UC DAVIS
UNIVERSITY OF CALIFORNIA

FLAMMABLE AND COMBUSTIBLE LIQUIDS

STANDARD OPERATING PROCEDURE (SOP)

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

All personnel 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 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. If you need assistance completing this SOP template or with hazard assessment for your chemical use please contact chem-safety@ucdavis.edu.

Date SOP Written: **2/8/22** Approval Date: **2/8/22**

SOP Prepared by: **Jay Rosenheim**
CLSC SOP Task Force

SOP Reviewed and Approved by (name/signature): **Jay Rosenheim**

Department: **Entomology and Nematology**

Principal Investigator/ Laboratory Supervisor: **Jay Rosenheim** Phone: **530-752-4395**

Lab Manager/ Safety Coordinator: **Jay Rosenheim** Phone: **530-752-4395**

Emergency Contact(s): **Emma Cluff** Phone: **530-752-4481**

Location(s) covered by SOP: Building: **Briggs** Lab
Room #(s): **320** Phone: **530-752-4481**

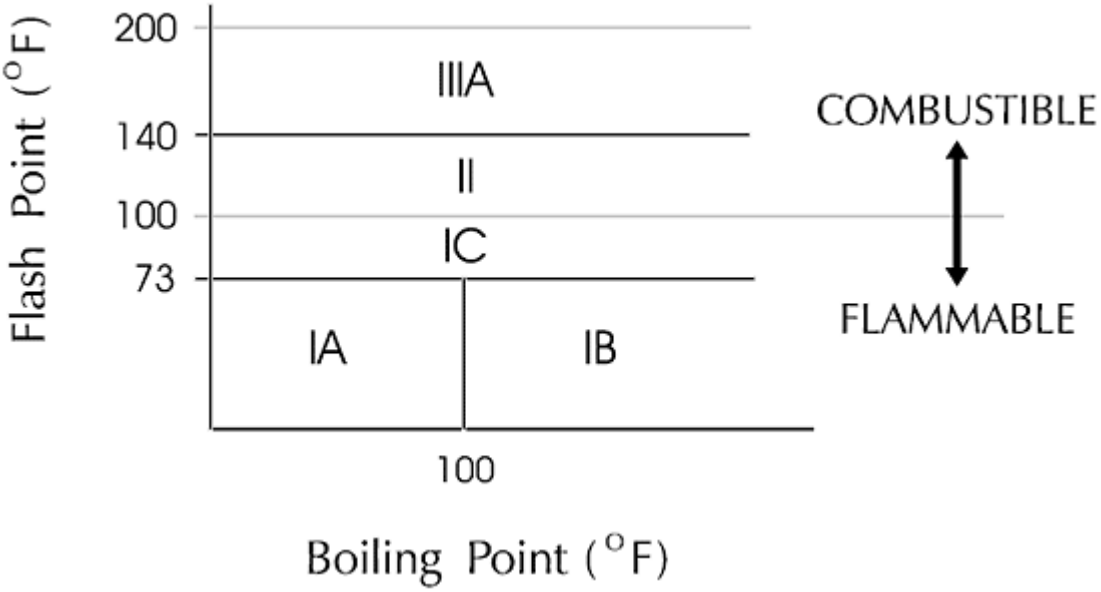
---

1. HAZARD OVERVIEW

Flammable and combustible liquids are those which can ignite when exposed to an ignition source at the flash point of the liquid. For a fire to occur three elements are required (fuel, ignition source, and oxygen), flammable and combustible liquids serve as fuel for a fire.

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

Flammable liquids are defined by their flash point (*i.e.*, the minimum temperature at which vapors are formed on the surface of a substance in sufficient quantity to ignite when exposed to an ignition source). OSHA and GHS (hazard codes H224, H225, H226) define flammable liquids as those with a flash point less than 37.8 °C (100 °F), while combustible liquids (hazard code H227) have a flash point greater than 37.8 °C (100 °F). The California Fire Code further classifies flammable liquids by their flash and boiling points. A summary table is provided below:



A few examples of common flammable or combustible liquids in use on the UC Davis campus are:

Chemical name	Boiling point	Flash point	Classification	GHS Code
Acetone	56 °C (133 °F)	-17 °C (1 °F)	IB	H225
1-Butanol	117 °C (243 °F)	29 °C (84 °F)	IB	H226
Diesel fuel	149 - 371°C (300 - 700 °F)	>65 C (149 F)	II	H226
Diethyl ether	36.6 °C (94.3 °F)	-45 °C (-49°F)	IA	H224
Ethanol	78.4 °C (173.1 °F)	12.8 °C (55.0 °F)	IB	H225
1-Propanol	97.2 °C (207 °F)	23.3 °C (74 °F)	IC	H225
Vacuum pump oil	476 °C (889 °F)	288 °C (550°F)	IIIA	H227

The classification of flammable liquids impacts the Maximum Allowable Quantity (MAQ) for the laboratory. Please contact Fire Prevention to assess the materials and space to determine the applicable MAQs. Additional information is available in a SafetyNet on Flammable Liquid Storage.

Ethanol

3. ENGINEERING/VENTILATION CONTROLS

Chemical Fume Hood

Flammable liquids should be used in a certified chemical fume hood. Flammable liquids should not be used in reverse-flow laminar flow benches (*e.g.*, clean bench), recirculating biosafety cabinets, poorly-ventilated rooms, or near ignition sources.

Flammable Liquid Storage Cabinets

Flammable liquid storage cabinets must meet NFPA 30 specifications, Flammable and Combustible Liquids Code, and the California Fire Code. Cabinets must also be Underwriter Laboratories (U.L.) 1275 listed. Self-closing doors with a latching mechanism are required. Cabinets should be placed so that they do not block or impede egress. Flammable liquid storage cabinets are not required to be vented. Any ventilation of a flammable liquid storage cabinet must be approved by UC Davis Fire Prevention (see UC Davis SafetyNet, "Venting Flammable Storage Cabinets"). Grounding is not required unless Class IA flammable liquids are being dispensed from the cabinet. If grounding is desired, the flammable liquid storage cabinet must be grounded to a static grounding terminal and not to the ground of an electrical receptacle. Any metal receiving container must be bonded to the grounded dispensing container.

Refrigerator/Freezers

If flammable liquids must be stored at reduced temperature, a U.L. Listed Flammable Material Storage Refrigerator/Freezer must be used. These refrigerator/freezers are designed to prevent ignition of flammable vapors inside the storage compartment. Explosion-proof refrigerators have very limited use and require special hazardous-location wiring rather than the simple plug-in type power cord. Consult with the UC Davis Fire Prevention Office before purchasing an Explosion proof Refrigerator.

Ethanol will be stored in the chemical storage cabinet below the fume hood.

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, 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);
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 or Laboratory Supervisor;
9. Notify the PI 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 Flammable Liquids described in this SOP; and
10. Abide by the laboratory-specific working alone SOP, if applicable.

For Flammable Liquids, the following are also required:

11. Areas where Flammable Liquids are used or stored must have access to a safety shower/eye wash station within ten seconds of travel, and a Class A/B/C fire extinguisher. Dry sand, Met-L-X, soda ash or dry lime extinguishing agents may be needed. All safety showers, eyewashes, and fire extinguishers in these areas must be fully functioning and inspected monthly.
12. No more than 10 gallons of flammable liquids, including hazardous waste, may be stored outside of an approved Flammable Liquid storage cabinet, at any time in any room;
13. Each Flammable Liquid storage cabinet must have self-closing doors with a latching mechanism;
14. Flammable Liquids must be separated from incompatible materials (*e.g.*, oxidizers, alkali metals, pyrophorics, and water-reactive materials); and
15. If stored outside of a Flammable Liquid storage cabinet, Flammable Liquids shall not be stored near ignition sources.

We do not expect to store any other chemicals with the ethanol. Total amount will be kept below 4 gallons.

(No special storage or handling practices.)

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 all work with Flammable Liquids:

A. Eye Protection:
   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. Clothing worn under PPE should not be constructed from synthetic materials
   ii. A flame-resistant laboratory coat that is NFPA 2112-compliant that fully extends to the wrist is required if using large quantities (>1 liter) or when using flammable liquids near an open flame or ignition source. The only exception to this requirement is for conducting Flame Sterilization following the campus approved SOP. Some FR fabrics (*e.g.*, Nomex®, Rhovyl®, Kevlar®, etc.) are highly permeable and do not provide good chemical resistance; and

iii. For chemicals that are corrosive and/or toxic by skin contact/absorption additional protective clothing (*e.g.,* face shield, chemically-resistant layer, 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.

i. Flame-resistant gloves should be considered if using large quantities (>1 liter) or using Flammable Liquids near an open flame or ignition source.

Gloves and lab coat.

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.

(No special clean-up; use clean-up kit.)

(No special emergency procedures.)

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.

No waste stream is anticipated.

(No special decontamination procedure is needed.)

Upon completion of work with hazardous chemicals and/or decontamination of equipment, remove gloves and/or PPE to wash hands and arms with soap and water. Additionally, upon leaving a designated hazardous chemical 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.

8. DESIGNATED AREA

(None.)

9. DETAILED PROTOCOL

Use ethanol in fume hood.

UCDAVIS
UNIVERSITY OF CALIFORNIA

TEMPLATE REVISION HISTORY

Version	Date Approved	Author	Revision Notes:
1.0	10/26/2015	CLSC Task Force	New template
1.1	3/10/2016	Chris Jakober	Updated URLs following website redesign, added URL to UCDHS ERG
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	Added email address to introduction
1.5	12/2/2020	Phillip Painter	Updated SDS hyperlink in section 4

LAB-SPECIFIC REVISION HISTORY

Version	Date Approved	Author	Revision Notes:

UCDAVIS
UNIVERSITY OF CALIFORNIA

Documentation of Standard Operating Procedure Training

(Signature of all users is required)

- ✓ Prior to using **Flammable Liquids**, 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
Jay Rosenheim		**JR**	**2/8/2022**