INDIANA UNIVERSITY

Laboratory Safety Guideline

Chemical Fume Hoods

Introduction

Chemical fume hoods are an important means of protecting workers from chemical exposure. Proper use of the fume hood is essential to provide the maximum level of protection. A thorough understanding of the equipment, its components and their effect on performance is essential to ensure proper use.

This document will describe the chemical fume hood, its features, and provides instructions and guidance to ensure the necessary level of protection is provided.

- Hazard Controls
- Laboratory Ventilation Equipment
- Chemical Fume Hoods
- Fume Hood Components
- Types of Chemical Fume Hoods
- Fume Hood Guidelines
- Common Misconceptions
- Reporting Malfunctions
- Fume Hood Evaluation Procedure

Hazard Controls

Protection from all workplace hazards are achieved by implementing hazard controls. These controls are implemented in the following order: 1) administrative controls followed by 2) engineering controls and finally 3) personal protective equipment.

Administrative controls include adequate training, warning signs, and standard operating procedures. Engineering controls include the physical equipment used to protect personnel and personal protective equipment includes items such as respirators, gloves, protective eyewear and clothing.

If administrative controls cannot adequately protect the person from these hazards engineering controls are implemented followed by the use of personal protective equipment.

A chemical fume hood is an engineering control designed to protect personnel from airborne chemical exposure. It is a partially enclosed work space that contains and captures chemical vapors and airborne particulates and exhausts them to the outside.

When used properly, a fume hood serves to minimize respiratory exposure to airborne contaminants before they enter the breathing zone of the person. The breathing zone is generally defined as the area within 0.5 meters of a person's nose and mouth. This is accomplished by 1) capturing and removing airborne contaminants and 2) providing a barrier (the sash) between the containment and the breathing zone of the person.

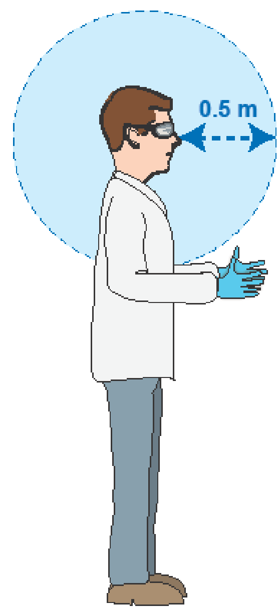

Figure 1. Breathing zone.

The fume hood is not designed to protect the skin or hands of workers placed inside the fume hood during activities so personal protective equipment (gloves and lab coat) must be used to protect the skin.

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Air currents outside the fume hood, such as up drafts, down drafts, side drafts, and back drafts, can affect the performance of chemical fume hoods. Similarly, drafts caused by adjacent equipment such as room supply and exhaust diffusers or movement of personnel walking past the fume hood can also affect performance.

Undoubtedly, the strongest draft affecting fume hood performance is the back draft caused by air being drawn into the containment and around the body of the worker under normal operating conditions. For this reason, the sash is used to protect the person's breathing zone from contaminants released in the containment.

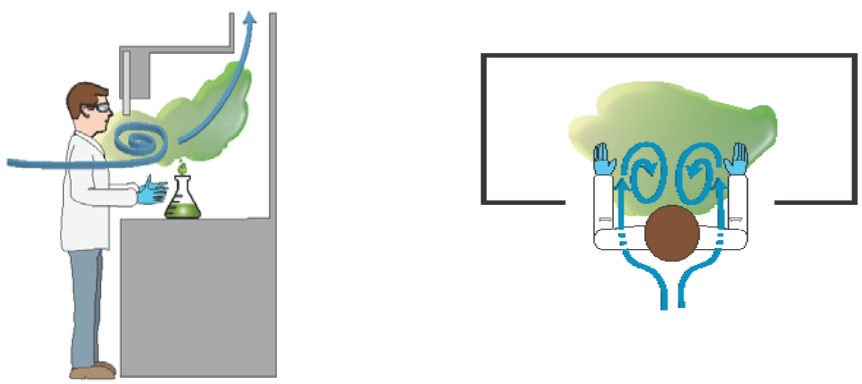

Figure 2. Turbulence caused by a back draft can expose a worker's breathing zone to contaminants released in a chemical fume hood.

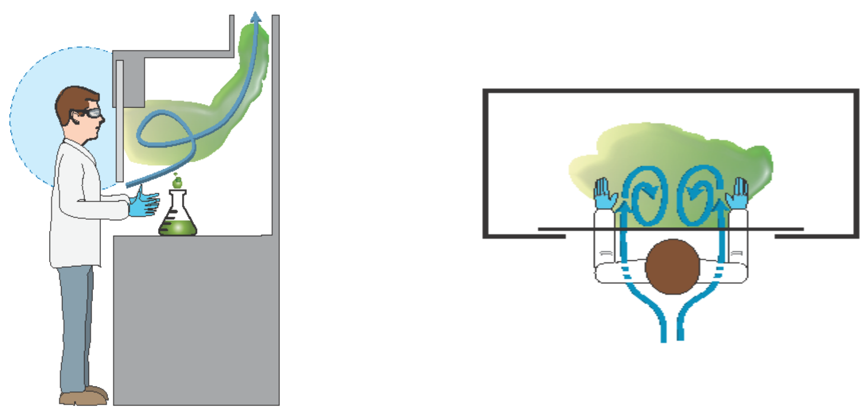

Figure 3. Using the sash at the proper operating height isolates the person's breathing zone from contaminants released in the hood.

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Laboratory Ventilation Equipment

Laboratory ventilation equipment can be thought of in three basic categories, 1) the biological safety cabinet, 2) the chemical fume hood, and 3) the clean bench as shown in the figure.

Each has its own purpose and should be utilized for that purpose. Caution should be exercised when utilizing equipment for multiple purposes and ensure that it is suitable for the intended purpose.

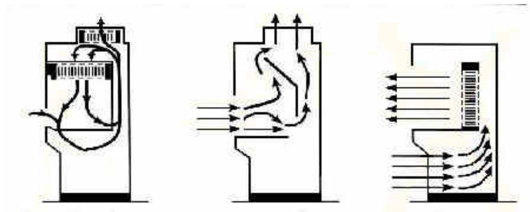

Figure 4. Laboratory ventilation equipment.

Biological safety cabinets (BSC) are intended to protect the worker and the product. Sometimes referred to as sterile cabinets, air is drawn in from the lab and passes through a grate along the front of the working surface inside the cabinet. Depending on the type of BSC, some of the air is recirculated through a “high efficiency particulate air” filter (HEPA) and some is exhausted either through another filter back into the lab or to the outside.

It should be noted that HEPA filters are very effective at removing particulates from the air stream. They are 99.97% efficient down to 0.3 microns and, theoretically, more efficient at smaller the 0.3 micron particle diameters. HEPA filters will not, however, remove toxic chemical vapors so caution should be exercised when using toxic chemicals in BSCs.

Chemical fume hoods are only intended to protect the worker. Air is drawn in from the laboratory and passes across the products in the hood and is then exhausted to the outside. Hazardous and toxic chemicals should only be handled in a chemical fume hood.

Clean benches are only intended to protect the product. Air is drawn in from the laboratory and passes through a HEPA filter. The clean air is then directed across the product and back into the laboratory. This type of device is not recommended for use with any potentially hazardous chemicals or infectious materials.

Chemical Fume Hoods

Original chemical fume hoods were constructed of very simple designs consisting of a cabinet, a fan, an exhaust plenum, perhaps without even a sash. As technology improved fume hood design incorporated new features to improve the performance of the equipment. Today we recognize two basic types of fume hoods known as 1) conventional fume hoods, and 2) high performance fume hoods.

Conventional Fume Hoods

Conventional fume hoods draw a constant volume of air through the sash opening. They have no other features to vary the velocity or volume or velocity of air entering the fume hood.

Early models lacked some of the modern features such as baffles or even a sash window. Most conventional hoods have a two panel baffle system and a moveable sash.

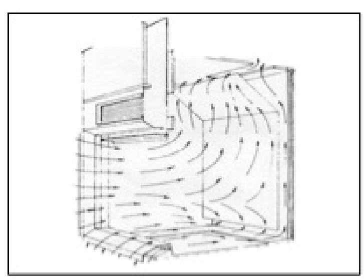

Figure 5. Conventional fume hood flow pattern.

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High Performance Fume Hoods

High performance fume hoods are more energy efficient than conventional hoods because of their lower total exhaust volumes. They are designed to take air entering through the sash opening and form a roll in the upper chamber called a vortex. This vortex enhances the hood's containment capability and has been engineered so that the vortex will not break down and collapse.

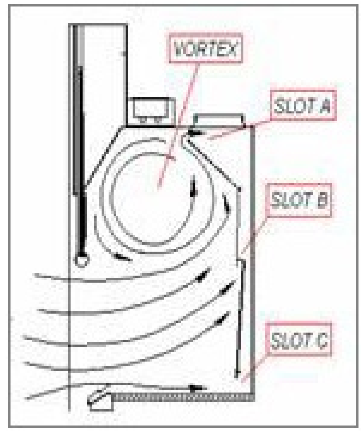

Figure 6. High performance fume hood flow pattern.

Many high performance hoods have sash doors that slide side to side (horizontally) and vertically. Only open the vertical moving sash to load/unload the hood. Use the horizontal sash doors to create a splash and blast shield while working in the hood.

Typically, high performance hoods have audible and visual alarms that will indicate if the air-flow is above or below preset alarm levels.

Some fume hoods are equipped with a manual on/off switch. Some may be equipped with either manual or automatic variable air velocity (VAV) controls that allow the user to turn the velocity down during periods of inactivity.

Fume Hood Components

Most fume hoods share common design characteristics. High performance fume hoods incorporate additional or modified components. The basic fume hood components include the hood body, sash, work surface, exhaust, and baffles.

- Hood Body

  The housing of the fume hood provides the containment for hazardous gases and vapors or the physical barrier between the containment and the outside air.

- Work Surface

  The work surface or deck is generally a laboratory bench top, but also the floor of a walk-in hood, this is the area under the hood where apparatus is placed for use.

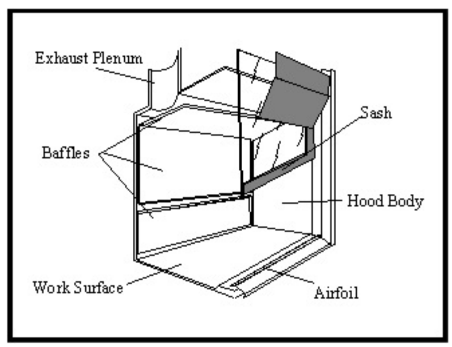

Figure 7. Fume hood components.

- Exhaust Plenum

  The shape and location of the exhaust plenum helps to distribute air flow evenly across the hood face. Materials such as paper towels drawn into the plenum can create turbulence in this part of the hood, resulting in areas of uneven air flow and poor performance.

- Air Foil Sill

The air foil sill is located along the bottom edge of the fume hood. The air foil performs several important functions: 1) it streamlines the airflow into the hood around the edge reducing turbulence and loss of containment as shown in the figure, 2) the flow continually sweeps the work surface, and 3) it provides a source of air for the hood to exhaust with the sash fully closed.

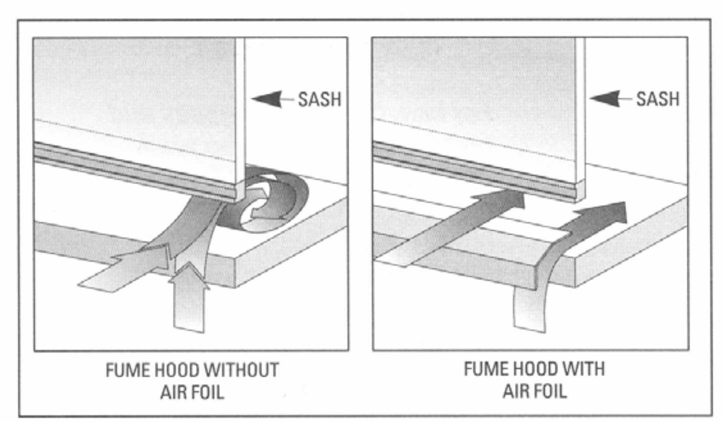

Figure 8. Reduction of turbulence provided by the air foil sill.

- Baffles

The baffles are moveable partitions used to create slotted openings along the back of the hood body. Baffles keep the airflow uniform across the sash opening to optimize capture efficiency and eliminate dead spots or possible reverse flows at the sash opening which would result in a loss of containment.

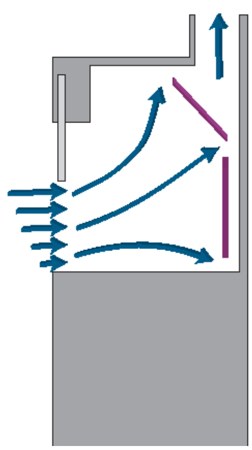

Figure 9. Conventional fume hood velocity profile with baffles.

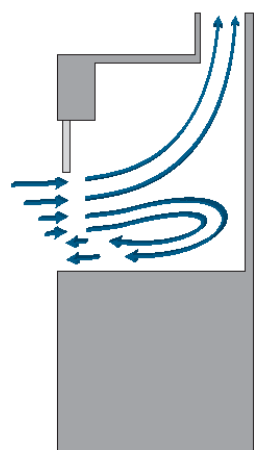

Figure 10. Conventional fume hood velocity profile without baffles.

A typical fume hood velocity profile across the sash opening will show a decreasing velocity from top to bottom as shown in Figure 9. A hood without baffles may create a reversal of flow at the base and a potential loss of containment as shown in Figure 10.

Chemical Fume Hoods

Baffle Positions

Adjusting the baffles allows the user to accommodate light vapors or dense, heavy vapors as necessary. High performance fume hoods have louvered or articulated baffles that allow more flexibility.

Baffle positions open and close the slots between the panels. In a three panel louvered baffle system the baffles would be adjusted as follows to accommodate light or dense vapors.

1. Light vapors: Maximum airflow is required at the top. Top slot is fully opened and the center and bottom slots are in the open position.
2. Normal Operation: The top, center, and bottom slots are all open evenly to provide uniform flow.
3. Heavy vapors: Maximum flow is required at the bottom near the work surface. The top slot is closed and the center and bottom slots are open.

- Sash

The sash located at the front of the hood can be adjusted to optimize the air flow into the fume hood. It provides a protective barrier, a window to observe the activities in the containment, and protects the workers breathing zone from vapors released in the containment.

Sash Opening

The sash opening or hood face is the imaginary plane from the bottom of the sash to the air foil sill. The face velocity is measured across this plane.

Sash Positions

There are three typical sash positions to be used by the operator.

1. Closed: All sashes should be closed when the fume hood is not in use.
2. Operating Position or Operating Height: A maximum of 18 inches. The sash should be used at this position whenever work is being performed in the containment.
3. Set-Up Position: Any opening greater than the operating position. The sash should only be used in this position for loading equipment and set-up of materials. Work should not be performed with the sash in the set-up position.

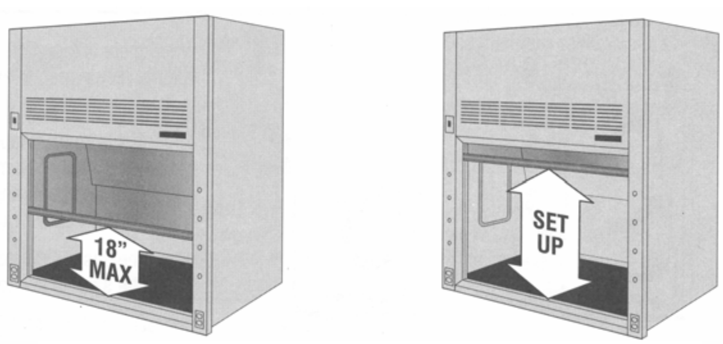

Figure 11. Fume hood operating height and set-up position.
Set-up position is only to be used during set-up.

Chemical Fume Hoods

Types of Fume Hoods

Hoods are categorized according to their exhaust characteristics as either 1) constant volume (CV) fume hoods or 2) variable air volume (VAV) fume hoods. Constant volume hoods draw the same volume of air out of the room at all times. Constant volume fume hoods can be further subdivided into several types known as 1) conventional, 2) bypass, and 3) auxiliary air fume hoods. Variable air volume hoods reduce or increase the volume of air being exhausted as the sash is lowered or raised respectively.

Conventional Fume Hood with Constant Volume Exhaust

Conventional fume hoods draw the same volume of air out of the room regardless of the sash height. As the sash is closed the area of the sash opening is reduced and the face velocity increases. Note that because of these high velocities at the sash opening materials placed near the front of the hood can adversely affected, become airborne, or be blown over as the sash is closed.

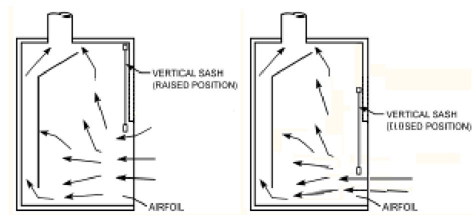

Figure 12. Conventional fume hood showing velocity increase.

Conversely, as the sash is raised the face velocity decreases. Because face velocity changes dramatically it is important to use the hood at the optimal sash opening or operating height.

The optimal sash opening is the point at which the average face velocity is between 80 and 120 feet per minute (0.4-0.6 m/s) and is typically set at 18 inches or the half sash opening position.

Bypass Fume Hood with Constant Volume Exhaust

Bypass fume hoods incorporate an opening above the sash for air to enter the hood as the sash is lowered.

This allows the velocity below the sash to remain nearly constant and not disturb materials placed in the hood.

It also serves to maintain a balance between the room air supply and the fume hood exhaust.

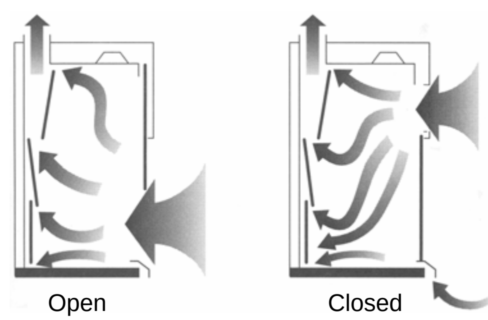

Figure 13. Bypass fume hood.

Auxiliary Air Fume Hood with Constant Volume Exhaust

Auxiliary air fume hoods also incorporate an opening above the sash for air to enter the hood as the sash is lowered, but provide an auxiliary air supply from outside.

This feature reduces the amount of conditioned air lost from the room though the fume hood exhaust. The auxiliary air may come directly from the outside and may or may not be conditioned to room temperature.

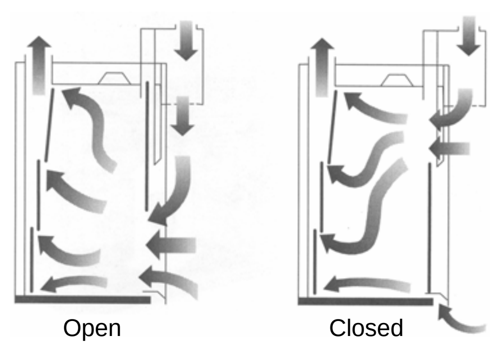

Figure 14. Auxiliary air fume hood.

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Variable Air Volume Exhaust Fume Hood

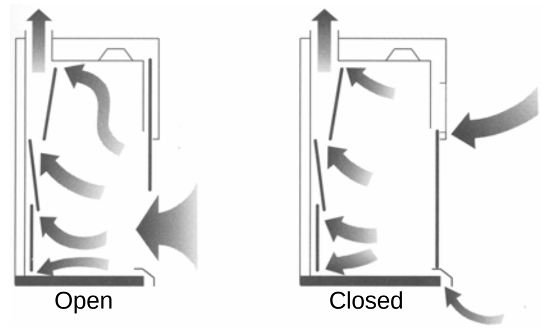

Figure 15. Variable air volume hood.

Variable air volume (VAV) fume hoods have the capability to adjust the volume and velocity of air entering the hood. This can be accomplished by adjusting the fan speed or the damper opening in the exhaust plenum.

These high performance fume hoods are equipped with either 1) manual controls or 2) automatic controls to adjust the volume of air entering the fume hood.

Manual Volume Controls

Manual controls allow the user to turn the volume and velocity down during periods of inactivity. Typically the user may select 25, 50, 75, 100, 125, 150 feet per minute or emergency “purge” velocity settings.

Under ordinary operating conditions the velocity setting should be set to 100 feet per minute. After adjusting these hoods, ensure that the air-flow velocity has been restored to the appropriate setting before use.

Automatic Volume Controls

Automatic controls adjust the volume as the sash is raised or lowered. These high performance hoods adjust a damper in the exhaust plenum to open or close to increase or decrease the volume and hence, the face velocity, as necessary.

During the volume adjustment the system may take 3-6 seconds to recover as the sash is opened. While the system adjusts, a momentary loss of containment may occur after which contaminants are drawn back into the hood.

Because of the momentary delay, users should only raise the sash to the operating position if chemicals or contaminants are present and protect the breathing zone with the sash as much as possible while the system responds. Open the sash to the fully open (set-up) position only when contaminants are not present within the fume hood containment.

Both of these controls provide an energy efficiency advantage because as the volume is reduced a decreasing the amount of conditioned air is lost from the building though the fume hood exhaust.

They also provide the additional advantage that as the volume is reduced the velocity decreases and this reduces the adverse affect that high velocities may have on objects and items placed inside the fume hood. This is especially true for automatic volume controls because as the sash is lowered the face velocity is reduced at the sash opening.

Both manual and automatic controls are typically equipped with audible and visual alarms to indicate low flow conditions if the velocity or volume is below preset alarm thresholds. They also both offer a manual emergency “purge” setting that can be activated in the event of an emergency or spill (whether inside or outside the hood) in which additional ventilation is required.

Chemical Fume Hoods

Test Procedures and Face Velocity

Three common standards discuss laboratory chemical fume hood test procedures.

- SEFA 1-2002 (Scientific Equipment and Furniture Association)
- AIHA Z9.5-2003 (American Industrial Hygiene Association)
- ASHRAE 110 Standard (American Society of Heating, Refrigeration and Air conditioning Engineers).

These are all recommended practices, or guidelines, on testing chemical fume hoods and their methods are not mandatory unless they are incorporated by reference in state or local codes and regulations.

In 1985, ASHRAE turned a society funded research project (RP-70) into the 110th standard to come from their organization. They took the current chemical fume hood testing standard at the time, SAMA (Scientific Apparatus Makers Association) LF10-1980, and added testing with an easily detectable gas, Freon (now replaced by sulfur hexaflouride), and several additional smoke tests. Also added was a test to measure the response time for a Variable Air Volume system. The tracer gas test was performed to measure the effectiveness of containment using a mannequin with an air monitor in its mouth, simulating an operator standing at the face of the hood.

The OSHA standard is very vague on test procedures. If one wants to know how to test a chemical fume hood they have several options. The most popular of which comes from one of the following recommended practices: SEFA 1-2002, ANSI/AIHA Z9.5-2003 & ANSI/ASHRAE 110-1995.

Prior to 2002, the SEFA 1.2 field evaluation test was taken directly from SAMA LF10-1980 and discussed a method of face velocity and smoke testing (outside the hood, at the face of the hood and around the side walls and equipment in the hood). In 1980 ASHRAE 110 wasn't a standard, so for many years face velocity and smoke testing was the only test method performed.

Since 2002, SEFA and AIHA have updated their guidelines and have put more emphasis on the tracer gas testing outlined in the ASHRAE 110 standard. SEFA, which originally just copied SAMA LF10, has updated their standard to include references to the ASHRAE 110 standard in its three test modes, "As Manufactured", "As Installed" and "As Used."

It is important to realize that ASHRAE 110 tests performed in fume hood commissioning activities after hood installation or renovation are performed according to the "as installed" conditions with the hood empty. Typical annual fume hood evaluations measuring face velocity are performed in the "as used" condition with equipment and other items in the hood. If the face velocity is out of the acceptable range then a loss of containment may be occurring.

The appropriate face velocity will vary depending on usage of the fume hood and the way in which the hood has been set up. The following published guidelines specify general ranges for face velocity settings. Additional state and local requirements for face velocity may also exist and could take precedence.

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Organization	Reference	Face Velocity Feet per minute (fpm)
OSHA	29 CFR & 1910.1450 App A, C. 4. (g) (non-mandatory)	60-100 fpm
OSHA	29 CFR 1910.1003(b) 13 Carcinogens (non-laboratories only)	125-150 fpm
ACGIH	Industrial Ventilation Manual 23rd Edition	60-100 fpm
ANSI/AIHA	Z9.5	80-120 fpm
NFPA	NFPA 45 Appendix A, A.6.4.6	80-120 fpm
SEFA	SEFA 1-2002, 4	100 fpm

Published Guidelines Referencing Fume Hood Face Velocity

In most cases, as stated in *Prudent Practices in the Laboratory*, the recommended face velocity at the operating sash height is from 80 to100 feet per minute. Face velocities from 100 to 120 fpm may be used for substances with very high toxicity or where outside influences adversely affect the fume hood performance. Face velocities approaching or exceeding 150 fpm should not be used because of turbulence created around the periphery of the sash opening that may lead to a loss of containment.

Select the appropriate face velocity for the hood taking into consideration the fume hood set-up processes and the specific application. Under typical operating conditions, fume hoods provide reliable containment at the levels specified by applicable industry standards when operated at a 100 feet per minute.

Additionally, face velocities that are out of the specified range “as manufactured” or “as installed” should be considered for maintenance. In many cases, typical equipment installation specifications require that fume hoods operate at 100 fpm ± 10%. Fume hoods designed specifically to accommodate low velocities should be evaluated according to the manufacturers recommendations for the installation.

Fume hoods with no manufacturer or installation specifications may be evaluated according to minimum face velocity standards established for those hoods. Ideally, based on the references above and without actual containment measurements in accordance with ASHRAE 110, a minimum face velocity of 60 fpm with the sash fully open (in the set up position) and 80 fpm with the sash half open (at the operating height) and a maximum of 120 fpm may be a reasonable range for fume hood performance evaluation.

Under certain circumstances maintaining a velocity below 150 fpm may be necessary and acceptable to maintain negative pressure in the laboratory or other reasons. For these fume hoods, face velocities below these minimum criteria (60 fpm fully open and 80 fpm half open) and face velocities greater than 150 fpm would be considered unacceptable and would require maintenance and improvement.

Chemical Fume Hoods

Fume Hood Guidelines

Chemical fume hoods are one of the most important items of safety equipment present within the laboratory. Therefore it is vitally important that they are properly used and maintained. Chemical fume hoods serve to control the accumulation of toxic, flammable, and offensive vapors by preventing their escape into the laboratory atmosphere. In addition, fume hoods provide physical isolation and containment of chemicals and their reactions and thus serve as a protective barrier between laboratory personnel and the chemical or chemical process within the hood.

1. Before using a fume hood, ensure that the fume hood is appropriate for your work. Refer to the conditions of use, including any restrictions, noted on the fume hood label. A chemical fume hood should be used for any chemical procedures that involve the following conditions:
   - All chemicals that the Occupational Safety and Health Administration (OSHA) considers “particularly hazardous substances” must be used in a fume hood. These substances include the select carcinogens, reproductive toxins (mutagens and teratogens), and any chemical considered to have a “high degree of acute toxicity” (all chemicals with an NFPA health hazard rating of 3 or 4).
   - Airborne chemical concentrations that might approach Permissible Exposure Limits (PELs) for an OSHA regulated substance.
   - Explosion and fire hazards or flammable/combustible vapors approaching one tenth the lower explosion limit (LEL). The LEL is the minimum concentration (percent by volume) of the fuel (vapor) in air at which a flame is propagated when an ignition source is present.
   - Perchloric acid must not be used in standard fume hoods and can only be used in a hood designated exclusively for its use, having appropriate wash down capabilities.
   - Odors that are annoying to personnel within the laboratory or adjacent laboratory/office units.
   - Radioisotopes must be used in fume hoods designated exclusively for its use.
   - Biohazardous materials must be used in a certified biological safety cabinet.
2. Ensure that you are aware of the location of the nearest emergency eyewash and shower. A lab coat, gloves, eye protection and appropriate footwear must be worn.
3. Ensure that fume hoods with on/off switches are turned on before starting work and allow time for the flow to stabilize. Before turning the hood off, ensure that any containers or vented experimental apparatus are closed.

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4. Fume hoods should be monitored daily by the user to ensure that air is moving into the hood. All fume hoods should have an "air flow indicator" attached to the sash or an electronic monitor with an alarm.

   Prior to starting work in a fume hood, check the ribbon or monitor to make sure air is flowing into the hood (the ribbon should be drawn into the hood). Fume hoods are evaluated annually but any malfunctioning hood must be reported for repair immediately and taken out of service.

Figure 16. Air flow indicator.

5. Always use the fume hood with the sash in the operating height position or less. The optimum sash opening may be located at the mechanical stopper, at half sash, or the sash opening indicated on the hood. The hood sash should be positioned with the minimum sash opening so that it acts as a protective barrier between laboratory personnel and chemical vapors.

6. Never use the hood with the sash in the set-up position unless equipment is being installed in the hood and no chemicals are present. Laboratory personnel should not extend their head inside the hood when chemicals are present.
7. Some high performance hoods have sash doors that slide side to side (horizontally) and vertically. Only open the vertical moving sash to load/unload the hood. Use the horizontal sash doors to create a barrier between you and the work. Place one panel in front of the face and body and work with the hands around the sides of the panel. Sliding horizontal sash windows should not be removed from the hood sash.
8. Hood baffles or slots should be positioned properly. The top baffle slot should be opened when chemicals with a vapor density of less than 1 (lighter than air) are used. The bottom baffle slot should be opened when chemicals with vapor densities greater than 1 (heavier than air) are used.
9. Minimize the amount of bottles, beakers and equipment used and placed inside the hood. These items interfere with the airflow across the work surface of the hood.
10. Chemicals and equipment (apparatus, instruments, etc.) should be placed at least 6 inches (15 cm) from the front edge of the hood. Equipment should be placed as far back in the hood as practical without blocking the slots between the baffles to ensure air is adequately drawn from the hood. Separate and elevate equipment by using blocks to ensure that air can flow easily around and under the equipment.
11. To prevent a disturbance or reduction in airflow at the sash opening, limit the number of individuals standing close to the fume hood and ensure that open doors and windows are not creating a cross draft.
12. Chemical fume hoods should be kept clean and free from unnecessary items and debris at all times. Solid material (paper, tissue, aluminum foil, etc.) should be kept from obstructing the rear baffles and from entering the exhaust ducts of the hood.

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13. Unplug electrical apparatus or other ignition sources inside the fume hood when flammable vapors or gases are present in the hood.
14. Electrical cords and tubing should be routed through the airfoil sill or between the sill and the sash if possible. Avoid routing electrical cords and tubing through the horizontally sliding sash panes to prevent disturbance if the vertical sash is raised.
15. Do not use a hood for storing chemicals unless it has been designated for storage. If so, the sash must be closed at all times. Be aware that unlike flammables cabinets, items stored in a fume hood may become involved in a fire, explosion, or spill creating a more serious problem. Use flammables cabinets to store flammable materials.
16. Never use a fume hood for evaporation of wastes. Evaporation for the purpose of disposal is an Environmental Protection Agency (EPA) violation and is strictly prohibited.
17. If a power outage occurs, fume hood ventilation will be compromised. Take precautions to ensure adequate protection. Prevent the build up of vapor or fumes by keeping all containers closed, turn off any gas supplies, turn off electrical equipment, secure your experiment, and close the sash.

Common Misconceptions

1. When working with highly dangerous materials, the higher the face velocity the better.

   While it is important to have a face velocity between 0.4 m/s (80 fpm) to 0.6 m/s (120 fpm), velocities higher than this can be less efficient. When face velocities are excessive, eddy (turbulent) currents can be created that allow contaminants to be drawn out of the hood, possibly increasing worker exposure.

2. A fume hood can be used for storage of volatile, flammable, or odiferous materials when an appropriate storage cabinet is not available.

   While it is appropriate to keep chemicals that are being used during a particular procedure inside the fume hood, hoods are not designed for permanent chemical storage. Each item placed on the work surface interferes with the directional air flow, causing turbulence and eddy currents that allow contaminants to be drawn out of the hood. Even with highly volatile materials, as long as a container is properly capped, evaporation will not add significantly to worker exposure. Unlike a fume hood, flammable materials storage cabinets provide additional protection in the event of a fire.

3. The fume hood can be used as a waste disposal mechanism (e.g. for evaporation of chemicals).

   It is not appropriate to use a fume hood for waste disposal because it vents directly to the atmosphere untreated and is a citable violation.

Reporting Malfunctioning Fume Hoods

Malfunctioning fume hoods are a safety hazard and need to be repaired immediately. For performance malfunctions first report the problem to your facility manager to get it repaired and to Environmental Health and Safety (855-6311). EH&S will re-evaluate the fume hood after the repair to ensure it is working properly.

For other problems with the physical structure of fume hoods (such as damaged air foils, jammed sashes, etc.) report the problem to your facility manager.

Chemical Fume Hoods

Fume Hood Evaluation Procedure

1. Check with lab personnel to see if it is a good time to check their hoods. Check hoods at a later time or date if an experiment is in progress in the hood or if the hood is being used by lab personnel.
2. Be sure the hood is ON! For VAV hoods with a manual control set the control to 100 fpm or whatever the specified velocity is for that hood (shown on the hood identification card or fume hood specification list) before taking face velocity readings and wait 30-60 seconds for the system to respond.
3. Use of laptop computers or data logging instruments is acceptable. For paper records, record all face velocity readings on the Hood Velocity Evaluation Form attached.
4. Record the department, building, faculty, evaluator, safety contact, information and date at the top.
5. Record each room/hood number, hood type, and hood width (sash width) and other information on the evaluation form.
6. Make note of any hood problems (i.e. burned out lights, broken sash, missing sash pieces, missing hood side panels, etc.) Also note any items that are inside that hood that would adversely affect the face velocity. Record comments in comment section of evaluation form.
7. Raise sash to operating height or position. Record the hood opening dimension (sash height) on the evaluation form. (Be very careful not to disturb items in the hood and return the sash to its original position.)
8. Follow the anemometer manufacturer's instructions. The air velocity meter will record individual velocity measurements and calculate the average. To decide on the number of readings to record and average, divide the sash opening into 1 square foot sections and take a reading in the middle of every square foot section. (Example. If the sash opening = $12ft^2$, then take 12 readings.) Remember, the meter sensor probe should be held in the plane of the sash and the dot on the probe should be facing outward. Make sure your body is not obstructing the air flow.

$6 \text{ ft} \times 2 \text{ ft} = 12 \text{ ft}^2$

x	x	x	x	x	X
x	x	x	x	x	X

9. Record face velocities at full-open sash and half-open sash. Record these velocities on the evaluation form. (*Note: the Dept. of Chemistry may require that face velocities be checked at other sash heights. Check hood ID card for the required sash height. Record sash height in the space provided on the evaluation form*.)
10. Ideal hood face velocities should range from 60-120 fpm at full-open sash and 80-120 fpm at half sash. The absolute minimum flows for a hood are 60 fpm at full-open sash and 80 fpm at half sash. **Any hoods with face velocities below 60 fpm at full-open sash and below 80 fpm or above 120 fpm at half sash will be considered unacceptable and will fail the inspection.**

Any hood velocities that fall at or slightly above these minimum values should be serviced and the flows increased to the ideal velocities. Record hood velocities and comments on evaluation form.

11. Complete a Fume Hood Evaluation sticker and affix to hood sash.
12. When all the hoods for a department have been tested prepare a comprehensive hood evaluation report. Send a copy of this report to the Departmental Safety Officer and the building manager. They will forward the list to maintenance personnel and submit a work order.

Procedure for Evaluating the "As Installed" Criteria

Acceptable face velocities for the Department of Chemistry and other new installations vary from the above guidelines. These hoods are tested in the "as installed" performance criteria. The majority of hoods in Chemistry were calibrated at the operating (half-sash) position when they were installed. When checking a hood, check it at the half-sash position at the 100 fpm setting on the manual control switch. Refer to the latest hood report to determine the face velocity setting for the variable speed control and the required sash opening. Set the face velocity to that shown on the list and set the sash opening to the required position and evaluate the face velocity.

The specifications require that face velocities should not vary more than 10% of their control setting value. (Example: at a setting of 100 fpm the hood flow at half-sash should be between 90 and 110 fpm with the sash half open). Report problems to the facility manager and send a completed hood report. The facility manager will forward a copy of the report to the maintenance personnel.

References

American National Standard for Laboratory Ventilation. ANSI/AIHA Z9.5-1992, American Industrial Hygiene Association. Fairfax, 1993.

CRC Handbook of Laboratory Safety, CRC Press, Washington DC, 2000.

Industrial Ventilation: A Manual of Recommended Practice, 18th Edition. American Conference of Governmental Industrial Hygienists. Cincinnati, 1984.

Laboratory Fume Hoods: a User's Manual, Saunders, T., John Wiley & Sons, Inc., New York, 1993.

Laboratory Fume Hoods, Fisher Hamilton, Project Planning Guide and Product Specification Catalog, 2002.

Methods for Testing Performance of Laboratory Fume Hoods. ANSI/ASHRAE 110-1995, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., Atlanta, 1995.

Prudent Practices in the Laboratory – Handling and Disposal of Chemicals, National Research Council, National Academy Press, Washington, D.C., 1995.

INDIANA UNIVERSITY

Hood Velocity Evaluation Form

Department:	**Building:**
Faculty/Staff:	**Contact Person:**
Evaluator:	**Date:**

Anemometer Model # and Serial #:______________________ Calibration Date:______________________________

Room/Hood Number	Hood Type (Conv., Byp., Aux., VAV)	Hood Width (inches)	Sash Opening Height (inches)	Velocity			Acceptable Velocity (Yes/No)	Notes
				Fully Open Sash	Half Open Sash	Other		

Comments: