



Biosafety Cabinet Manual

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BIOSAFETY CABINET PROGRAM

This document outlines the methods by which EH&S will implement the FIU Biosafety Cabinet Program for certification, inspection, maintenance, and relocation of Biosafety Cabinets as recommended by the Centers for Disease Control (CDC), National Institutes of Health (NIH), and the US Department of Health and Human Services (HHS).

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The Biosafety Officer is responsible for assuring this program meets the compliance requirements of the agencies listed above. The following individual is designated to fulfill this responsibility:

Tamece Knowles
Employees name or title

348-3387
Telephone #

BIOSAFETY CABINET PROGRAM

Biological Safety Cabinets (BSC) are primary barriers used to prevent exposure to or contamination of biohazardous or infectious agents. A BSC surrounds the immediate area where work is being done, but it does not assure that some aerosols may not escape.

Classifications

There are four classes of BSCs: Class I, Class II-Type A, Class II-Type B, and Class III. All four classes are suitable for work with biohazardous materials in BSL 1 to BSL 3. The Class III BSC is required for BSL 4 work. The following provides a brief overview of the types of BSCs available for use in laboratories. See Appendix A for guidelines on how to select the appropriate BSC. A more thorough explanation for usage and maintenance can be found at the NIH website: <http://www.niehs.nih.gov/odhsb/biosafe/bsc/bsc.htm>.

Class I

The Class I BSC functions to protect the user and the environment, but not the experiment. Therefore it accommodates experiments using equipment such as sonicators, shielded centrifuges, blenders, and mixers. This cabinet is a partial containment unit. Sudden withdrawal of hands may compromise the airflow and may expose the user to aerosols

Class II

The Class II BSC is a front opening cabinet with inward air flow to protect personnel, the work, and for environmental protection. These are more commonly referred to as laminar air flow hoods. There are two types of Class II BSCs, A and B, that differ principally as to vertical dimensions of the front opening, proportion of air recirculated, velocity of inflow air, manner of exhaust discharge, and whether contaminated air plenums are under positive pressure.

Due to the high percentage of air recirculation, Type A BSCs are restricted to work with BSL level 1 to 3 agents in the absence of volatile or toxic chemicals and radionuclides. The type B cabinets allow work with toxic chemicals and radionuclides. The type B BSCs are further sub-typed to types B1, B2, and B3.

Class III

The Class III BSC has enclosed ventilated cabinets which offer the highest degree of personnel and environmental protection. In addition, the experiment is protected because manipulations of cultures are performed through attached rubber gloves.

The Class III BSC can be compromised by punctures of the gloves or the use of highly volatile materials that contribute to the decline of the negative pressure barrier. Flammable gas should not be piped to these units.

Laminar Flow Hoods

Laminar flow clean benches are not BSCs. They discharge HEPA-filtered air across the work surface and toward the user. This type of engineering control only protects the product. They can be used in dust-free assembly of activities for items such as electronics

and sterile equipment. **These benches should never be used when handling cell cultures or infectious agents.**

CERTIFICATION

Recommendations and requirements for biosafety cabinet certification come from a variety of sources. All manufacturers and the National Sanitation Foundation (NSF) recommend field certification. The Centers for Disease Control (CDC) and the National Institute of Health (NIH) state that it is imperative that Class I and II biosafety cabinets be tested and certified; and NIH funded grants require cabinet certification. In addition, proper maintenance, including certification, of biosafety cabinets falls under the Occupational Safety and Health Administration (OSHA) General Duty Clause.

As part of a good quality control program and to assure that the BSC is working properly, all BSCs must be inspected and certified under the following circumstances:

- When it is newly installed
- After the filter has been replaced or the motor has been changed
- After being moved (even if moved within the same room)
- At least annually

Scheduling

The Biosafety Officer is responsible for contracting the services of an authorized certification company, preparing an annual certification schedule, and forwarding the schedule to lab managers and PIs.

Preparation

Lab managers and PIs are responsible for preparing the biosafety cabinets/laminar flow hood for certification and providing access to the area according to the certification schedule. Before the certifying technician can begin testing the cabinet, the following tasks must be completed:

- Removed all materials and equipment from the cabinet
- Decontaminate the cabinet work surface, interior walls, and grill

Costs

The Department of Environmental Health & Safety assumes the responsibility for the annual certification cost for biosafety cabinets/laminar flow hoods. Individual departments are responsible for any costs associated with replacement parts or any other corrective actions required to bring the cabinet/hood up to standard. Departments are also responsible for certification costs resulting from relocating cabinets, replacement of filters or any other repairs/maintenance operations requiring recertification beyond the annual scheduled certification.

Certificates

The certification contractor is responsible for posting certification documents on the outside of each cabinet after completion of certification, and submitting written certification reports to the Biosafety Office the day of each certification. The Biosafety Office shall maintain certification reports on file for 3 years.

Inspections

Biosafety cabinets and laminar flow hoods are inspected during lab safety inspections to assure certification documents are posted and current. BSCs must be clearly labeled with the class and type, the date of the last performance test, the name of the person performing the test, the company name, and a certification of performance. All personnel working with BSCs should be appropriately trained in the use of the cabinets to assure proper handling.

Assistance

To schedule repairs/maintenance, the lab manager /PI should contact the Biosafety Office. The Biosafety Office is responsible for obtaining and submitting quotes of the required work for approval. Certain repairs/maintenance will require recertification of the equipment.

INSTALLATION, RELOCATION, OR REMOVAL

PIs must receive approval from the Biosafety Officer **PRIOR** to installation, relocation, or removal of biosafety cabinets/laminar flow hoods. Complete the attached approval form and fax to the Biosafety Officer at 348-3574.

BIOSAFETY CABINET SAFE WORK PRACTICES

- The BSC should be on at all times while in use.
- Before using the BSC, turn it on and let it purge the air for at least 5 minutes. This will remove any suspended particles in the cabinet
- Keep the UV light off at all times when in use, as it can cause eye and skin damage.
- Place all necessary items inside the cabinet before beginning work. There should not be any clutter inside that may impede the flow of air.
- A small waste container should be placed inside for any disposable materials.
- No materials should be placed on the air-intake valves to avoid impeding the air flow.
- While working inside the BSC, always wear lab coats and gloves
- Try to limit arm motions and quick, rapid movements inside the cabinet. These motions may cause a disturbance in the air flow pattern letting aerosols escape and causing possible exposure.
- Do not use a Bunsen burner inside the BSC as this will interfere with the air flow inside the BSC. If a procedure calls for the use of a flame, use a burner with a pilot light and place it to the rear of the work space where any type of air turbulence will have a minimal effect.
- Do not place large objects such as a centrifuge inside the BSC. It may impede the air flow.
- If an accident occurs during a procedure, immediately clean the area with appropriate disinfectant solution and dispose of the used clean-up materials properly. Leave the BSC on during this time to minimize exposure to aerosols.
- It is important to remember that a BSC is not the same as a chemical fume hood and should not be used for both purposes.

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- Once the work is completed, secure waste containers and organize materials used.
- Allow the cabinet to operate for five more minutes to finish purging the air inside.
- Remove all materials from inside the cabinet, decontaminate the work surface, and turn on the UV light.
- When cleaning/decontaminating the BSC, the work surface, interior walls, and the interior surface of the window should be wiped with 70% ethanol
- Apply proper sterilization/disinfection techniques. The UV light does provide for some sterilization of the environment when work is finished, but it should not be used alone to assume that sterilization is complete.
- When not in use the BSC should not be used for storage of materials.

WASTE MANAGEMENT

HEPA filters are used in biosafety cabinets, laminar flow hoods, and other air handling equipment to provide clean work environments. When a HEPA filter is changed, proper disposal of the used filter is always a concern.

HEPA filters may only filter room air. In these cases, the filters may contain only normal particulates found in the air. These filters are typically not viewed as being contaminated and may be disposed as non-regulated waste.

Biological

HEPA filters used for biohazard work are considered to be contaminated with whatever biological agents are used in the biosafety cabinet. OSHA Blood-borne Pathogen Standard states that equipment which may be contaminated with blood or other potentially infectious materials shall be decontaminated as necessary. Formaldehyde gas contamination is the commonly accepted method for neutralizing biological hazards in a Class II biosafety cabinet.

Most HEPA filters that have been decontaminated with formaldehyde are viewed as non-hazardous and are disposed as non-regulated waste. Some biological agents are resistant to formaldehyde treatment and may need special handling.

Chemical

HEPA filters used in biological cabinets for chemo (anti-tumor) drug preparation pose a chemical hazard. Characteristics of chemo drugs which could be hazardous are genotoxicity, carcinogenicity, teratogenicity, and toxic manifestation. Chemo drugs can pose a variety of acute and chronic occupational exposure hazards. The current document is published in OSHA Technical Manual, Section VI, Chapter 2.

When a HEPA filter is changed in a biosafety cabinet used for chemo drugs, the old filter is considered as hazardous drug waste. It should be bagged in plastic, labeled, and disposed as solid hazardous drug waste. Disposal of hazardous drug waste can be regulated by the EPA, state, and local waste laws depending on the drug used. Contact EH&S for proper disposal.

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Radioactive

Radioactive solutions used in biosafety cabinets could give off vapors which would pose a Beta and even Gamma radiation hazard. Since a HEPA filter does not provide protection against vapors, it is expected that the radiation vapors will leave exit the biosafety cabinet and the building through the ventilation system. Prior to accessing and changing a HEPA filter, the Radiation Safety Officer should assess and document that the biosafety cabinet is free of radiation hazards.

The HEPA filter would be decontamination as biological or chemical waste, prior to removal and disposed of as non-hazardous waste unless otherwise regulated. If HEPA filters do contain radioactive waste, the Radiation Safety Officer shall advise on proper procedures.

TRAINING

Lab managers and PIs are responsible for ensuring that all lab personnel assigned to work in biosafety cabinets have received the proper training. "Safe Use of Biological Safety Cabinets" is available through the EH&S "Online Anytime" Safety Training Program.

APPENDIX

A. BIOSAFETY CABINETS GUIDELINE TABLES

**B. APPROVAL FOR INSTALLATION, RELOCATION, OR REMOVAL
FORM**

APPENDIX A

Table 1. Selection of a Safety Cabinet through Risk Assessment				
Biological Risk Assessed	Protection Provided			BSC Class
	Personal	Product	Environmental	
BSL 1-3	Yes	No	Yes	I
BSL 1-3	Yes	Yes	Yes	II (A1, A2, B1, B2
BSL-4	Yes	Yes	Yes	III II – When used in suitroom with suit

Table 2. Comparison of Biosafety Cabinet Characteristics				
BSC Class	Face Velocity	Airflow Pattern	Applications	
			Nonvolatile Toxic Chemicals and Radionuclides	Volatile Toxic Chemicals and Radionuclides
I	75	In at front through HEPA to the outside or into the room through HEPA	Yes	When exhausted to outdoors 1,2
II, A1	75	70% recirculated to the cabinet work area through HEPA; 30% balance can be exhausted through HEPA back into the room or to outside through a canopy unit	Yes (minute amounts)	No
II, A2	100	30% recirculated, 70% exhausted. Exhaust cabinet air must pass through a dedicated duct to the outside through a HEPA filter	Yes	Yes (minute amounts) 1,2
II, B1	100	No recirculation; total exhaust to the outside through a HEPA filter	Yes	Yes (small amounts) 1,2
II, B2	100	Similar to II, A1, but has 100 lfpm intake air velocity and plenums are under negative pressure to room; exhaust air can be ducted to outside through a canopy unit	Yes	When exhausted to outdoors (minute amounts) 1,2
III	N/A	Supply air is HEPA filtered. Exhaust air passes through two	Yes	Yes (small amounts)

		HEPA filters in series and is exhausted to the outside via a hard connection		
1. Installation may require a special duct to the outside, an in-line charcoal filter, and a spark proof (explosion proof) motor and other electrical components in the cabinet. Discharge of a Class I or Class II, Type A2 cabinet into a room should not occur if volatile chemicals are used.				
2. In no instance should the chemical concentration approach the lower explosion limits of the compounds.				

Reference:

CDC/NIH Primary Containment for Biohazards: Selection, Installation, and Use of Biological Safety Cabinets

Installation, Relocation, or Removal of Biosafety Cabinets

Please complete and submit the completed form to the Biosafety Officer in AHC4 121 for approval **PRIOR** to installation, relocation, or removal.

NAME OF P.I.:		DEPT.	
P.I.'S TELEPHONE #		FAX:	EMAIL:

Installation Approval		
Location of BSC: _____ Installation Date: _____		
Number of BSC(s) to be installed: _____		BSC Type(s): _____
Manufacturer: _____	Model No: _____	Serial No. _____
Work to be performed:		

Relocation Approval		
Initial location of BSC: _____ Relocation Date: _____ Final location: _____		
Number of BSC(s) to be relocated: _____		BSC Type(s): _____
Manufacturer: _____	Model No: _____	Serial No. _____
Has BSC been decontaminated? Yes No* Decontamination Date: _____		
*If no, contact the Biosafety Officer to schedule decontamination		

Removal Approval		
Location of BSC: _____ Removal Date: _____		
Number of BSC(s) to be removed: _____		BSC Type(s): _____
Manufacturer: _____	Model No: _____	Serial No. _____
Has BSC been decontaminated? Yes No* Decontamination Date: _____		
*If no, contact the Biosafety Officer to schedule decontamination		
Reason for removal:		

PI Signature: _____ **Date:** _____

EH&S Internal Use

Approved By:	Date Received:
Approval No.	Date Returned