

HS328

Information Sheet - Biological Safety Cabinets (BSCs) - guide for use



UNSW
AUSTRALIA

BSCs must be selected, installed and used in accordance with AS 2252 (parts 1, 2, and 4) and AS/NZS 2243 (Safety in Laboratories, part 3, microbiological safety & containment).

Common mistakes workers make when working in BSCs:

1. Selecting the wrong cabinet
2. Assuming that the previous worker decontaminated the cabinet after use
3. Overfilling the cabinet with work materials
4. Placing items in the front grill
5. Working too close to the front edge/front grill
6. Moving arms in & out of the cabinet
7. Discarding materials to a waste container outside the cabinet and not into one inside the cabinet
8. Not decontaminating materials before withdrawing them from the cabinet
9. Relying on the UV light to decontaminate the interior of the cabinet
10. Using Bunsen burners, vortexes & centrifuges inside the cabinet
11. Using volatile chemicals & radionucleotides inside the cabinet

BSCs are all about AIRFLOW, and that the interior compartment is potentially contaminated.

The following, from the Canadian Biosafety Standards and Guidelines (1st edition), has been modified.

General

BSCs provide effective primary containment for work with infectious material or toxins when they are properly maintained and used in conjunction with good laboratory work practices. Worker protection is provided through a continuous stream of inward air which helps prevent aerosols from escaping through the front opening. The exhaust air, which is exhausted into the containment facility, is HEPA-filtered to protect the environment. Some classes of BSCs also offer product protection by using HEPA-filtered downflow to flush the cabinet interior of airborne contaminants and to prevent unfiltered inflow air from entering the work area.

No items should be stored in a cabinet. Cabinets must be closed when not in use.

It is not appropriate to use volatile or hazardous chemicals in a BSC.

Class I (AS 2252.1)

Class I BSCs provide protection to workers and the containment facility environment and can be used to enclose aerosol-producing equipment (e.g., fermenters, homogenizers) or for procedures where product protection is not a concern (e.g., cage changing). Room air is drawn into the cabinet through the front opening, moves directly across the workspace, and is then discharged from the BSC through

a HEPA filter, back into the containment facility. BSCs that are used as cage changing stations may require more frequent filter replacement, due to filter loading.

Class II (AS 2252.2)

In addition to providing protection to workers and the containment facility environment, Class II BSCs also provide work (or product) protection. Room air is drawn into the cabinet through the front opening, is drawn through HEPA filters either back into the cabinet or out into the containment facility.

Class III

Class III BSCs are fully enclosed to provide work protection, and maximum worker and environment protection. They are designed for work with high risk pathogens. All cabinet penetrations are airtight and the BSC is kept under negative pressure by a dedicated exhaust system. Manipulations are performed through attached heavy-duty long sleeved gloves, which prevent direct contact with biological material.

Installation (AS 2252.4)

Movements in the vicinity of BSCs can easily counteract the basic safety feature of the cabinets, which is the generation and maintenance of an air curtain at the front aperture. Changes in air movement at the face of the cabinet can be due to situations such as the location of the room air supply/exhaust grilles, opening/closing room doors, people walking behind the operator while using the cabinet, the operator pushing themselves away from the cabinet (while sitting on a wheeled chair). The following should be considered with respect to the installation of BSCs:

- Adequate clearance should be provided between the exhaust outlet on top of, or the side of, the BSC and any overhead obstructions or adjacent furniture and fittings.
- Adequate clearance should be provided on each side of the BSC to allow access.
- BSCs should not be located directly opposite seated work stations, other BSCs, or chemical fume hoods.
- Flow failure alarms need investigating.
- Supporting BSCs on emergency power will help to ensure containment is maintained during emergency situations.

Testing

BSCs should be tested regularly and at least every 12 months. Following use, and before maintenance and/or testing, the cabinets must be fumigated. Whenever a cabinet has been relocated or has required maintenance, it should be retested before use, as the integrity of the HEPA filters and plenums may have been affected, resulting in the exposure of workers and/or the environment to infectious material and toxins.

The results of the test must be displayed on the front or side of the cabinet. If the cabinet fails the test or is out of date, adequate out-of-service warning signs must be in place and the cabinet must not be used until it has been tested.

Proper use of BSCs

The following requirements for the proper use of a BSC should be incorporated into the applicable SWPs that are to be followed by facility workers.

Start-up

- Ensure that the sash is at the appropriate height. Adjust stool height so that underarms are level with the bottom of the sash.
- Check the pressure gauges to ensure that readings are within the acceptable range.
- 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 drawn in.
- Disinfect the interior surfaces with a disinfectant effective against the infectious material and toxins in use in the laboratory. If a corrosive disinfectant must be used, the surface should be rinsed with water after disinfection.
- Assemble all materials required and load into the BSC. Do not overcrowd the cabinet or block the front or rear grilles. This will help ensure that the appropriate airflow patterns are not compromised.
- When there is significant potential for splatter or splashes to occur during manipulations of infectious material or toxins, it is advisable for operators to include additional eye protection and respiratory protection.
- The work area can be lined with a plastic-backed absorbent pad if there is significant potential for splatter or splashes to occur during manipulations of infectious material or toxins, however, it is important to keep the front and rear air grills completely unblocked.
- It is not advisable to place aerosol generating equipment (e.g., mixers, vortex) in BSC Class II cabinets because the use of these items can generate air movements which interfere with the front air curtain. If used in Class I cabinets, place the equipment towards the back of the cabinet. The Class I cabinet must have been tested with that equipment in place and in operation, and have passed the test.
- After loading material in the BSC, allow sufficient time for the airflow to stabilise before initiating work.

Work in BSC

- Ensure that elbows and arms do not rest on the grille or work surface.
- Perform operations as far to the rear of the work area as possible, without interfering with the rear grille.
- Minimise arm movement and avoid moving hands and arms through the front opening. Such movements disrupt the air curtain at the front of the BSC, which can allow contaminants to enter or escape the cabinet. 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.
- 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.
- At the conclusion of work, and in the event of a spill, decontaminate the surface of all objects before removing them from the BSC. The work area should be decontaminated while the BSC is still in operation.

- Open flames are prohibited in the BSC as they create turbulence, disrupt airflow patterns, and can damage the HEPA filter. Non-flame alternatives (e.g micro-incinerators, or sterile disposable inoculation loops) should be used whenever possible.
- Work in a BSC should only be conducted by one person at a time.

Clean up after work in BSC

- Close/cover all containers.
- Upon completion of work, allow sufficient time for the air in the BSC to pass through the filter before disrupting the air curtain by removing hands and/or unloading material from the BSC.
- Decontaminate the surface of all items before removing them from the BSC.
- Disinfect all the interior surfaces of the BSC, including sides, back, and interior of the glass, with a disinfectant effective against the agents that was used (see AS/NZS2243.3 appendix F). If a corrosive disinfectant 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 ethanol

Use of UV light

The use of UV irradiation germicidal lamps is strongly discouraged due to their limited effectiveness at disinfecting the inside of BSCs compared with the level of risk from UV energy. Workers wishing to use UV irradiation in BSCs should receive training on the safe work practices required and the hazards of UV radiation beforehand, including the following elements:

- The cabinet sash must be fully lowered, or the aperture guard in place for the duration of the UV irradiation
- UV irradiation of the work area should only be considered a secondary method of maintaining the disinfected status of a cabinet. Never rely on UV irradiation alone to disinfect a contaminated work area.
- UV irradiation is ineffective if a microorganism is protected by dust, dirt, or organic matter. A liquid chemical disinfectant should 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.
- If using UV, the lamp should be routinely tested with a UV meter to ensure that the proper intensity (is being delivered at the appropriate wavelength (i.e., 254 nm) in the centre of the work area.
- Exposure to UV radiation can lead to skin and eye damage, and melanoma. UV is a group 1a human carcinogen.