**Carcinogens**

**STANDARD OPERATING PROCEDURE (SOP)**

**Type of SOP:** ☐ Process ☐ Hazardous Chemical ☒ Hazardous Class

**All personnel who are subject to these SOP requirements must review a completed SOP and sign the associated training record. Completed SOPs must be kept with the UC Davis Laboratory Safety Manual or be otherwise readily accessible to laboratory personnel. Electronic access is acceptable. SOPs must be reviewed, and revised where needed, as described in the** [**UC Davis Laboratory Safety Manual**](http://safetyservices.ucdavis.edu/article/laboratory-safety-manual)**. Note that not all hazardous chemicals are appropriately addressed in a single control-banded SOP, and some chemicals are subject to several control-banded SOPs. Unique properties of each chemical must be considered before including it into a control band. This SOP is not appropriate for the “Listed” Carcinogens, as described in** [**8 CCR §5209**](https://www.dir.ca.gov/title8/5209.html) **and controlled by the** [**Listed Carcinogen SOP template**](https://ucdavis.box.com/s/w7nd45hy1uaxaoj7wf6tav88cd8kv4hq)**.**

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| Date SOP Written:  | **1/25/22** |  | Approval Date: | **1/25/22** |
| SOP Prepared by: | **Dietmar Kueltz** |
| **CLSC SOP Task Force** |
| SOP Reviewed and Approved by (name/signature): | **Dietmar Kueltz** |
| Department:  | **Animal Science** |
| Principal Investigator/Laboratory Supervisor:  | **Dietmar Kueltz** | Phone:  | **530-752-2991** |
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| Emergency Contact(s):  | **Leslie Oberholtzer** | Phone:  | 530-219-6664 |
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| Location(s) covered by SOP: | Building: | **Meyer Hall, Cole B** | Lab Phone: | **530-752-7322** |
| Room #(s):  | **1323 – 1333, 120, 133** |

1. **HAZARD OVERVIEW**

Carcinogens are chemicals that are known to cause cancer in humans and/or animals, or are suspected of causing cancer. Some of the chemicals used in academic laboratory research, industrial processes, and daily activities are carcinogenic. Recognition of the hazards associated with the transportation, use, storage, and disposal of these materials is essential. Precautions must be taken to minimize any potential chemical exposure to Carcinogens.

1. **HAZARDOUS CHEMICAL(S)/CLASS OF HAZARDOUS CHEMICAL(S)**

Carcinogens are chemicals that are capable of causing 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.

Carcinogens regulated by the California Occupational Safety and Health Administration (Cal/OSHA) can be found in [Title 8 of California Code of Regulations (8 CCR), Article 110](https://www.dir.ca.gov/title8/sb7g16a110.html), §5200-5220. Additionally, Cal/OSHA defines Carcinogens in [8 CCR §5191](http://www.dir.ca.gov/title8/5191.html) as materials that meet any of the following:

1. Is a regulated Cal/OSHA Carcinogen;
2. Is listed as “known to be carcinogens” in the National Toxicology Program (NTP) [Annual Report on Carcinogens](http://ntp.niehs.nih.gov/pubhealth/roc/index.html);
3. Is listed as Group 1 (“carcinogenic to humans”) by the International Agency for Research on Cancer (IARC) [Monographs](http://monographs.iarc.fr/ENG/Classification/); or
4. Is listed in either Group 2A (“probably carcinogenic to humans”) or 2B (“possibly carcinogenic to humans”) by IARC or under the category, “reasonably anticipated to be carcinogens” by NTP, and causes statistically significant tumor incidence in experimental animals under defined conditions (see [8 CCR §5191](http://www.dir.ca.gov/title8/5191.html) for more details).

Carcinogens can be identified in the Globally Harmonized System by the Hazard Codes H350 (May cause cancer) and H351 (Suspected of causing cancer). Some common examples of UC Davis laboratory Carcinogens include:

1. Arsenic and Arsenic compounds (inorganic)
2. Benzene
3. Cadmium and Cadmium compounds
4. Chromium (VI) compounds
5. Cobalt and Cobalt compounds
6. Dichloromethane
7. Formaldehyde
8. Lead and Lead compounds (inorganic)
9. Nickel compounds
10. Polycyclic Aromatic Hydrocarbons (PAHs)

Note, many Carcinogens have additional chemical hazards. Review a current Safety Data Sheet for each Carcinogen prior to use.

**Acrylamide, Bleomycin sulfate, Chloramphenicol, Chloroform, Diammonium salt, Drierite, Etoposide Phosphate, Formaldehyde, Formalin 10% buffered solution, Nickel (II) sulfate hexahydrate, Paraformaldehyde, Phenolphthalein, Phenol: Chloroform: Isoamyl alcohol, TBP, Trypan blue, Thiourea, Vacuum pump oil, and others**

1. **ENGINEERING/VENTILATION CONTROLS**

Use available engineering/ventilation controls to keep exposure to Carcinogens as low as possible. The following is a general plan for Carcinogens:

1. Use containment devices (*e.g.,* chemical fume hoods, glove boxes, localized exhaust (“snorkel”), etc.) when:
	1. Using volatile and/or semi-volatile substances;
	2. Manipulating substances that may generate aerosols; and
	3. Performing laboratory procedures that may result in an uncontrolled release.
2. Use high-efficiency particulate air (HEPA) filters, carbon filters, or scrubber systems with containment devices to protect effluent and vacuum lines, pumps, and the environment whenever feasible.
3. Ventilated containment should be used to weigh out solid chemicals (*e.g.,* ventilated balance safety enclosure, etc.). Alternatively, the tare method can be used to prevent inhalation of the chemical. While working in a fume hood, the chemical is added to a pre-weighed container. The container is then sealed and can be re-weighed outside of the fume hood. If a chemical needs to be added or removed, this manipulation is carried out in the fume hood. In this manner, all open chemical handling is conducted in the fume hood.

If you must use Carcinogens without/outside of engineering or ventilation controls, you must contact the Chemical Hygiene Officer or chem-safety@ucdavis.edu for an exposure assessment. Formaldehyde use in anatomy, histology and pathology laboratories must be evaluated by EH&S to ensure airborne concentrations of formaldehyde are below the Action Level of 0.5 parts per million by volume.

**Use in a certified chemical fume hood with the sash closed to the lowest practical position.**

1. **ADMINISTRATIVE CONTROLS**

The following elements are required:

1. Complete the [UC Laboratory Safety Fundamentals](http://safetyservices.ucdavis.edu/training/uc-laboratory-safety-fundamentals) (or approved equivalent) training prior to working in the laboratory;
2. Complete laboratory-specific safety orientation and training on laboratory-specific safety equipment, procedures, and techniques to be used, including any applicable laboratory-specific Laboratory Safety Plan(s), prior to receiving unescorted access to the laboratory;
3. Demonstrate competency to perform the procedures to the Principal Investigator (PI), Laboratory Supervisor, laboratory-specific Safety Officer, and/or trainer;
4. Be familiar with the location and content of any applicable Safety Data Sheets (SDSs) for the chemicals to be used ([SDS can be accessed online](https://safetyservices.ucdavis.edu/units/ehs/research/safety-data-sheets));
5. Implement good laboratory practices, including good workspace hygiene;
6. Inspect all equipment and experimental setups prior to use;
7. Follow best practices for the movement, handling, and storage of hazardous chemicals (see Chapters 5 and 6 of [Prudent Practices in the Laboratory](http://ucanr.edu/sites/ucehs/files/133892.pdf) for more detail). An appropriate spill cleanup kit must be located in the laboratory. Chemical and hazardous waste storage must follow an appropriate segregation scheme and include appropriate labeling. Hazardous chemical waste must be properly labelled, stored in closed containers, in secondary containment, and in a designated location;
8. Do not deviate from the instructions described in this SOP without prior discussion and approval from the PI and/or Laboratory Supervisor.
9. Notify the PI and/or Laboratory Supervisor of any accidents, incidents, near-misses, or upset condition (*e.g.,* unexpected rise or drop in temperature, color or phase change, evolution of gas) involving Carcinogens described in this SOP; and
10. Abide by the laboratory-specific working alone SOP, if applicable.

For Carcinogens, the following are also required:

1. Work surfaces should be protected (*e.g.*, disposable absorbent bench paper, aluminum foil, etc.) and must be decontaminated after each use;
2. All waste containing Carcinogen materials at greater than 0.001% wt., including preserved tissue samples, must be disposed as hazardous waste; and
3. This SOP is **not** meant to address [8 CCR §5209](https://www.dir.ca.gov/title8/5209.html) “Listed” Carcinogens. If you are using one of these materials you must develop a separate [Listed Carcinogens SOP](http://safetyservices.ucdavis.edu/sites/default/files/documents/ListedCarcinogens_SOP_template.docx).

**All Carcinogens: Keep container tightly closed in a dry and well-ventilated place. Chloroform- avoid inhalation of vapour or mist. Formaldehyde- avoid inhalation of vapour or mist. take measures to prevent any build up of electrostatic charge. Formalin- avoid inhalation of vapour or mist. take measures to prevent any build up of electrostatic charge. Paraformaldehyde- keep away from sources of ignition. Phenol: Chloroform: Isoamyl alcohol- keep away from sources of ignition.**

1. **PERSONAL PROTECTIVE EQUIPMENT (PPE)**

At a minimum, long pants (covered legs) and closed toe/closed heel shoes (covered feet) are required to enter a laboratory or technical area where hazardous chemicals are used or stored.

In addition to the minimum attire required upon entering a laboratory, the following PPE are required for work with Carcinogens:

1. Eye Protection: Eye protection is required for all work with Carcinogens.
	1. At a minimum ANSI Z87.1-compliant safety glasses are necessary.
	2. Splash goggles may be substituted for safety glasses, and are required for processes where splashes are foreseeable or when generating aerosols.
	3. Ordinary prescription glasses will NOT provide adequate protection unless they also meet the Z87.1 standard and have compliant side shields.
2. Body Protection: At a minimum a chemically-compatible laboratory coat that fully extends to the wrist is necessary.
	1. If a risk of fire exists, a flame-resistant laboratory coat that is NFPA 2112-compliant should be worn.
	2. For chemicals that are corrosive and/or toxic by skin contact/absorption additional protective clothing (*e.g.,* face shield, chemically-resistant apron, disposable sleeves, etc.) are required where splashes or skin contact is foreseeable.
3. Hand Protection: Hand protection is needed for the activities described in this SOP. Define the type of glove to be used based on: A) the chemical(s) being used, B) the anticipated chemical contact (*e.g.*, incidental, immersion, etc.), C) the manufacturers’ permeation/compatibility data, and D) whether a combination of different gloves is needed for any specific procedural step or task.

**Chloroform- fluorinated rubber**

**Phenol: Chloroform: Isoamyl alcohol- fluorinated rubber**

**All other chemicals- Nitrile gloves**

1. **SPILL AND EMERGENCY PROCEDURES**

Follow the guidance for chemical spill cleanup from [SafetyNet #13](http://safetyservices.ucdavis.edu/safetynet/guidelines-chemical-spill-control) and/or the [UC Davis Laboratory Safety Manual](http://safetyservices.ucdavis.edu/article/laboratory-safety-manual), unless specialized cleanup procedures are described below. Emergency procedure instructions for the UC Davis campus and UCD Medical Center are contained in the [UC Davis Laboratory Safety Manual](http://safetyservices.ucdavis.edu/article/laboratory-safety-manual), [campus Emergency Response Guide (ERG)](http://safetyservices.ucdavis.edu/sites/default/files/documents/Emergency_Response_Guide.pdf), and [UCD Health System ERG](http://www.ucdmc.ucdavis.edu/medresearch/downloads/labsafety/2.6-UCDHS-Emergency-Response-Guide.pdf). The applicable ERG must be posted in the laboratory. All other locations must describe detailed emergency procedure instructions below.

For spills of solid materials, DO NOT dry sweep.

**Small (<1 L) – Proceed only if injury to yourself or others is unlikely and it is neither an emergency nor likely to become an emergency. if properly trained begin clean-up effort. Use appropriate personal protective equipment and clean-up material for chemical spilled. Double bag spill waste in clear plastic bags, label and take to the next chemical waste pick-up.**

**Large (>1 L) – Dial 911 and EH&S at (530) 752-1493 for assistance.**

**Chloroform- Soak up with inert absorbent material and dispose of as hazardous waste.**

**Formaldehyde and formalin- Contain spillage, and then collect with noncombustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations.**

**Phenol: Chloroform: Isoamyl alcohol- contain spill, collect with an electrically protected vacuum or by wet brushing and place in container for disposal according to local regulations.**

EH&S **must be notified immediately** for any uncontrolled release of Carcinogens; please call (530) 752-1493. Some examples of an uncontrolled release include, but are not limited to, equipment failure, rupture of containers, or failure of control equipment. EH&S must report this information to Cal/OSHA within 24 hours.

1. **WASTE MANAGEMENT AND DECONTAMINATION**

Hazardous waste must be managed according to [Safety Net #8](http://safetyservices.ucdavis.edu/safetynet/guidelines-disposal-chemical-waste), and must be [properly labeled](http://safetyservices.ucdavis.edu/article/hazardous-waste-storage-and-labeling). In general, hazardous waste must be removed from your laboratory within 9 months of the accumulation start date; refer to the [accumulation time for waste disposal](http://safetyservices.ucdavis.edu/article/hazardous-waste-storage-and-labeling). Hazardous waste pick up requests must be completed using [WASTe](https://ehs.ucop.edu/waste/#/).

**Note:** See the [WASTe Factsheet](http://safetyservices.ucdavis.edu/sites/default/files/documents/WASTe_Factsheet.pdf) for instructions on how to complete a label.

**Segregate carcinogen waste from other waste**

**Carcinogenic waste must first be placed in a plastic bag, or other suitable impermeable container, and then in a primary container. Label the outer container with (a) the name of the carcinogen and (b) "CAUTION: Cancer Suspect Agent"**

**Waste containing more than 0.1% of a campus-recognized chemical carcinogen must be labeled: “CAUTION: CANCER SUSPECT AGENT”.**

**Double-bag dry waste using transparent bags. Waste must be under the control of the person generating and disposing of it.**

**Affix a completed hazardous waste label on all waste containers as soon as the first drop of waste is added to the container. Label can be found at:**

[**https://safetyservices.ucdavis.edu/categories/hazardous-materials-management**](https://safetyservices.ucdavis.edu/categories/hazardous-materials-management)

**Dispose of regularly generated chemical waste according to the UC Davis waste disposal policy and procedures.** [**https://safetyservices.ucdavis.edu/article/hazardous-waste-storage-and-labeling**](https://safetyservices.ucdavis.edu/article/hazardous-waste-storage-and-labeling)

**Request a waste pick-up on-line:** [**https://ehs.ucop.edu/waste**](https://ehs.ucop.edu/waste)

Decontamination procedures vary depending on the material being handled. Carefully inspect work areas to make sure no hazardous materials remain. Following dispensing or handling, all surfaces and equipment should be wiped with the appropriate cleaning agent to prevent accumulation of Carcinogen chemical residue. Dispose of cleaning materials properly. Be sure all ignition sources are secured before beginning clean up with flammable liquids. Decontaminate vacuum pumps or other contaminated equipment before removing them from the regulated area or before resuming normal laboratory work in the area.

**See paragraph below**

Upon completion of work with Carcinogens and/or decontamination of equipment, remove gloves and/or PPE to wash hands and arms with soap and water. Additionally, upon leaving a designated Carcinogen work area remove all PPE worn and wash hands, forearms, face and neck as needed. Contaminated clothing or PPE should not be worn outside the lab. Soiled lab coats should be sent for professional laundering. Grossly contaminated clothing/PPE and disposable gloves must not be reused.

1. **DESIGNATED AREA**

Designated area(s) for the use and storage of Carcinogens shall be established where limited access, special procedures, knowledge, and work skills are required. Signage indicating the materials being used and/or stored and the applicable hazards should be easily visible for the designated work space and/or storage area, for example: DANGER! CARCINOGEN WORK AREA!

**Designated work area for these substances are in the certified chemical fume hood located in Meyer hall, room 1329. Designated storage area is in flammable cabinet in room 1329 in Meyer hall. Both designated work areas and storage areas are labeled with “CAUTION! Cancer suspecting agent” and “Carcinogen storage area”.**

1. **DETAILED PROTOCOL**

**All work with chemicals/ materials falling into this hazard category needs to be discussed with the PI and the corresponding SOP for the specific type of work needs prior written approval by the PI.**

**All lab workers who will be using this material(s) must review this SOP and sign the associated training sheet. Lab workers must have specific training on the proper handling of this material(s) and understand the hazards.**

**Lab workers using this material(s) must demonstrate competence to the Principal Investigator or designee by being able to 1) identify the hazards and list any particularly hazardous handling techniques (use of a Schlenck line, rotary evaporation, cannula transfer, extremes of pressure or** **temperature, etc.), 2) list the foreseeable emergency situations, 3) describe the proper response to** **the emergency situations, and 4) know the control measures to minimize the risks.**

**When working in the lab, a laboratory worker must:**

1. **Not work alone (if you are alone in the laboratory, leave),**
2. **Be cognizant of all of the SDS and safety information presented in this document,**
3. **Find/follow a literature experimental procedure describing the use of this reagent covered by this SOP in a related chemical transformation … if a pertinent literature protocol cannot be found, the researcher MUST discuss the planned experiment with the PI (or designee) prior to using this reagent,**
4. **Not deviate from the literature experimental protocol mentioned in (3) in either temperature or pressure without PRIOR APPROVAL from the PI (or designee),**
5. **Follow all related SOPs in the laboratory SOP bank (PPE, syringe techniques, waste disposal, etc. as appropriately modified by any specific information in the SDS information presented in this document),**
6. **Employ (< quantity) of this reagent in any given reaction (larger quantities REQUIRE the approval of PI or designee), and**

**Discuss ALL issues or concerns regarding this reagent with the PI prior to its use.**

**TEMPLATE REVISION HISTORY**

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| --- | --- | --- | --- |
| **Version** | **Date Approved** | **Author** | **Revision Notes:** |
| **1.0** | **4/14/2015** | **CLSC Task Force** | **New template** |
| **1.1** | **3/10/2016** | **Chris Jakober** | **Updated URLs following website redesign, added URL to UCDHS ERG, removed reference to Carcinogen Manual and SafetyNet #32** |
| **1.2** | **11/30/2016** | **Lindy Gervin** | **Unlocked editable fields** |
| **1.3** | **3/13/2017** | **Lindy Gervin** | **Updated links in section 7 to WASTe system** |
| **1.4** | **5/10/2017** | **Lindy Gervin** | **Updated email address in section 3** |
| **1.5** | **12/2/2020** | **Phillip Painter** | **Updated SDS hyperlink in section 4** |

**LAB-SPECIFIC REVISION HISTORY**

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| --- | --- | --- | --- |
| **Version** | **Date Approved** | **Author** | **Revision Notes:** |
| 1.0 | 4/5/14 | Dietmar Kueltz |       |
| 1.1 | 4/2/18 | Leah Rechlin |  |
| **1.2** | 9/14/18 | **Leah Rechlin** | Updated chemical list. |
| **1.3** | 4/12/19 | **Leah Rechlin** | **updated chemicals**  |
| **1.4** | 1/25/22 | **Dietmar Kueltz** |       |
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**Documentation of Standard Operating Procedure Training**

*(Signature of all users is required)*

* Prior to using **Carcinogens**, laboratory personnel must be trained on the hazards described in this SOP, how to protect themselves from these hazards, and emergency procedures.
* Ready access to this SOP and to a Safety Data Sheet for each hazardous material described in the SOP must be made available.
* The Principal Investigator (PI), or the Laboratory Supervisor if the activity does not involve a PI, must ensure that their laboratory personnel have attended appropriate laboratory safety training or refresher training within the last three years.
* Training must be repeated following **any** revision to the content of this SOP. Training must be documented. This training sheet is provided as one option; other forms of training documentation (including electronic) are acceptable but records must be accessible and immediately available upon request.

**Designated Trainer:** *(signature is required)* Dietmar Kueltz

**Signatures for this SOP are included in the Initial and Annual Lab refresher training documents**

I have read and acknowledge the contents, requirements, and responsibilities outlined in this SOP:

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| **Name** | **Signature** | **Trainer Initials** | **Date** |
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