low as possible. Or in an inert atmosphere glovebox.</p> | <p><b>Eye protection:</b> Wear ANSI Approved tight-fitting safety goggles or safety glasses with side shields.</p> <p><b>Face Protection:</b> Face shields are to be used when there is no protection from the hood sash.</p> <p><b>Hand Protection:</b> Confirm compatibility of glove material with chemical being used. General guidance (unless otherwise specified in the specific SDS): Nitrile gloves must be used to prevent incidental contact. For spill handling or for potential contact with larger quantities, use double nitrile or heavier gauge nitrile or neoprene gloves. Gloves must be inspected prior to use. Wash and dry hands after use.</p> <p><b>Clothing:</b> Wear lab coat; full length pants or equivalent; and close-toed, close-heeled shoes.</p> | <p>Avoid inhalation of these materials.</p> <p>Rotary evaporator must not exhaust inside the room (connect to house vacuum or exhaust vacuum pump into the fume hood). If it is necessary to condense the solvent, use a cold trap system.</p> <p>Pressure can be built up when these solvents are used in closed reaction vessels. Adequate ventilation (e.g. pressure bubbler on Schlenk manifold or an equilibrating balloon) must be used to prevent dangerous over pressurization.</p> <p>Pressure may be built up if when performing extractions. Adequate ventilation (open the valve frequently during the extraction) has to be used to prevent dangerous over pressurization. The vapor in such a process must be released in a fume hood.</p> <p>If heated, the reaction apparatus has to be fitted with an adequately sized condenser and an adequate flow of cooling water has to be provided to prevent evaporation. Cooling hoses have to be secured with hose clamps to the condenser and the outlet.</p> <p>When used to clean glassware, leave the cleaned glassware in the fume hood until the solvent has evaporated off.  </p> |
| <b>Notes</b>   | <b>Any deviation from this SOP requires approval from PI.</b>   |  |   |   |



| Procedure/Use   | Scale  | Engineering Controls/Equipment   | PPE (eye, face, gloves, clothing)   | Procedure Steps and Precautions   |
|---|--|--|---|---|
| <p>3. Using Mutagens or Reproductive Toxins as solvents in column chromatography (CC) or thin layer chromatography (TLC).  </p> | <p>Up to 50 mL (as supplied in the reagent bottle) when used in TLC</p> <p>No more than 2000 mL (as supplied in the reagent bottle) when using for CC.</p> <p style="color: red;">Remember to obtain PI approval if higher scale is necessary.</p> | <p>All chromatography operations using these materials must be performed in a properly operating fume hood with the sash as low as possible. Or in an inert atmosphere glovebox.</p> | <p><b>Eye protection:</b> Wear ANSI Approved tight-fitting safety goggles or safety glasses with side shields.</p> <p><b>Face Protection:</b> Face shields are to be used when there is no protection from the hood sash.</p> <p><b>Hand Protection:</b> Confirm compatibility of glove material with chemical being used. General guidance (unless otherwise specified in the specific SDS): Nitrile gloves must be used to prevent incidental contact. For spill handling or for potential contact with larger quantities, use double nitrile or heavier gauge nitrile or neoprene gloves. Gloves must be inspected prior to use. Wash and dry hands after use.</p> <p><b>Clothing:</b> Wear lab coat; full length pants or equivalent; and close-toed, close-heeled shoes.</p> | <p>Avoid inhalation of these materials.</p> <p><b>Thin Layer Chromatography:</b> allow the plate to dry in the fume hood after removal from the development bath.</p> <p><b>Column Chromatography:</b> collect fractions of interest and concentrate as needed.</p> <p>Rotary evaporator must not exhaust inside the room (connect to house vacuum or exhaust vacuum pump into the fume hood). If it is necessary to condense the solvent, use a cold trap system.</p> <p>After use in the column, allow the solvent to evaporate from the packing material prior to proper disposal of the packing material.</p> |
| <b>Notes</b>  | <b>Any deviation from this SOP requires approval from PI.</b>  |  |   |   |





**List of Chemicals**

| Chemical(s)  | Chemical(s)                            | Chemical(s)   |
|--|--|---|
| (chloromethylene)dimethyliminium chloride          | (r)-(+)-indoline-2-carboxylic acid     | (s)-(-)-indoline-2-carboxylic acid  |
| 1,2,3-benzenetriol                                 | 1,2,4-triazole                         | 1,2-benzenediamine  |
| 1,2-dimethoxyethane                                | 1,2-epoxy-5-hexene                     | 1,3,5-trioxane  |
| 1,3-butadiene, gas                                 | 1,3-dichloroacetone                    | 1,3-dimethyl-2-imidazolidinone  |
| 1,3-dimethyl-3,4,5,6-tetrahydro-2(1h)-pyrimidinone | 1,3-diphenylguanidine                  | 1,3-phenylenediamine  |
| 1-amino-2,4-dinitrobenzene                         | 1-methyl-2-pyrrolidinone               | 2,2,6,6-tetramethylpiperidinylmagnesium chloride lithium chloride complex |
| 2,3-dichloro-1-propene                             | 2-aminophenol                          | 2-butenal   |
| 2-chloroethylamine hydrochloride                   | 2-methoxyethanol                       | 2-methyl-2-butene   |
| 2-methylimidazole                                  | 2-nitropropane                         | 2-nitrotoluene  |
| 4,4'-bis(dimethylamino)benzophenone                | 4-aminophenol                          | 4-nitrosophenol   |
| 5-bromoisatoic anhydride                           | actidione                              | aniline   |
| aniline hydrochloride                              | benzamide                              | benzene   |
| benzene, 1-methoxy-4-methyl-                       | benzenethiol                           | bis(2,4,6-trimethylpyridine)iodine(i) hexafluorophosphate                 |
| bis(acetylacetonato)cobalt                         | boric acid                             | cadmium chloride  |
| carbon disulfide                                   | carbon monoxide                        | chromium trioxide   |
| cobalt chloride hexahydrate                        | cobalt dichloride                      | crotonaldehyde, predominantly trans                                       |
| cyanamide  | cyclohexylamine                        | cyclopropylboronic acid   |
| dibutyl tin dichloride                             | dibutylboryl trifluoromethanesulfonate | dibutyltin dilaurate  |
| dibutyltin(iv) oxide                               | diethylaluminum cyanide                | Diglyme   |
| dimethyl methylphosphonate                         | dimethyl phosphite                     | dimethyl sulfate  |
| disodium tetraborate                               | ferrocene                              | formaldehyde  |
| formaldehyde, 37% in water                         | formamide                              | furan   |
| gallium triiodide                                  | glufosinate-ammonium                   | glyoxal   |
| haloperidol  | hexafluoroacetone                      | hexafluoroacetone trihydrate  |
| hexafluoroisopropanol                              | hexamethylphosphoramide                | hydroquinone  |
| indium triiodide                                   | isobutyl nitrite                       | isopropyl bromide   |
| isopropyl chloroformate                            | lead dibromide                         | lead dichloride   |
| lead tetraacetate                                  | magnesium methyl carbonate             | mercury(ii) chloride  |
| methoxyacetic acid                                 | methylformamide                        | n,n-dimethylacetamide   |
| n,n-dimethylformamide                              | nickel dibromide                       | nickel diiodide   |
| nickel sulfate hexahydrate                         | nickel(ii) chloride hexahydrate        | nickel(ii) perchlorate hexahydrate  |



**Mutagens and Reproductive Toxins**  
 Chemical Class Standard Operating Procedure  
 Berkeley **EH&S**

|                             |   |                                |
|-----------------------------|---|--------------------------------|
| nitrobenzene                | n-nitroso-n-methylurea                        | o-anisidine                    |
| o-chlorotoluene             | phenol  | phenolphthalein                |
| phenylhydrazine             | potassium dichromate                          | propargyl bromide              |
| propylene oxide             | p-tert-butylphenol                            | pyrocatechol                   |
| quinoline                   | sodium bis(2-methoxyethoxy)aluminiumhydride   | sodium dichromate dihydrate    |
| sodium mercury amalgam      | sodium perborate monohydrate                  | sodium tetraborate decahydrate |
| stannous chloride dihydrate | styrene oxide                                 | tebbe reagent                  |
| tert-butyl hydroperoxide    | tert-butyl hydroperoxide (5.0-6.0M in decane) | thiourea                       |
| tin(ii) chloride            | toluene                                       | tosyl azide                    |
| trimethyl phosphate         | tris(2-methoxyethoxy)(vinyl)silane            |                                |
|                             |   |                                |
|                             |   |                                |
|                             |   |                                |