Safe Usage of Chemical Fume Hoods

Chemical Fume Hood's primary functions:

1) Exhaust hazardous air contaminants such as chemical fumes, vapors, gases, dusts, mists, and aerosols.

2) With its box-like structure equipped with a movable sash window, this ventilation system serves as a physical barrier between reactions and the user, offering a measure of protection against inhalation exposure, chemical spills, run-away reactions and fires.

This engineering control functions by maintaining a relatively negative pressure in its interior to prevent any contaminant from escaping while drawing air in through the opening at a consistent rate.

Responsibilities

Laboratory Supervisors/PIs

- Ensure users received Safety training and are knowledgeable about related Guidelines and this present guide.
- Ensure users follow best lab practices while operating.
- Ensure no work is carried out in a malfunctioning fume hood.
- Coordinate maintenance, repair and new equipment needs.

Chemical Fume Hood Users

- Rigorously follow best laboratory work practices.
- Use hoods only according to the present guide and other Guidelines for safe use.
- Notify Lab Supervisor/PI immediately in the event of hood malfunction.

Risks of Improper Usage

A well-designed Chemical Fume Hood, when calibrated every year, offers a substantial degree of protection to the user **if it is used appropriately and its limitations are well understood.** Improper use will result in direct exposure to hazardous and noxious materials that can affect all laboratory occupants because their containment is not effective. Deficient airflows can result in contaminants escaping if:

- Poor work practices are applied during the experiment (*e.g.* sash being left open, excess clutter),
- The proper operation of the equipment is impeded due to light materials sucked into the duct or a restricted duct damper.

General Misconceptions

1) A Chemical Fume Hood must NOT be considered as a substitute of an appropriate storage cabinet for permanent storage of volatile, flammable, or odoriferous materials!

It is appropriate to keep chemicals that are only being used during a particular experiment inside the hood. Each item placed on the work surface interferes with the directional airflow, causing turbulences that can allow contaminants to be drawn out the hood.

2) For a Chemical Fume Hood, the face velocity *(i.e. the speed of air entering the hood through the sash opening)* **does NOT define by itself the protection level of the equipment!**

Other factors such as its design, its location within the laboratory, the quality of the supply air distribution, and most importantly the work practices of the user, are to be considered. Standards recommendations assume that all these factors have been optimized.

3) When working with highly hazardous materials, a higher face velocity is NOT necessarily better!

The large majority of the Chemical Fume Hoods at Concordia University have face velocities of between 85-100 fpm (0.43-0.51 m/s), as recommended by the American National Standard for Laboratory Ventilation ANSI/AIHA Z9.5 3.3.1, and CSA Z316.5-15. For different reasons mentioned above, operating at higher velocities will not be safer for the user.

Note: A few workplaces at Concordia University host High-Performance Low-Flow Fume Hoods that allow proper containment at low face velocities (55-60 fpm). They are designed for operating with this face velocity.

4) Flow monitors are NOT to be disconnected!

The control box displaying the face velocities is the only way to know if the fume hood is working within the required standard.

5) The airfoil on the front of a hood is NOT of minor importance!

Airfoils are critical to efficient operation of a Chemical Fume Hood. With the sash open an airfoil smooths flow over the hood edges. With the sash closed, the opening beneath the bottom airfoil provides for a source of exhaust air, as does the bypass grill above the sash.

6) The Chemical Fume Hood is NOT a substitute for Personal Protective Equipment (PPE)!

A Chemical Fume Hoods has limitations and PPE (*i.e.* safety glasses or goggles, lab coats, and chemical gloves) must be worn when working in or around it. Additional PPE may be necessary in certain experiments.

ENVIRONMENTAL
HEALTH AND SAFETY

Guidelines for Safe and Effective Usage of a Chemical Fume Hood

— *Lab Hygiene and Good Housekeeping Practices* —

- ✓ **Maintain** the hood clean and tidy. Clean-up any spill immediately and keep sufficient space that allows for safe handling of chemicals.
- ✓ **Maintain** regular clean-ups (equipment, surfaces, frame, sash, and airfoils) to prevent excessive chemical exposures and avoid unpredictable hazardous reactions between incompatible materials.
- ✓ Do **NOT** keep stock supplies of Chemicals or Waste where they clutter space, interfere with the hood's airflow, and may increase the risk of a fire in the laboratory. All portable chemical containers must be removed at the end of the working day.

A one or two day supply of materials should be considered as the maximum quantity.

- ✓ **Keep** solid objects and light/loose materials (*e.g.* weighing papers, paper towels, paper filters) away from the exhaust ducts, fans, and airfoils. They can adversely affect their operation *via* obstruction or intrusion.
- ✓ Do **NOT** leave uncapped bottles of reagents inside. Minimize the amount of evaporation/fuming for the environment and operator safety.
- ✓ Do **NOT** use bleach to clean a Chemical Fume Hood. *Some exceptions may apply (e.g. neutralization of DAB HCl).*

— *Good Work Practices* —

- ✓ **Keep** the exhaust fans ''ON'' at all time and **check its correct operation before starting work**.
- ✓ While operating, do **NOT** overload or clutter the Chemical Fume Hood. Vortices, dead spots, and eddies can form, reducing the containment efficiency and allowing the hazardous accumulation of ignitable concentrations of flammable/combustible materials.
- ✓ Do **NOT** accumulate flammable materials in a hood that contains hot plates, open flames, or equipment that may generate electrical sparks.
- ✓ **Place** all equipment and chemical sources at least 15 cm (6 in.) from the sash opening (but do not obstruct baffles or vents).
- ✓ **Elevate** large equipment at least 5 cm (2 in.) off the base and place it away from the sidewalls to allow airflow underneath and around.
- ✓ **Place** heat-generating equipment and devices at the rear of the fume hood.
- ✓ **Never** allow your head into the hood opening while operating and potential contaminants are being generated.
- ✓ Do **NOT** modify hoods in a way that adversely affects performance (*e.g.* adding shelves, removing or changing any of the components).
- ✓ Do **NOT** place power bars, or other spark producing sources inside the hood: Connect all electrical devices outside of the hood.
- ✓ **Keep** foot traffic past the face of the fume hood to an absolute minimum while it is being used. Generated vortices and cross drafts can overcome the face velocity and pull contaminants into the vortex, and into the laboratory.
- ✓ The sinks inside fume hoods are **NOT** designed for disposing of Chemical Wastes.
- ✓ **Ensure** that the hood is being used as intended (*e.g.* no evidence of perchloric acid in a chemical hood not designed for it).
- ✓ **Understand** your laboratory's action plan in case an emergency, such as a power failure, occurs.

— *Sash operation* —

- ✓ Always **operate** the hood with the sash as low as practical, keeping it between you and your work. The normal operating sash position is typically in the 35-50 cm (14-20 in.) range. It should be indicated on the fume hood as a reminder.
- ✓ **Keep** the sash closed when the hood is not actively attended. **Open it only when necessary!**
- ✓ **Avoid** opening/closing the sash rapidly to prevent turbulences that affect the containment efficiency.
- ✓ **Keep** the sash panes clean in order to have a clear and unobstructed view of the fume hood interior.
- ✓ Sash **must** be smooth throughout its travel and free of any sign of degradation.
- ✓ Do **NOT** place equipment in the hood that stops the sash from closing or easy opening (*e.g.* wires, hoses, squeeze bottles, apparatus).
- ✓ Conventional glass or plastic sashes offer splash or spray protection but are **NOT** designed to provide explosion protection. If there is a need for safety/blast shields within the hood, inform EHS. The shields should be obtained separately.

— *Panel Controls* —

- ✓ **Make sure that a continuous performance-monitoring device is present: ''85-100 fpm''** on the display panel + green **LED** light.
- ✓ **Never disconnect the control box!**
- ✓ In the event the alarm condition **does not correct itself** after a short delay, **close the sash**.
- ✓ Promptly **report** any hood that is not functioning properly or requires tests. The hood should be "tagged" and taken out of service until repairs can be completed. **Do not wedge the mute button to silence the alarm instead of reporting the malfunction!**

Standard maintenance/calibration is carried out annually by Facilities Operations or a certified external contractor.

Contacts: **Facilities Management 514-848-2424 #2400** or Call2400@concordia.ca for maintenance or calibration.
EHS for guidance on the safe and proper use of Chemical Fume Hoods: **514-848-2424 #4877** or ehs@concordia.ca

For more information about Chemical Fume Hoods, consult the Laboratory Safety Manual (Section 5.2) at: bit.ly/LabSafetyManual