Biological Safety Cabinet Guidelines

2017

University of Saskatchewan

Table of Contents

1 Introduction

Biological safety cabinets (BSCs) provide effective primary containment for work with infectious materials or toxins when they are properly maintained and used in conjunction with good microbiological laboratory practices. The various classes and types of BSCs operate under the same basic principles. Personnel protection is provided through a continuous stream of inward air, known as inflow, which helps prevent aerosols from escaping through the front opening. The air that is exhausted into the surrounding containment zone or directly to the outside atmosphere is passed through high efficiency particulate air (HEPA) filters to protect the environment.

Class II, A2 BSCs, the most common type of cabinet used on campus, provide protection for the individual and environment, and also protection for the materials being worked within the cabinet. Refer to **Figure 1**.

The elements outlined below for the proper use of a BSC should be incorporated into the applicable standard operating procedures that are to be followed by facility personnel.

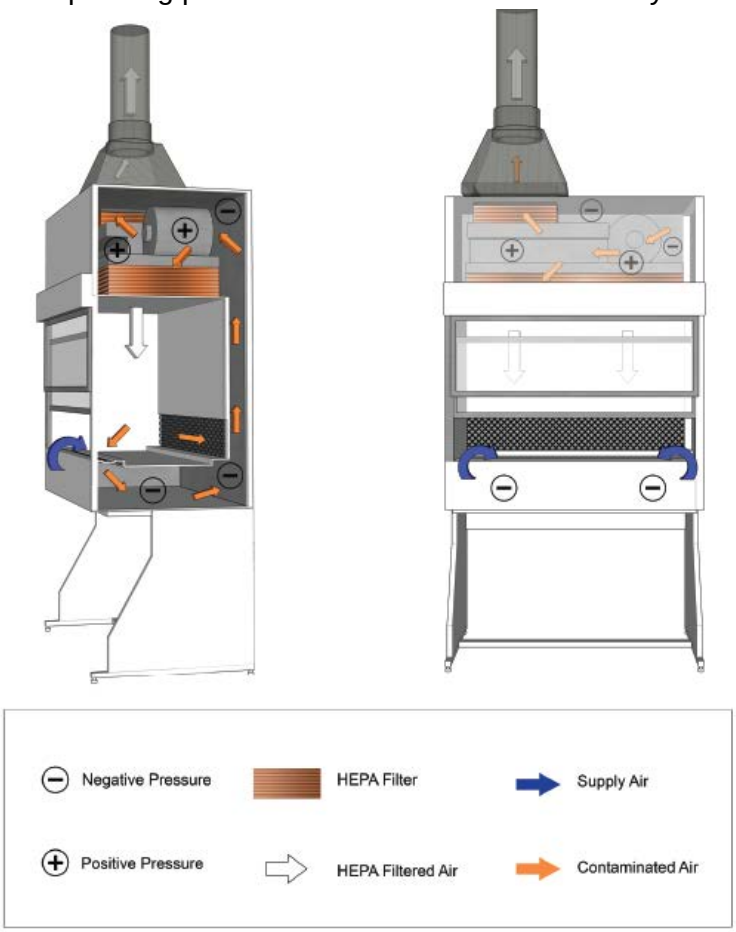

Figure 1: Illustration of a Class II A2 Biological safety Cabinet (BSC)

The physical containment, operational practice, and performance and verification testing requirements relating to BSCs in containment zones that are regulated by the Public Health Agency of Canada (PHAC) and the Canadian Food Inspection Agency (CFIA) are described in matrices 3.7, 4.6, and 5.1 of the *Canadian Biosafety Standard (CBS)*, 2nd Edition.

For further information or assistance with BSCs, please contact a member of the Biosafety Group:

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2 BSC Start-Up Considerations

During the set-up of your BSC, employ the following safety parameters:

- Ensure the BSC has been tested and certified in the last year. A certification sticker must be visible on the front of the cabinet.
- Ensure that the BSC sash is at the appropriate height. Adjust stool height so that an individual working at the BSC has their underarms level with the bottom of the sash.
- Check the pressure gauges to ensure that readings are within the acceptable range as defined by the manufacturer.
- If present, test the airflow alarm and ensure it is switched to the “on” position.
- Confirm inward airflow by holding a tissue at the middle of the edge of the sash to ensure that it is drawing to the interior of the BSC.
- Disinfect the interior surfaces with a disinfectant that is effective against the infectious materials and toxins in use the specific laboratory.
- If a corrosive disinfectant (i.e. bleach) must be used, the surface must be rinsed with water after disinfection.
- Assemble all materials required for manipulation of the biological materials and load them into the BSC.
- Care must be taken not to overcrowd or block the front or rear grilles to ensure that the appropriate airflow patterns are not compromised.
- When there is significant potential for splashes to occur during manipulations of infectious biological materials, the work area should be lined with a plastic-backed absorbent pad.
- Place aerosol-generating equipment (e.g., mixers, vortex) towards the back of the BSC, without blocking the rear grille.
- After loading material in the BSC, allow sufficient time for the airflow to stabilize before initiating work.

3 Working in the BSC

When working with a BSC, employ the following safety parameters:

- Perform operations as far to the rear of the work area as possible.
- Ensure that elbows and arms do not rest on the grille or work surface.
- Avoid excessive movement of hands and arms through the front opening, which can disrupt the air curtain.
- Arms should enter/exit the BSC slowly and perpendicular to the front opening.
- Keep a bottle of an appropriate disinfectant in the BSC while work is performed to avoid having to move hands outside of the BSC.
- Segregate non-contaminated (“clean”) items from contaminated (“dirty”) items.
- Work should always flow from “clean” to “dirty” areas. Refer to **Figure 2**.

Figure 2: Proper setup when working in a BSC.

- Material should be discarded in a waste container located towards the rear of the cabinet workspace.
- **Do not** discard materials in containers **outside** of the cabinet.
- Decontaminate the surface of all objects in the BSC in the event of a spill.
- The work area should be decontaminated while the BSC is still in operation.
- Sustained open flames in the BSC are prohibited (e.g. Bunsen burners, ethanol burners, etc.). On-demand open flames (e.g., touch-plate micro burners) may be used as the duration of time for which the flame is produced can be controlled and limited. Non-flame alternatives (e.g. micro incinerators, sterile disposable inoculation loops) should be used whenever possible.
- Natural gas and propane are prohibited from use in a BSC and any gas installed within the BSC is prohibited.
- Work in a BSC should only be conducted by one person at a time.
- Equipment creating air movement (e.g. vacuum pumps, centrifuges) may affect the integrity of the airflow and should not be used within the BSC.
- Windows that open should be kept closed when the BSC is in use.

4 Completion of Work in the BSC

When completing work in a BSC, employ the following safety parameters:

- Allow sufficient time for the air in the BSC to pass through the filter before disrupting the air curtain by removing hands or unloading material from the BSC.
- Close/cover all containers.
- Surface decontaminate items before removing them from the BSC.
- Disinfect the interior surfaces of the BSC, including sides, back, and interior of the glass, with a disinfectant effective against the biological materials used.
- If a corrosive disinfectant (i.e. bleach) is used, the surface should be rinsed with water after disinfection to avoid corrosion of the stainless steel surfaces.
- Routinely remove the work surface and disinfect the tray beneath it.
- Routinely wipe the surface of the lights within the BSC with a 70% ethanol solution.

5 Ultraviolet Lights

Use of UV irradiation germicidal lamps in a BSC is not recommended as a primary disinfectant.

Personnel wishing to use UV irradiation in BSCs should receive training on the safe work practices required and the hazards of UV radiation beforehand, which includes the following:

- UV irradiation of the work area should only be used as a secondary method of disinfection of a BSC.
- Never rely on UV irradiation alone to disinfect a contaminated work area.
- UV irradiation is ineffective if a microorganism is protected by dust, dirt, organic matter, or does not have DNA (i.e. RNA viruses).
- A liquid chemical disinfectant must be the primary method of cleaning and disinfecting the interior of a BSC.
- UV irradiation does not penetrate into cracks or through the grilles of a BSC.
- UV irradiation can cause deterioration of various materials, including certain plastic and tubing.
- Never touch a UV bulb with bare hands as the natural oils from hands may leave a fingerprint and create dead space on the bulb's surface.
- UV bulbs should be cleaned frequently with an appropriate disinfectant.

The UV lamp should be routinely tested with a UV meter to ensure that the proper intensity (40 $\mu W/cm^2$) is being delivered at the appropriate wavelength (254 nm) in the centre of the work area.

6 Testing and Certification

BSCs must be certified to manufacturer's specifications or NSF49 standards upon initial installation, annually, and after any repairs, modifications, or relocation. External service providers at the University provide this service. Contact the Biosafety Group for further information.

7 Other Resources

- *Canadian Biosafety Standards (2nd. Ed., 2015)*
- *Canadian Biosafety Handbook (2nd Ed., 2016)*
- *CDC Biosafety in Microbiological and Biomedical Laboratories (5th Ed., 2009)*