Safety Code of Practice 14

Part 6

Control of Biological Hazards

Microbiological Safety Cabinets

University of Reading Safety Code of Practice 14 Part 6

Microbiological Safety Cabinets

Contents

Summary ii
1. Introduction 3
2. Responsibilities 3
   1.1 Duties on managers 3
   1.2 Duties on staff who use Microbiological Safety Cabinets 4
3. Types of Microbiological Safety Cabinet and ventilation systems 5
   1.3 Types of Microbiological Safety Cabinets 5
   Class I cabinets 6
   Class II cabinets 6
   Class III cabinets 8
4. Protection for the work – laminar flow cabinets 8
5. Ventilation arrangements for MT1 nte

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Microbiological Safety Cabinets

Summary

1 Microbiological Safety Cabinets (MSCs) are normally used to protect workers from exposure to biological agents, and, as such, are considered to be "control measures" under the Control of Substances Hazardous to Health (COSHH) Regulations. As a form of local exhaust ventilation (LEV), they require a thorough examination and test at regular intervals.

2 All users of MSCs must be trained in the proper safe use of each cabinet they work with. They should be able to demonstrate their competence in the use of the cabinet before undertaking work with hazardous biological agents within the cabinet.

3 All MSCs should meet the construction and performance criteria of the relevant Standards, both on installation prior to use, and following any maintenance.

4 Before any cabinet used with hazardous biological agents is subjected to the "*thorough examination and test*", it must be rendered safe for the examination and testing to be carried out.

5 All records of examination and test must be kept for a minimum of 5 years, and be readily available for inspection if required. As MSCs are School/departmental equipment, it is the responsibility of the School/department to keep these records.

the results of every examination and test (plus details of any maintenance undertaken).

All users of MSCs are trained in the safe use of those cabinets they will use, and that records are kept of the training.

All users are instructed to promptly report any faults which affect the proper functioning of a cabinet to a designated person, who will arrange for the cabinet to be taken out of use, and arrange for a proper repair to the cabinet.

One or more individuals are appointed and properly trained to oversee and/ or effect the decontamination of cabinets prior to a visit by an engineer to carry out the servicing, examination and test of the cabinet.

1.2 Duties on staff who use Microbiological Safety Cabinets

All staff wishing to use a microbiological safety cabinet (MSC) with viable biological agents must receive appropriate training to be able to use the cabinet safely.

They should use the cabinet in accordance with the training they have received.

They must promptly report any fault conditions within the cabinet to the designated person, and as far as possible, render the cabinet “safe” before closing the cabinet and posting a “Faulty æ r M o l’ M si”

3. Types of Microbiological Safety Cabinet and ventilation systems

1.3 Types of Microbiological Safety Cabinets

The principle of operation of any MSC is to create a working area that is held at negative pressure relative to the surrounding laboratory, and to protect the worker by ensuring that air contaminated by an aerosol of a viable biological agent is directed away from the worker's breathing zone.

All MSCs consist of a physical "containment chamber" in which work with the potential to disperse hazardous microorganisms is performed. Any aerosol is removed from the cabinet by extracting the air from the cabinet, and filtering it through a high efficiency particulate air (HEPA) filter before discharge.

There are three main types of MSC, open-fronted (Class I and Class II) or closed (Class III).

Table 1: Types of Microbiological Safety Cabinet

Class I	Are effectively fume cupboards with the addition of a High Efficiency Particulate Air (HEPA) filter on the exhaust, and are designed to prevent dispersal of contaminated aerosols into the environment of the laboratory or outside the building. The exhaust air is ducted to outside air. They offer worker protection, but do not protect the work from contamination as they pull in a flow of unfiltered air which passes over the working area, then is discharged, normally through a single HEPA filter to the exterior of the building.
Class II	Combine the worker protection benefit of a working environment held at negative pressure, with the work protection benefit of bathing the work area in a flow of ŵÒÓÄÑÈËÄŶ ʼBHEPdz ÅÈËÓÄÑÄÃБ ÀÈÑş Class II cabinets may either be ducted or discharge filtered air into the laboratory.
Class III	Protect both the worker and the work by ensuring that the work is undertaken in a

the filtered air into the building extract system. Where thimble systems are in place, the building extraction must be such that more air is extracted from the room via the thimble than the cabinet is capable of expelling, so that the exhaust air from the cabinet is entrained in the general extract from the room via the thimble.

Where the cabinet is used at Containment Level 3, the room supply, cabinet extract and any duct or roof-mounted fan should be interlinked so that the air supply will cut off and the alarm sounds if the extract fan fails. This is to avoid positive pressurisation of the room.

6. Cabinet selection

A risk assessment should be undertaken to determine the Class of cabinet appropriate for a particular work activity, taking into account the ducting arrangements. This should consider the nature of the potential hazards in terms of not only the microorganisms involved and their route of infection but also the techniques to be carried out, any other hazards and whether protection of the work is needed. The class of cabinet required is not linked to the containment level assigned to the work.

Class I cabinets should be used if procedures within the cabinet are likely to generate a significant aerosol and or disrupt the air flow pattern within a class II cabinet and so compromise operator protection. Class I cabinet would be preferentially selected over a Class II for work with certain pathogens that infect via the airborne route.

The following flow diagram provides further guidance on the selection of the correct MSC for a ta-2(id fally)sa-2q4.63 T2(oll)8(owi633 /2(la)4(s)11(ow d4tETBT1 0 0 1 372.55 ai63(-)-2(b)-4(e)11( )-2(u)10(nderta

7. Safe use of safety cabinets

1. Before using a cabinet, the fans should be switched on and run for 2-5 minutes to allow

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8. Training

It is important that users of microbiological safety cabinets are trained in correct use, not only in order to understand how the cabinet works but also because poor technique can compromise the operation protection afforded by the cabinet.

Training should cover:

- Principles of how the different classes of cabinets work including airflow patterns, suitability of different cabinets for particular types of work
- Principles of airflow and limitations of cabinet performance
- How to work at cabinets safely
- Operation and function of all controls and indicators
- How to decontaminate the cabinet after use and requirements for fumigation, and, where appropriate how to do this.

Users must be able to distinguish between laminar flow cabinets and microbiological safety cabinets, and never use the former for work with viable biological agents, as they are not designed to nor do they offer any protection to the user.

9. Maintenance and Testing

Where a safety cabinet is used as a “control measure” in terms of the COSHH Regulations, it must be regularly subject to “thorough examination and testing” at intervals not exceeding 14 months (in practice, this means annually) (COSHH Regulation 9). Additional guidance is

10. Cabinet fumigation

If Microbiological Safety Cabinets have been used for work with hazardous micro-organisms, they must be fumigated in the following circumstances:

- after a major spillage or a spillage where inaccessible surfaces have been contaminated

Where a cabinet vaporiser is not fitted, the technique used for formalin evaporation should minimise potential exposure of all personnel to the gas: ideally, a thermostatically controlled electric heating mantle should be used. The use of potassium permanganate to create the gas should be avoided, as it is difficult to control the rate of evolution of the gas, and, once started, cannot be stopped.

Cabinet fumigation is straightforward for any cabinet that has the exhaust air permanently ducted to the outside of the building. However, special arrangements will be required for "recirculating" cabinets, where the discharged air would be returned to the laboratory. There are two main options:

Flexible “elephant’s trunking” ductwork to safely remove any fumigant - the trunking could be directed into a fume cupboard, or out of a convenient window. If a window is chosen, the window must not overlook an area such as a central well in a building where the discharged gas could accumulate. All adjacent windows must be sealed shut to prevent any formaldehyde from re-entering the building.

neutralise the formaldehyde with ammonia, so that discharge to the environment is avoided.

Formaldehyde MUST NOT be recirculated into the laboratory under any circumstances.

For formaldehyde to act to maximum effect it must be able to penetrate (pre-cleaning is helpful if it can be done without jeopardising safety). It must be able to dissolve at adequate concentrations in a film of moisture in the immediate vicinity of the organisms to be inactivated. Water vapour generated in the process of dispersing formaldehyde provides the essential optimum level of relative humidity and so it is important to ensure that water is added to the formalin prior to vaporisation. Too much formaldehyde results in the deposition of sticky deposits of paraformaldehyde and in cabinets may contribute to filter blockage. The amounts of formalin and water required for fumigation are given below.

Fumigation is most effective above 20°C and relative humidity of 65%. Below 18°C formaldehyde fumigation is less effective. Below 9°C, formaldehyde sublimes and is less easy to vaporise.

Table 3: Typical quantities of formalin required for fumigation of the different types of cabinets

	Volume of 37-40% (w/v) Formaldehyde	Volume of Water
Class I cabinet	20 ml	20 ml
Class II cabinet (1200 mm wide)	25 ml	25 ml
Class II cabinet (1800 mm wide)	30 ml	30 ml

Formaldehyde should be left to disperse within the cabinet for at least six hours, after which time the fumigant should be exhausted to atmosphere by switching on the fan and allowing air from the room to enter the cabinet. Before venting the formaldehyde in this way it is essential to ensure that no one is in the vicinity of the exhaust outlet. The cabinet should be left running to purge the cabinet of formaldehyde for at least 2 hours.

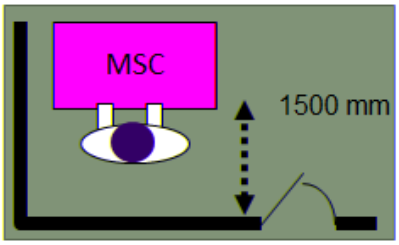
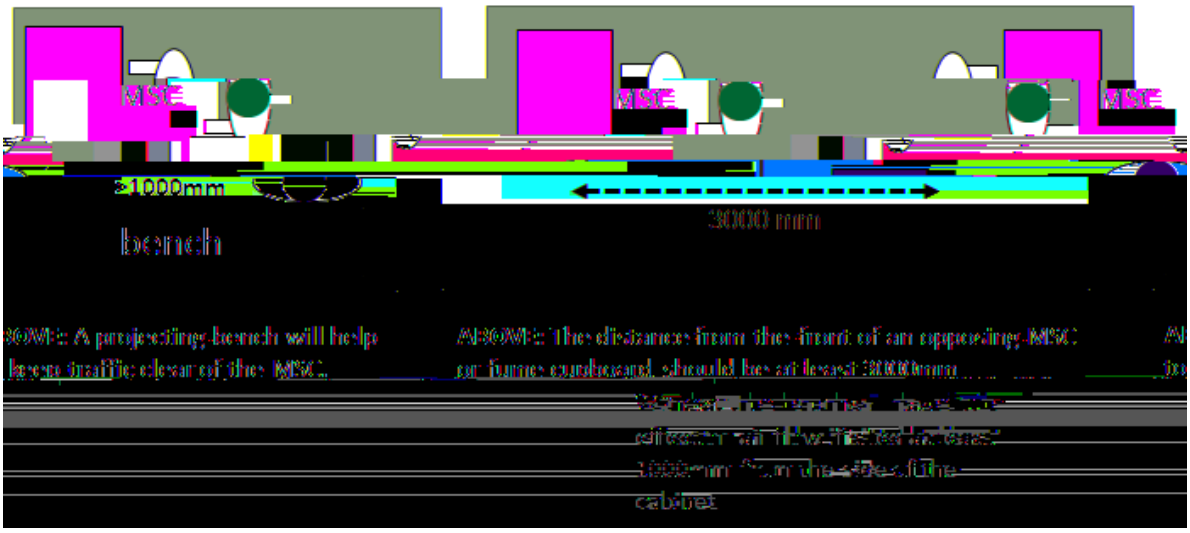
Whilst fumigation is in progress a large notice must be posted on the front of the cabinet to warn that the cabinet is being fumigated. During fumigation access to the room should be restricted.

A risk assessment and standing operating procedure must be in place for cabinet fumigations, including contingency plans. All persons carrying out cabinet fumigations must receive documented training on the above documents.

1.6 Vaporised hydrogen peroxide systems

An alternative system to formaldehyde is to use vaporised hydrogen peroxide (VHP). VHP systems claim the advantage that the overall time taken to achieve decontamination is reduced, as the

Figure 4 Correct sitting of microbiological safety cabinets



Doorways should not be situated within 1500mm of the front of an MSC or within 1000mm of the side of the cabinet. The only exception is when a door includes air transfer gills. Testing should be carried out to ascertain a suitable distance. Opposing benches should not be situated within 1500mm of the front of a working cabinet