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Revision: 2.0	**Subject:** **Biological Safety Cabinets**	

When properly maintained and used in conjunction with good laboratory techniques, Biological Safety Cabinets (BSCs) provide effective primary containment for work with human and animal pathogens.

The type of BSC determines whether it provides only protection for the operator, or protection for both the operator and the material in use i.e. whether or not it provides an aseptic environment. P

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Canadian Biosafety Standards, 2nd Edition, 2015 (CBS; Public Health Agency of Canada (PHAC) and Canadian Food Inspection Agency (CFIA))

Canadian Biosafety Handbook, 1st Edition, 2016 (CBH; PHAC and CFIA)

National Sanitation Foundation (NSF) Standard No. 49-2010 for the design, manufacture and testing of BSCs (NSF-49)

Clean air benches have HEPA filtered laminar airflow *towards the worker.* They provide a flow of clean air over the product and protect it from contaminants in the environment. A clean air bench provides product protection only. The worker is directly exposed to aerosols and particulates from the work. Clean air benches are not to be used for work with biohazard risk group 2 material, hazardous volatile chemicals (or particulates), or radioisotopes.

HEPA filters can remove at least 99.97% of airborne particles 0.3 µm in diameter. Particles of this size are the most difficult to filter and are thus considered the *most penetrating particle size* (MPPS). *Particles that are larger or smaller* than 0.3 µm are filtered with even higher efficiency. However,
HEPA filters are composed of a mat of randomly arranged fibres. Particles are trapped (stick to a fibre) by one of the following three mechanisms:

1) *Interception,* where particles following a line of flow in the air stream come within one radius of a fibre and adhere to it.
2) *Impaction,* where larger particles are unable to avoid fibres by following the curving contours of the air stream and are forced to embed in one of them directly; this effect increases with diminishing fibre separation and higher air flow velocity.
3) *Diffusion,* an enhancing mechanism is a result of the collision with gas molecules by the smallest particles, especially those below 0.1 µm in diameter, which are thereby impeded and delayed in their path through the filter; this behaviour raises the probability that a particle will be stopped by either of the two mechanisms above; it becomes dominant at lower air flow velocities.

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After loading material in the BSC, allow sufficient time for the air to purge and the airflow to stabilize before initiating work. This will be specified in the manufacturer's instructions, and is generally 3-5 minutes.

Wear protective gloves that cover the cuffs of lab coat sleeves to prevent contaminated air from entering the sleeve. Lab coats (or closed front gowns) with fitted cuffs rather than loose sleeves are recommended.

Perform operations as far to the rear of the work area as reasonable. Ensure that elbows and arms do not rest on the grille or work surface.

Movement of arms into and out of the cabinet can disrupt airflow, which can allow contaminants to enter or escape the BSC. Whenever possible, place all materials needed for a procedure inside the cabinet before starting. Move arms slowly and move straight out of the cabinet perpendicular to the front opening; do not sweep arms across the front of the cabinet. Do not walk quickly in front of a cabinet when someone else is working.

Place supplies, equipment and papers well back from the front of the cabinet, positioned so that air intake or exhaust grills are not obstructed.

Never put anything on the grill at the front opening of the cabinet.

Do not block the air openings/grill at the back of the cabinet.

Segregate non-contaminated ("clean") items from contaminated ("dirty") items. Work should always flow from "clean" to "dirty" areas

Material should be discarded in a

as soon as they occur. Remove and disinfect the grill if contaminated and remember to clean under the grill.

If the spill was relatively large or contained concentrated infectious material then allow the cabinet to sit undisturbed for at least 5 minutes for aerosols to clear before beginning cleanup.

Disinfect or dispose of personal protective equipment appropriately and wash hands.

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.

Work in a BSC should only be conducted by one person at a time (even in a large BSC).

Natural gas and propane should not be used in a BSC; sustained open flames (e.g., Bunsen burner) in BSCs are prohibited. On-demand open flames (e.g., touch-plate microburners) are to be avoided as they create turbulence in the BSC, disrupt airflow patterns, and can damage the HEPA filter (CBS Matrix 4.6).

The HEPA filters in the BSCs remove particulates from air, but they are

If you need to use such material in a BSC, contact the Biosafety Officer for advice.

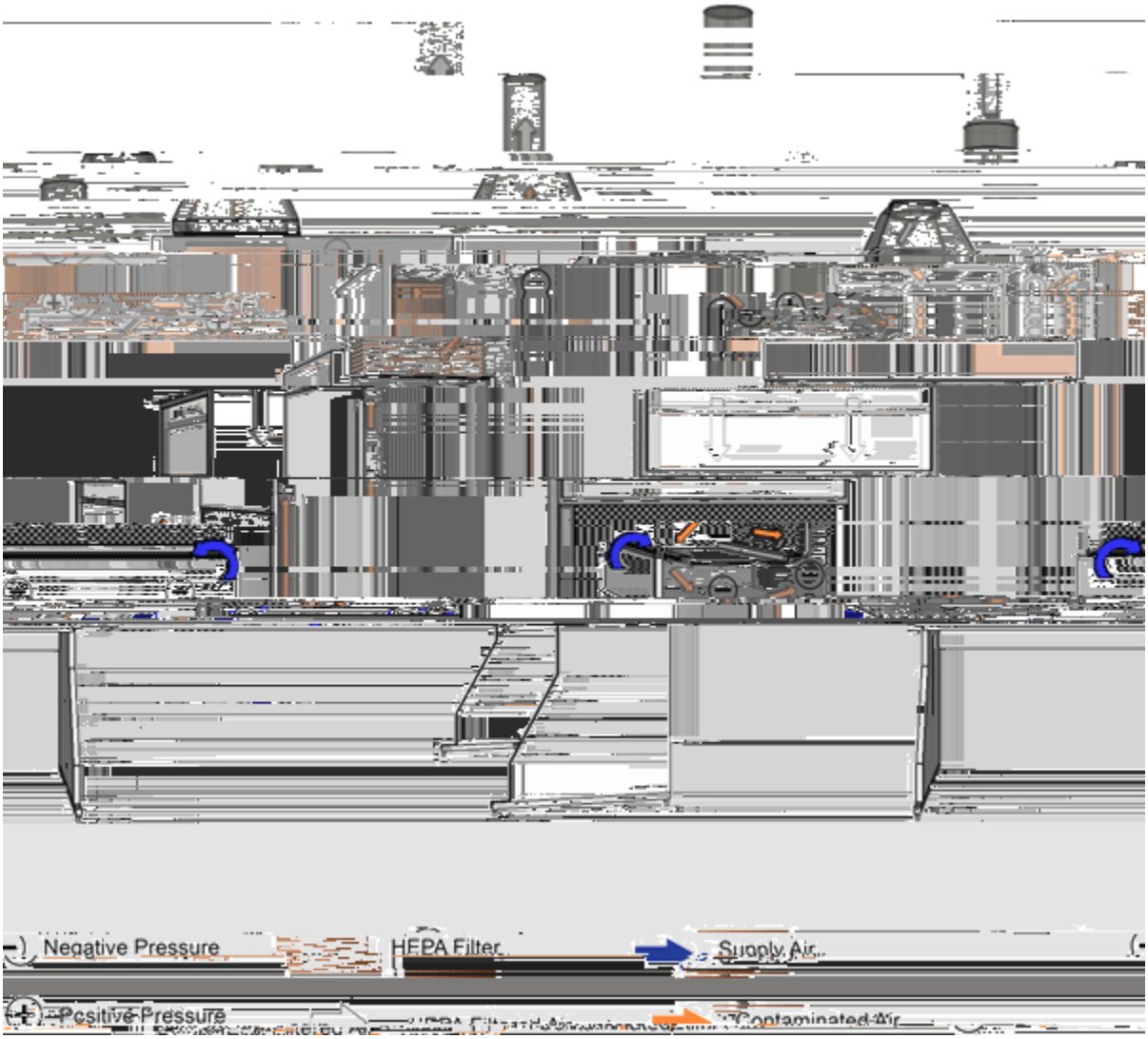
(see section 5.2, Lighting).

- Seal, surface decontaminate and remove any biohazardous material.
- Decontaminate the interior of the BSC.
- Switch off the alarm or the power if the motor is making noise.
- Place a sign on the cabinet to indicate that it is broken and must not be used.
- Contact Environmental Health and Safety for advice and servicing (ext. 32999).

0.38 m/s [75 fpm]	0.51 m/s [100 fpm]	0.51 m/s [100 fpm]	0.51 m/s [100 fpm]
30% of the air is exhausted out of the BSC and 70% of the air is recirculated within the BSC	30% of the air is exhausted out of the BSC and 70% of the air is recirculated within the BSC	>50% of the air is exhausted out of the BSC and <50% of the air is recirculated within the BSC	100% of the air is exhausted out of the BSC
Composed of mixed downflow and inflow from common plenum	Composed of mixed downflow and inflow from common plenum	Inflow air	Drawn from the containment zone or from the outside atmosphere
Recirculated to the containment zone or directly to the outside atmosphere	Recirculated to the containment zone or directly to the outside atmosphere	Exhausted through dedicated exhaust plenum to the outside atmosphere	Exhausted through dedicated exhaust plenum to the outside atmosphere
Can be thimble connected	Can be thimble connected	Hard-ducted	Hard-ducted
Negatively pressured or surrounded by negatively pressured ducts or plenums; plenum may be positively pressured in some models	Negatively pressured or surrounded by negatively pressured ducts or plenums	Negatively pressured or surrounded by negatively pressured ducts or plenums	Negatively pressured or surrounded by negatively pressured ducts or plenums
No	Minute amounts if exhausted through thimble connection	Low levels of volatile toxic chemicals and trace amounts of radionuclides	Yes

Cabinet exhaust may be recirculated into the room or vented to the outside atmosphere through an air gap type (thimble) connection, as shown. Purple shading indicates positively pressured contaminated plenum.

Cabinet exhaust may be recirculated into the room or vented to the outside atmosphere through an air gap type (thimble) connection, as shown. Cabinet shown has a negatively pressured plenum.



Cabinet is vented to the outside atmosphere through a hard-ducted connection, as shown.