

**Fume Cupboard Safety and Inspection**

**General Introduction**

Fume cupboards and other forms of Local Exhaust Ventilation (LEV) are used across the University to remove potentially harmful gases, vapours mists and dusts generated by experiments and other processes. Fume cupboards are the most common type of LEV used within the laboratory environment and provide excellent protection from chemicals when used properly. Fume cupboards are covered by a British Standard (BS EN 14175) which covers performance requirements, design, testing and maintenance. When purchasing a new fume cupboard, you should ensure it conforms to the requirements of this standard taking advice from a competent person to ensure that the system is safe to use and fit for purpose.

Two different types of fume cupboard are generally used in the University of Glasgow. These are **ducted fume cupboards** where a motor and fan draw air away from the cupboard along a duct and discharge it to the air above roof level where it is rapidly diluted and dispersed. **Recirculating fume cupboards** on the other hand draw air from the cabinet through a filter to remove any contamination and then recirculate the cleaned air back into the laboratory. Although both types can be effective, each type has advantages and disadvantages:

**Ducted Fume Cupboards**

Ducted fume cupboards usually take up more space than recirculating cabinets and when fitting a ducted cabinet there is a requirement for changes to be made to the building infrastructure to accommodate the ducting and associated equipment (e.g. motor and fan). This means that they tend to be significantly more expensive overall and can be very disruptive to install. They are likely to require detailed design drawings prior to installation and specialist assistance will most likely be required to ensure they are designed and installed correctly.

Ducted fume cupboards do not require filters and therefore need less maintenance and eliminate the risk of a filter becoming saturated and allowing hazardous vapours into the laboratory. They provide good protection against most hazardous substances and remove the need to choose the correct filter type for the substances in use although different types are available for certain specialist applications (e.g. use of perchloric acid).

**Note: When planning for the installation or removal of a ducted fume cupboard the Estates Team should be informed as early as possible to facilitate any additional works required and ensure that the asbestos register has been checked prior to work beginning.**

**Recirculating (Filtered) Fume Cupboards**

Recirculating fume cabinets are cheaper and easier to install than ducted cabinets requiring no structural changes to the building and can often be simply placed on a suitable workbench. Recirculating fume cupboards are supplied with a filter and the correct type of filter must be selected for the processes undertaken. Filters can become blocked and saturated over time and will need to be changed regularly to ensure that users are protected. It is not always easy to predict when a filter will become saturated and there is usually no way to tell when a filter needs to be replaced (unless an odour is detectable in the laboratory). When a filter is removed it should be treated as potentially contaminated and disposed of as hazardous waste via the University’s specialist waste contractor. Until this can be arranged it should be double-bagged and stored in a suitable location.

**Specialist Fume Cupboards**

Other specialist fume cupboards are available for certain applications for example:

* Walk-in fume cupboards for large processes often involving large-scale equipment or pilot-plants for scaling up chemical reactions.
* Acid resistant cabinets are available where the ducting and fume cabinet are lined in plastic to reduce the risk of corrosion.
* Fume cupboards are available with wash-down facilities for projects where perchloric acid is regularly used due to the highly reactive / explosive nature of this substance. Where equipment of this type is required specialist advice should always be sought from a competent person.

**General Considerations**

When choosing a new fume cupboard there are many considerations that may affect the selection of equipment and the manner of its installation. Consider the following:

* The depth and size of the working area should be sufficient to accommodate the equipment and tasks being undertaken to reduce the risk of accidents.
* Some fume cupboards are available with transparent sides and rear panels. These are often used for teaching and demonstrations and can be an excellent way to allow students to witness a process before they try it for themselves. They have the added advantage of improving sight lines in a laboratory making it more likely that accidents or dangerous occurrences will be observed.
* Fume cupboards may be supplied with vertical or horizontal sashes (the former being more common). Consider the nature of the process and which type will provide users with the best protection.
* Some modern fume cupboards have work surfaces that are height-adjustable. This allows them to be used comfortably by staff and students with specific physical requirements. These tend to be more expensive but can improve both accessibility and comfort for users.
* Identify which services may be required in the fume cupboard e.g. power, water, gas supplies, drainage sinks etc. and ensure that the cabinet purchased fulfil these requirements.
* Fume cupboards should be constructed of chemical resistant materials that are easy to clean e.g. stainless steel. Care should be taken to avoid surfaces likely to be damaged by the chemicals that will be used in the fume cupboard.
* Modern fume hoods should be of the variable air-flow type and where practical consideration should be given to installing high efficiency low flow fume hoods to reduce the environmental impact of the equipment. Note that the required air flow rate should be determined by a competent person based on the hazard associated with the work being undertaken and it is not always appropriate to select the lowest possible flow rate.
* The location of a fume cupboard can have a major effect on how well it operates. Many things can affect the efficiency of the air flow and hence the level of fume extraction achieved:
  + Fume cupboards should be situated away from draughts, air conditioning systems etc. as these can affect the efficiency of the air flow and introduce turbulence which could lead to harmful vapours escaping from the cabinet.
  + Heated equipment can also cause turbulence and eddy currents within the cabinet increasing the risk of vapours escaping.
  + Ducted fume cupboards constantly remove air from the laboratory which must be replaced. The source of “make-up air” should be considered and provisions made for this to avoid draughts and pressure changes which can lead to uncomfortable working conditions, turbulence etc.

**Note: Microbiological Safety Cabinets (MSC) and Laminar Air Flow (LAF) Cabinets are not fume cabinets and will provide only limited protection from hazardous chemical vapours. The correct type of cabinet should be used for the main hazard associated with the work being undertaken.**

**Safety Tips and Operational Guidance**

**General Safety**

* Fume cupboards **do not** provide 100% protection to users although they do reduce the level of exposure significantly though dilution and extraction when used correctly. The use of fume cupboards is strongly encouraged when working with chemicals but forms only a part of a safe system of work.
* Fume cupboards will always be supplied with a user manual and guidance from the supplier and should be formally commissioned following installation. They should always be installed, tested and operated in accordance with the manufacturer’s instructions.
* Most fume cupboards are easy to operate but all users should still take the time to familiarise themselves with any safety features installed. New users should be trained by an appropriate person to work safely in a fume cupboard.
* Fume cupboards should be assigned a unique reference number such that they can be easily identified. This number should be prominently displayed and recorded clearly on any out of hours experiment forms.
* Many fume cupboards are supplied with ventilated cabinets underneath them. These cabinets can be connected to the extraction system allowing any vapours to be removed form the cabinet. This is especially useful for the storage of volatile, corrosive and malodourous substances.
* One of the main risks associated with fume cupboards (in particular ducted fume cupboards) is the risk of a fire occurring within the working area and spreading into the associated ducting where it could cause significant damage to the building. Consider the following when working with electrical equipment or flammable materials within a fume cupboard:
  + When flammable solvents or vapours are used in a process care should be taken to ensure that no ignition sources are present in the same area. Electrical equipment should only be used in fume cupboards where there is no risk of a flammable atmosphere developing (normally the flow of air will prevent this).
  + Electrical equipment used in fume cupboards should be regularly tested for electrical safety. Regular visual safety checks should be carried out by users and any equipment that shows evidence of overheating or electrical faults should be removed from service.
  + Pyrophoric substances should only be used after a stringent risk assessment and additional fire precautions taken where necessary. Pyrophoric materials should be destroyed or rendered inert once the process is completed.
  + Overnight experiments and processes involving electrical equipment and/or flammable substances should be fully risk assessed before they are undertaken and a procedure in place to highlight where these are being undertaken with information available to out of hours contacts and the security team.
  + Where possible fume cupboards should be equipped with built-in fire suppression system that will detect and react to a developing fire, quickly extinguishing with a suitable agent it before it spreads.
  + The quantity of flammable solvents and other chemicals (including waste) stored in cabinets should be minimised. Chemicals should only be present in a fume cupboard when they are in use and lab waste containers should be stored in fire resistant cabinets or external storage areas when full.

**Safe Operation of Fume Cupboards**

* One of the key indicators that a fume cupboard is working properly is the face velocity (i.e. the speed of air moving across the open part at the front of the cabinet). This should be clearly indicated on the front of the cabinet which should be equipped with a visual and audible warning in the event that the face velocity exits the acceptable working range.
  + For most applications a face velocity of between 0.3ms-1 and 0.5ms-1 is desirable, if the face velocity is too low (below 0.3ms-1) the cabinet will not extract vapours effectively and if it is too high (above 0.6ms-1) eddy currents will cause vapours to be released from the cabinet increasing the risk of exposure. Where higher risk substances such as toxic or carcinogenic substances are in use higher flow rates (0.5-0.6ms-1 ) will most likely be required to ensure user protection.
  + Fume hoods with a “purge” mode should not be left in this mode during normal working due to the increased risk of turbulence. Safety devices such as low flow alarms and sash closing systems should not be bypassed or disabled.
* Fume cupboards should be cleaned regularly to avoid a build-up of contamination on surfaces. Housekeeping should also be considered as storage of large equipment and other materials can block the baffles at the rear of the cabinet reducing the efficiency of the cabinet, therefore storage in this area should be limited. In addition to making it harder to work safely clutter in the cabinet can also cause turbulent airflow reducing the level of containment achieved. **Fume cabinets should not be used as storage areas or dumping grounds for waste or unwanted chemicals / equipment.**
* To provide the best level of protection the front 15cm (6”) of the fume cupboard should be kept clear. This helps ensures that an adequate air flow is maintained and reduces the risk of spillages escaping from the front of the fume cupboard and affecting the user. Some fume cabinets have this area clearly marked.
* With pressures on space being highlighted across the university it is unsurprising that many fume cupboards are regularly shared by two or more people. In general, it is impractical for more than two people to work in one cabinet at the same time.
* Care should be taken to ensure that only compatible processes are undertaken in a single fume cupboard. Communication is key where more than one user works in the same fume cupboard to avoid adverse chemical reactions or interactions.
* Waste containers are often stored in fume cupboards to ensure any vapours generated are contained for extraction. While this is perfectly acceptable care should be taken not to block the baffles at the rear of the cabinet affecting the airflow or generating clutter in the cabinet. Where waste containers are present secondary containment should be considered to control leaks and spills. Where possible storage of waste in vented cabinets underneath fume cupboards is preferable.
* In addition to helping to control the airflow the fume cupboard sash acts as a physical barrier between the user and the chemical process taking place. The sash should always be kept in the correct position, ideally between the user and the process whenever possible. Users should avoid leaning into fume cupboards or placing their head and shoulders inside when the fume cupboard is in use or chemicals are present.
* It is common practice in laboratories to place signs on fume cupboards and write on the sashes. This should be discouraged and care should be taken to keep this from restricting the user’s vision increasing the risk of an accident.
* Care should be taken when operating equipment used for heating (e.g. heating mantles, hotplates, ovens etc.) inside a fume cupboard. In addition to the increased fire risk the heat can affect the airflow inside the fume hood reducing its effectiveness. This does not mean that such equipment cannot be used in fume cupboards only that the possible reduction in efficiency should be considered in the risk assessment.
* Remember that just because a process is being carried out in a fume cupboard does not mean that the normal PPE requirements in a laboratory can be ignored. In particular, the sash of the fume cupboard while providing some physical protection does not remove the need for safety glasses.

**Other Key Safety Information**

* Before a fume cupboard can undergo significant maintenance, be moved from one laboratory to another or be decommissioned at the end of its life it should be fully decontaminated. The method required will depend on the precise nature of the chemicals handled but often a thorough clean with a detergent solution will be sufficient. Once decontamination has been completed the fume cupboard should be clearly labelled to confirm that it has been cleaned.
* The bevelled aerofoil at the front of the cabinet is an important design feature that helps to regulate the airflow and prevent turbulence which can reduce its effectiveness. The aerofoil should never be removed, damaged or modified by users.
* Many fume cupboards are equipped with services including electrical supplies, water and gas taps. Care should be taken to avoid hanging PPE or other equipment on fume cupboard taps.
* While it is perfectly acceptable for empty chemical bottles to be left open in a ducted fume cupboard to allow any residue to evaporate this technique should not be used as a disposal method for larger quantities of volatile chemicals. These should be disposed of properly via the University chemical waste contractor.
* Certain malodourous chemicals (e.g. mercaptans and other stenching agents) should only be used in fume cupboards and even then, their use should be restricted to minimise the amount of time that containers open. Secondary containment is highly recommended when moving chemicals of this type to and from fume cupboards and where practical they should be stored in ventilated cabinets close to the fume hood where they will be used.
* Recirculating fume cupboards rely on the use of a suitable filter to remove hazardous vapours from the air before recirculating it into the laboratory. While filters can be very effective they have a limited lifespan and can become saturated reducing their effectiveness. It is often difficult to tell when a filter is operating at reduced efficiency and it is strongly recommended that filters are changed regularly in accordance with suppliers’ guidelines. If it suspected that a filter has become saturated or the efficiency of the fume hood appears reduced then it should be taken out of service until a new filter can be fitted.

**Note: Chemically contaminated filters from recirculating fume cupboards should be considered as chemical waste and should be safely contained for disposal via the University’s chemical waste contractor. They should never be disposed of as general waste.**

**Note: In the event of a power failure the extraction system will no longer operate. If this occurs it is recommended that the sashes of all affected ducted fume cupboards is fully lowered if safe to do so. This will allow some extraction to occur via the chimney effect. This technique is not effective for recirculating fume cupboards.**

**Inspection and Testing Regime**

**Thorough Examination and Testing (TExT)**

It is a legal requirement under the CoSHH Regulations for all LEV systems (including fume cupboards) to undergo a Thorough Examination and Test (TExT) by a competent person at least every 14 months. In practice fume cupboards belonging to Units in the University of Glasgow are examined annually by an external contractor who carries out the full examination and produces a report. These reports (and other related records) must be maintained for 5 years after the inspection has been completed. However, as with all inspection reports tis simply confirms that the LEV system was fit for purpose at the time of inspection

**Note: If a fume cupboard (or other LEV system) has not been inspected within the preceding 14-month period it must not be used. This also applies to any fume cupboard that has failed the previous inspection until appropriate repairs have been completed and the unit successfully retested.**

**Regular User Inspection**

SEPS strongly recommend that all fume cupboards are regularly inspected by users to ensure that they are in good condition and remain fit for purpose between statutory inspections. Appropriate checks should be performed on each fume cupboard by users on at least a monthly basis. Weekly checks are recommended for fume cupboards that are used for high risk substances. In support of this process a sample checklist has been produced by SEPS and is included in the appendix. Where user checks have been carried out, they should be formally recorded and any remedial actions identified carried out in a timely manner.

**Further Information**

Further information on working safely in (and inspecting) fume cupboards can be obtained by contacting the Safety and Environmental Protection Service. Note that this guidance document is specific to chemical fume cupboards and some of the information will not apply to other equipment such as Microbiological Safety Cabinets (MSC) or Laminar Flow Cabinets.

Additional information on fume cupboard safety can also be obtained from the HSE CoSHH Essentials guidance sheet G201 (Fume Cupboards), by consulting manuals and guidance from suppliers or within BS14175.

**General Office:** 0141 330 5532

**Chemical Safety Adviser:**  0141 330 2799

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| **Fume Cabinet Inspection Checklist** | | | | | |
| **Checklist Item** | | **Yes** | **No** | **Notes and observations** | |
| **Thorough Examination and Test completed within the previous 14-month period** | |  |  |  | |
| **Any signs of physical damage to the cabinet (internal or external)** | |  |  |  | |
| **Cracking, damage or degradation of the sealant at the edges of the cabinet** | |  |  |  | |
| **Sash moves smoothly through full range and remains in position when released** | |  |  |  | |
| **Fume cupboard sash clear and not obscured with writing or signs.** | |  |  |  | |
| **Alarm is operational (visual and audible) when sash raised above safety point** | |  |  |  | |
| **Sash high position restrictor in place and functioning properly** | |  |  |  | |
| **Air flow reading indicator present and working correctly (note air flow reading)** | |  |  |  | |
| **Cabinet lights (where present) are functioning** | |  |  |  | |
| **Water supply to cabinet (where present) working and flushed for 2 minutes.** | |  |  |  | |
| **Gas supply (where present) operational with no evidence of damage or leakage** | |  |  |  | |
| **Recirculating filter present and changed within supplier guidelines** | |  |  |  | |
| **Visible ductwork associated with cabinet in good condition with no obvious breaches** | |  |  |  | |
| **Good housekeeping with no restriction to air flow at the rear of the workspace** | |  |  |  | |
| **Surfaces reasonably clean and free of contamination** | |  |  |  | |
| **Debris or detritus present on the ventilation grille / baffles at rear of the cabinet** | |  |  |  | |
| **Secondary containment of waste containers and other stored liquids** | |  |  |  | |
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| **Fume Hood Location** |  | | **Fume Hood Reference** | |  |
| **Inspector Name** |  | | **Date of Inspection** | |  |