

## OHS INFORMATION SHEET 13: USE OF LOCAL EXHAUST VENTILATION SYSTEMS: FUME CUPBOARDS

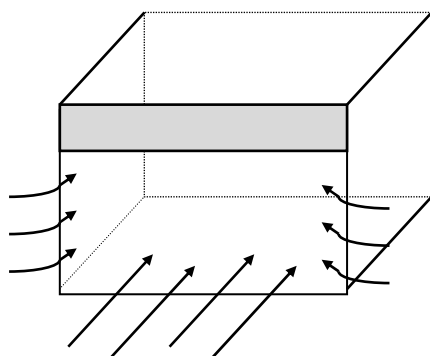
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### Introduction

This information sheet has been prepared to provide information about local exhaust ventilation systems in use at Monash University.

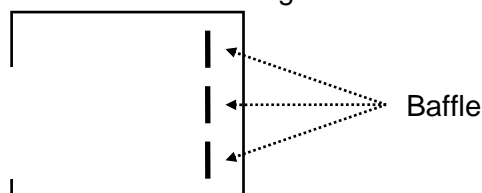
### Fume Cupboards - Function and Usage

A fume cupboard is essentially a ventilated box with an adjustable work opening. It provides extraction to remove any fumes produced within the box. It is designed to have laminar flow through the front opening, i.e. the flow is to be even and non-turbulent through the open face of the cupboard as shown in *figure 1*.



**Figure 1: Normal even flow of air into a fume cupboard**

To obtain even flow through the face of the fume cupboards baffles are generally installed at the back of the cupboard. These baffles are set to extract the air from two or more heights across the back of the fume cupboard (*figure 2*). If the openings provided by the baffles are blocked by items stored in the cupboard then the air flow through the face of the cupboard can become uneven.



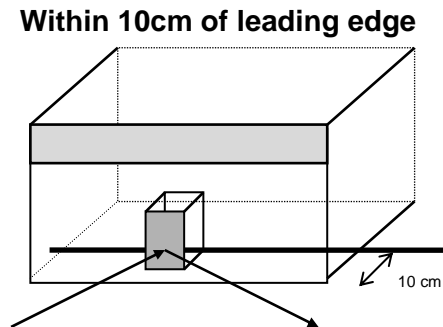
**Figure 2: Side view of fume cupboard showing a cross section through the baffles**

Whenever anything is placed within the fume cupboard it introduces turbulence into the cupboard. This means that the containment of fumes may be affected. If a fume cupboard is not used in the proper manner then there may be situations in which fumes escape out of the front of the fume cupboard towards the user instead of being drawn away from the user, especially with heavier vapours such as formaldehyde.

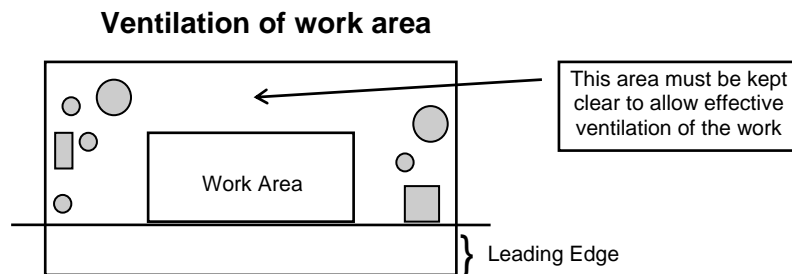
## Make-up air

As fume cupboards draw air out of the room, there needs to be adequate air available or the fume cupboard will not be able to draw sufficient air and will subsequently not function properly. Where the room is small or there are a large number of fume cupboards an additional supply of air, other than the normal room ventilation, may be required. This additional air is known as the make-up air. If the make-up air is not adequate or the make-up air is switched off then the fume cupboards may not be able to achieve the required face velocity. Alternatively, if there is no make-up air and the room ventilation is switched off, there may be a deficit of air and the fume cupboards may not be able to achieve the required face velocity.

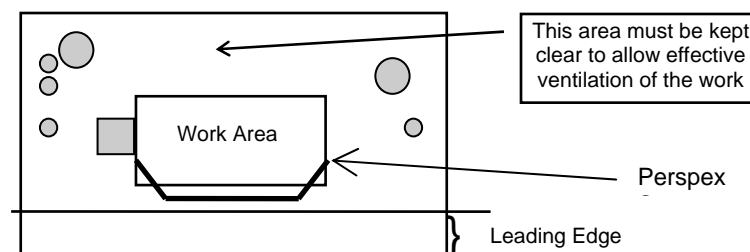
## Working within the fume cupboard



**Figure 3: Fume cupboard showing use of the first ten centimetres:** The incoming air can 'bounce' off an item placed in this zone with a high enough speed to escape from the cupboard, which can result in fume escape. This is of particular concern when fumes are generated within this zone as they may be entrained and escape the fume cupboard's containment. A user standing in front of the cupboard exacerbates the situation.



**Figure 4: Base of fume cupboard shown from above.** This shows a typical work area *and* illustrates the area that must be kept clear to allow effective ventilation of the work area.



**Figure 5: Base of fume cupboard shown from above with a perspex screen in use.** This shows a typical work area *and* illustrates the area that must be kept clear to allow effective ventilation of the work area with a perspex screen in place. The use of a screen will result in turbulence directly behind the screen. If the area behind the work area is not

kept clear there is a high potential for a “dead spot” to be created in this area which will increase the potential for fume escape.

## **Fume Cupboard Performance and Recommended Sash Height:**

Fume cupboards are required to be constructed and maintained in accordance with Australian Standard AS/NZS 2243.8 - 2001 Safety in Laboratories - Fume Cupboards. This standard details an adequate face velocity for the containment of fumes. An adequate face velocity is defined as being an average of  $\geq 0.5$  m/s across the face, with individual readings being within +/- 20% of the average. The Australian Standard requires fume cupboards to have the performance tested on a regular basis. Testing of the face velocity together with smoke testing occurs on an annual basis.

Monash University has over 500 fume cupboards and a significant proportion of these are over fifteen years old. Many of these cupboards were constructed prior to the introduction of the Australian Standard and thus not all of the fume cupboards are able to provide an adequate face velocity at full sash height. To address this problem there are two programs in progress; these are:

1. **Recommended Sash Height:** In the short term, the regular testing of the face velocity together with smoke testing are used to determine the optimum working height for the sash. A yellow sticker (refer to *figure 6*) is located at the side of each cupboard to indicate the working height. This sticker also contains the date of the last test, together with the initials of the tester. A database of test results is held by Occupational Health, Safety and Environment (OHSE). A summary of the test results is held by the departmental/school resources manager. If there is no yellow sticker on the fume cupboard then it may indicate that the cupboard has not been tested. OHSE should be contacted to arrange testing if this is the case. If a cupboard is not functional it will be labelled with a red sticker (refer to *figure 7*) and a tag indicating the cupboard fault (refer to *figure 8*).
2. **Fume Cupboard Upgrade Program:** In the long term a significant annual budget has been committed to the upgrade of inadequate fume cupboards. This program has been in existence since 2000.



**Figure 6: “Recommended Sash Height” Sticker**



Figure 7: "Fume Cupboard Out Of Order" Sticker

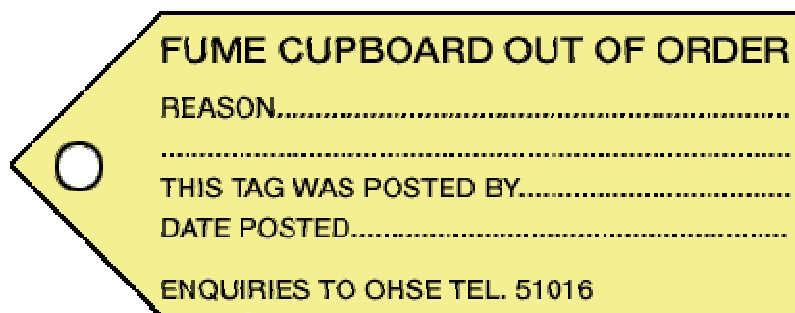


Figure 8: "Fume Cupboard Out Of Order" Tag

## Variable Air Volume (VAV) Fume Cupboards

This type of fume cupboard is often employed in new or refurbished laboratories. These cupboards can achieve considerable savings in operating costs because the sash height determines the volume of air exhausted from the cupboard per second. As the sash height is lowered from the 'fully up' position the volume of air that is exhausted progressively decreases until the sash is at the 'fully down' position. At ALL sash positions the cupboard should achieve a face velocity of 0.5 m/s of air flow.

The VAV fume cupboards are tested in the same way as ordinary cupboards with the exception that no "Recommended Sash Height" label is affixed to the cupboard (since lowering the sash should not affect the resulting face velocity that is achieved).

To reduce energy consumption and operating noise, it is recommended that the sash be lowered as much as is practicable during use.

## Use of Perchloric Acid in fume cupboards

The handling and use of concentrated perchloric acid (5M or greater) in fume cupboards is prohibited, unless the cupboard has been fitted with a scrubber and wash-down facility. Perchloric acid can react with metal surfaces in the fume cupboard to produce metal perchlorates that may explode if subject to impact. Perchloric acid also reacts with organic chemicals to form unstable products that may explode on impact. The function of a wash-down facility is to wash away any chemical residues that may accumulate on the internal surfaces of the fume cupboard. A scrubber is a device that neutralises chemical effluents in the exhaust duct of the fume cupboard before they are released into the air.

Fume cupboards are labelled to indicate their suitability for using concentrated perchloric acid. Only a small number of cupboards have been fitted with scrubbers and wash-down facilities to enable perchloric acid to be used safely in them. The departmental/school Safety Officer should be contacted in all cases where the use of perchloric acid is required.

## Guidelines for working in fume cupboards

The following details need to be considered to ensure that the fume cupboard's performance is not compromised:

- Do not work within ten centimetres of the leading edge (refer to *figure 3*). The larger the item, the further back it needs to be within the fume cupboard to overcome the turbulence created.
- Do not place storage items behind the area you are working in (refer to *figure 4*). This is of particular importance where a perspex screen or lead bricks are used for radioisotope work (refer to *figure 5*).
- Minimise the number of items stored within the fume cupboard. If hazardous materials must be stored, secondary containment (e.g. a spill tray) must be used to ensure compliance with trade waste agreements in case of accidental spillage.
- Do not put large equipment, such as ovens, in the fume cupboard, as they block the baffles and produce regions of zero or low flow in the workspace.
- Always have the sash at the recommended height when the cupboard is in use. This is marked on a yellow sticker at the side of cupboard (refer to *figure 6*).
- Minimise traffic past the front of the fume cupboard as this can cause turbulence which may result in fume escape.
- Do not use fume cupboards with a porous bench surface (eg terracotta tiles) for work with radioactive material.
- Do not open windows which may create draughts in the vicinity of the fume cupboard.
- If doors are within 1 metre of fume cupboards they should be kept closed during use of the fume cupboard.
- The make-up air supply and room ventilation should be on whenever the fume cupboard is in use.

For further information:

**Contact your OHSE Consultant or OHSE on 9905 1016**