This document is a schedule from University hazardous Substances Policy. It sets out requirements for selecting, using and maintaining recirculating filtration fume cupboards. This document forms a part of the University Health and Safety Policy. It has been approved by the Environment, Health and Safety Executive Committee, in consultation with the Joint Safety Advisory Committee, and it will be subject to review.

June 2009 (revised)
UHSP/15/HS/09 Schedule 3.11
Hazardous Substances - Control Measures

Recirculating Filtration Fume Cupboards
Requirements and Guidance for Safe Use and Routine Maintenance

The air flowing through a recirculating filtration fume cupboard picks up contaminants released within the work chamber and then passes through a filter that removes most of the contaminants before the air is discharged back into the workroom. Recirculating filtration fume cupboards are often chosen to avoid the high fume exhaust system and installation costs of conventional installed ducted fume cupboards. However, a recirculating filtration fume cupboard is not a straight replacement for a conventional installed ducted fume cupboard. Moreover, because of design differences, low airflow and the limitations of the filter system, a recirculating filtration fume cupboard cannot give the equivalent level of performance to even a general purpose conventional installed fume cupboard. Additionally, unless a suitable (but expensive) monitor, such as a flame ionisation detector, is installed it is not possible to predict when filters for gases and vapours are likely to fail. Very careful consideration must be given, on a case by case basis, as to whether a recirculating filtration fume cupboard can give adequate and reliable control of hazardous gases and vapours, bearing in mind advice from the Health and Safety Executive that “These devices are not recommended for highly toxic chemicals, regular use of toxic and/or flammable solvents in large quantities or for carbon nanotubes”.

The actual features of individual recirculating filtration fume cupboards vary according to model and manufacturer. Filter applications are similar, but the filters may have different names.

NB Recirculating filtration fume cupboards are subject to the same or very similar requirements for safe use and siting and also maintenance and testing as installed fumecupboards

Recirculating filtration fume cupboards are not suitable for:
- Any substance for which the installed filters are not specified.
- Small molecules such as nitrogen, carbon monoxide or hydrogen because the filterblocks do not absorb these gases.
- Boiling off large quantities of solvents or acids because the filter blocks are intended only to deal with vapours and fumes at ppm concentration, equivalent to solvent evaporation rates of between about 3ml per minute for small models to 6ml per minute for higher capacity models.
- High heat loadings, where internal surfaces are of heat sensitive plastics.
- Unventilated workareas.

Requirements for selecting recirculating filtration fume cupboards:
- The fume cupboard, its type testing and commisioning must conform to BS 7989:2001.
- For optimum performance the preferred model is that where the design of the enclosure meets as many as possible of the design features set down in University Policy for ducted fume cupboards (UHSP/15/HS/08 S 3.10).
- The fan must be on the discharge side of the filter housing so that the filter housing is under negative pressure.

Requirements for using recirculating filtration fume cupboards:
- The correct filter or combination of filters must be installed for the substance(s) to be used.
- The power to the fan must be switched on, to high speed if there is a dual setting.
- The airflow and filter saturation must be checked on a regular basis.
• Fume cupboards with a conventional vertical sliding sash should be used with the sash in the lowest practical position. For those models with a hinged flap which leaves a permanent opening, the face velocity at the working aperture (and therefore containment of fumes) is at a maximum with any flap in the closed position. The fume cupboard should be used with the flap in the closed position whenever practical.
• A Bunsen burner or other heat source should not be placed too close (not less than 150 mm) to the side or back panels. It is not recommended that an open flame or heat source be positioned closer than 300 mm from the bottom of the filter bed.
• Whilst the work surface may have some chemical resistance, obviously spilled chemicals should be removed from the surface as soon as possible.
• Major spillage within the fume cupboard should be cleared up immediately, preferably using spillage absorption granules, rather than tissue paper which may increase the evaporation of vapours/fumes from the spillage area. The reason for this is that high-concentrations of fumes or vapour entering the filter block may temporarily reduce the filtration efficiency.
• Following a major spillage the main filters must be changed, as the heat of wetting may reduce filter efficiency. After stabilisation, the old filters can normally be re-used, provided retention capacity has not fallen below 50% when tested in accordance with the appropriate method from BS 7989:2001.
• Always keep a spare set of filters available.

Siting requirements:
(In order to prevent air currents in the room affecting the performance of the fume cupboard)
1 the distance from the plane of the sash to any space used frequently or for movement of other personnel should be at least 1000 mm;
2 the distance between the plane of the sash and a bench opposite to it and used by the same operator should be at least 1400 mm;
3 there should be no opposing wall (or other obstruction likely to affect the airflow) within 1400 mm of the plane of the sash;
4 no fume cupboard should be installed in a position where it is likely to be affected by another item of equipment. In particular, the distance from the plane of the sash to the sash of an opposing fume cupboard, to the face of an open fronted safety cabinet, or to the edge of an exhaust hood, should be carefully considered; 400 mm of the sash;
5 no fume cupboard should be positioned with either side closer than 300 mm from a wall or similar obstruction;
6 no large obstruction, e.g. an architectural column, projecting beyond the plane of the sash should be within 300 mm of the side of the fume cupboard;
7 no doorway or opening window should be within 1000 mm of the plane of the sash or within 300 mm of the side of a fume cupboard;
8 if a fume cupboard is not designed to contain a possible fire or explosion, the fume cupboard should not be sited in a position where exit from a work space to the only escape route will necessitate passing directly in front of the fume cupboard.

Inspection, Testing and Maintenance

Regular maintenance is a statutory requirement, especially of The Control of Substances Hazardous to Health Regulations 1994. The procedures for inspection, testing and maintenance are laid down in UHSP/15/HS/08 Schedules 3.8 and 3.9.

WARNING! Before attempting any inspection or replacement of electrical components in the head assembly, always isolate the fume cupboard from the mains electricity supply.

Airflow

Some models may be fitted with a low airflow alarm. With these models the alarm should be tested once a year, following the manufacturers instructions, to ensure it is operating correctly.
With other models NOT supplied with a low airflow alarm, the airflow should be checked with an anemometer once a month

**Filter Saturation**

Some models are fitted with an alarm which will alert the user to significant fume levels in the exhaust air. Other models may be fitted with a *Filter Saturation Alarm*. In these cases the alarm should be tested once a year, following the manufacturers instructions, to ensure it is operating correctly.

With other models NOT supplied with filter condition monitoring equipment, replace the filter if the record of usage indicates impending saturation

**Cleaning and Inspection**

The following is in addition to the annual statutory examination and test (see Schedule 3.8, "Examination and Test of Local Exhaust Ventilation (LEV)."

**Every week,** carry out a visual check on all internal LEV components to ensure:

- all visible items are functioning correctly;
- there are no signs of physical deterioration that could lead to impaired performance; and
- the separation distances specified under “Siting Requirements” are being maintained.

**Every six months,** the following procedures should be carried out:

(a) Remove the rear baffle and spill tray, if possible, and wash these and the entire interior surface of the fume cupboard/enclosure/hood with dilute detergent solution and repair defects as necessary. Linings fabricated from PVC should have a coating of an anti-static compound applied. Clean both the baffle and the rear of the chamber.

(b) Measure average face velocity using the procedures specified in Schedule 3.8. Use a shortened version of the method set out in schedule 3.8, taking readings only at the centre and the four corners of the fume cupboard face opening. Call for corrective maintenance if any individual measurement of velocity is less than the design value specified in the logbook.

(c) Inspect the extract air fan and motor for correct running.

(d) Carry out formal visual inspection for electrical safety in accordance with Electrical Safety Policy UHSP/18/ES/02

**Every 12 months,** the following additional maintenance should be carried out, as applicable.

(e) Replace filters unless remaining capacity > 50% when tested.

(f) Check filter housing for leak-tightness.

(g) Test for electrical safety in accordance with Electrical Safety Policy UHSP/18/ES/02

**Filters**

**Pre-filters**

**Filtrete pre-filter** This is a high performance, electrostatic particle filter, designed to remove particulates from the air stream. Filter efficiency should be at least 97% for particles down to 0.3 micron. Filtrete will remove fine particles, aerosols and mists.

**Gauze pre-filter** This may be used for protecting the main filter block from particle contamination.

**Main filters.**

A number of different types of filter media are available for the main filter bed. Most are impregnated versions of the activated carbon general purpose filter. Impregnated activated carbon is used to provide a higher filter capacity for lower molecular weight organic compounds. Various types of impregnated activated carbon are used for particular organic compounds and for inorganic gases and vapours. In all cases, absorption efficiency will not be exactly 100%. In certain conditions it is possible for desorption to occur.

**General Purpose** This the most widely used filter, primarily for solvent vapour removal. This filter is intended for the majority of organic vapours with a molecular weight greater than 30 and a boiling point
greater than 60°C (aliphatic and aromatic hydrocarbons, aldehydes, ketones, alcohols, organic acids, esters) and also halogens, sulphur compounds, and nitrogen compounds not otherwise specified for other filters.

**Radioactive Iodine**  This filter is impregnated with halide salts, and is used for the high efficiency removal of radioactive iodine and methyl iodide. It is frequently used for iodination reactions with low-level radioactive iodine.

**Mercury**  This filter is impregnated with iodine compounds for removal of mercury vapour.

**Ammonia and Amines**  This filter is impregnated with copper compounds to efficiently remove ammonia from dilute ammonia solutions, and to remove low molecular weight amines.

**Inorganic Acids**  This alkali impregnated filter will neutralise volatile inorganic acid vapours such as hydrochloric and hydrofluoric acids, and acid gases such as sulphur and nitrogen oxides.

**Hydrogen Sulphide and Organosulphur Compounds**  A potassium iodide impregnated filter, designed to remove hydrogen sulphide and low molecular weight mercaptans.

**Hydrogen cyanide and cyanides**  A multi-impregnated filter for removal of hydrogen cyanide gas. Many cyanide compounds will evolve HCN gas if acidified, so this filter is normally specified if working with any cyanide compound.

**Formaldehyde**  This filter is impregnated with an oxidising agent to oxidise formaldehyde to formate salts. This filter is also specified for glutaraldehyde.

**Diethyl Ether and Dimethyl Ether**  These ethers are poorly absorbed by all filters. The special impregnation of this filter allows a chemical reaction which increases filter capacity.

**Alkaline Odour Filter**  This odour filter is used to deal with odours from excreta, urine and other materials essentially alkaline in nature.

**Acid Odour Filter**  This odour filter is for human and animal acid type smells caused by bacterial decay, such as cadaverine and putrescine, and other odours which are acidic in nature.

**Molecular Sieve Filter**  This filter may be used to remove small molecules, usually water vapour but also carbon monoxide.

**HEPA Filters**  The High Efficiency Particulate Air filter is for high efficiency particulate filtration (usually 99.997% at 0.3 micron). A HEPA filter is sometimes known as an absolute filter.

**Multiple-Layer Filters**  These may have up to four layers of filter using the above materials in one filter block. In addition, filters which are 50% HEPA and 50% carbon based may be supplied.