Title: CHEMICAL FUME HOODS/BIOLOGICAL SAFETY CABINETS

Principle:

Chemical Fume Hoods are suitable when working with chemicals and non-sterile work to prevent vapors and gases build up in laboratory. Chemical Fume Hoods exhaust chemical fumes and vapors outside the laboratory and does not filter the air. Biological Safety cabinets are used to prevent airborne particulates and aerosols by use of a HEPA filtration of air intake and exhaust. Biological Safety Cabinets will recirculate filtered air in to the laboratory.

Procedures:

1. FUME HOODS

A. MAINTENANCE

Fume hoods should have regularly scheduled maintenance done at least annually, preferably semi-annually. The UC Denver Health and Safety Office will check the face velocity of each hood annually using standardized voltmeters or anemometers. Various sash height settings will be tested with necessary laboratory equipment left in the hood. Health and Safety will attach marking stickers to the side of each hood indicating the appropriate sash heights for both minimum and maximum face velocity. Health and Safety will also retain records of all maintenance performed by their office. UCH Maintenance Department will annually inspect and repair (if needed) any electrical outlets, gas, water, or air lines, and blower fans on or in the fume hoods. In addition, UC Denver Maintenance Dept. will inspect annually the building's HVAC system to assure proper ventilation from the hoods to the outside environment. Laboratory personnel should also set up a schedule (depending on usage) to regularly clean and disinfect each hood.

B. TRAINING

Each year all laboratory personnel review the laboratory safety manual, including the section on chemical fume hoods.

C. TYPES OF CHEMICAL FUME HOODS

There are several types of fume hoods commercially available, the seven general types are listed below.

1. Conventional hood with vertical sash

2. Conventional hood with horizontal sash

3. Bypass hood

4. Auxiliary air hood

5. Walk-in hood

6. Self contained hood

7. Canopy hood

In addition, specialty fume hoods for perchloric acid, radioisotopes, and carcinogens are available. As a general rule, Perchloric acid should not be used in a chemical fume hood. However, exemptions to this rule may be allowed with special permission from UC Denver Health and Safety Department.

Conventional hoods with vertical sashes are the most common type of fume hood and are the only type presently in use in this laboratory. Therefore any further discussion of chemical fume hoods will exclusively apply to this type of hood.

D. FACTORS AFFECTING HOOD PERFORMANCE

1. FACE VELOCITY

Satisfactory performance of a fume hood requires that airflow past the opening sash (face velocity) occur within minimum and maximum limits. If the face velocity is too low fumes will leak out through the front opening and come in contact with the operator and escape into the laboratory. The minimum velocity must be great enough to ensure that the direction of air will always be into the hood. The upper limit of air velocity is related to the flow pattern created by the air stream flowing past the operator in front of the hood and past the equipment itself in the hood. Although hoods can be operated at 60 feet per minute (fpm; 1 ft = 30.48 cm), it is suggested that the **minimum face velocity be 100 fpm** in order to provide a safety margin for variable operating conditions. The **maximum acceptable face velocity should be 150 fpm.**

2. VERTICAL SASH HEIGHT

The height of the vertical sliding sash can affect performance significantly and directly control the face velocity of the hood. Face velocity should be checked yearly at various sash heights, and if necessary the sash heights should be adjusted to maintain the proper face velocity (see Maintenance for further details). The sash height is also an important factor in protecting the operator from serious splashes and explosions and should at the very least cover the operator's face.

3. DISTANCE OF FUME SOURCE

The closer the fume source is to the opening vertical sash the more likely hazardous vapors are to escape from the front of the hood into the room. All experiments should be conducted <u>behind</u> the level of the vertical sliding sash, the deeper into the hood the better.

4. PRESENCE OF HEAT SOURCE

A heat source will cause increased spillage of any toxic vapors present inside the hood, and should be avoided if possible.

5. AMOUNT AND LOCATION OF MATERIALS

The more equipment and materials located in the hood, the greater the air turbulence. Air turbulence can disrupt designed air flows and reduce the effectiveness (face velocity) of the hood.

In general, a deeper hood provides more room to adequately have proper space between laboratory equipment in order to minimize turbulence. The further back into the hood materials can be placed, the better the air flow will be. A chemical hood should not be used for general storage of materials.

6. CHEMICAL STORAGE

Generally, chemicals of any type should not be stored on a permanent basis within the hood. However, small working quantities may be temporarily stored within the hood area while assays are being performed. Exceptions to this rule may be allowed with special permission from UC Denver Health and Safety Dept.

II. BIOLOGICAL SAFETY CABINETS

Biological safety cabinets are designed to provide for control and collection of airborne particulates and aerosols within a confined space through the use of directional airflow and high efficiency particulate arresting (HEPA) filters. When cabinets are used in conjunction with good microbiological techniques, they provide an effective containment system for safe manipulation of moderate and high risk microorganisms. Hepa filters remove only particulates, not vapors or gasses. Therefore <u>biological safety cabinets are not suitable for toxics or volatiles</u>.

A. MAINTENANCE

Maintenance and performance evaluations will be done annually (by contract with ENV Services Inc.) on all Class II biological safety cabinets located in the Department of Anatomical Pathology. All maintenance records will be kept in each department. Each Biological Safety Cabinet is disinfected daily. Note: Contractor performing annual maintenance is Sercom Scientific Equipment Repair Company. Phone number: 877-5sercom.

B. TRAINING

Each year, all laboratory personnel will review safety manual and the proper use of a Class II biological safety cabinet.

C. TYPES OF BIOLOGICAL SAFETY CABINETS

1. CLASS I

- Is a modification of a chemical fume hood.
- Airflow is inward across the work surface.
- No recirculation of air.
- No product protection is afforded, cross contamination may result from contaminated air flowing over the work area.

2. CLASS II

- Must meet National Sanitation Foundation (NSF) Standard number 49 in order to be classified as a Class II Biological Safety Cabinet.
- Provides more protection for user and product.
- Proper airflow pressure is critical to preventing any possible contamination.
- Uses clean vertical airflow with auxiliary air entering from the front of the cabinet.
- Vertical laminar airflow and front access opening are common to all classes of Class II cabinets. However, airflow patterns, airflow velocities, Hepa filter positions, ventilation rates, and exhaust methods vary in different Class II cabinets.

a. Four Types of Class II Cabinets

Type A
Type B1
Type B2
Type B3

3. CLASS III

- Is a closed front, self contained, ventilated cabinet that is operated under negative pressure in relation to the laboratory environment.
- Provides absolute isolation and containment of infectious materials.
- Work inside the cabinet is performed through arm-length rubber gloves.
- Provides a very high level of protection and security for the operator.

Presently the Department of Anatomical Pathology at University Hospital has only Class II biological safety cabinets. Therefore any further discussion will focus on this class of biological safety cabinets.

D. USE OF CLASS II BIOLOGICAL SAFETY CABINETS

It is essential that owners and users of Class II biological safety cabinets have a working knowledge of such equipment Only Class II biological safety cabinets listed by NSF, meeting standard #49 should be purchased. Every NSF listed Class II cabinet is subjected to a battery of tests by manufacturers to verify that design specifications and standards have been met. Each cabinet must also successfully pass a microbiological challenge test, airflow velocity, and flow parameters. Certification of a safety cabinet is essential. Without proper working equipment, safety cannot be assured. NSF Standard #49 states that Class II cabinets should be certified prior to use (after proper installation), at least annually, whenever Hepa filters are changes, when maintenance repairs are necessary, and when cabinets are relocated.

Written by: Heather Currens, SCT (ASCP), 8/1/2008

Revised by: Gail Zander, CT (ASCP), 8/18/2012

References: GEN.76600

Approval of Procedure:

Medical Director Signature: M. Scott Zein, MD

Date: 8/29/12

ANNUAL SIGNATURE REVIEW

PROCEDURE TITLE: CHEMICAL FUME HOODS/BIOLOGICAL SAFETY CABINETS

Signature on this page insures that each procedure has been reviewed annually. Any changes will be reflected on the procedure by the revised date. GEN.73200

MEDICAL DIRECTOR	SIGNATURE	DATE
M. Scott Lucia, MD	M. Scott Lucia	8/29/12
	M. Scott Lucia	3/24/14