

**ADVISORY NO. 8.0: LABORATORY FUME HOODS: OPERATION AND USE  
CONSIDERATIONS**

**DESCRIPTION OF FUME HOOD**

A laboratory fume hood is a ventilated enclosed work space consisting of side, back and top enclosure panels, a work surface or deck, a work opening called the face, and an exhaust plenum equipped with horizontal adjustable slots for the regulation of air flow distribution. The work opening may be unrestricted or may be equipped with operable glass doors for observation and shielding purposes. Doors may be vertically operable; horizontally operable; or vertically and horizontally operable. The location of exhaust port distinguishes hoods either as up-draft hoods, if the connection is at the top of the exhaust plenum, or downdraft hoods, if located at the bottom. The up-draft design is most often employed.

**USE CONSIDERATIONS**

Protection afforded by a fume hood is directly affected by the manner in which the fume hood is used. To maximize the protection provided, the user should follow the guidelines listed below:

- Blockage of the lower exhaust slots with containers will alter air flow, allowing more air to be exhausted near the top of the hood opening, and contaminants to be removed less efficiently from the work surface. Containers must be arranged at the sides of the hood to permit air passage from the airfoil to the rear slot.
- Bulky equipment near the face of the hood will cause variations in the airflow. All such equipment should be placed deep in the fume hood to avoid leakage of contaminants into the work area. If equipment is too large to place deep in the hood, place equipment on risers to minimize the effect on airflow.
- The largest obstruction to airflow in a fume hood is the user. To minimize the escape of contaminants caused by a human body, place the work at least six inches inside the hood face and stand back, while working with arms extended. When using highly toxic materials, lower the sash below face level.
- The air passage may become obstructed by papers and other debris entrained in the air system. Check the air passageways for obstructions. Any items that may have been sucked in should be flushed out. This can often be done by directing a small water stream with a hose into the air passage at the rear of the hood. If the hood is not equipped with a drain, the back wall of the hood may have to be removed in order to clear out obstructing materials.
- At some time a power failure may occur in the building, shutting down exhaust fans to fume hoods. As a result containers which continuously emit toxic materials should not be permanently stored in fume hoods as the primary means of control. In addition, contingency plans for fume hood failure should be designed into the experiment.

**FUME HOOD LIMITATIONS**

A fume hood properly used and maintained will afford protection against low velocity contaminants in the form of gases, vapors, aerosols, and particulates. However, it has some explicit limitations, which must be followed:

**High Velocity Aerosols, Particulates and Pressurized Gases**

Fume hoods are not capable of containing high velocity aerosols and particulates with the sash open. Work with the sash closed when using these materials or pressurized gases or vapors.

### **Toxic and Malodorous Effluents**

A fume hood is nothing more than a back-up safety device to contain emissions. An unfiltered fume hood exhausts contaminants directly to the atmosphere. In addition, with less than perfect weather conditions, contaminants may re-enter the building without sufficient dilution. For these reasons, users must provide local scrubbing of effluent if:

- Highly toxic chemicals are used that can cause harm in minute quantities
- Chemicals causing objectionable odors in minute concentrations are used.

Chapters 10 and 11 of the A.S.H.R.A.E. Guide and Data Book outlines air cleaning equipment.

### **Perchloric Acid**

Unless equipped with a specially designed washdown system, and dedicated specifically for perchloric acid, a ventilating system should not be used for perchloric acid vapors. Failure to do this may result in deposition of perchlorate crystals in ductwork which may detonate.

### **Explosives**

A fume hood is not capable of containing an explosion even if the sash is fully closed. If an explosion hazard exists, the user must provide properly anchored barriers of sufficient strength around the experiment. Such barriers will affect the airflow within the hood.

## **COMMON MISUSES OF LABORATORY FUME HOODS**

### **Air-Foil Sills**

Many fume hoods are equipped with flat or rounded sills or airfoils, which direct air in a sweeping motion across the work surface. Objects should never be placed on such sills. Materials released from containers on sills may not be adequately captured since such containers are not actually inside the hood at all. In addition, an object on the sill prevents the quick and complete closure of the sash in an emergency. Any container of liquid on a sill is an immediate spill hazard.

### **Spill Containment Lips**

Containers of liquid should not be placed on the hood lip. Most modern fume hoods have recessed work surfaces or spill containment lips to help contain minor liquid spills. In many cases, these lips are several inches wide and are very attractive depositories for small and medium sized beakers and flasks. Unfortunately, a spill from this location has a good chance of flowing under the airfoil sill, onto the floor, and the user's legs and feet.

### **Horizontal Sliding Sashes**

To provide space for two or more people working simultaneously at the same hood, it is not unusual for one or more horizontal sliding sashes to be removed from a hood. Since horizontal sash hoods are designed and balanced with no more than half the face open at any time, this removal immediately creates a fume hood with an inadequate face velocity. Procedures requiring the protection of a fume hood may be performed in a horizontal sash unit only when all sashes reside in their proper tracks.

### **Interior Utility Access Panels**

It is often desirable to vent exterior equipment through a hood or to connect it to equipment in a hood. Wiring and tubing for this purpose is often run into the hood by way of the utility access panels in the interior walls. Often, the panels are not replaced. This produces a direct connection to the room for purposes of air flow and effectively increases the size of the hood face; thus decreasing the face velocity. Tubing is frequently used to channel exhaust to the hood from equipment located some distance away. The long runs of tubing involved in such cases, and the consequent high resistance to flow, places the efficacy of such a procedure in considerable doubt.

### User Constructed Connections to the Exhaust System

The user may perceive the need for local exhaust ventilation other than that provided by an existing fume hood. The user should not unilaterally construct and connect such devices to an existing fume hood exhaust system. Adding additional devices to even the simplest exhaust system without adequate evaluation and adjustment will usually result in decreased performance of the existing hood and/or inadequate performance of the addition. The advice of the Design and Construction Department should be sought before altering or installing any exhaust system.

### HOOD FACE VELOCITIES

- The velocity of air entering a hood at its face determines whether or not the hood will be safe, because an adequate face velocity is the basic requirement for capture and control of a contaminant generated within a hood.
- An average face velocity of 100 feet per minute is recommended for all general laboratory hoods.
- Hoods for highly toxic materials require higher face velocities, ranging from 125 to 200 fpm. However, recent studies have indicated that containment does not improve with increasing face velocity above 100 fpm, and may in fact deteriorate. Therefore, if containment greater than 100 fpm fume hood is required, a glove box should be used.

### TESTING PERFORMANCE OF LABORATORY VENTILATION SYSTEM

- Existing hood systems flow rate and face velocities are evaluated by Environmental Health and Safety at a minimum annually and reevaluated whenever there is a change to the ventilation system. Construction Management should be involved in new hood system installation and modification of existing systems so that a licensed mechanical contractor can properly install, test, and balance the system prior to turnover to Facilities Management.
- Constant volume hoods systems maintain relatively constant exhaust airflow. As the sash is closed the face velocity increases. A yellow sticker with an arrow indicates the sash opening, is placed to the left or right of the sash, where a measured face velocity of 100 feet per minute (fpm) +/-5 percent is achieved. If the hood is not capable of maintaining 100 fpm face velocity at a minimum sash opening of 14 inches a **“WARNING Use of This Fume Hood”** sign is posted on the sash then a work order is placed with Facilities Management. Constant volume hoods are located in the following buildings:
  - West Campus:** Crosley Tower, Rieveschl Hall, Rhodes Hall, Geology Physics, DAAP, Old Chemistry, and Braunstein
  - East Campus:** French East, Hoxworth, HPB, MSB, SRU, Radiation Safety, and CARE
  - Satellite Campuses:** Clermont College, RWC Muntz Hall, College of Applied Science, GRI
- Variable Air Volume (VAV) hoods adjust the hood airflow with respect to the sash opening to maintain a 100 fpm face velocity. Environmental Health and Safety checks the flow at full open, half open, quarter open, and 18 inches to insure the flow adjust with the sash opening. The face velocity sticker is then placed on the left or right side of the sash at the 18 inch level if the face velocity is +20%/-10% of 100 fpm. At an 18 sash height there is more even airflow and a degree of face protection in case of a spill. If the hood flow is low a **“WARNING Use of Fume Hood is Prohibited”** sign is posted on the hood sash then a Work Order is placed with Facilities Management. Once the hood is repaired the hood face velocity is checked by Environmental Health and Safety. VAV hoods are located in the following buildings:

**West Campus:** ERC and French West

**East Campus:** CVC Kettering Complex, Vontz, and Wherry Hall

**Satellite Campuses:** Center Hill Leather Industries, RWC Science and Allied Health Building

### **MAINTENANCE WORK ON LABORATORY VENTILATION SYSTEMS**

- Maintenance of fume hoods is a function of Facilities Management. Because the hood user is the person most aware of how a hood is being used, it is in the final analysis the user's responsibility to determine when maintenance (other than routine preventative maintenance) is necessary and to request that it be performed.
- Please note that if you are having difficulty with your fume hood, the airflow rate decreases as you raise the sash. To maximize your airflow rate, keep the sash as low as possible. The user may obtain initial maintenance through Facilities Management, Zone Maintenance. Call your area zone and place a work order. Facilities Managements phone number is listed at the bottom of the yellow fume hood sticker.
- If maintenance efforts are not sufficient to correct the deficiency, engineering changes may be necessary. When notified of such a situation, the user or user's department should request the Design and Construction Department to evaluate the problem and propose a solution.

### **PROCEDURES FOR LABORATORY HOOD MAINTENANCE WORK**

- When hood fan maintenance work is required, it may be necessary to schedule a shutdown of an entire bank of hoods regardless of the number of hoods actually being serviced.
  - The zone coordinator will send a shutdown request form to the building administrator who will confirm shutdown dates and times and notify the zone coordinator and the affected academic departments.
  - The zone coordinator will send a shutdown verification form to the building administrator and Environmental Health & Safety.
  - At least three days prior to scheduled work, zone maintenance personnel will post signs, indicating date and time of hood shutdown on the affected hoods. The affected hoods will be out of service during the period indicated on the sign regardless of whether or not the fans are actually operating.
  - Zone maintenance personnel will also check for rooms keyed off the master. If a researcher has room locks, which are keyed off the master, a key for that lock must be furnished to the zone manager and/or building administrator.
- Immediately prior to scheduled work (Friday afternoon if the work is done Saturday), trained maintenance personnel will conduct a visual inspection (**Appendix A**) to check for any unlabeled, open containers or running operations/experiments. When a hood passes inspection, a seal will be fitted to the hood sash latch securing it in a closed position until scheduled work has been completed. Any violation will result in the cancellation of scheduled work. Removal of seals by lab personnel is a violation of U.C. Safety Policy.
  - It is the researcher's responsibility to cover all containers, including those containing residual material, or temporarily remove them from the hood. Water/oil baths can be left uncovered only if so labeled.
  - **NO** operations/experiments, including closed systems, shall be conducted in the hood during maintenance. If an instrument must be left on (standby mode), it is the researcher's

responsibility to contact Environmental Health & Safety (556-4968) who will tag the instrument.

- Upon conclusion of scheduled work, zone maintenance personnel will remove the signs and seals, at which point the hoods are ready for use. Any questions should be directed to the zone (number listed on the posted sign) or Environmental Health & Safety at 556-4968.

### **AIR DISTRIBUTION**

Air supply to a laboratory space should be arranged to minimize temperature gradients and air turbulence, especially near the face of the exhaust hood opening. Do not attempt any ventilation modifications to building systems as this may have a detrimental effect. Contact the Design and Construction Department at 556-5200.

### **ANIMAL ROOM VENTILATION**

- Design conditions vary widely, depending on whether animals are subjected to test environments or simply quartered. Contact the Design and Construction Department at 556-5200 for proper requirements for animal housing.
- Odor control within animal rooms requires 100 percent outdoor air or odor removal from recirculated air. Air rates range from 10 to 20 air changes depending on the animal occupancy and density. See A.S.H.R.A.E. Guide and Data Book, Chapter No. 15, Table No. 7, ...Average Odor-Free Air Requirements.

APPENDIX A:

**HOOD INSPECTION GUIDELINES FOR MAINTENANCE WORKERS**

- Do not lean head inside of hood, beyond the hood sash, when performing the inspection.
- If an item in a hood must be moved, in order to lower hood sash, etc., handle that item with a glove or paper towel. Avoid unnecessary handling of objects in the hood.
- Do not cover any open containers. That is the responsibility of the researcher. Only empty containers and labeled, water/oil baths can be left uncovered.
- Only instruments which have been tagged by Environmental Health & Safety (EH&S) are allowed to be kept on during maintenance. The signed, dated tag shall read:

**“NO HAZARDOUS MATERIALS”**

The tag shall be removed by EH&S after completion of maintenance procedures.

- If a violation is apparent, i.e., unlabeled, open containers, running operations and/or experiments, untagged instruments left on or a lab cannot be entered for inspection, make a note of the violation or reason for not entering a lab and continue inspecting and sealing the remaining affected hoods. At the end of inspection, the list of violations shall be reported to EH&S, 556-4968.
- Any questions regarding the visual inspection should be addressed to EH&S at 556-4968. If Industrial Hygienists cannot be reached at the above phone number, they can be paged through Communications (556-1111, 558-1111, or 911).