**Lab-Specific Standard Operating Procedures for General Hazard Classes: Flammable Liquids & Solids**

**Introduction**

The hazard class Standard Operating Procedures (SOPs) provided by the Department of Environmental Health and Safety (DEHS) are intended as a voluntary resource to provide general guidance on how to work with these materials and to provide a template for laboratories to customize to fit their needs.

These SOPs templates should be used for materials with one hazard class and for procedures and materials requiring only basic PPE (i.e., lab coats, goggles, and nitrile gloves).

For more complex procedures and materials with multiple hazards these templates can be used as guidance when conducting your lab’s own risk assessment, and writing procedure specific SOPs.

If you have any questions about writing Standard Operating Procedures, chemical safety, hazard assessment, or any other research safety questions, contact your Departmental Safety Officer (DSO) or call your DEHS Research Safety Professional (612) 626-6002.

**Instructions**

All text or spaces in yellow are intended for customization by your laboratory. Fill in the information needed, customized for your lab’s accepted practices, materials used, available resources, etc. Consider which materials your lab uses in the hazard class, and what your lab is experienced with and feels comfortable handling. You can also add any specific information, best practices, or other lab-specific information you would like.

If you are unsure if a specific material or procedure requires its own SOP, contact DEHS for guidance.

When complete, ensure the SOP is approved by the lab’s PI and added to your lab’s safety manual and annual training. SOPs should be reviewed with all lab members annually, and should be reviewed and updated at a minimum of every 3 years.

**Lab-Specific Standard Operating Procedure**

**Safe Use and Handling of Flammable Liquids & Solids**

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| ***PI:*** | *Cooper, S.* | ***Lab Location:*** | *Loeb 1709* |
| ***Issue Date:*** | *9/12/2016* | ***Revision Date:*** | *9/12/2019* |
| ***Prepared by:*** | *Hofstadter, L.* | ***Approved by:*** | *Penny* |

***Hazard Identification***

Flammable material containers must be labeled at a minimum with the name of the contents and the word “Flammable” or the GHS pictogram for flammable materials, pictured to the right. Information on the specific hazards of specific materials can be found in their SDS.

Examples of flammables in use in the Cooper lab include:

* Example 1
* Example 2
* Example 3

***Risk Assessment***

The primary risk of working with flammable materials is the potential for ignition and fires.

This SOP should not be used for any flammable gases. A specific SOP should be written for any use or handling of these materials, including information from the Gas Cylinder SOP template.

Flammables may have additional hazards associated with them, such as toxicity, corrosiveness, or being a peroxide former. Materials with additional hazards are not addressed in this SOP – instead, a material-specific SOP must be written.

Peroxide-forming materials should be handled with particular care. While they can be included as materials in this fact sheet, refer to the fact sheet at [www.z.umn.edu/safetyfactsheets](http://www.z.umn.edu/safetyfactsheets) for more information on proper storage and handling.

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| **Lab-Specific Working Limits** | |
| **Maximum Storage Amount** | *List the maximum amount of this hazard class that is allowed to be stored in your lab.* |
| **Maximum Scale** | *List the maximum amount of a chemical with this hazard class that your lab allows to be used at one time* |
| **Maximum Concentration (if applicable)** | *List the maximum concentration that your lab allows to be used* |
| **Working Temperature Range** | *List the general range of temperatures where your lab allows work with this hazard class. This can be very general, as all chemicals may be slightly different* |
| **Working Pressure Range** | *List the range of pressures where your lab allows work with this hazard class.* |
| **Allowable Container Types** | In general, flammables should be kept in their original shipping containers. Otherwise, metal or plastic-coated amber bottles are recommended. Clear glass makes peroxide formation more likely and is discouraged, unless for short term use. Glass containers may not be more than 1 gallon. No container may be larger than 5 gallons (20 L). Contact DEHS if planning on using reagent containers > 4 L. |

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| **Transfer and Transportation Limits** | |
| **Maximum in hood** | *List the maximum amount of flammable material that your lab allows to be used/transferred inside the hood. This may be the same as your maximum scale, listed above.* |
| **Maximum out of hood** | *List the maximum amount of flammable material that your lab allows to be used/transferred outside of the hood. Regent Containers must be < 4 L* |

***Control Plan***

*Storage and Transport*

* Flammables must never be stored near oxygen or heat sources.
* Flammables often have additional hazards associated with them, such as toxicity, corrosiveness, or being a peroxide former. Flammability has a higher priority than these other hazards and they should all be stored within the flammable storage area. E.g. Glacial Acetic acid is both flammable and corrosive and needs to go in the flammable storage cabinet.
* Metal or plastic-coated amber bottles are recommended to block light from forming peroxides and for strength and integrity.
* Contact DEHS if you want to purchase flammables in containers > 4 L. You must create a transfer, grounding and bonding plan. The maximum size for ANY waste container is 5 gallons (20 L). If you need to store flammables in a container larger than 5 gallons (such as a drum), contact DEHS at (612) 626-6002 for guidance.
* When moving flammables through public spaces, flammable containers should be fully enclosed so the contents would be contained if the bottle was dropped or broken.
* When not in use, all flammables must be stored in safety cans, flammable storage cabinets, or flammable-safe fridges. Flammable glass cleaning baths, and chromatography equipment that cannot fit in a hood should be reviewed by DEHS to ensure vapors are controlled and there is protection from ignition sources.
* Because of the storage requirements for flammable materials, space may be limited, so materials should only be ordered on a space-available basis. Be aware of limits on the size of individual containers of flammable materials, as well as limits on the total volume of flammables allowed in your space. For more information on volume limits for flammables, contact DEHS.
* Flammables are allowed to be kept in all space below fume hoods, and any built-in flammable storage cabinets. DEHS recommends that free-standing cabinets in laboratories have a capacity of less than 45 gallons per cabinet, with no more than 3 free-standing cabinets per row of bench space or small room.
* Chemical storage cabinets must be kept closed. If the cabinet is not connected to ventilation, bungs must also be kept closed. If ventilated, a flash arrestor (a fine metallic screen) should be installed to prevent backflow or flashbacks of flames if the vapors on either side should ignite. The bottom bung should be used for venting because flammable vapors tend to be heavier than air. If the cabinet venting stops working, clean the screen with a wire brush. If that doesn’t work contact FM to ensure dampers are open and have adequate flow.
* Minimize contact with air, and when possible, keep a blanket of inert gas over the material.
* Small amounts of flammables (< 1 L) may be left out in the lab. On a space-available basis, combustibles and containers < 1 L should be stored in flammable cabinets.
* Halogenated organics which are not flammable are not required to be stored in a flammable cabinet. You may choose to put them there to control vapors on a space-available basis.
* If materials must be refrigerated, only a flammable-safe refrigerator should be used. Although cooled, refrigerator temperatures are still higher than the flash points of most flammables, meaning a fire is still possible, even at these lowered temperatures. This makes using a flammable-safe fridge very important.
* If you are moving containers between campuses, or will be shipping any material, contact DEHS at (612)-626-6002 before doing so.

*Set-Up and Active Work*

* Open flame should never be used around flammables.
* If you must use open flame, remove all flammables from the area, even if they are in closed containers.
* Good transfer and dispensing technique includes securing the receiving container, transferring at a slow rate, minimizing turbulent flow, keeping close contact between containers, and using a funnel. Splashing and turbulence should be avoided during transfers as they create mists and increase vapor generation.
* Transfers should be done slowly, so the accumulated charge has time to disperse. If you must transfer flammables quickly, it should be handled in an inert atmosphere.
* Avoid heating flammable materials to or above their flash points.
* If more than 0.25 L of flammable material is heated in a glass container, secondary containment is required.
* Select personal attire to minimize static generation. Cotton is static-neutral and recommended. Ideally, shoe soles should be leather for static dissipation – rubber should be avoided as it is insulated. Synthetic rubber, which is carbon impregnated, is conductive.
* Keep all potential heat or spark-producing equipment a safe distance away from where flammable materials are handled. This equipment includes burners, induction heaters, ovens, furnaces, gas-fired space heating or water-heating equipment, and electrical equipment such as stirring devices, motor relays, switches, and other parts.
* Only non-sparking explosion-proof (intrinsically safe) equipment should be used with large volumes of flammables (>4 L).

*Exposure Controls*

* Dispensing or transfers of flammables must be done in a fume hood or with other appropriate ventilation.
* Avoid using containers with large openings, such as beakers, baths, or vats, when possible, as they may result in higher rates of vapor generation. If you must use them, ventilation controls, such as a fume hood, are recommended to decrease the hazard of flammable and inhalable vapors.
* Dispensing of squeeze bottles is allowed outside of a fume hood. Filling the bottles should be done inside the hood. Squeeze bottles do not need to be ventilated.

**Minimum PPE Requirements**

PPE requirements include:

* Lab coat (if applicable to your lab)
* Safety glasses/goggles (if applicable to your lab)
* Nitrile gloves (if applicable to your lab)
* Additional PPE (if applicable)

If procedure or material-specific PPE is required beyond the minimum listed above, another SOP should be available for that procedure or material. (Example: cartridge respirator, neoprene gloves, etc.)

***Spill & Accident Planning/What-If***

During lab-specific training, researchers should be informed where fire extinguishers, safety showers, alarm pull stations, and egress routes are. All labs are set up so that this emergency equipment is readily available and near exits.

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| **Lab-Specific Emergency Response Procedures** | |
| **Small Fire** | *Define what (if any) fires your lab allows to be handled internally. Describe lab-specific response procedures.* You are never required to attempt to extinguish a fire – it should only be attempted it if can be done safely and you are comfortable doing so. |
| **Large Fire** | Move away from the fire and contain it by shutting doors or sashes. Notify others and call 911. Pull the fire alarm as well, if available. Evacuate the area. |
| **Small Spill** | *List the maximum amount of spill that your lab is comfortable with and prepared for cleaning up yourselves. Describe your lab-specific response procedures.* |
| **Large Spill** | If the spill is larger than XX liters, >1 liter in a public area, reaches a drain, or is a stench chemical, contact DEHS for assistance at (612) 626-6002. Close sashes or doors to isolate the spill and evacuate yourself and others from the area. |
| **Utility Failure** | *Describe lab-specific procedures related to flammable materials for responding to a power, water, or gas outage.* |

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| **Route of Exposure** | **Signs/Symptoms of Exposure** | **First Aid/Response** |
| **Inhalation** | Dizziness, nausea, light-headedness, headache, confusion | Move person to fresh air. Seek medical attention if symptoms do not improve. |
| **Eye Absorption/Contact** | Splashes into eyes, burning, stinging | Use emergency eyewash and rinse eyes for a minimum of 15 minutes. |
| **Skin Contact** | Cooling sensation (caused by evaporation of spilled material) | Remove contaminated gloves or clothing, wash with soap and rinse. If major exposure, use safety shower. |
| **Ingestion** | Ingestion is unlikely in the standard lab setting. | Seek medical attention. |
| **Injection** | Injection is unlikely in the standard lab setting. | Seek medical attention. |
| **Fire** | Fire involving flammable materials | Do not remove charred clothing. Use safety shower if needed. Seek medical attention as soon as possible – call 911 if needed. |

All fires, injuries, or damage to the facility must be reported to and investigated by DEHS. Injuries which require medical treatment require a First Report of Injury (FROI) to be filed.

***Waste Storage and Disposal***

* Metal or plastic-coated amber bottles are recommended to block light from forming peroxides and for strength and integrity.
* Glass containers may not be larger than 1 gallon.
* Often, waste is poured without a funnel or too quickly, so that it washes off the label. Other times, the funnel is left in for convenience and is not closed. To avoid fines for label wash-off and open containers, it is recommended that groups use a flip-top funnel. This fits securely and is considered closed if the lid is down. Another option for the label is to post a log near the waste container indicating its contents.
* Equipment is often rinsed with flammables before oven drying. Dirty equipment should be washed before using. See “Cleaning Glassware” fact sheet at [www.z.umn.edu/safetyfactsheets](http://www.z.umn.edu/safetyfactsheets) for a discussion of decontamination. Small amounts can be wiped up with a sorbent. These contaminated wipes should be collected in a hazardous waste container.
* Waste bottles of flammable materials should be kept in flammable storage containers, unless in use or a pickup request has been made.
* Hazardous waste containers of flammable materials are subject to the same container size and total volume limits as all flammables.
* More information on hazardous waste procedures and pick-up can be found here: [www.z.umn.edu/hazwaste](file:///\\files.umn.edu\us\uhs\UHS%20All\Lab%20&%20Research%20Safety\7%20Projects\SOP%20Templates\www.z.umn.edu\hazwaste)

In the Cooper lab, hazardous waste is stored: *list the location of your hazardous waste storage area(s).*