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|  Department of Medicine | Doc. No: | SOP-Medicine-10 |
| | Standard Operating Procedure | |
| Title: FLAMMABLE AND COMBUSTIBLE LIQUIDS | Ver No: | 003 |
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| Yeo Soh Bee Prepared by | A/Prof Dan Yock Young Approved By | 15-04-2019 Issue Date |
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1. OBJECTIVE

This SOP provides the general guidance on how to work safely with flammable and combustible liquids in the Department of Medicine research laboratories.

2. SCOPE

This SOP is applicable to all staff and students in Department of Medicine research laboratories at MD1, MD6 and NUH.

3. RESPONSIBILITY AND ACCOUNTABILITY


- 3.1 The principal investigator (PI) is responsible for ensuring that their staff and students are aware of the risk assessment and are trained for the safe handling of flammable and combustible liquids. The PIs shall ensure that necessary safety equipment is available in the laboratory.
- 3.2 All staff and students using flammable and combustible liquids in the laboratory must be aware of the potential hazards, and must be properly trained in the practices of such material safely in accordance to the safety data sheet (SDS) and local legislations.

4. PROPERTIES

- a. Flammable and combustible liquids can burn and are classified, or grouped, as either flammable or combustible by their flashpoints.
- b. Flammable liquids will ignite and burn easily at normal working temperatures.
- c. Combustible liquids have the ability to burn at temperatures that are usually above working temperatures.
- d. Flammable liquids have a flashpoint below 37.8°C while combustible liquids have a flashpoint at or above 37.8°C and below 93.3°C.

5. PHYSICAL AND HEALTH HAZARD

- a. Combustible liquids may produce ignitable vapors at elevated temperatures and flammable liquids may produce ignitable vapors at normal ambient temperatures. The concentrated vapors can cause vapor trails which can travel to reach an ignition source, resulting in a flashback fire. Fire can also result from reactions between flammables or combustibles and oxidizers.
- b. Flammable liquids e.g. hexane, toluene, etc. can pose health hazard if they enter into human body through inhalation, ingestion or contact with skin. Exposure to flammable liquid may cause skin irritation, sensitization or dermatitis, or damage to the central nervous system and organs such as liver, etc. Some flammable liquids are also known to be carcinogenic.

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As the hazards may vary by compound, users must familiarize themselves with the specific hazards of the compounds they are working with, which can be found on the chemical's SDS.

6. TRAINING

All staff/students using or handling flammable and combustible liquids must complete Chemical Safety module (OSHCHM01) via IVLE. New users of flammable liquids should receive instruction in its use from safety lead or experienced members in the laboratory.

7. PERSONAL PROTECTIVE EQUIPMENT (PPE)


- a. Eye Protection
Safety glasses must be worn whenever handling flammable liquids. When there is the potential for splashes, goggles and/or a face shield must be worn.
- b. Hand Protection
Gloves must be worn when handling flammable liquids. Nitrile gloves are generally adequate for handling these compounds in laboratory settings when skin contact is unlikely.
- c. Skin and Body Protection
Long pants or clothing that covers the body to the ankles and closed-toe solid top shoes must be worn when handling flammable liquids. Laboratory coats must be worn. When working with large amounts of flammable liquids, a 100% cotton or flame resistant laboratory coat is preferred.
- d. Respiratory Protection
If flammable and/or combustible liquids are being used outside of a chemical fume hood, respiratory protection may be required.

8. ENGINEERING CONTROLS

Use of flammable and combustible liquids should be conducted in a properly functioning chemical fume hood whenever possible.

9. SAFE WORK PRACTICES

- a. Read the SDS for each flammable liquid prior to use.
- b. Eliminate, substitute less flammable chemicals or reduce the quantities of flammable liquids being used if possible.
- c. A current copy of the SDS for the specific flammable/combustible liquids being used must be made available to all personnel working in the laboratory at all times.
- d. Wear personal protective equipment as indicated in SDS or the laboratory's workplace hazard assessment form.
- e. Work with flammable liquids in a chemical fume hood.
- f. Keep the flammable liquid containers closed when not in use.

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- g. Quantities of flammable liquids should be limited to the amount necessary for the work in progress.
- h. Eliminate ignition sources (sparks, smoking, flames, hot surfaces) when working with flammable and combustible liquids.
- i. Never heat flammable substances using an open flame. Use oil baths, steam baths, water baths, heating mantles or hot air baths.
- j. Know the locations of fire alarms, fire extinguishers, safety showers, eye wash and other emergency equipment.
- k. Transport all flammable/combustible liquids with the ChemSafe Transporter Trolley or safety bottle carriers.

10. STORAGE


- a. Flammable liquids should be stored in rated flammable storage or explosion-proof cabinets when not in use.
- b. Flammable storage cabinets should not be vented if possible.
- c. Storage cabinets of flammable material must be labeled with either the words "Flammable- Keep Fire Away" or a red flammable diamond sticker.
- d. Flammable liquid storage areas should be free of ignition sources (e.g., electrical outlets, open flames, hot surfaces, static electricity, etc.)
- e. Laboratory operators are strongly advised and encouraged to minimize their amount of flammable liquids on benches by returning them to chemical store or safety cabinets when the liquid are not needed for the day. The quantity of these liquid placed on benches and fume cupboards shall not exceed 10% of total MAQ within the laboratory unit. Liquid used for running and operating laboratory instruments or other work-in-progress which may require some quantities of solvents to operate are exempted from the 10% limit.
- f. Flammable liquids should be stored separately from strong oxidizers, corrosives and other incompatible materials.
- g. Storage of flammable liquids must not block any route of egress.
- h. Spark free freezer / refrigerators used for the storage of flammable liquids.

11. FIRST AID PROCEDURES

- a. If inhaled: Remove to fresh air.
- b. In case of skin contact: Go to the nearest emergency shower if contaminated. Yell for assistance and rinse for 15 minutes, removing all articles of clothing to ensure contaminate is completely removed.
- c. In case of eye contact: Go to the nearest emergency eyewash. Yell for assistance and rinse for 15 minutes.

12. SPILLS

- a. Small Spill
If a small spill of a low toxicity flammable liquid occurs, laboratory personnel should be able to safely clean it up by following standard spill clean-up procedures:
 - Alert people in immediate area of spill
 - Increase ventilation in area of spill (open fume hood sashes)
 - Wear personal protective equipment, including utility grade gloves

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- Confine/adsorb spill with spill clean-up pads or absorbent
 - Collect residue, place in container, label container, and dispose of as hazardous waste
 - Clean spill area with soap and water
- b. Larger Spill / Any spill outside a fume hood
- Call NUS Campus Security @68471616
 - Inform Department safety coordinator Yeo Soh Bee, Tel: 66015195, YLL SOM Assistant Director Dr Doreen Tan, Tel: 6605594 and OSHE Safety Officer Dr Christine Hu, Tel: 66012263 when necessary.
 - Evacuate the spill area
 - Post someone or mark-off the hazardous area with tape and warning signs to keep other people from entering.
 - Stay nearby until emergency personnel arrive and provide them with information on the chemicals involved.

13. WASTE MANAGEMENT

Refer to SOP on Chemical Waste Disposal (SOP-Medicine-004)

14. INCIDENT REPORTING

Accidents resulting in injuries must be reported to the PI and/or laboratory safety lead immediately after first aid is applied.

Seek medical attention when necessary at the University Health Centre or proceed to the Accident & Emergency units of National University Hospital after office hours.

All incidents or accidents have to be notified to OSHE within 24 hours via the online NUS Accident and Incident Management System (AIMS)

@https://inetapps.nus.edu.sg/osh/portal/eServices/ehs360_aims.html. The AIMS report can be submitted by the injured staff/student, safety leads, his or her supervisor/representative if the staff or student is unfit/unable to do the initial report.

15. REFERENCE

NUS Laboratory Chemical Safety Manual (NUS/OSHE/M/02)

16. REVISION HISTORY

| Date Revised | Version No. | Author | Summary of Revisions |
|--------------|-------------|-------------|---|
| 20-04-2016 | 001 | Yeo Soh Bee | |
| 01-10-2016 | 002 | Yeo Soh Bee | Section 14: Revised Accident and Incident Reporting System (AIRS) to Accident and Incident Management System (AIMS) |
| 15-04-2019 | 003 | Yeo Soh Bee | Section 12.b: Amended contact details |