Safe Work Practices and Maintenance
RDM Fume Hoods

Safe Work Practices for
Laboratory Chemical Fume Hoods

No large open face hood with a low face velocity can provide complete safety against all events that may occur in the hood, nor provide protection for volatile airborne contaminants with a threshold limit value (TLV) in the low parts per billion range. For more ordinary exposures, a well-designed hood in a properly ventilated laboratory can provide adequate protection. However, certain work practices are necessary in order for the hood to perform capably. The following work practices are generally required; more stringent practices may be necessary under some circumstances.

- Conduct all operations that may generate air contaminants at or above the appropriate TLV inside a hood.
- Keep all apparatus at least 6 inches back from the face of the hood. A stripe on the bench surface is a good reminder.
- Users should keep their faces outside the plane of the hood sash.
- Hood sash openings should be kept to a minimum. Hoods are tested (and should be used) with a hood sash opening of 15 inches.
- Do not use the hood as a waste disposal mechanism except for small quantities (<10 mL) of volatile materials.
- Do not store chemicals or apparatus in the hood. Store chemicals in an approved safety storage cabinet.
- Keep the slots in the hood baffle free of obstruction by apparatus or containers.
- Minimize foot traffic past the face of the hood to prevent disruptions in air flow.
- Keep laboratory doors closed when working in the hood.
- Traps, scrubbers or incinerators should be used to prevent toxic and/or noxious materials from being vented into the hood exhaust system.
- Do not place electrical receptacles or other spark sources inside the hood when flammable liquids or gases are present. No permanent electrical receptacles are permitted in the hood.
- Use an appropriate barricade (e.g. a blast shield) if there is a chance of explosion or implosion.

- Remain alert to changes in air flow.

- Do not remove hood sash or panels except when necessary for apparatus set-up; replace the sash or panels before operating.

- Exhaust ports from the hood and supply air vents to the room (Nesbitt units or unit ventilators) should not be blocked.

- Prepare a plan of action in case of an emergency, e.g., a power failure.

- To save energy, turn off the blower and close the hood sash when the hood is not in use.

General Maintenance Information

Fume hood maintenance can involve daily, periodic, and annual inspections.

- Daily fume hood inspection
    - The fume hood area is visually inspected for storage of material and other visible blockages.
- If hood function indicating devices are not a part of the fume hood, a 1-inch (25 mm) by 6-inch (150 mm) piece of soft tissue paper should be placed at the hood opening and observed for appropriate directional flow into the hood.

- Periodic fume hood function inspection

- Capture or face velocity is typically measured with a velometer or anemometer. Hoods for most common chemicals must have an average face velocity of 100 feet (30 m) per minute at sash opening of 18 inches (460 mm) or higher. Face velocity readings should not vary by more than 20%. A minimum of six readings shall be used determine average face velocity.
- Other local exhaust devices shall be smoke tested to determine if the contaminants they are designed to remove are being adequately captured by the hood.

- Annual maintenance

Exhaust fan maintenance, (i.e.,lubrication, belt tension, fan blade deterioration and rpm), shall be in accordance with the manufacturer's recommendation or as adjusted for appropriate hood function.

Preventive Maintenance

Only appropriately trained personnel should carry out repairs or preventive maintenance. As the laboratory fume hood is a critical piece of laboratory safety equipment, fume hoods must not be turned off prior to notification of the laboratory supervisor or service personnel. The laboratory supervisor or service personnel should verify that the hood is not in use and follow the standard Lockout/Tagout procedures prior to performing the work.

The following maintenance tasks should be performed on an annual basis:

- Remove all corrosion, spot prime and paint.
- Inspect electrical connections, tighten as required.
- Inspect motor control contacts for wear or pitting, replace as needed.
- Tighten all terminal lugs.
- Replace the drive belt as needed.

The facilities or safety manager should keep records of the preventative maintenance checks performed on all laboratory fume hoods.

Routine Surveys of Chemical Fume Hood Performance

A. Hood Performance Testing

The final version of the Laboratory Standard[1] requires that employers incorporate into their Chemical Hygiene Plan measures to assure the proper functioning of fume hoods and other safety equipment. However, the final standard does not specify face velocities for fume hoods. Briefly, OSHA recognizes that there is considerable debate over what optimum velocities should be in light of differences in hood design and methods of operation. Moreover, it was felt that requiring specific face velocities was not consistent with the performance orientation of the standard. In order to facilitate routine surveys of hood performance, a numerical method for evaluating hood performance using face velocity measurements is given below. However, the second test, involving visualization of the flow patterns within the fume hood is recommended whenever possible.

1. Numerical testing procedure

The linear flowrate into the hood should be measured with a calibrated velometer (e.g. Alnor Thermometer). The following procedure is employed[2,3]:

- The hood sash is adjusted to yield a hood opening of 15 inches.
- The resulting rectangular work opening is divided into three vertical zones.

- The velometer is used to measure the linear flow rate at a height of 3 inches and 11 inches above the hood floor in each zone. The inlet for the velometer should be located 1 inch behind the plane defined by the hood sash.
- For the hood to be considered safe and **pass**, the average of the six measurements must equal or exceed 80 linear feet/minute. If the average of the six measurements is below 80 linear feet/minute, the hood is considered unsafe and the laboratory user(s), laboratory supervisor and the facilities manager should be notified. In addition, a lock along with a danger tag will be placed on the hood to prohibit its use.

2. Flow Visualization:

If there is any doubt as to the containment efficiency of the fume hood (without regard to the results of the numerical testing procedure described above), a flow visualization method may be employed using smoke tubes. A trained fume hood certifier should perform this test. The purpose of the test is simply to observe if there is flow within the hood. Typically, the test should be performed at the safe hood sash opening height.

3. ANSI/ASHRAE 1995-110 Standard Method:

The ANSI/ASHRAE 1995-110-performance test gives a relative and quantitative determination of the efficiency of the hood containment under a conditioned environment. This method involves releasing a small amount of a tracer gas (either sulfur hexafluoride, or a gas of similar molecular weight and stability) at a fixed rate within the laboratory fume hood, while monitoring the concentration of the tracer material observed in the user's breathing zone using highly specialized testing equipment.

B. Hood Failure

If any of the above tests indicate inadequate hood performance, the following steps should be taken immediately:

- The hood is prominently tagged with a label indicating that it is unsafe and should not be used. The hood should be locked out using a lockout device to prohibit use.
- Notify the laboratory supervisor responsible for the hood by telephone and/or electronic mail.
- Notify the facilities manager so the proper maintenance work may begin.

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References

1. Department of Labor, Occupational Safety & Health Administration, 29 CFR.1910, "Occupational Exposures to Hazardous Chemicals in Laboratories; Final Rule", Federal Register, January 31, 1990.
2. Lou DiBerardinis, "A Laboratory Fume Hood Maintenance Program", Dept. of Environmental Health & Safety, Harvard University, Cambridge, MA, 1987.
3. William J. Mahn, Fundamentals of Laboratory Safety: Physical Hazards in the Academic Laboratory, New York: Van Nostrand Reinhold, 1991.