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Guidelines for Chemical fume hoods

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Chemical fume hoods and other capture devices such as local exhaust ventilation, glove boxes, and other containment enclosures, as well as ventilated storage cabinets, are the engineering controls that are considered the first line of defence in the laboratory for the reduction or elimination of the potential exposure to hazardous chemicals, biological hazards or physical hazards. Fume hoods offer a high level of safety for the user when utilised appropriately. User safety when working with hazardous compounds will be ensured if the user is aware of the restrictions, recommended maintenance procedures, and general design of the fume hood.

General Information About Fume Hoods

Fume hoods are safety devices for handling odorous or hazardous materials that limit exposure to users of the hood and other lab users by preventing the release of chemicals into the lab. A secondary objective is to minimize the impact of a spill by partially enclosing the work area and drawing air into the enclosure using an exhaust fan. The amount of material moving out of the hood and into the lab is reduced by the dynamic barrier that is created by this inward flow of air.

Each laboratory should be provided with efficient fume hoods, equipped with a sink for the washing of apparatus used for handling toxic materials.

It is not permitted to use ductless fume hoods or to circulate any laboratory fume hood exhaust air, as they do not provide sufficient protection and cannot handle extreme heating of chemicals. Filters designed for specific chemicals may cause plaguing the ductless fume hoods due to desorption of vapors. Ductless fume hoods contain internal blowers which may hamper effective communication within the lab.

The Exterior/ interior walls, work surfaces, and duct material of a fume hood are chosen based on the intended usage of the hood. PVC/FRP ducting should be provided from the fume hood to the available duct opening on the wall.

The fume cupboard should have corrosion-proof fittings. It should be provided with a light, so placed that the whole cupboard is illuminated. The hood sash should be made with shatterproof or reinforced see-through glass. The exterior is built of fully powder-coated galvanized iron, while the interior has polypropylene coating on all surfaces except the worktop.

The front shutter may be provided with small windows so that apparatus can be manipulated through these without lifting the shutter. The cupboard should be so designed that there is strong upward draught even when the shutter is open and there is no chance of any fumes entering the laboratory. In rooms where work with extremely poisonous gases is done, it is advisable to have an air inlet at the bottom so arranged as to sweep everything to the exhaust.

Perchloric acid hoods are constructed of stainless steel, or PVC duct and a properly timed water wash-down system.

The cabinet shouldn't be too deep to allow for easy access to the fittings inside, and controls for the service connections should be placed outside.

The face velocity of hoods will be measured using an anemometer velocity matrix, grid-style attachment. For fume cupboard, the exhaust fan should be able to create a face velocity of 30 m/min (or 100 fpm) at normal working height (say 0.3 m or 1.0 ft). Cabinets for highly toxic materials require higher face velocities (45 m/min or 150 fpm). If any single face velocity reading is less than 100 lft/min, the performance of the fume hood will be deemed unacceptable, and it will be marked with a red and black “DANGER HOOD IS NOT WORKING! DO NOT USE!” tag. In order to prevent the possibility of dangerous turbulence that could result in exposure to the user, hoods should never operate beyond 150 fpm.

However, it is the responsibility of laboratory personnel to immediately report to the department as soon as any malfunctions are observed in fume hoods. EHS or an authorized third party must assess the operation of hoods annually.

Other Exhaust Ventilation Systems

Other Capture Devices beside the fume hood include compressed gas cabinets, vented storage cabinets, Glove boxes(used for reactions with inert atmosphere requirements, handling air reactive chemicals (Pyrophorics), and local exhaust ventilation(LEV) such as Elephant Trunk (useful for small sources of emissions), Canopy (useful for hot operations or to exhaust materials that are lighter than air) and Slot and Plenum (useful for heavy vapors or particulates because they pull the contaminant backwards, away from the user, into the plenum before exhausting it up and out). These LEV operate at the point of generation to capture and entrain chemical vapours, fumes, and dusts. Working with dry nanomaterials, vacuum pumps, welding, atomic absorption units, and many other laboratory operations are a few examples of situations where these devices would be useful.

General Rules Regarding Laboratory Fume Hoods

Through the proper use of a fume hood, avoiding the use of hazardous chemicals on the workbench, ensuring chemical containers are kept tightly closed, and making sure all chemical spills are promptly cleaned up, laboratory workers can protect themselves from chemical exposure through inhalation.

When using a fume hood, the following points must be strictly adhered to in order to achieve maximum performance, the greatest level of personal protection, and reduced energy consumption:

- Assess the level of hazard that the material involved before beginning any work, and use only hoods with an adequate face velocity.
- Keep all of your work at least 6 inches away from the hood sash's plane. This provides for the greatest amount of capture and removal of airborne contaminants.
- The user should always remain outside the hood. Never put your head inside an operating laboratory hood to check an experiment.
- Always place the hood sash, which serves as a barrier between contaminated and uncontaminated air, between the user and the hood's contents:
- On hoods where sashes open vertically, work with the hood sash in the lowest possible position; this is generally at the elbow height. Never work with the sash in the fully open position.
- On hoods where sashes open horizontally, position one of the doors to act as a shield in the event of an accident in the hood.
- Always close the fume hood sash before leaving the lab or moving away from the hood.
- Avoid storing chemicals in fume hoods except for those being currently used.
- Hood space should not be wasted by using them to store unwanted equipment, chemicals, or any waste disposables as this might obstruct airflow, reduce working space and raise the risk of a spill, fire, or explosion. Keep at least 50% of the work area clear.
- Do not clog hoods with bottles or equipment; keep them clear and tidy. Do not block the baffles at the back of the hood. These allow for the proper exhausting of contaminants from the hood.
- As with any work involving chemicals, always practice good housekeeping and clean up all chemical spills immediately. Make sure to wash both the working surface and hood sash frequently. Ensure that your experiment is not a source of contamination for others' experiments.
- When working with potentially explosive materials, always carry out the experiment in a fume hood with an appropriately rated safety shield. Make sure to remove all unnecessary equipment and chemicals, especially those that are highly toxic and flammable, from the vicinity of the work area.
- Remove spark sources or electrical units from the hood while working with flammable liquids or gases. Electrical cords should not prevent the closing of the hood sash.
- Do not exhaust items, such as vacuum pumps, through the fume hood's face as this will disrupt the airflow into the hood and may cause non-containment.

- Fume hoods shall not be located near busy walkways or in front of air diffusers.
- Any equipment that needs to remain in hoods should be elevated on racks or feet to allow airflow underneath.
- Fume hoods should not be used to evaporate hazardous waste. Evaporating hazardous waste is illegal.
- Any solvent stills in which flammable liquids are purified by distillation with reactive metals or metal hydrides possess possibly the greatest danger associated with the potential fire and explosion hazards. **All Solvent distillation equipment** should be kept inside a fume hood.
- Hot concentrated perchloric acid should be handled in separate fume cupboards where its vapour does not contact any organic matter. (Separate fume hoods should be designed for perchloric acid hoods, cleaning should be done twice a week and a record of cleaning should be available. Material of construction of the fume cupboard and allied implements/fixtures should not contain any organic constituents.)
- Lecture bottles of poisonous and pyrophoric gases which are small gas cylinders (about 2 inches by 13 inches) must always be kept inside the fume hood, whether or not they are in use.
- Label all your samples appropriately before storing in the fume hood; it will be important for all the users of fume hood to be aware of the contents inside the hood.
- Any experiments generating air contaminants at or above the permissible exposure limit (refer MSDS) should be conducted inside the fume hood.
- Before working with pyrophoric materials, remove all flammable and combustible material from the fume hood/glove box that is not associated with the procedure you are about to accomplish
- Minimize foot traffic by the face of the hood. Avoid making swift movements when taking items (chemicals, particulate matter, and apparatus) in and out of the hood.
- When a reaction becomes uncontrollable, turn off the heat, stop adding reagents, alert any nearby lab personnel, and keep the chemical fume hood fully closed until the temperature goes down.
- Fume hood is only the first line of defence against accidents. The users of the hood should wear safety goggles, lab coats, and appropriate chemical gloves while working around the fume hood.
- Do not use the waste disposal mechanism of the hood to discard volatile materials.
- Fume hoods do not prevent accidents or chemical splashes. Hood users must be trained for usage of chemicals and be informed on nature of hazard of chemicals in use.