1.0 Introduction

The Standard Operating Procedure for Fume Hoods was developed by the Department of Environmental Health and Safety (EH&S) in conjunction with Physical Plant Services, in accordance with the University Policy Statement on Health and Safety and to ensure compliance with the applicable legislation governing the installation, maintenance and use of Fume Hoods.

Applicable Legislation:

Occupational Health and Safety Act
R.S.O. 1990

Ontario Fire Code
Part 4 (Reg. 388127)

Canadian Standards Association (CSA)
Z316.5-94 Fume Hoods and Associated Exhaust Systems

Health Canada Laboratory Biosafety Guidelines
2nd Edition 1996

Occupational Health and Safety Administration
Standard 29 (CFR) 1910.1450 Appendix A 4(a)(b)(e)(g)(f)

Scientific Equipment & Furniture Association (SEFA)
SEFA 1.2/1996

ANSI*/ASHRAE**

* American National Standards Institute
** American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc.
2.0 Scope and Definitions

A chemical fume hood consists of an enclosed working chamber with an exhaust ventilation system attached. The workspace of the fume hood is ventilated by an induced flow of air through the face opening. The air flow is intended to capture and contain gases, vapours or aerosols generated within the enclosure. These airborne contaminants are then exhausted from the cabinet. Laboratory fume hoods are used as a primary means of protection to the employee from inhalation of and exposure to odorous and/or hazardous chemicals.

Biological Containment cabinets and Laminar Flow cabinets are not chemical fume hoods and therefore not in the scope of this document.

2.1 Definitions

Perchloric acid fume hood: a fume hood where construction materials have been selected to prevent a reaction with perchloric acid.

Radioisotope fume hood: a fume hood constructed to contain spills, be easy to decontaminate and strong enough to bear the weight of any necessary radiation shielding material.

Recirculating fume hood: a fume hood that is not ducted outside, but instead air is passed though chemical-specific filters and the ‘clean air’ is returned to the laboratory. (The Department of Environmental Health and Safety will not approve applications for use of recirculating fume hoods.)

Face opening: the part of the fume hood through which work is performed.

Face velocity: the velocity of air moving through the face opening, usually expressed as feet per minute. In a laboratory setting the recommended face velocity is 100fpm +/- 20 fpm.

Sash: term used to describe the movable glass panel that covers the face area of a fume hood.

Baffles: Movable panels located on the sides and/or back wall of the fume hood that create slots in which air is exhausted. The pattern of air moving into and through the hood is determined by the setting of the baffles.

Bypass: Compensating opening in a fume hood that functions to limit the maximum face velocity as the sash is raised or lowered.
3.0 Responsibilities

This section outlines the responsibilities within the university for implementation of this SOP.

3.1 Physical Plant Services

Physical Plant Services have the following responsibilities under this SOP:

- Comply with CSA Standards when installing chemical fume hoods.
- Perform preventative maintenance on fume hoods, fans, and ductwork on a scheduled basis (at least annually).
- Inspect and perform maintenance on sashes, lights, service fixtures and interior.
- Perform repairs or maintenance identified by scheduled inspections or by fume hood users.
- Notify the Department of Environmental Health and Safety when maintenance or modifications to fume hoods has occurred.

3.2 The Department of Environmental Health and Safety

Responsibilities of the Department of Environmental Health and Safety include the following:

- Ensure that the fume hoods are evaluated at least annually.
- Maintain documentation of relevant legislation.
- Establish criteria of acceptable performance.
- Perform field tests for verification of face velocity and test the operation of the air flow alarm.
- Perform field tests for verification of proper airflow and patterns.
- Implement and maintain a sticker program for testing verification.
- Report any variations from “acceptable performance” to Laboratory Supervisor/Principal Investigators, Departmental Safety Officer and Physical Plant Services.
- Certify sash height for safe working conditions based upon face velocity testing results and post appropriate signage.
- Maintain documentation of testing result records.
- Review this Policy and Procedure Manual annually and amend as necessary.

3.3 Directors, Department Heads and Managers

Each has the following responsibilities under this SOP:

- To ensure that pertinent Supervisors, employees, and students are notified of their responsibilities for working with fume hoods.
- To ensure that all employees and students have received instructions in the proper operation of fume
hoods.
- To ensure that procedures, equipment and materials appropriate for the fume hoods under his/her authority are provided to protect the health and safety of all employees and students.
- To ensure that all employees and students are given adequate supervision and instructions on the hazards of chemical usage and fume hood operation.
- To ensure the components of this SOP and the applicable legislation are implemented in all facilities under his/her authority.

3.4 Departmental Safety Officer

Departmental Safety Officers shall:

- Ensure that supervisors/principal investigators and all fume hood users are aware of their responsibilities under this document.
- Receive report from EH&S regarding fume hood testing results specific to department.
- Establish department-specific policies as necessary.

3.5 Laboratory Supervisors/Principal Investigators

Supervisors must be knowledgeable about hazards and standard operating procedures associated with working with the fume hoods under his/her authority, the education and training requirements, as well as the other requirements of this program. He/she has the following responsibilities:

- Ensure that Fume Hood Users receive safety training regarding best laboratory work practices and fume hood user guidelines prior to commencing work with fume hoods.
- Ensure that all fume hood users follow best laboratory practices when operating fume hoods.
- Ensure that no work or experiments are carried out in a malfunctioning fume hood.
- Receive report from EH&S regarding results of fume hood testing specific to respective laboratory.
- Coordinate modifications, maintenance, repair and new equipment needs with Physical Plant Services and/or the Department of Environmental Health and Safety.

3.6 Fume Hood Users

The responsibilities of fume hood users include the following:

- Rigorously follow best laboratory work practices.
- Use hoods only according to recommended guidelines for safe use.
- Notify Laboratory Supervisor/Principal Investigator immediately in the event of malfunction.
4.0 User Guidelines

4.1 General Use Chemical Fume Hoods

It is highly recommended that all operations that involve the following WHMIS hazard classes be performed in a functioning fume hood.

- Class B; Flammable and Combustible Materials
- Class C; Oxidizing Materials
- Class D1 (a & b); Materials with Immediate and Serious Toxic Effects
- Class D2 (a); Materials with Other Toxic Effects
- Class E; Corrosive Materials
- Class F; Dangerously Reactive Materials

Do not use any chemical without being aware of its physical characteristics and toxicity.

When using a fume hood, it must be remembered that the hood does not provide absolute containment or absolute protection from the materials in the hood. However, an appropriately designed hood in an appropriately designed laboratory will provide adequate protection if the following practices are observed:

Do not conduct work in a malfunctioning fume hood. Ensure that the fume hood is on before commencing any work. (Note – Fume hoods should be kept running at all times).

1. Substitute toxic chemicals with less hazardous materials whenever possible.
2. No adjustments to the interior of the fume hood, (i.e. baffles) or to mechanical sash stops should be made.
3. The sash of the fume hood should be kept closed except when making adjustments to equipment or actually carrying out manipulations in the fume hood. At those times the sash should be raised to it’s certified height based on face velocity testing. In some cases the fume hood doubles as a general room exhaust, and in those instances the sash would be left open at all times. Physical Plant Services can provide that information to the lab operators.
4. All equipment and materials should be placed at a minimum of six inches back from the face of the hood in order that these items not obstruct the movement of air into the hood.
5. It is recommended that blocks or racks be used to elevate equipment one or two inches off the hood deck surface in order that air flow easily around all apparatus.
6. Never put your head inside a hood while operations are in progress and potential contaminants are being generated.
7. Use extreme caution with ignition sources inside a fume hood. Electrical receptacles or other spark sources shall not be placed inside the hood when flammable liquids or gases are present.
8. Keep the interior of the fume hood clean and tidy. Clean up any spills immediately.
9. Keep storage in the fume hood to a minimum. The hood should not be used as a storage area for chemicals nor should it be overloaded with unnecessary equipment and materials. The presence of these materials can seriously affect the airflow in the fume hood.

10. Do not use the fume hood as a waste disposal mechanism (e.g., for evaporation of chemicals). Refer to the Hazardous Wastes Disposal Procedures for instructions on waste disposal.

11. Foot traffic past the face of the fume hood should be kept to an absolute minimum while it is being used. Air flow caused by such traffic can seriously impede the operation of the hood and cause gases and vapors to be drawn out of the hood and into the laboratory.

12. It is recommended that chemicals and amounts used should be recorded in a log book, dedicated to one fume hood, in order that appropriate monitoring protocols may be used.

4.2 Radioisotope Fume Hoods

Fume hoods used for radioisotope work will be appropriately labeled and located in radioisotope laboratories only.

Refer to Radiation Safety Policy and Procedures for general rules for working with radioisotopes.

4.3 Perchloric Acid Fume Hoods

Perchloric acid is highly corrosive and oxidative and can react with organic materials to form explosive perchlorate salts and esters. The use of a perchloric acid fume hood will be required when conducting frequent procedures, using large quantities, heating perchloric acid or using anhydrous perchloric acid.

(Note: Acid digestions using acids other than perchloric should be performed in fume hoods designed to withstand the corrosive and damaging effects of repeated manipulations using acid. Consult with Physical Plant Services or the Department of Environmental Health and Safety for further information.)

4.4 Recirculating (Ductless) Fume Hoods

It is the policy of the Department of Environmental Health and Safety not to allow recirculating fume hoods to be used on campus for several reasons:

- They have limited use because of the wide variety of chemicals used at Queen’s University.
- The use of inappropriate chemicals or compounds or other misuses of the recirculating fume hood could resulting contaminated air being recirculated into the laboratory.
- It is difficult to determine whether the filters are functioning adequately or when they need to be changed. Therefore, the potential for recirculating toxic materials into the laboratory is significant.
5.0 Maintenance and Testing

Emergency and Scheduled Maintenance of Fume Hoods is the responsibility of Physical Plant Services and all other inquiries regarding these matters should be directed to that department. Face Velocity and Air Flow testing is the responsibility of the Department of Environmental Health and Safety.

5.1 Scheduled Maintenance

In accordance with CSA Standard Z316.5-94, every six months the baffle(s), sash and interior surfaces of fume hoods shall be cleaned as applicable by the user.

Every twelve months, the maintenance schedule shall include the following (as applicable):

- Inspect the sash mechanism for corrosion and damage;
- Inspect the fans, motors, drives, and bearings for correct operation and wear;
- Operate the wash down system and observe the performance to ensure thorough washing;
- Test the controls of the services to the fume hood for proper operation;
- Check the stability and condition of the discharge stack;
- Check the laboratory make-up air balance and temperature and adjust as necessary;
- Check the operation of any balancing damper;
- Repair defects and lubricate as necessary;

5.2 Face Velocity and Containment Testing

Fume hoods must be tested for minimum control functions and face velocity as follows:

- After new installation;
- After any repair or modifications are made to the fume hood or exhaust system;
- At least once per year.

Air velocity and air flow testing will be carried out by the Department of Environmental Health and Safety according to the above schedule and also by request of the Department Head/Principal Investigator or Physical Plant Services.

Testing will include the following:

- Average face velocity of the fume hood when the sash is fully opened;
- Determination of sash height at which the average face velocity is 100 fpm, unless otherwise specified;
- Smoke test to determine air flow patterns and leakage.
5.3 Certification and Labeling

The Department of Environmental Health and Safety will implement a labeling and certification program. Each fume hood on campus will be provided with a label that carries the following information:

- Fume hood identification number;
- Average face velocity reading;
- Sash opening height requirements to maintain 100 fpm face velocity;
- Date that annual field test was performed;
- Date that the fume hood was inspected and by whom.

6.0 Installation of Fume Hoods

The installation of any fume hood on campus requires the approval of Physical Plant Services and the Department of Environmental Health and Safety.

Physical Plant Services will be responsible for assessing the installation with respect to the existing exhaust systems and coordinating the design of the installation to meet all applicable legislation. Physical Plant Services will also be responsible for amending existing Ministry of Environment Certificate Approval or applying for Certificates of Approval for new installations.

The Department of Environmental Health and Safety is responsible for receiving and approving the proposed design of the installation before construction work begins.

6.1 Fume Hood Selection

Only By-pass type fume hoods shall be installed. Auxiliary and Recirculating fume hoods shall not be used.

Before a fume hood is selected, a risk assessment of the anticipated use of the fume hood should be undertaken. Failure to do so may result in the selection, purchase and use of substandard or inappropriate equipment. This could therefore increase the risk of injury to the fume hood user.

6.2 Fume Hood Location

The efficiency of a fume hood is directly related to its location in the laboratory. Traffic can cause air turbulence, which can then cause contaminants to be drawn outside the hood. Therefore, fume hoods should be located in areas with as minimal traffic as possible.
The fume hood should be located away from major air patterns (air inlets and other sources of air turbulence).

Seated work stations should not be located directly opposite fume hood openings.

More specific recommendations for fume hood location can be found in CSA Standard Z316.5-94(9).

### 6.3 Fume Hood Exhaust Systems

Radioisotope and perchloric acid fume hoods must be exhausted separately from each other and from general-use chemical fume hoods.

Duct materials should be compatible with vapors to be exhausted. Stainless steel can be used with most solvents and potentially flammable vapors. The use of perchloric acid and corrosive vapors require the installation of acid resistant, non-reactive, impervious materials.

The ductwork shall:

- be designed in a manner that will provide optimum air flows in the working chamber of the fume hood;
- avoid horizontal runs in order to minimize the collection or build up of corrosive materials;
- provide circular cross-sections to reduce the number of corners and crevices where corrosion can occur.

Fume hood exhaust ducts shall not contain fire dampers.

The exhaust system shall meet legislative requirements and have a valid Ministry of Environment Certificate of Approval to discharge air.

### 6.4 Fume hood – Make up (Supply) Air

Supply air should be balanced with hood exhaust in the laboratory such that supply air should be slightly less than exhaust air to allow for the laboratory to be under negative pressure at all times.

Supply air should be at a suitable temperature to be acceptable by laboratory users.

### Revision History:

Revision 1.0 – Initial Release
Appendix A
Application For Fume Hood Procurement / Installation

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<th>Contact Person:</th>
<th>Phone Number:</th>
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**Location Information:**

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**Fume Hood Information:**

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<th>Will this hood replace an existing fume hood?</th>
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<tr>
<th>Has the area been engineered to support the hood?</th>
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If yes, by whom (ex. PPS engineer): ________________________
When _________________________________

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<th>Has a list of chemicals to be used in this fume hood been submitted to EH&amp;S</th>
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<tr>
<th>Area Manager Approval:</th>
<th>_________________________________</th>
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| Additional Details: (Attach schematic drawings, designs, sketches etc.) |
|---------------------------|-----------------------------|
|                           |                             |

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