

FLAMMABLE SOLIDS

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: Click here to enter a date. Approval Date: Click here to enter a date.

SOP Prepared by: REQUIRED - Insert Preparer's Name
CLSC SOP Task Force

SOP Reviewed and Approved by (name/signature): REQUIRED - Insert Approver's Name & Signature

Department: REQUIRED - Insert Department

Principal Investigator/
Laboratory Supervisor: REQUIRED - Insert Name Phone: REQUIRED - Insert Phone#

Lab Manager/
Safety Coordinator: REQUIRED - Insert Name Phone: REQUIRED - Insert Phone#

Emergency Contact(s): REQUIRED - Insert Name Phone: REQUIRED - Insert Phone#

Location(s) covered by SOP: Building: REQUIRED - Insert Name Lab
 Room #(s): REQUIRED - Insert Number Phone: REQUIRED - Insert Phone#

1. HAZARD OVERVIEW

Flammable Solids are solid or semi-solid substances which are easily ignited by brief contact with an ignition source (e.g., open flame, spark, etc.) or friction. There are two categories of flammable

solids: A) Category 1 - rapidly burning materials very resistant to being extinguished by water; and B) Category 2 - slower burning materials that may be extinguished by water.

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

Flammable solids included in this control band are those which burn rapidly or intensely when ignited, and which may be difficult to extinguish with water. Examples include powdered aluminum, sodium dodecyl sulfate, camphor, paraformaldehyde, magnesium, zinc metal dust (greater than 44 microns particle size or 325 mesh), etc. Particle size must be considered when determining if materials, such as finely divided metals, have additional hazards for water reactive or pyrophoric behavior. For example, zinc metal dust smaller than 44 microns is considered water reactive and also subject to the requirements of the Water Reactive SOP. Flammable solids for this control band may be identified with the GHS Hazard code H228.

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

3. ENGINEERING/VENTILATION CONTROLS

Some flammable solids are quite fluffy and can be difficult to control and contain in a fume hood or ventilated enclosure. Careful assessment of the handling hazards in the protocol context will determine the need for ventilation controls.

REQUIRED IF APPLICABLE - Insert descriptions of lab-specific ventilation controls and equipment safety features utilized to reduce the risk of Flammable Solid chemical exposures.

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 (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 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 Solids described in this SOP; and
10. Abide by the laboratory-specific working alone SOP, if applicable.

For Flammable Solids, the following are also required:

11. Areas where flammable solids 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. Minimize handling these compounds near open flames or other common ignition sources, strong oxidizers, or other incompatible chemicals. Reduce the quantity of other adjacent flammable or combustible materials when using these materials; and
13. Due to the fire risk, incompatibility, and reactivity of these materials, Flammable Solids should be stored in a manner that is consistent with their properties:
 - a. Stored with other compatible Flammable Solids;
 - b. Stored in a glove/dry box, inert gas-filled desiccator, dedicated flammable storage cabinet, or exhausted enclosure;
 - c. Segregated from:
 - Oxidizers;
 - Flammable Liquids; and
 - Water and aqueous solutions.

REQUIRED - Insert descriptions of any additional administrative controls (*e.g.*, restrictions on procedure/quantity/work equipment/work locations/unattended operations/etc.), including controls that may be chemical-specific (*e.g.*, peroxide formers).

INSERT IF APPLICABLE- Descriptions of any special handling or storage requirements.

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 Solids:

- 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 may be required, if quantities in use are large or if the activities include the use of flammable solids in the presence of an open flame or ignition source. 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 quantities in use are large or when using Flammable Solids near an open flame or ignition source.

REQUIRED - Insert descriptions of PPE and hygiene practices used with the Flammable Solids described in this SOP, including any specialized PPE needed for a procedural step/task.

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.

Dry sweeping or wiping is not appropriate to clean up small spills of flammable solids. Wet-wiping with a suitable solvent is required. Pre-wetting the spilled material might be helpful. Dispose contaminated wipers and solvent in an appropriate fire-resistant container.

INSERT - Descriptions of any specialized spill clean up procedures for the 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.

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

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.

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).

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

Signage indicating the presence and use of Flammable Solids should be easily visible for the designated work space and/or storage area, for example: DANGER! FLAMMABLE SOLIDS WORK AREA!

INSERT - Description(s) of designated area(s) for your laboratory. Designated areas are required for "Particularly Hazardous Substances". The entire laboratory, fume hood, or a portion of the laboratory may be used, and must be labeled with the hazards.

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 such as SafetyNets, journal citations, etc. that are applicable.

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

LAB-SPECIFIC REVISION HISTORY

Version	Date Approved	Author	Revision Notes:

Documentation of Standard Operating Procedure Training

(Signature of all users is required)

- ✓ Prior to using **Flammable Solids**, 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