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UNIVERSITY OF CALIFORNIA

Reproductive Toxins

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. 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. The unique properties of each chemical must be considered before including it into a control band.

Date SOP Written: **10/28/19** Approval Date: **9/3/22**

SOP Prepared by: **Jeff Walton**, **CLSC SOP Task Force**

SOP Reviewed and Approved by (name/signature): **James Ames**

Department: **NMR Facility**

Principal Investigator/ Laboratory Supervisor: **Derrick Kaseman** Phone: **530 752-7794**

Lab Manager/ Safety Coordinator: **Derrick Kaseman** Phone: **530 752-7794**

Emergency Contact(s): **Derrick Kaseman** Phone: **530 752-7794**
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James Ames **530 752-6358**

Location(s) covered by SOP: Building: **Chemistry 93, MS1D - All Rooms, NMR Trailer - All Rooms**
Room #(s): **See Above** Lab Phone: **530 752-7794**

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1. HAZARD OVERVIEW

There is a broad spectrum of chemicals that pose the potential to be Reproductive Toxins (*e.g.,* mutagenicity, teratogenicity, etc.). Recognition of the hazards associated with the transportation, handling, storage, and disposal of these materials is essential.

2. HAZARDOUS CHEMICAL(S)/CLASS OF HAZARDOUS CHEMICAL(S)

Reproductive Toxins are substances or agents that may have adverse effects on various aspects of reproduction in both women and men, including fertility, gestation/pregnancy, birth defects, lactation, genetic effects, and general reproductive performance. Many chemicals used in laboratory study and research, industrial processes, and daily activities pose reproductive hazards.

Materials that meet this criteria can be identified using the following Globally Harmonized System Hazard Codes, which should be included on current Safety Data Sheets:

1. H340 - May cause genetic effects;
2. H341 - Suspected of causing genetic effects;
3. H360 - May damage fertility or the unborn child;
4. H361 - Suspected of damaging fertility or the unborn child; and
5. H362 - May cause harm to breast-fed children.

A few examples of common Reproductive Toxins used at the UC Davis campus include, but are not limited to, the following:

1. Chloroform
2. Toluene
3. Benzene
4. Lead
5. Anesthetic gases (*e.g.,* halothane, isoflurane, etc.)

REQUIRED - List (or attach) the applicable chemical(s) for your laboratory, and describe important properties and signs/symptoms of exposure.

Samples denoted by asterisks (*) are sealed NMR samples

Benzene-d6
1,4-Dioxane, 40% solution in benzene-d6 with 5mg/mL chromium(III) acetylacetonate*
40% Para-Dioxane 60% Deuterobenzene*
Formamide 90% Deuterodimethylsulphoxide 10%*
0.05% Alpha, Alpha, Alpha-Trifluorotoluene in Deuterobenzene*
Benzene solution NMR reference standard, 80% in acetone-d6 (99.9 atom % D), NMR tube size 5 mm x 8 in.*
1,4-Dioxane solution NMR reference standard, 40% in benzene-d6 (99.6 atom % D), NMR tube size 5 mm x 8 in.*
Hexamethyldisiloxane solution NMR reference standard, 25% in benzene-d6 (99.6 atom % D) chemical structure*
Rhodium(III) chloride
Vanadium(V) oxide
Lead(II) nitrate
Sodium borate solution
Chloroform-d
Cesium chloride
0.0485M Triphenylphosphate in Deuterochloroform *

Cesium chloride, 1M solution in water
Sodium metavanadate
Ethylbenzene solution NMR reference standard, 0.1% in chloroform-d ("100%", 99.96 atom % D) *
1% Iodomethene-13C, 1% Trimethylphosphite 0.2% Cr(acac)3 in Deuterochloroform *
Ethylbenzene solution NMR reference standard, 10% in chloroform-d (99.8 atom % D)*
Ethylbenzene solution NMR reference standard, 0.1% in chloroform-d (99.8 atom % D), TMS 0.01 % *
Ethylbenzene solution NMR reference standard, 0.1% in chloroform-d (99.8 atom % D), TMS 0.01 % *
Ethylbenzene solution NMR reference standard, 0.1% in chloroform-d (99.8 atom % D), NMR tube size 8 mm x 7 in.*

3. ENGINEERING/VENTILATION CONTROLS

The following is a general plan for all Reproductive Toxins:

A. Use containment devices (*e.g.,* chemical fume hoods, glove boxes, etc.) when:
   i. Using volatile and/or semi-volatile substances;
   ii. Manipulating substances that may generate aerosols; and
   iii. Performing laboratory procedures that may result in an uncontrolled release.
B. 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.
C. Ventilated containment should be used to weigh out solid chemicals (*e.g.,* certified laboratory chemical fume hood). 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 Reproductive Toxins without engineering or ventilation controls, you must contact chem-safety@ucdavis.edu for an exposure assessment.

REQUIRED - Insert descriptions of the lab-specific ventilation controls and equipment safety features utilized to reduce the risk of Reproductive Toxin chemical exposures.

When used as NMR standards in capped/sealed NMR tubes, no controls are required. Sample preparation, should be done in a fume hood in Medical Sciences 1D Room 18C. NMR Standard samples should generally be less than 1 ml. Appropriate PPE for the Chemical should be worn – goggles, lab coat, gloves of the appropriate material.

4. ADMINISTRATIVE CONTROLS

The following elements are required:

1. Complete the 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 (online SDSs can be accessed from UC SDS);
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 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 the Reproductive Toxins described in this SOP; and
10. Abide by the laboratory-specific working alone SOP, if applicable.

For Reproductive Toxins, the following are also required:

11. Work surfaces should be protected (*e.g.,* disposable absorbent bench paper, aluminum foil, etc.) and must be decontaminated after each use.

Laboratory personnel considering pregnancy or who become pregnant may want to consult the additional information on the Reproductive Health webpage.

REQUIRED - Insert descriptions of any special handling or storage requirements.

Storage of NMR Standard samples containing reproductive toxins as solvents are to be kept in a drawer, container, or rack designed for holding the samples when not in use.

INSERT IF APPLICABLE - Describe any additional administrative controls (*e.g.,* restrictions on procedure/work equipment/work locations/unattended operations). Include any chemical-specific administrative controls (*e.g.,* peroxide formers).

NMR Standard samples are to be used in rooms with NMR Spectrometers. Sample preparation must be completed in fume hood.

5. 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 is required for work with Reproductive Toxins:

A. Eye Protection: Eye protection is required for all work with Reproductive Toxins.
   i. At a minimum ANSI Z87.1-compliant safety glasses are necessary.
   ii. Splash goggles may be substituted for safety glasses, and are required for processes where splashes are foreseeable or when generating aerosols.

iii. Ordinary prescription glasses will NOT provide adequate protection unless they also meet the Z87.1 standard and have compliant side shields.

B. Body Protection: At a minimum a chemically-compatible laboratory coat that fully extends to the wrist is necessary.
   i. If a risk of fire exists, a flame-resistant laboratory coat that is NFPA 2112-compliant should be worn.
   ii. 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.

C. Hand Protection: When 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.

REQUIRED - Insert descriptions of PPE and hygiene practices used with each process, hazardous chemical(s), or hazardous chemical class, including any specialized PPE needed for a procedural step/task.

Appropriate PPE for the Chemical should be worn – goggles, lab coat, gloves of the appropriate material shall be worn during the preparation of NMR Standard samples. Once samples are sealed, no PPE is necessary.

6. SPILL AND EMERGENCY PROCEDURES

Follow the guidance for chemical spill cleanup from SafetyNet #13 and/or the UC Davis 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, campus Emergency Response Guide (ERG), and UCD Health System ERG. The applicable ERG must be posted in the laboratory. All other locations must describe detailed emergency procedure instructions below.

REQUIRED - Insert descriptions of any specialized spill clean up procedures for hazardous chemicals used in this SOP (*e.g.,* hydrofluoric acid, pyrophorics, phenol, etc.). Additional details of lab-specific spill cleanup should be provided if applicable.

Absorb with an inert material and put the spilled material in an appropriate waste disposal.

INSERT IF APPLICABLE - Descriptions of any specialized emergency procedures for locations outside of the UC Davis main campus and the UCD Medical Center campus.

NA

7. WASTE MANAGEMENT AND DECONTAMINATION

Hazardous waste must be managed according to Safety Net #8, and must be properly labeled. 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. Hazardous waste pick up requests must be completed using WASTe.

Note: See the WASTe Factsheet for instructions on how to complete a label.

REQUIRED - Insert descriptions of laboratory-specific information on the waste streams generated, storage location, and any special handling/storage requirements.

These samples are standard samples and are not consumed. Thus no waste is generated under normal use. Broken samples should be treated as a spill and disposed of appropriately. Samples that must be prepared (e.g. using a vial of benzene to make an NMR sample) may generate a waste stream. Any waste should be disposed of using an appropriate container and the WASTe system.

Decontamination procedures vary depending on the material being handled. The toxicity of some materials can be neutralized with other reagents. All surfaces and equipment should be wiped with the appropriate cleaning agent following the dispensing or handling of reproductive hazards to prevent accumulation. Decontaminate vacuum pumps or other contaminated equipment before removing them from the designated area or before resuming normal laboratory work in the area.

Carefully inspect work areas to make sure no hazardous materials remain. Clean contaminated work areas with an appropriate cleaning agent, and dispose of cleaning materials properly. Be sure all ignition sources are secured before beginning clean-up with flammable liquids.

REQUIRED - Insert descriptions of decontamination procedures for equipment, glassware, and controlled areas (*e.g.,* glove boxes, restricted access hoods, perchloric/hot acid fume hoods, or designated portions of the laboratory) in your description.

NA

Upon completion of work with Reproductive Toxins and/or decontamination of equipment, remove gloves and/or PPE to wash hands and arms with soap and water. Additionally, upon leaving a designated Reproductive Toxin work area remove all PPE 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.

8. DESIGNATED AREA

Designated area(s) are required for use and storage of Reproductive Toxins. Such areas must be clearly marked with signs that identify the chemical hazard and include an appropriate warning; for example: DANGER! REPRODUCTIVE TOXIN WORK AREA!

REQUIRED - Insert description(s) of the designated area(s) for your laboratory, which is required for Reproductive Toxins. The entire laboratory, a portion of the laboratory, a chemical fume hood, etc. can be designated.

For use as a sealed standard sample, any where in the lab. During sample preparation, a fume hood such as in room 18C of Med. Sci. shall be used. Sealed source material in 1 ml or less vials may be stored in office drawers. Larger quantities should be stored in room with a fume hood.

9. DETAILED PROTOCOL

REQUIRED - Insert or attach detailed laboratory-specific procedures for the process, hazardous chemical(s), or hazard class. You may also include any relevant supporting resources (*e.g.,* SafetyNets, journal citations, etc.) that are applicable.

When in use, standard samples are placed in a spinner and a depth gauge is used so that they do not hit the bottom of the NMR probe. Air pressure is turned on and the sample/spinner assembly is

placed in the column of air so that it floats. The air is turned off so the sample floats down into the probe.

Source material is in 0.5 ml (typical) sealed glass vials. The vials are designed to be snapped open. They should be snapped open in the hood while wearing appropriate PPE. The contents from the vial are then pipetted into and NMR tube

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TEMPLATE REVISION HISTORY

Version	Date Approved	Author	Revision Notes:
1.0	12/1/2014	CLSC Task Force	New template
1.1	4/16/2015	Chris Jakober	Changed SDS link, language relating to soiled PPE
1.2	3/10/2016	Chris Jakober	Updated URLs following website redesign, added URL to UCDHS ERG, corrected error in common examples list
1.3	11/30/2016	Lindy Gervin	Unlocked editable fields
1.4	3/13/2017	Lindy Gervin	Updated links in section 7 to WASTe system
1.5	5/10/2017	Lindy Gervin	Updated email address in section 3

LAB-SPECIFIC REVISION HISTORY

Version	Date Approved	Author	Revision Notes:
1	10/28/19	Jeffrey Walton	Initial SOP generation
2	9/3/22	Derrick Kaseman	Updated chemical inventory and contact information

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Documentation of Standard Operating Procedure Training

(Signature of all users is required)

- ✓ Prior to using **Reproductive Toxins**, laboratory personnel must be trained on the hazards involved in working with this SOP, how to protect themselves from the 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)*

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

Name	Signature	Trainer Initials	Date