Chemical Fume Hoods

A UCSC Users' Guide

The fume hood is often the primary control device for protecting laboratory workers when working with flammable and/or toxic chemicals.

A fume hood should be used in the following situations:

- When working with significant inhalation hazards, such as hazardous chemical vapors, volatile radioactive materials, toxic gases or respirable toxic powders
- When carrying out procedures that could explode or generate high pressure
- When chemical vapors generated could cause a fire hazard
- When working with compounds that have an offensive odor

Before using a fume hood:

- ☑ Receive training on proper hood use.
- ☑ Understand how the hood works.
- ☑ Know the hazards of the chemical(s) you are using; refer to SOPs or Safety Data Sheet(s) if you are unsure.
- ☑ Verify that the hood is on and alarm is functioning.
- ☑ Make sure that the sash is open no higher than the proper operating level, as indicated by arrows on the frame.
- ☑ Make sure that the air gauge indicates that the airflow is within the required range.

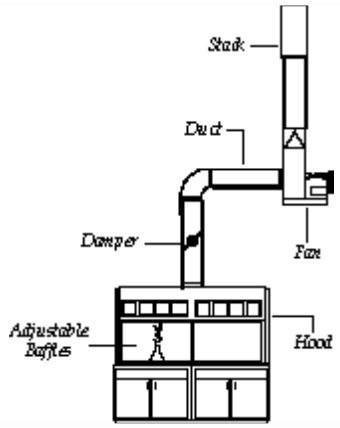
Fume hood work practices:

- ☑ Keep the sash between you and your work. Never allow your head to enter the plane of the hood opening. For example, for vertical rising sashes, keep the sash below your face; for horizontal sliding sashes, keep the sash positioned in front of you and work around the side of the sash.
- ☑ Use appropriate eye protection.
- ☑ Be sure that nothing blocks the airflow through the baffles or through the baffle exhaust slots.
- ☑ Elevate large equipment (e.g., a centrifuge) at least two inches off the base of the hood interior to allow air flow underneath.
- ☑ Keep all materials inside the hood at least six inches from the sash opening.
- ☑ When not working in the hood, close the sash.
- ☑ Do not permanently store any chemicals inside the hood.
- ☑ Promptly report any hood that is not functioning properly (e.g., continuous low flow < 100 fpm while working). The sash should be closed and the hood "tagged" and taken out of service until repairs can be completed. *Note: If the hood goes into alarm inappropriately due to sash height – Call it in via 9-4444. Do not wedge the mute button to silence the alarm instead of reporting the malfunction.*
- ☑ When using extremely hazardous chemicals, alert others working in the area and understand your laboratory's action plan in case an emergency, such as a power failure, occurs.

To capture vapors adequately, a fume hood should provide an average face velocity of at least 100 feet per minute (fpm) through the work opening. UCSC checks campus fume hoods once a year to verify that the inward air velocity at the work opening is within an acceptable range. The air velocity measurements are noted on a tag on the hood. If the hood is found to be operating unsatisfactorily with a face velocity

below 100 fpm, a warning label will be posted on the sash of the fume hood and Physical Plant will be notified to correct the problem.

The fume hood is powered by exhaust fans on the roof that draw air up from the fume hoods through ducts and push the hood air out the exhaust stack. The exhaust ducting from several hoods is often connected together before exhausting through the stack. The hood exhaust fan is typically driven by an electric motor and a fan belt.



Just like any mechanical system, a fan or motor can break, which prevents airflow from exhausting properly. Low exhaust airflow can create a hazard for the hood user, so it is important that hood users frequently check the airflow and report any problem.

In an electrical power outage, the laboratory ventilation will not work properly. The fans are cut to half or less and the sashes must be closed during outages. Occupancy of most labs will not be possible during outages as the ventilation is insufficient to protect the occupants.

Verify Proper Hood Airflow. All hoods should have an airflow indicator that informs the user if the hood is working properly. The indicator reads-out in feet per minute, and will alarm when the airflow is not satisfactory. If the airflow monitor is not working, promptly report this or any hood that is not functioning properly (e.g., continuous low flow < 80 fpm while working). The sash should be closed and the hood "tagged" and taken out of service until repairs can be completed.

Note: The hoods in CBB go into a "soft" alarm state when the sash is closed. The alarm light will turn orange but the alarm will not sound. This is a part of normal operation.

On the other hand, with airflow velocities that are too high, turbulence can bring airborne contaminants back toward the user. But if there is a spill of a volatile liquid in the hood, closing the sash and pushing the "PURGE" button will greatly increase the air volume moving through the hood and exhaust the excess vapors with a greater capture capacity. This is for Emergency situations only and you should never attempt to work at the hood with this function activated. Please make sure that there are no small objects likely to get sucked into the hood when activating this function.

Adjust the Sash to Protect You. Fume hoods have glass sashes that slide vertically. Adjust the sash to shield yourself from splashes or flying objects. The sash in the hoods in CBB are controlled by a panel on the right side of the hood. The up arrow opens the sash to the correct height and the down arrow closes the sash completely. The screen on the panel shows the status of the proximity sensor.

Turn the fume hood light ON before working with hazardous materials. If the hood light is not working, request that the light be repaired. It is important to be able to see properly when working with hazardous materials.

Setback Operation and Proximity Sensor. Variable air volume (VAV) hoods have controls that vary the airflow depending on the position of the sash, but keep the face velocity constant. When the sash on a VAV hood is closed, the volume of air exhausted is decreased. Closing the sash when it is not being used is generally safer because it isolates chemical hazards that are in the hood. When the hood is VAV controlled it will save energy when the sash is closed, and it may be quieter. The hoods in CBB include additional energy savings as they

throttle back the speed of the air intake to 60 fpm, which saves thousands of dollars a year and tons of CO_2 emissions. To ensure that the hood is in full operation whenever it is in use, they have a proximity sensor that detects the user's presence and immediately ramps up the hood flow rate to 100 fpm. If the user is still for too long, the screen above the sash controller will warn that no user is present and lower the sash and airflow after 30 seconds. To stop this from happening, move under the proximity sensor and the hood will recognize that you are present again.

Proximity Sensor:

Preparation for Repairs. In the event that the hood system needs repairs, the lab group will need to clear out and clean the hood to prepare it for the HVAC Mechanic or contractor who will make the repairs. This includes clearing the hood of all apparatus, chemical reagents and waste, as well as wiping down any gross contamination or recognizable hazardous substances and ensuring the hood is free from other recognizable hazards (radiation, biohazards, etc.).

Non-Conforming Use. No matter how well a system is designed or maintained, no matter what lengths an institution has gone to for the sake of safety and energy conservation, if laboratory personnel do not use the equipment properly, individual users can defeat these efforts with their own behaviors.

Laboratory personnel who insist on working at the edge of the laboratory chemical hood, raise the sash above its maximum operating height, defeat alarms, disable sash closures, do not move a snorkel hood close to the source, block baffles, *use loose materials (Kimwipes) in the chemical hood and clog the ductwork*, leave the sash open when not working at the chemical hood, or fail to report a malfunction reduce safety and sustainability efforts. Sometimes these actions are due to lack of consideration; sometimes personnel may simply not understand the implications; but it is everyone's responsibility to ensure proper hood use.

All Laboratory Personnel Should Receive Training that Includes:

- How to use the fume hood
- Consequences of improper use
- What to do in the event of system failure
- What to do in the event of a power outage
- Special considerations or rules for particular uses, materials or apparatus
- Significance of signage and postings
- Reminder to lower the sash when not in use

Training is achieved through completion of the online "Laboratory Safety Fundamentals" course, one-on-one discussion, review of the online UCSC Lab Safety Manual (http://ehs.ucsc.edu/lab-safety-manual), and review of this document and any other relevant operational documents. Use the formats that best fit the culture and needs of the laboratory, but some form of direct mentoring and documentation are to be included.

Users Must Identify:

- ☑ Correct sash position for laboratory chemical hoods
- ☑ Quantitative airflow indicator function
- ☑ Meaning of any audible or visual alarms and appropriate response
- ☑ Occupancy sensors function (e.g., set back mode tied to light switch), and
- ☑ Equipment/Apparatus-specific measures to protect the users, their colleagues and the service personnel who may be affected by hood contamination.