Indian Institute of Science
Office of Laboratory Safety & Environmental Health

Document number: OLSEH/GUI(CHE)24/03(01) (A)
Version: 1.02
Date: 1st March 2024

Email: safety.olseh@iisc.ac.in
Phone: +91-80-2293-**3199**
Emergency: +91-80-2293-**5555**

Guideline for Chemical Fume Hoods & Exhausted Containments

Document number	OLSEH/GUI(CHE)23/05(01)
Version	1.02
First Issued on	May 16th 2023
Author	Dr. Mithun Chakraborty

1 Introduction

1. This guideline apply to all exhausted containments where an exhaust is being used to evacuate chemical vapors, like chemical fume hoods, local exhaust ventilation (LEV), Canopy, chemical glove boxes, ventilated storage cabinets, exhausted dustbins, etc. In this document the term "Fume hoods" refers to all such containments.
2. The guideline does NOT apply to gas cabinets.

2 What are Fume Hoods?

1. Fume hoods are engineering controls used for the reduce or eliminate exposure to hazardous chemicals, biological hazards or physical hazards. They consist of a semi-enclosed area connected to an exhaust fan so that a certain minimum air-flow is always maintained. This dynamic barrier drastically reduces the amount of fumes that the user is exposed to.
2. Fume hoods are primarily used for handling odorous or hazardous materials with minimal exposure. A secondary objective is to protect the user from spill by partially enclosing the work area.
3. Ductless fume hoods that re-circulate the exhaust back into the laboratory are not replacement for fume hoods, as they do not provide sufficient protection from hazardous vapors. The use of ductless hoods is deprecated even if they have active filters designed for specific chemicals. The filters are hard to maintain and verify.

3 Flow in a Fume Hood

The flow is a food is measured in terms of linear flow velocity, usually denoted in feet/min or metre/hour. To calculate the exhaust capacity, you must multiply flow velocity with hood area (in

m2 or ft2) to calculate cubic flow rate, usually denoted in cubic-feet/min (CFM) or cubic-metre/hour (CMH).

1. The hoods require a minimum face velocity of 30 m/min (i.e. 100 liner feet per minute) at normal working conditions. Hoods for highly toxic materials (NFPA>2 in health or explosive category) require higher face velocities (up to 45 m/min or 150 linear feet/min). Fume hoods should never operate beyond 150 ft/min to prevent turbulence that could expose the user to fumes.
2. Hoods often have a sash or door that can be opened or closed. In such cases the "normal working height" must be clearly marked. The minimum (100 LFM) and maximum (150 LFM) positions must also be marked. Ideally, mechanical stops should be installed to prevent the sash from exceeding the minimum and maximum positions.
3. If flow is less than 75 LFM, the fume hood is unusable. Unusable hoods must be marked with a "DANGER HOOD IS NOT WORKING! DO NOT USE!" tag.
4. The face velocity of hoods must be measured using an standard anemometer.
5. Ideally, the anemometer must be permanently installed in hoods. Users are expected to check the flow before starting work in a hood.
6. If anemometer is not installed, the lab safety in charge must measure the flow in the hood every month using a portable anemometer. These readings must be recorded in a register or poster that is easily seen by all users.
7. EHS Officer or an authorized third party must assess the operation of hoods once a year.

4 Operations

1. Assess the level of hazard that the material involved before beginning any work and use hoods with an adequate face velocity.
2. The user should always remain outside the hood. Never put your head inside a hood to check on an experiment.
3. Place the hood sash at the working height. Never work with the sash in the fully open position. When not in use, place the sash at lowest position to conserve power.
4. On hoods where sashes open horizontally, position one of the doors to act as a shield in the event of an accident in the hood.
5. Avoid storing chemicals in the working area fume hoods. This not only clutters the workplace but also disturbs the flow.
6. Label all your samples appropriately before storing in the fume hood; it will be important for all the users of fume hood to be aware of the contents inside the hood.
7. Keep your work at least 6 inches away from the hood sash's plane.
8. Keep at least 50% of the work area clear, so the flow is not disturbed.
9. Any equipment that needs to remain in hoods should be elevated on racks or feet to allow airflow underneath.
10. Do not block the baffles at the back of the hood. These allow for the proper exhausting of contaminants from the hood.
11. Remove spark sources or electrical units from the hood while working with flammable liquids or gases. Electrical cords should not interfere with sash movement.
12. Do not exhaust items, such as vacuum pumps, through the fume hood's face as this will disrupt the airflow into the hood.

13. Fume hoods shall not be located near busy walkways or in front of air diffusers.
14. Minimize foot traffic by the face of the hood. Avoid making swift movements when taking items (chemicals, particulate matter, and apparatus) in and out of the hood.
15. When working with potentially explosive materials, always carry out the experiment in a fume hood with an appropriately rated safety shield. Make sure to remove all unnecessary equipment and chemicals, especially those that are highly toxic and flammable, from the vicinity of the work area.
16. Any experiments generating air contaminants at or above the permissible exposure limit (refer MSDS) should be conducted inside the fume hood.
17. Any solvent stills in which flammable liquids are purified by distillation with reactive metals or metal hydrides possess possibly the greatest danger associated with the potential fire and explosion hazards. **All Solvent distillation equipment** should be kept inside a fume hood.
18. Hot concentrated perchloric acid should be handled in separate fume cupboards where its vapour does not contact any organic matter. Cleaning should be done twice a week and a record of cleaning should be available. Material of construction of the fume cupboard and allied implements/fixtures should not contain any organic constituents.
19. Lecture bottles of poisonous and pyrophoric gases which are small gas cylinders (about 2 inches by 13 inches) must always be kept inside the fume hood, whether or not they are in use.
20. Before working with pyrophoric materials, remove all other flammable and combustible material from the fume hood/glove box.
21. When a reaction becomes uncontrollable, turn off the heat, stop adding reagents, alert any nearby lab personnel, and keep the chemical fume hood fully closed until the temperature goes down.
22. Fume hood is only the first line of defence against accidents. The users of the hood should wear safety goggles, lab coats, and appropriate chemical gloves while working around the fume hood.
23. Do not use the hood exhaust to evaporate volatile materials. Use normal chemical waste disposal channels only. Empty bottles can be dried in the hoods.
24. Fume hoods do not prevent accidents or chemical splashes. Hood users must be trained for usage of chemicals and be informed on nature of hazard of chemicals in use.
25. Fume hood is not a replacement for PPE. The users of the hood should wear the requisite personal safety equipment while working around the fume hood like goggles, lab coats, and gloves.

5 Construction

1. OLSEH recommends commercially sourced hoods. Home-built hoods are deprecated. Responsible OEMs often provide correct guidance based on your application.
2. Hoods are constructed of a material that is appropriate for the hazard. Polypropylene hoods are recommended for corrosives. Solvents can be handled in powder-coated galvanized iron hood with polypropylene coating. Wood and cardboard must be avoided.
3. The hoods must have corrosion-proof fittings.
4. Hoods must have an inbuilt light, so placed that the whole cupboard is illuminated.
5. The hood sash should be made with shatterproof or reinforced see-through glass/plexiglass.

6. Chemical cupboards should be so designed that there is strong upward draught even when the shutter is open and there is no chance of any fumes entering the laboratory. For extremely poisonous vapors it is advisable to have an air inlet at the bottom so there is a continuous air flow and evacuation.
7. The hood shouldn't be too deep to allow for easy access to the fittings inside, and controls for the service connections should be placed outside.
8. The Exterior/ interior walls, work surfaces, and duct material of a fume hood must be chosen based on the intended usage of the hood, e.g. PVC/FRP ducting is often used for corrosives.
9. **Perchloric acid hoods** need stainless steel or PVC duct and a properly timed water wash-down system.
10. The exhaust blower should be compatible with the fumes created in the hood. It must be sized appropriate (see the section on flow). Exhaust blowers need to be services atleast once a year.