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Biological Safety Cabinet Policy

Biological and Chemical Safety Advisory Committee
University of Texas Southwestern Medical Center at Dallas

INTRODUCTION

Biological safety cabinets (BSC) are primary devices intended to contain and minimize exposure when working with biohazardous materials. They are often referred to as tissue culture hoods. BSCs are designed to protect laboratory personnel against exposure during experimental procedures (personnel protection), as well as protect experimental materials from contamination (product protection). They are recommended for manipulations of infectious agents that are likely to create aerosols (i.e., aspirating with a syringe, removing caps from tubes after centrifugation, vortexing of open tubes, sonication, etc.). Additionally, they are also used when manipulating human blood and body fluids, generating high concentrations or large volumes of infectious agents, and when working with and maintaining sterile cell and tissue cultures.

ROLES AND RESPONSIBILITIES

Principal Investigator

- Adhere to BSC policy
- Notify EH&S dept. at (x8-2250) of recertification as well as any movement of BSC with Biological Safety Cabinet Movement/Installation form on EH&S website

Physical Plant

- Proper movement and installation of BSCs

Supervisors

- Ensure workers are trained in BSCs procedure for normal as well as in emergency use.

Environmental Health and Safety

- Maintain Biological Safety Cabinet database.
- Supply additional safety information and third party service information
- Provide periodic audits to ensure compliance with policies

CERTIFICATION

Certification of BSCs by third party firms shall be the responsibility of the user and it shall be done under the following circumstances:

- Annually;
- If a cabinet has been moved;
- If a cabinet is suspected of functioning improperly

A list of vendors that do biosafety cabinet certification is listed on the EH&S website at:

http://www.utsouthwestern.edu//utsw/cda/dept145569/files/341525.html

USE REQUIREMENTS

BSCs shall be used in accordance with the following minimum requirements:

1. Obtain approval from the EH&S – Radiation Safety office at 214-648-2250 prior to using radioactive materials within the cabinet
2. Keep rear exhaust and front air intake grilles unobstructed so as not to hamper proper airflow into and within the cabinet;
3. Do not store boxes or other materials on top of the cabinet;
4. Turn off the ultraviolet (UV) light while working in the laboratory;
5. Minimize movement in and around the hood; and
6. Use proper personal protective equipment to prevent product and user contamination.

TYPES OF BIOLOGICAL SAFETY CABINETS

Three general classes of cabinets are defined; class I, open-front air inflow cabinet; class II, several subtypes of open-front vertical airflow cabinets (very common); and class III, totally enclosed, gas-tight ventilated cabinets with work operations conducted through fixed, attached rubber gloves. All Cabinets utilize HEPA filters. HEPA or High efficient Particulate Air filters have 99.97% efficiency for 0.3 micron-sized particles. Class I II and III types and subtypes cabinets are described below as well as on the links below.
http://www.cdc.gov/od/ohs/biosfty/bsc/bsc.htm

http://www.utsouthwestern.edu//vgn/images/portal/cit_56417/28/13/290032Ventilated_Hoods_and_Cabinets.pdf

Class I:

Good protection for the operator, but no product protection, is provided with these cabinets. Air flow, at a minimum inward face velocity of 75 linear feet per minute (lfpm), is directed through the front opening, across the work area and out through the HEPA filter on top. This cabinet is conventionally used with a full width open front, or can be used with an attached armhole front panel with or without attached rubber gloves. Although class I cabinets are simple and economical, and radioisotopes and some toxic chemicals can be used (if exhaust is ducted to the outside), filtered air is not provided over the work area. These cabinets do not protect your materials from contaminants introduced from the environment or the operator.

Class II:

Unlike class I cabinets, class II cabinets afford protection for the operator and the work performed. The capacity to protect materials within the cabinet is provided by the flow of HEPA-filtered air over the work surface. There are four subtypes of Class II cabinets based on the construction, inflow air velocities, and the exhaust systems. These cabinets can be used to manipulate low to moderate risk agents.

Class IIA: Air, at a face velocity of 75 lfpm, is drawn into the front grille of the cabinet away from the work surface. The air is directed through a HEPA filter and downward over the work area. As the air approaches the work surface, the blower draws part of the air through the front grille and the remainder through the rear grille. Approximately 70% of the air is recirculated to the work zone through the supply HEPA filter, and about 30% is exhausted to the room through another HEPA filter. This cabinet is unsuitable for work that involves radioactive materials and toxic chemicals because of the buildup of vapors in the air recirculated within the cabinet and out into the laboratory.

Class IIB1: As with the class IIA cabinet inflow air (face velocity of 100 lfpm) is ultimately forced through a HEPA filter and over the work area, where there is a split of downward flowing air. About 70% of the air is directed through a HEPA filter to the outside (must be hard-ducted, preferably with its own exhaust system), whereas 30% is drawn through the front grille and recirculated. Minute amounts of toxic chemicals and trace amounts of radioisotopes can be used within the hood, although activities should be conducted toward the rear of the cabinet.

Class IIB2: This cabinet is a total exhaust cabinet; no air is circulated within it. A supply blower draws in room air or outside air at the top of cabinet, through a HEPA filter and down into the work area. Additional room air is drawn through the front grilles at a face velocity of 100 lfpm. The air discharged from this cabinet must be 100% exhausted outside through a HEPA filter in a dedicated hard duct. Small quantities of toxic chemicals and radioisotopes can be used within the hood. The exhaust of a large volume of conditioned room air makes this cabinet very expensive to operate. Additionally, the cabinet must be running continuously so as not to interfere with room exhaust. Should building or cabinet exhaust fail, the blower motors should be turned off to prevent a back flow of pressurized air from the cabinet work area into the laboratory.

Class IIB3: This is a combination A/B cabinet with a face velocity of 100 lfpm. This cabinet can be used as a class A cabinet where exhaust air is recirculated in the laboratory. Alternatively, it can be used as a class IIB cabinet and exhaust air vented to the outside with a thimble unit connected to the duct. Biologically contaminated ducts and plenums are under negative pressure to the room and exhaust air. Approximately

70% of the air is exhausted, whereas 30% is recirculated within the cabinet. Minute quantities of toxic chemicals and trace amounts of radioisotopes can be used.

Class III:

The Class III Biological Safety Cabinet is a totally enclosed, ventilated cabinet of gas-

tight construction and offers the highest degree of personnel and environmental protection from infectious aerosols, as well as protection of research materials from microbiological contaminants. Class III cabinets are most suitable for work with hazardous agents that require Biosafety Level 3 or 4 containment.

All operations in the work area of the cabinet are performed through attached arm length rubber gloves or half-suits. The Class III cabinet is operated under negative pressure. Supply air is HEPA-filtered and the cabinet exhaust air is filtered through two HEPA filters in series, or HEPA filtration followed by incineration, before discharge outside of the facility.

SOME OTHER EQUIPMENT WITH HEPA FILTERS

Clean Benches:

Clean Benches direct HEPA-filtered air horizontally over the work area to protect research materials from contamination. Applications for clean benches include media plate preparation, electronics inspection, medical device assembly and pharmacy drug preparation. Because they do not provide protection to the user, they must not be used in with biohazardous material, hazardous chemicals, or radionuclides.

Cage Change Stations:

Some rooms in the ARC animal housing facilities have cage change stations that are used for protecting the animals from pathogens and limiting exposure of personnel to allergens. Those units are not designed as biosafety cabinets or fume hoods. They are labeled with signs stating “Do not use with Hazardous Chemicals or Infectious Biological Agents”.

ULTRAVIOLET LIGHTS

Ultraviolet lights are a common accessory of many BSCs. These lamps are regarded as biocidal devices, "protecting" the operator from exposure to infectious agents and experimental materials from contamination. However, the actual effectiveness of UV light in providing this "sterile" environment has been questioned. Additionally, there are potential occupational hazards that carry significant risks (e.g., serious eye and skin injury) associated with the use and misuse of these lamps. Ultraviolet lamps must be periodically tested to ensure that the energy output is adequate to kill microorganisms. The radiation output should be at least 40 microwatts/ cm2 at 254 nm when measured with a UV flux meter placed in the center of the work surface. The output performance of the lamps is adversely affected by dust accumulating on the surface of the lamps (UV light is unable to penetrate through dust or other materials), and microorganisms adhering to floating dust particles or other fixed objects are also protected and unaffected by UV illumination. Ultraviolet exposure damaging to the eyes and skin exists well after the output of the lamps has dropped below the biocidal level. The effective life spans of the lamps are relatively short and the bulbs are expensive to replace. As a result, Environmental Health & Safety dissuades operators from using UV lights to maintain a clean working environment. A significantly more effective and recommended strategy to reduce or eliminate contamination utilizes well-practiced microbiological procedures, good aseptic techniques, operational procedures outlined in this document, and thorough decontamination procedures before and after BSC use.

FOR ADDITIONAL INFORMATION

- Contact Environmental Health and Safety at 214-648-2250.