LABORATORY FUME HOOD SPECIFICATION AND MAINTENANCE PROGRAM

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1.0 INTRODUCTION AND SCOPE

A fume hood is an enclosed working chamber fitted with an exhaust ventilation system. It is one component of an exposure control system which is designed to contain, dilute and disperse gases, vapors and aerosols to the external environment. It is also an integral part of the building air handling system. The fume hood is the primary control device in most laboratories for protecting employees and students from exposure to hazardous chemicals, also, the efficiency of operation is essential in maintaining good air quality in laboratories. It is therefore imperative that it function properly at all times during its operation.

1.1 Objective

It is the objective of this program to ensure that laboratory fume hoods are appropriately selected, installed, used and maintained such that the health of laboratory personnel is safeguarded in accordance with safe working practices. See NFPA 45-Fire Protection for Laboratories Using Chemicals, OSHA-29 CFR Part 1910-Occupational Exposures to Hazardous Chemicals in Laboratories, and standards set by ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc.).

1.2 Scope

This program applies to By-pass and Variable Air Volume fume hoods. Specialty fume hoods such as Re-circulating, Walk-in, Explosion Proof and Perchloric Acid fume hoods require special design considerations that are dealt with on a case-by-case basis through either the WVU Department of Environmental Health and Safety or the Biohazard Safety Committee. This program is also intended to provide a standard for selection, installation, usage and maintenance of the laboratory exposure control systems.

2.0 RESPONSIBILITIES

This section outlines the responsibilities within the University for implementation of the fume hood specification and maintenance program.

2.1 Deans and Directors

Deans and Directors have the following responsibilities under this program:

- To ensure that pertinent supervisors, Chemical Hygiene Officers, principal investigators; and fume hood users are notified of their responsibilities as defined in this program.

2.2 Laboratory Supervisors/Principal Investigators

Laboratory Supervisors/Principal Investigators have the following responsibilities under this program:

- To ensure that all fume hood users perform the necessary "Maintenance Checks" on a routine basis;
- To ensure that no work or experiments are conducted in a malfunctioning fume hood; and
- To ensure that all fume hood users follow prudent work practices when operating fume hoods.

2.3 Fume Hood Users

Fume hood users have the following responsibilities within this program:

- To regularly inspect the physical condition of the hood interior and the mechanical services inside the hood and to report malfunctions to the appropriate authority;
- To routinely test (switch on monitor) the air flow monitoring device (if present) to assure functional status; and
- To rigorously follow prudent work practices.

2.4 Director, Facilities Management Maintenance

The Director or designate has the following responsibilities within this program:

- To routinely inspect and adequately maintain all exhaust systems (ducting, exhaust fans and exhaust stacks);
- To respond when notified of a system malfunction; and
- To provide appropriate service for malfunctioning fume hood cabinets (working chambers) ---e.g. repair malfunctioning sashes, etc.

2.5 Director, Office of Environmental Health & Safety (EHS)

The Director, Office of Environmental Health and Safety, or designate has the following responsibilities within this program,

- To test all fume hoods annually for proper flow rates;
- To re-validate (test and re-calibrate) all fume hood (air flow) monitoring devices on a regular basis;
- To review and update this program on a regular basis;
- To audit the implementation of this program; and
- To ensure that new installations conform to policies listed in the System Design Specification section.

3.0 USER GUIDELINES

The efficiency of a fume hood is very dependent on its functional status and on how it is used.

Users must ensure proper operation of fume hoods by performing the following "Maintenance Checks" before each use:

- Inspect the physical condition of the hood interior, sash and visible duct work;
- Check sash for ease of operation;
- Test air-flow monitoring device (if present);
- Check mechanical services inside the hood (e.g.. water, steam, compressed air, gas, vacuum, etc.); and
- In case of fume hood malfunction, do the following:

    - Discontinue use of fume hood;
    - Inform your supervisor or Chemical Hygiene Officer;
    - Be sure the Facilities Management is notified; and
    - Report your name, phone number, exact location and reason for call.

When using a fume hood, one must remember that the hood does not provide absolute containment or absolute protection from the materials in the hood, however, a properly designed hood in a properly designed room can provide adequate protection if prudent practices are observed.

Prudent Work Practices

- All work involving hazardous or odorous chemicals should be performed in a fume hood.
- All equipment and materials should be placed at least 6 inches back from the face of the hood, these items should not obstruct the movement of air into the hood.
- One should not place one's head into the hood when contaminants are being generated.
- The sash should be used to minimize the size of the working aperture and to act as a safety screen, one should use an appropriate barricade if there is a chance of an explosion.
- The hood should not be used as a storage area or overloaded with unnecessary equipment and materials. The presence of these materials can seriously affect the air flow in the hood. Suitable storage facilities can often be provided underneath the fume hood or in approved safety storage cabinets.
- The hood should not be used for long-term storage of hazardous chemical wastes. To dispose of these wastes complete the Hazardous Waste Disposal Form on the Environmental Health and Safety webpage (http://ehs.wvu.edu).
- Electrical receptacles or other spark sources should not be placed inside the hood when flammable liquids or gases are present. Electrical connections should be made outside the hood and no permanent electrical receptacles should be permitted in the hood.
- Foot traffic past the face of the hood should be minimized. Air flow caused by such traffic can seriously disrupt the operation of the hood and cause gases and vapors to be drawn out of the hood into the room. Cross drafts from windows and doors close to

improperly located fume hoods will also affect the stability of the air flow within the fume hood.
- Keep the interior of the hood clean and tidy.
- **Do not conduct work in a malfunctioning fume hood**.

4.0 SYSTEM DESIGN SPECIFICATIONS

The fume hood is one component of the exposure control system, its performance therefore cannot be judged in isolation from the rest of the system. The total system consists of:

- working chamber;
- exhaust system;
- fume hood location;
- make-up air to the fume hood;
- system indicators;
- operational parameters; and
- system maintenance.

The following specifications provide the standard for acceptable performance and efficiency of fume hood systems, all new installations should conform to these specifications and existing installations should be brought to this standard as funding permits

4.1 Working Chamber Requirements

- By-pass type hood when constant volume systems are required. The interior of the working chamber should be constructed of non-flammable, acid resistant material;
- A back baffle system to more evenly distribute the air across the face of the chamber such that uniform air flow through the face of the hood will result;
- An airfoil along the lower edge and the tapered configuration on the other edges to provide the streamlined front entrance profile;
- A vertical/horizontal sliding sash to minimize the size of the working aperture and to act as a safety screen; and
- A recessed work surface to retain spilled liquids.

4.2 Exhaust System

- The ducting shall be designed to provide optimum air flows in the working chamber:

    - size to minimize noise levels;
    - avoid horizontal runs to minimize collection of corrosive condensates; and
    - provide circular cross sections to reduce the number of corners and crevices where corrosion might occur;

- The exhaust stack shall discharge vertically upwards at the appropriate exit velocity and of sufficient height and so positioned as to ensure that emissions are unable to re-enter the building or adjacent buildings:

    - All Laboratory exhaust should be 100% exhausted and never re-circulated to other parts of the building.

4.3 Fume Hood Location

- A fume hood shall be located in such a way as to minimize risks to persons in the event of fire or explosion, and away from major traffic patterns (doorway, etc.) and major air patterns (air inlets and other sources of air disturbance) that produce cross drafts.
- Supply air diffusers in the laboratory shall be of the low velocity style.

4.4 Make-Up Air to the Fume Hood

- Provide make-up air to replace air exhausted by the fume hood.
- The make-up air shall be at a suitable temperature to avoid wind chill effects and be acceptable to the laboratory staff.
- Supply air diffusers shall be sited so as to maximize the general dilution ventilation of the laboratory without disturbing the air flow pattern in the fume hood.
- Laboratory air should change 4 to 12 times per hour depending on the type of substances being used.

4.5 System Indicators

If the airflow in the system is not monitored, the hood operator may not be aware when a partial or complete failure of the exhaust system occurs.

- All new fume hoods shall be fitted with an alarming (audible & visual) air flow monitoring device. These monitors are required and part of the installed cost when new fume hoods are purchased.
- Existing installations should be retrofitted with an air flow monitoring device.

4.6 Operational Parameters

- For a by-pass fume hood (constant volume) at the maximum face opening (sash fully raised), the air flow through the hood should provide an average face velocity of 80 ft/min. Closure of the sash should not increase the face velocity above 150 ft/min.
- For a variable air volume (constant velocity) system, the air flow through the hood should provide an average face velocity of 100 ft/min regardless of sash height.

5.0 SYSTEM MAINTENANCE

5.1 Introduction

For many employees not directly engaged in research or teaching, laboratories are an unfamiliar environment. Support staff employees whose job responsibilities require them to work in these areas must communicate with laboratory occupants before beginning work to avoid creating a situation that may be hazardous to one or both parties. Advance planning of projects and effective communication will help to ensure that everyone involved understands all the potential implications of the work.

The classic example is chemical fume hood system maintenance. If the user attempts to work in the hood while maintenance is being performed, the individual working on the system may be exposed to contaminants being exhausted through the hood or to mechanical or electrical hazards. Similarly, laboratory personnel may be exposed if an exhaust fan is shut down without warning during an experiment. Following the procedures given below will help to assure that all necessary precautions are taken and that jobs are completed without undue risk.

5.2 Scope and Application

The System Maintenance procedure applies to any maintenance, repair or renovation activities that may impact laboratory operations or create a potentially hazardous work environment for support staff. Examples of specific circumstances are listed below:

- Maintenance on fume hood exhaust systems requiring fan shut down or work involving fan, ductwork, or fume hood interior surfaces is a Lockout/Tagout procedure,
- Changing of filters,
- Servicing plumbing and traps which may be contaminated with chemical residues,
- Maintenance of exhaust systems which have been used for perchlorates, radioactive materials, etc.,
- Working in chemical storage areas, and
- Materials being used or stored in the hood may be extremely hazardous.

5.3 Basic Procedure

Consult the Lab Occupants

Consult the people responsible for the area where the work will be done before beginning. These are the people who can supply the most information about the hazards likely to be found in the work area. They also are the people who most need to be informed about the work and how it might impact their work area. Often, the Chemical Hygiene Officer (CHO) can help contact the right people.

Consult EHS

If consultation with the user concludes that exposure to hazardous materials may occur, contact Environmental Health and Safety as far in advance of the planned work as possible. EHS will survey the work area and/or provide specific recommendations or precautions relating to the work. When in doubt, consult EHS.

Notify the Occupants

Notify the occupants of all affected areas immediately before beginning work. Post warning signs on equipment, such as sinks or hoods, which may be affected. Be sure to remove the signs when the work is finished, so there is never any doubt that an "Out of Service" sign truly means that the equipment cannot be used. This is a Lockout/Tagout procedure.

If health or safety problems arise in the course of the work, suspend work and contact your supervisor or EHS.

5.4 Maintenance of Laboratory Ductwork/Fume Hoods

West Virginia University shall apply reasonable measures to reduce the risk of chemical exposures during maintenance of laboratory ventilation systems. This procedure recognizes that the safety of the employee during maintenance of laboratory ventilation systems depends on the coordinated efforts of the Facilities Management staff, department chairpersons, faculty, staff, and Environmental Health and Safety. These procedures pertain to all maintenance of laboratory ventilation systems including the fume hoods, ductwork, and components therein. Safe work practices shall be used during all maintenance procedures to avoid possible exposures to hazardous materials. At a minimum, all personnel performing maintenance on laboratory ventilation systems shall be made aware of the potential for exposure to hazardous substances during maintenance activities. A consultation with the laboratory supervisor and/or the chemical hygiene officer shall precede any work. Some operations could be Lockout/Tagout procedures.

Additional Requirements

Special precautionary procedures are required for the following:

- "Hot Work" - work involving torch cutting, welding or any related work.
- Maintenance of Perchloric Acid Hoods or any laboratory hoods suspected of using perchloric acid.
- Maintenance of radioactive hoods or biological safety cabinets.

5.5 Maintenance Inside Ductwork/Fume Hoods

After consulting with the hood user and/or the Chemical Hygiene Officer, appropriate work procedures and personal protective equipment (PPE) can be utilized.

If no specific hazard is identified by the laboratory supervisor and/or the Chemical Hygiene Officer, the following minimum work procedures and PPE shall be employed:

- Wet work practices - All areas shall be wetted and washed down before work begins.
- Acid resistant gloves.
- Splash proof goggles.

If specific hazards or potential hazards have been identified or if entry into the ventilation system is required, the following minimum work procedures and PPE should be employed:

- Wet work practices - All areas shall be wetted and washed down before work begins.
- Acid resistant gloves.
- Splash proof goggles.
- Disposable hood and clothing.
- Half mask respirator with appropriate cartridge.
- Should respirators be necessary, compliance with OSHA's Respiratory Protection Standard 29 CFR 1920.134 and WVU's Medical Monitoring Policy is required. Contact Environmental Health and Safety if assistance in respirator selection is required.)

For More Information

Contact EHS at 304-293-3792
