Carcinogens

H350 H351

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 Signature: _____
Internal Lab Safety Coordinator or Lab Manager:	Name: Melissa Hardy/Justin Jurczyk Lab Phone: 406-696-1225/412-728-1952 Office Phone: 510-642-6312
Emergency Contact:	Name: Melissa Hardy/Justin Jurczyk Lab Phone: 406-696-1225/412-728-1952
Location(s) covered by this SOP:	Latimer Hall 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 carcinogens.

For a list of Carcinogens 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.

2. Physical & Chemical Properties/Definition of Chemical Group

Carcinogens are a category of chemicals where the available evidence strongly indicates that the substances cause human carcinogenicity.

3. Potential Hazards/Toxicity

Carcinogens are chemicals that cause cancer or tumor development, typically after repeated or chronic exposure. Their effects may only become evident after a long latency period and may cause no immediate harmful effects. Some carcinogens including arsenic, benzene, cadmium, hexavalent chromium, ethylene oxide, methylene chloride, asbestos, and formaldehyde have individual standards that govern their use.

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

H350 May cause cancer

H351 Suspected of causing cancer

Carcinogens may also have other hazardous properties in addition carcinogenicity. 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 the Protocol/Procedure section.

- Work with carcinogens 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 carcinogens 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 the Protocol/Procedure section.

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 the 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 nonflammable carcinogens within secondary containment.
- Chemicals that require refrigeration must be stored appropriately.
- Store flammable carcinogens within flammable storage cabinet and secondary container.

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 (e.g., use caution tape, barriers, etc.).

- **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 if you are trained, proceed to clean it. 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 the Protocol/Procedure section.

- 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.

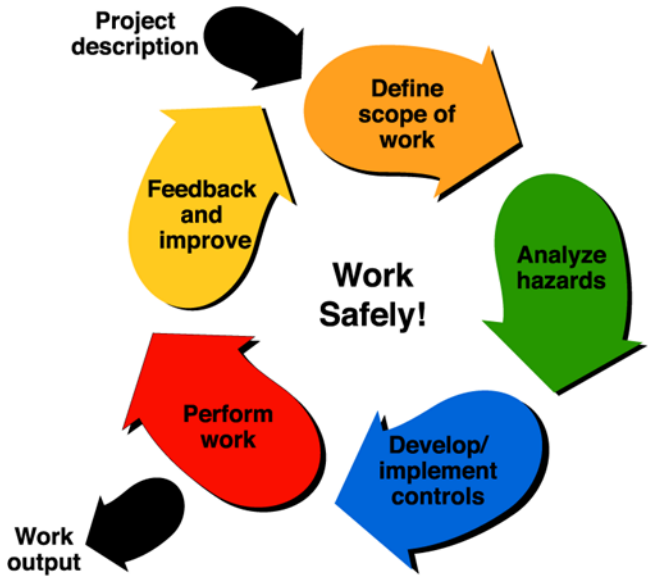
Dispose of Waste

- 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://ucsds.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 – Carcinogens

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 Carcinogenic chemicals as reagents.	Up to 20 g or 200 mL as supplied in the reagent bottle. 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.	**Eye protection**: Wear ANSI Approved tight-fitting safety goggles or safety glasses with side shields. **Face Protection**: Face shields are to be used when there is no protection from the hood sash. **Hand Protection:** 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. **Clothing**: Wear lab coat; full length pants or equivalent; and close-toed, close-heeled shoes.	Avoid the formation of dusts with solids. Carefully weigh materials as normal. Use enclosed balance or tared method with secondary containment. Immediately move to fume hood when weighing is complete. In a properly functioning fume hood, add reagent to the reaction vessel. If the reagent is a liquid, dispense and transfer to the reaction vessel using either a syringe or pipettor.
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
2. Using Carcinogenic chemicals as solvents in reactions, for extractions or cleaning glassware.	**Solvent in a Reaction:** Up to 200 mL as supplied in the reagent bottle. **Cleaning Glassware:** Up to 500 mL as supplied in the reagent bottle. **Extractions:** Up to 500 mL as supplied in the reagent bottle. 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.	**Eye protection**: Wear ANSI Approved tight-fitting safety goggles or safety glasses with side shields. **Face Protection**: Face shields are to be used when there is no protection from the hood sash. **Hand Protection:** 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. **Clothing**: Wear lab coat; full length pants or equivalent; and close-toed, close-heeled shoes.	Avoid inhalation of these materials. 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. 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. Pressure may be built up 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. 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. When used to clean glassware, leave the cleaned glassware in the fume hood until the solvent has evaporated off.
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
3. Using Carcinogenic chemicals as solvents in column chromatography (CC) or thin layer chromatography (TLC).	**TLC:** Up to 50 mL as supplied in the reagent bottle. **CC:** Up to 2000 mL as supplied in the reagent bottle. 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.	**Eye protection**: Wear ANSI Approved tight-fitting safety goggles or safety glasses with side shields. **Face Protection**: Face shields are to be used when there is no protection from the hood sash. **Hand Protection:** 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. **Clothing**: Wear lab coat; full length pants or equivalent; and close-toed, close-heeled shoes.	Avoid inhalation of these materials. Thin Layer Chromatography: allow the plate to dry in the fume hood after removal from the development bath. Column Chromatography: collect fractions of interest and concentrate as needed. 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. After use in the column, allow the solvent to evaporate from the packing material prior to proper disposal of the packing material.
Notes	**Any deviation from this SOP requires approval from PI.**			

13. Documentation of Training (signature of all users is required)

- Prior to conducting any work with carcinogens, 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 a copy of the relevant SDSs provided by the manufacturer.

I have read and understand the content of this SOP:

Name	Signature	Identifier	Date

List of Chemicals

Chemical(s)	Chemical(s)	Chemical(s)
(1,3-dioxolan-2-ylmethyl)magnesium bromide	(r)-epichlorohydrin	(r)-styrene oxide
(trimethylphosphoranylidene)acetonitrile	1,1,2-trichloroethane	1,1-dimethylhydrazine
1,2-benzenediamine	1,2-bis(diphenylphosphino)ethane nickel(ii) chloride	1,2-dibromoethane
1,2-dichloroethane	1,2-epoxy-5-hexene	1,2-epoxypentane
1,3-butadiene, gas	1,4,5,6,7,7-hexachloro-5-norbornene-2,3-dicarboxylic anhydride	1,4-dichlorobenzene
1-bromo-2-chloroethane	1-methyl-2-propenylmagnesium chloride	1-propenylmagnesium bromide, 0.05 mol/l in THF
1-propynylmagnesium bromide, 0.05 mol/l in THF	2,2,6,6-tetramethylpiperidinylmagnesium chloride lithium chloride complex	2,2-dimethyl-4-pentenal
2,4,6-trichlorophenol	2,6-diaminopurine	2,6-dimethylaniline
2-aminobiphenyl	2-chloro-1,3-butadiene	2-chloroacrylonitrile
2-cyanoethylzinc bromide	2-furanmethanol	2-hydroxyethylhydrazine
2-methyl-2-butene	2-methyl-5-nitroaniline	2-methylimidazole
2-nitropropane	2-nitrotoluene	2-propenenitrile
3,3'-dimethylbenzidine dihydrochloride	3-hydroxyanthranilic acid	3-methoxybenzylzinc chloride
3-methoxyphenylmagnesium bromide	3-methoxyphenylmagnesium bromide, 0.1 mol/l in THF	3-methylquinoline
4,4'-bis(dimethylamino)benzophenone	4,4'-dibromobiphenyl	4-aminostyrene
4-chloro-1,2-phenylenediamine	4-ethoxy-1,1,1-trifluoro-3-buten-2-one	5-nitroquinoline
9-bromo-9-borabicyclo[3.3.1]nonane	acetamide	acetic acid, dichloro-
Acetic acid, nickel(2+) salt, tetrahydrate	aniline	aniline hydrochloride
benzene	benzofuran	benzophenone
benzyl azide	benzyl chloride	benzyl chloromethyl ether
benzylmagnesium chloride	benzylzinc bromide	bis(tricyclohexylphosphine)nickel(ii) chloride
bis(tricyclohexylphosphine)nickel(ii) dichloride	bis(triphenylphosphine)nickel(ii) chloride	borane tetrahydrofuran complex
cadmium chloride	Carbazole	carbon tetrachloride
chenodeoxycholic acid sodium salt	chloramphenicol	chloroacetaldehyde
chloromethyl methyl ether	chromium trioxide	cis-1,4-dichloro-2-butene
cisplatin	cobalt chloride hexahydrate	cobalt dichloride
cobalt octacarbonyl	diarsenic pentaoxide	dicarbonylbis(triphenylphosphine)ni

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Dichloromethane	dicobalt octacarbonyl	diisopropyl azodicarboxylate
dimethyl phosphite	dimethyl sulfate	dimethylcarbamoyl chloride
epibromohydrin	epichlorohydrin	ethyl azidoacetate
ethylhydrazine oxalate	ethylmagnesium bromide	ethylmagnesium bromide, 0 in THF
ethynylmagnesium bromide	formaldehyde	formaldehyde, 37% in water
formamide	furan	furfural
hexachloroethane	hexamethylphosphoramide	hydrazine hydrate
hydrazine sulfate	hydrazine, anhydrous	hydroquinone
hydroxylamine sulfate	hydroxylammonium chloride	iodomethane
isobutyl nitrite	isophorone	isopropylmagnesium chloride
isoquinoline	lead dichloride	lithium 2-thienylcyanocuprate
lithium diisobutyl-tert-butoxyaluminum hydride	lithium diphenylphosphide	lithium triethylborohydride
l-selectride	l-selectride, 1M in THF	methyl carbamate
methyl vinyl ketone	methylmagnesium chloride, 0.3 mol/l in THF	molybdenum trioxide
molybdenyl acetylacetonate	n,n-dimethylaniline	n,n-dimethylsulfamoyl chloride
naphthalene	nickel	nickel dibromide
nickel diiodide	nickel dioxide	nickel sulfate hexahydrate
nickel(ii) chloride hexahydrate	nickel(ii) perchlorate hexahydrate	nickel, bis[(1,2,5,6-η)-1,5-cyclooctadiene]-
nitrobenzene	nitromethane	n-nitroso-n-methylurea
o-anisidine	octadecylmagnesium chloride	o-nitroanisole
o-toluenesulfonamide	o-toluidine	p-aminotoluene
p-anisidine	paraformaldehyde	p-chloroaniline
phenolphthalein	phenylhydrazine	phenylmagnesium chloride
phenylmagnesium chloride, 0.2 mol/l in THF	potassium bromate	potassium dichromate
propylene oxide	pulegone	quinoline
sodium dichromate dihydrate	styrene oxide	tetrachlorophthalic anhydride
tetrakis(triphenylphosphine)nickel	tetralin	tetranitromethane
thiourea	trimethyl phosphate	trimethylsilyldiazomethane
tris(dibenzylideneacetone)dipalladium-chloroform adduct	tri-sec-butylborane	vinyl acetate
vinyl bromide	vinylmagnesium bromide	x-phos