Safe Use of Fume Hoods
Code of Practice

Reviews and Revisions

Date	Reason	Reviewer	Next review date	Approved by
17/05/2016	Production of new document. Required to set standards	Lee Rounds	17/05/2018	HSMG
02/05/2019	Periodic review and rebranding	Adam Swinburne	17/05/2020	Emrys Pritchard
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Introduction

Fume hoods are used widely in laboratories and are designed to capture and remove air-borne hazardous substances generated during laboratory experiments (e.g. gases, vapours, aerosols and particulates/dust). Work with substances that produce/generate toxic or harmful fumes, vapours, gases, dust or chemical aerosols should be carried out in a fume cupboard to eliminate or reduce the risk of exposure to an acceptable and safe level.

A fume hood is a ventilated enclosure in which gases, vapours and fumes are contained. An exhaust fan situated on the top of the laboratory building pulls air and airborne contaminants into the hood through ductwork connected to the hood and exhausts them to the atmosphere.

The typical fume hood found in our laboratories is equipped with a movable front *sash* and an interior *baffle*. Depending on its design, the sash may move vertically, horizontally or a combination of the two and provides some protection to the hood user by acting as a barrier between the worker and the experiment.

A fume hood is used to control exposure of the hood user and lab occupants to hazardous or odorous chemicals and prevent their release into the laboratory. A secondary purpose is to limit the effects of a spill by partially enclosing the work area and drawing air into the enclosure by means of an exhaust fan. This inward flow of air creates a dynamic barrier that minimizes the movement of material out of the hood and into the lab.

Work with substances that produce/generate toxic or harmful fumes, vapours, gases, dust or chemical aerosols should be carried out in a fume cupboard to eliminate or reduce the risk of exposure to an acceptable and safe level.

Fume hoods must NOT be used for the containment of biological materials. Where such containment is required a microbiological safety cabinet must be used.

Where the weighing of powders may cause airborne particles a dust booth with HEPA filter should be used (e.g. Nanoparticles/ micronized particles).

Many fume hoods are designed to run continuously and the room air intake is balanced to account for this. Some other fume hoods may be switched off after being emptied and cleaned, but this must only be done in laboratories where this does not impact on other safety considerations, such as room pressure regimes. This should be indicated in the lab risk assessment or local rules.

General Principles

This guidance instructs users of fume hoods both ducted and recirculating on how to use them effectively and safely. It should be read in conjunction with:

- Control of Hazardous substances (COSHH) – Code of Practice
- Safe use of Nanomaterials – Code of Practice
- Safe use of Ionising Radiation – Code of Practice

Responsibilities

Faculty Responsibilities

Before using a fume cupboard, users must first assess whether there is a safer way to do the work which will eliminate or reduce the risk of exposure to hazardous materials. Only if the hazard cannot be eliminated or reduced by alternative methods should the work go ahead in a fume cupboard.

- Each Faculty must identify the location of each ducted/ductless fume cupboard under their control, and ensure these are registered with Campus Services.
- Each Faculty must maintain copies of records of system inspections, tests and maintenance.
- Each Faculty must take any fume cupboard that fails an inspection or test out of use immediately, and must ensure that it is clearly marked as such.
- Users must be trained in correct use, including selection of the correct cupboard for the proposed work; function of alarms and gauges; correct sash height; avoiding air flow disturbance; emergency procedures; and good housekeeping.
- Each Faculty must conduct and record a weekly inspection of each fume hood to ensure correct operation.
- The fume cupboard is made safe before maintenance work is undertaken (i.e. removing hazardous substances, decontamination, fumigation where necessary).
- A list of chemicals used in the fume hood should be provided to Campus Services prior to any maintenance.

Campus Services Responsibilities

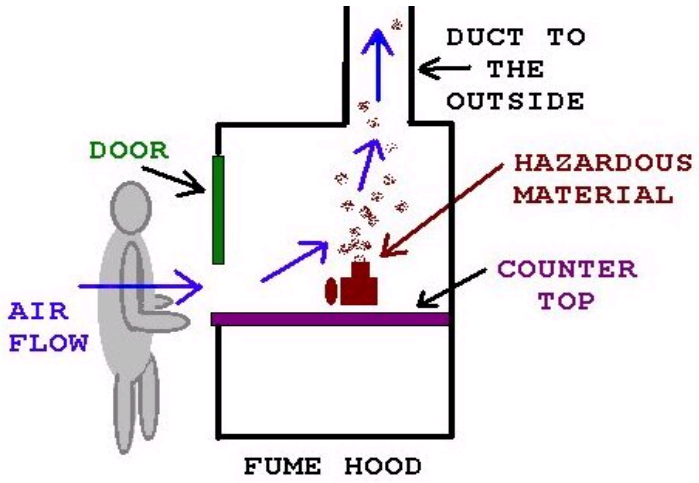
- Campus Services must arrange for statutory inspections and tests of ducted fume hoods, as required under the Control of Substances Hazardous to Health Regulations (COSHH), and in accordance with the relevant British Standards.
- Campus Services must arrange for statutory inspections and test of recirculating fume cabinets.
- Every fume cupboard must undergo thorough examination and testing at least every 14 months. If this period is exceeded the fume cupboard must be taken out of use until it has been tested.
- Persons carrying out inspections and tests must mark any fume cupboard that fails with a red ‘Fail’ label. Campus Services will inform Faculty of any systems that fail an inspection or test.
- Campus Services will maintain records of inspections, tests and maintenance of ducted systems and will advise Faculty of the need to undertake repairs or maintenance.
- Campus Services must maintain a record of the location of all fume hoods, with identification/asset tags.

Types of Chemical Fume Hoods

Extract or ducted fume hoods

Extract or ducted fume hoods are the most common type of fume cupboard at the University. They function by drawing in laboratory air into the fume cupboard, thus containing and diluting the contents before discharging them to the environment, usually without filtration, three meters above roof level.

Most ducted fume hoods are constant air volume hoods – these always pull the same amount of air regardless of sash position. As the sash is moved the velocity of the fume cupboard face changes (increases as sash is lowered/decreases as it is raised).

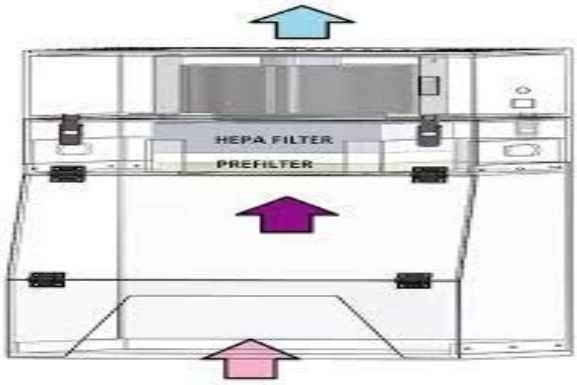


Recirculating (Ductless)

Recirculating filtered fume hoods - operate by drawing air into the fume cupboard and exhausting it though a set of filters (for example a particulate pre-filter, a HEPA filter for powders and a carbon filter for chemicals, these type of filters must be specified, an Inorganic filter will not work for organics) before the air is passed back into the laboratory.

They are designed to reduce the airborne concentration of a defined range of chemical vapours, fumes, smells and dusts in the air to acceptable levels. They can mop up low levels of some vapours and fumes very efficiently but they might not cope well with gross spillages or boiling off solvents or acids.

A sign should be placed on each recirculating hood showing the type of filters and what the hood can be used for.



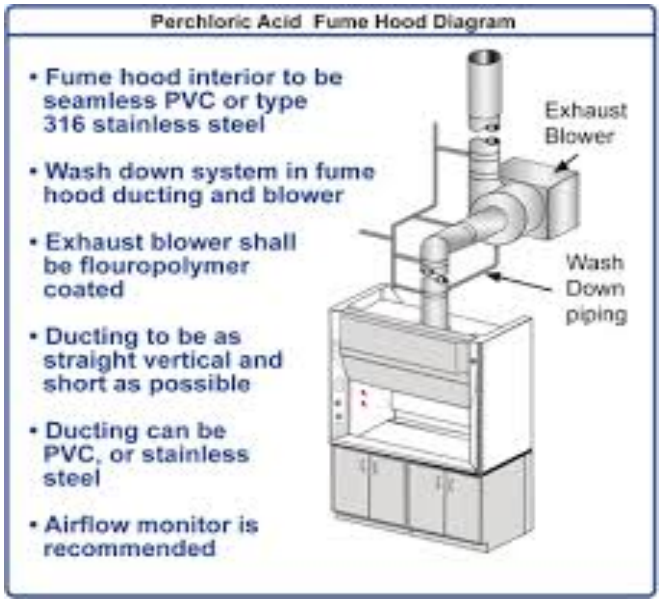
Recirculating fume hoods must not be used for highly toxic chemicals, or for regular use of toxic and/or flammable solvents in large quantities. They are not suitable for:

- Radioactive substances
- Any substance for which the filters are not specified
- Small molecules such as nitrogen, carbon monoxide or hydrogen
- Boiling off large quantities of solvents or acids
- High heat loadings, where internal surfaces are heat sensitive plastics
- Unventilated work areas

Wash-down or scrubber systems fume hoods

Wash down or scrubber fume hoods are a form of ducted fume cupboard where contaminated air from the fume hood enters a wash-down unit where water spray and exchange systems are used to remove contaminants such as water-soluble gases, vapours, aerosols and particulates which dissolve into the scrubbing liquor. The purified air is released up the stack. The scrubbing liquor is re-circulated from the sump and back to the top of the system using a pump. They are typically used when working with hydrofluoric acid or perchloric acid.

- Note: ducted fume hoods are not suitable for non-soluble hazardous materials that require filtration before being exhausted to atmosphere.



User Checks

It is essential that fume hoods are effective at extracting contaminants from the worker's breathing zone. Users must check that the fume hood that they intend to use can meet the University standards– this will normally be indicated on the test label and in the fume hood log book. They must also check the fume hood face velocity indicator before use to check the fume hood is operating within safe parameters (>0.5m/s).

If there is any doubt, an additional smoke visualisation test, a containment test, or monitoring of the worker's breathing zone may be required to verify that the fume hood is capable of extracting the hazardous material from the worker's breathing zone.

User guide key points

- Complete the weekly check list for the fume hoods and if you are a new user check it has been done. (see appendix 1).
- Before and after using a fume hood, make sure your work area is clean and uncluttered.
- Ensure fume hood type is the correct one for your work.
- Check the fume hood flow meter to establish if there is an air flow within the fume hood.
- The fume hood average face velocity should be between 0.3 -1.0m/s.
- Do not use the fume hood if it is not working properly.
- Verify the date on the inspection sticker on the fume hood, an inspection must be done annually.
- Never put your head inside a fume hood.
- Never use the fume hood to store chemicals and equipment between procedures. Solvent cabinets are to be used for storage of chemicals.
- Ensure equipment does not block the baffles at the rear of the hood.
- Keep all apparatus at least 15 centimetres inside the fume hood.
- Avoid opening and closing the sash rapidly and avoid swift arm and body movements in front of or inside the hood. These actions may increase turbulence and reduce the effectiveness of the fume hood.
- Position the sash so that it acts as a shield. Keep the sash as low as possible and always look through the sash, not under it.
- Avoid too many labels/writing on the sash - it is meant to be transparent so that you can see through it.

The performance of any fume hood can be severely compromised by incorrect use, in particular anything that disturbs the flow of air into the enclosure. Any of the following could cause interference to airflow and cause fumes or vapours from within the enclosure to enter the worker's breathing zone:

- External draughts (caused by the user's sudden movements, by people walking past the front of the hood, by doors opening, by air conditioning units or by other fans).
- The use of naked flames, hot air fans, ovens, hotplates, fans or centrifuges, all of which may cause turbulence.
- Large items placed too close to the front opening or too close to the back baffle.
- The use of screens for protection against ionising radiation or explosion.

Use of Specific Materials

Radioactive Material

The use of open sources must be closely monitored and co-ordinated, if users wish to use radioactive material, this must be approved by the University Radiation Protection Supervisor (see guidance on "Safe use of Ionising Radiation – Code of Practice")

Nanoparticles

Anyone proposing to work with nanoparticles must consult the Central Health and Safety Team in the first instance about safety precautions and the suitability of extract systems. (See guidance "Safe use of Nanomaterials - Code of Practice).

Safe Use of Fume Hoods

Before starting work in a fume hood

Any process involving the use of hazardous substances must have been subject to a risk assessment before starting the work. In addition to considering the use of a fume hood, it must also have considered whether it is practical to:

- Use less hazardous materials
- Change the process to eliminate the production of hazardous substances
- Totally enclose the process
- Reduce the quantities of the substances used
- Reduce the amount of substance released into the airflow e.g. use a condenser, watch glass cover etc.
- Use a slower reaction rate
- Apply simple controls such as fitting lids

Ensure you are using the correct type of fume hood.

- Check that the fume hood has a test sticker fixed to the front of the cabinet to confirm that it has been tested/examined within the last 14 months, and has passed the test. Check that the retest date has not been passed. Do not use the fume hood if it is outside the 14-month period.
- Confirm that the fume hood is working satisfactorily by a visual check of function lights and the air flow gauge is in safe zone (normally above 0.5 m/s).
- Check for obvious surface contamination. Clean if necessary to avoid adverse reactions with the chemicals you intend to use.
- Ensure that you have enough space to conduct your work safely and that all unnecessary items of equipment and chemicals not required in the process are removed.
- Where practical, ensure that all items for the operation are available in the fume hood.
- If using flammable materials, check that you know the location of the nearest suitable fire extinguisher.
- If using flammable liquids above their flash point, avoid direct heating by Bunsen burners, and take particular care to minimise spills. If practical, place electrical equipment where it will not be splashed from a spill.

Preparing to use the fume hood

- Switch the hood on and allow 5 minutes for the air to balance itself before starting work.
- Position equipment, apparatus, and materials in the centre and back of the hood to minimise disturbance to the airflow. Do not obstruct the rear baffle.
- Equipment in the fume hood should be kept to a minimum and sited at least 150mm inside the plane of the sash to ensure efficient containment. Keep items away from the sash opening to allow instant closure in an emergency.
- Avoid placing large pieces of equipment in a fume hood - they spoil the aerodynamic flow and may reduce the containment of fumes. If their use cannot be avoided they should be raised up about 10cm using lab jacks, in order to allow air to pass unimpeded across the work surface and to be exhausted from the rear of the fume hood.
- The experimental materials must be sited at least 15 cm inside the plane of the sash to ensure efficient containment.

During use

- Fume hoods should be used with the sash as low as reasonably practicable as this gives the best containment of fume/vapour and helps contain any fire or explosion that may occur. The maximum height when working at the fume cupboard should be 0.5m, and where reasonably practicable should be lower.
- Use the sash position to your advantage -
    - Fully open, to provide access for setting up equipment.
    - Partially open, to a comfortable work height when handling the material inside the cupboard.
    - Lowered as far as is practicable, when the process is in operation and your intervention is no longer required, including when stepping away for any period of time.
- Try to avoid sudden rapid movements in front of the hood. These can cause turbulence that may draw the airborne hazardous material out of the hood.
- Do not use naked flames as they will have a serious adverse effect on the air flow.
- Perchloric acid and hydrofluoric acid must not be used in fume hood, unless fitted with wash down facility.
- Chemicals must not be stored in a fume hood used for experimental work - they could escalate an accident.
- Hotplates must be kept to a minimum and be aware that they might adversely affect the airflow. If hot plates are used, these should be placed at least 10 cm from the side and back of the hood to avoid damage to the hood structure.
- Any accidental spill of chemicals must be cleaned up immediately (i.e. as soon as it is safe to do so).
- If an experiment is left running out of hours, a contact name and telephone number must be prominently displayed. Do not leave potentially hazardous work unattended.

After use

- At the end of your experiment remove equipment and clean the surfaces. Leave the fume hood in a clean, tidy and safe state.
- Dispose of waste in a safe appropriate manner as identified by the risk assessment and in accordance with laboratory rules.

- If permitted by local rules/lab risk assessment, switch off the fume hood.

Emergencies

- If the ventilation system fails, immediately stop working. If safe to do so, replace lids on containers and terminate any ongoing processes.
- Pull the sash as low as possible and move away from the fume hood. Warn other workers there is a problem.
- Deal with spillages immediately, using the correct absorption materials. Dispose of as hazardous waste.
- Treat fires with extreme caution. The use of high pressure CO2 may spread flames and eject items out of the fume hood. Only tackle fires if you have the correct firefighting equipment and have been trained to use it. Otherwise, close the sash and if possible turn off the fume hood. Raise the alarm by activating the fire alarm (press red manual call point) and phone Security (Ext: 3200). Evacuate the building.

Training, Instruction and Information

Users of fume hoods must be trained in correct use (see appendix 2), not only in order to understand how the hood works, but also because poor technique can compromise the operation protection afforded by the hood.

Training should cover:

- Principles of how hoods work, the airflow and limitations of hood performance
- How to work at hoods safely
- Operation and function of all controls and indicators
- Operating fume hoods in an energy efficient manger, whilst maintaining safety standards
- How to check if the system is extracting all the hazardous materials
- Actions to be carried out in the event of a system failure/what to do if something goes wrong

Records of all training, including refresher training, must be kept and only those trained are authorised to use the system. This applies to all users (whether staff or students).

If the extraction system changes (removal of hood on the system, change in extract routes or fans), the system must be re-commissioned and the users re-trained. Consideration must also be given to the possible need to clean the system of any residues from previous uses.

In mixed or shared extract stack systems, an assessment of the need to restrict the use of certain substances must be undertaken to prevent the mixing of incompatible substances in the extract ducting and stack.

Appendix 1

Fume Cabinet Weekly Checklist

Weekly visual Inspections: to be carried out by technical staff and checklist completed. Where there are any observations or comments arising from any operational issues, the cabinets are to be taken out of service until further checks are carried out and resolved. This should be done by contacting the Helpdesk on email: eahelpdesk@northumbria.ac.uk

Room Reference:	RSA Serial Number:		Clean Air Ref. No.:
WEEKLY CHECKLIST	**YES**	**NO**	**OBSERVATIONS/COMMENTS**
Any signs of damage, internal or external			
Cracking or deterioration of sealant at edges			
Build-up of debris on ventilation grille to the rear of the cabinet			
Sash is free to move through its full range, and remains at the position it is released at (no rising or falling)			
Sash alarm is operational, giving visual and audible alarm when raised above safety point			
Where an air flow rate reading is possible, record this			
Sash high limit is functioning			
No internal or external obstructions to air flow into the cabinet			
Lights are functional			
Flush water supply to cabinet for 2 minutes			
Gas tap operational – No leakage (press finger over outlet with tap shut and check for any build-up of pressure)			
Inspect external ductwork from cabinet, to room exit point for any damage, cracks or breaches			
Inspectors name (print):	Inspectors signature:		Date of Inspection:

Logs should be kept with the cabinet and should be available for inspection.

Appendix 2

Training Requirements for Fume Hood Users

Subject	Item covered		Competency assessed	
	Yes	No	Yes	No
This guidance has been read				
Control panel, alarms and indicators – what they all mean				
Safe operating parameters for air velocity				
How to turn the fume hood on and off				
The importance of lowering the sash to the lowest position possible when working at the hood				
The importance of shutting the sash whenever the operator does not need access to within the hood				
Techniques to avoid disrupting the airflow				
Local rules on whether the hood can be left on or off				
Permitted equipment allowed within the hood				
Dealing with waste within the fume hood, do not let it accumulate or use the hood for waste storage. If sinks are in the hood instruct on what can be disposed of to drain				
Restrictions on what work can be carried out in a recirculating hood				
Dealing with spillages within the hood				
Emergency actions – what to do if the power or airflow fails				
Routine cleaning of the hood after use				
Principles of airflow, performance testing and containment testing				
Who to report to if the hood is “out of test date”				

Both trainer and trainee agree that the above training has been fully completed and that the trainee is considered to be competent to use the fume hood for the specific project/work

	Name	Signature	Date
Trainer			
Trainee			