EHS Laboratory Guidance

Chemical Fume Hood Safety

**Background**

One of the primary safety devices in a laboratory is a chemical fume hood. A well-designed hood, when properly installed and maintained, can offer a substantial degree of protection to the user, provided that it is used appropriately and its limitations are understood. All fume hoods and other capture devices must be installed in consultation with Facilities and EHS. All new installations or relocation of fume hoods must be commissioned by EHS prior to use. To request that a new or relocated fume hood be commissioned, contact EHS. If you know your fume hood is not working properly, contact Facilities for your building or submit a work order. If you are not sure if your hood is working properly, contact EHS to request a hood evaluation.

**How a Fume Hood Works**

A fume hood is a ventilated enclosure in which gases, vapors and fumes are contained. An exhaust fan situated on the top of the laboratory building pulls air and airborne contaminants through connected ductwork and exhausts them to the atmosphere.

The typical fume hood found in UI laboratories is equipped with a movable front sash and an interior baffle. Depending on its design, the sash may move vertically, horizontally or a combination of the two and provides some protection to the hood user by acting as a barrier between the worker and the experiment.

The slots and baffles direct the air being exhausted. In many hoods, they may be adjusted to allow the most even flow. It is important that the baffles are not closed or blocked since this blocks the exhaust path.

The airfoil or beveled frame around the hood face allows more even airflow into the hood by avoiding sharp curves that can create turbulence.



There are basically two types of fume hoods at UI, they are:

* *Constant volume* – where the exhaust flowrate or quantity of air pulled through the hood is constant. Therefore, when the sash is lowered and the cross-sectional area of the hood opening decreases, the velocity of airflow (face velocity) through the hood increases proportionally. Thus, higher face velocities can be obtained by lowering the sash.
* *Variable air volume (VAV)* - where the exhaust flowrate or quantity of air pulled through the hood varies as the sash is adjusted in order to maintain a set face velocity. Therefore, when the sash is lowered and the cross-sectional area of the hood opening decreases, the velocity of airflow (face velocity) through the hood stays the same while less total air volume is exhausted.

**Fume Hood Materials and Design**

*Sash Glass* – This is made of multi-paned safety glass. It will withstand impacts and small explosions by “spidering” but not shattering.

*Interior Linings* – This is made from a number of different types of materials, depending on designed use. Radioactive use hoods are usually made of rolled and seamless stainless steel. Chemical use hoods are made of chemical resistant materials. Some older hoods on campus have a transite (asbestos) liner. This transite liner is safe for use but must not be drilled, broken or removed by lab staff. If there are any concerns about the hood lining, please contact EHS.

*Ductwork* – Chemically compatible ductwork has been installed for all hoods when the hood was installed or the building was built. It is understood that over time, the lab’s functions and focus changes, which may mean different chemicals are being used than the original designed use. If there is any concern about the use of chemicals in the hood and their compatibility with the hood and duct materials, please contact EHS to have the hood and duct materials assessed.

*Sash Counterweight System*– These are designed to aid in the movement of the sash. Lead or steel weights are attached by cables to the sash to counter the weight of the sash. If these break, please contact Facilities to have these repaired.

*Utilities*– Air, gas, water, vacuum, etc. may be supplied to the hood for lab staff use. If these need to be repaired, do not attempt to repair or alter these utility hook-ups. Please contact Facilities to have them repaired.

*Airflow Monitors*– These alarm units are required for all new or renovated hoods and labs. These monitor airflow and will alarm (both audibly and visually) when airflow falls below a safe setting. This reduced airflow will not have the capture velocity to collect and remove chemical vapors. These may flow out of the hood and be hazardous to staff. Older hoods are not required to have these monitors, but they may be installed at the lab’s expense.

**When is a Fume Hood Necessary?**

The determination that a fume hood is necessary for a particular experiment should be based on a hazard analysis of the planned work. Such an analysis should include:

* A review of the physical characteristics, quantity and toxicity of the materials to be used;
* The experimental procedure;
* The volatility of the materials present during the experiment;
* The probability of their release;
* The number and sophistication of manipulations; and
* The skill and expertise of the individual performing the work.

**Fume Hood Operating Guidelines**

To maximize hood effectiveness and minimize personal exposure to toxic vapors or gases, use fume hoods in accordance with these operational guidelines:

* Operate the hood at the lowest sash height necessary to perform work in order to provide additional protection from splashes, sprays, and fires.
* The EHS inspection sticker located on the front of the hood is placed at the maximum sash height of 17 inches.
* Minimize release of contaminants into the work area by reducing pedestrian traffic in front of hoods, particularly during hazardous experiments. Also minimize nearby disturbances, such as doors opening or closing, people walking by, and any quick motion in order to prevent cross drafts.
* Do not position fans or air conditioners so as to direct airflow across the face of the hood. This can interfere with airflow and containment of hazardous chemicals.
* Do not block airfoil. The airfoil provides airflow across the floor of the hood, especially when the sash is closed. If you use absorbent paper in the hood, please do not block the airfoil.
* Side panels must not be removed. Doing so will interfere with airflow and containment, as air will be brought into the hood from these openings. It is dangerous to use the hood in this condition. If side panels are found missing, EHS will remove the hood from service until they are installed.
* Place bulky equipment away from sidewalls to allow airflow around the equipment.
* Place any bulky equipment towards the rear of the hood and raise it about 2 inches off the surface with blocks or bricks. This will allow airflow around and under the equipment. Equipment placed near the hood face will cause great variation in airflow. The use of riser blocks will prevent obstruction of back exhaust slots.
* Work as far inside the hood as possible, at least 6 inches from the front edge with the sash face between you and task at hand. All equipment should be a minimum of 9-12 inches away from the hood face.
* Keep sash face clean and clear. To encourage use of sash as added protection against splashes, sprays, etc. keep sash face clean. If sash face must be blocked with paper for certain experiments, please take it down after the experiment is complete.
* Do not use the hood as a storage cabinet for chemicals or equipment. Materials stored in fume hoods should be kept to a minimum and stored in a manner that will not interfere with airflow. Place any heat-generating equipment in the rear of the hood. Heating devices in the hood produce convection currents that can disrupt airflow.
* Do not use a hood for any function it was not designed for, such as perchloric acid, radioisotopes, etc. The generation of perchloric acid vapors requires specially designed fume hoods with wash-down systems. Failure to use a wash-down system will result in the deposit of explosive perchloric acid crystals that may detonate in the hood ductwork. Hoods used for radioisotopes must be approved by the Radiation Safety Officer.
* Wear protective equipment! Fume hoods do not prevent accidents or chemical splashes. Personnel protective equipment (safety glasses, gloves, aprons, etc.) appropriate to the conditions must always be worn.
* In addition to showing you the current air flow, some monitors on campus have the ability to purge the hood in case of emergencies. This will increase the air flow in case of a spill.
* Close sash when finished with hood work or when leaving experiments or chemicals unattended! This simple procedure has contained many fires and explosions within a hood.

**Chemical Fume Hood Inspections**

Chemical fume hoods utilized by UI students, faculty and staff are inspected annually by EHS. The reason for certification is to assure that hoods are functioning within specifications to protect the workers using them. If a hood fails an inspection, EHS will tag it out of service and contact Facilities for repair. If there is concern that the hood is not functioning properly or if the certification date on the EHS fume hood profile sticker is more than a year old call EHS to have the hood inspected.