C13 Safety Guidelines for Biological Safety Cabinets

1. Background

As laboratories involved in biomedical technology account for a majority of research laboratories at the Science Park, a great number of laboratory personnel are frequently exposing to biological hazards during their works especially when procedures and equipment promoting aerosol formation are involved. The microbiological safety cabinet had its inception in 1909, when the W. K. Mulford Pharmaceutical Co. in Glenolden (PA, USA) designed a ventilated hood to prevent infection with *Mycobacterium tuberculosis* during the preparation of tuberculin.

Aerosol particles are created by any activity that imparts energy into a liquid or semi liquid material, such as shaking, pouring, stirring or dropping liquid on to a surface or into another liquid. Laboratory activities including streaking agar plates, inoculating cell culture flasks with a pipette, using a multichannel pipette to dispense liquid suspensions of infectious agents into microculture plates, homogenizing and vortexing infectious materials, and centrifugation of infectious liquids, or working with animals, can generate infectious aerosols.

Aerosol particles of less than 5 μm in diameter and small droplets of 5 – 100 μm in diameter are not visible to the naked eye. The laboratory worker is generally not aware that such particles are being generated and may be inhaled or may cross-contaminate work surface materials. Biological safety cabinets (BSCs), when properly used, have been shown to be highly effective in reducing laboratory-acquired infections and cross-contaminations of cultures due to aerosol exposures.

2. Introduction

Over the years the basic design of BSCs has undergone several design modifications. A major change was the addition of a high-efficiency particulate air (HEPA) filter to the exhaust system. The HEPA filter traps 99.97% of particles of 0.3 μm in diameter and 99.99% of particles of greater or smaller size. This enables the HEPA filter to effectively trap all known infectious agents and ensure that only microbe-free exhaust air is discharged from the cabinet. A second design modification was to direct HEPA-filtered air over the work surface, providing protection of work surface materials from contamination. This feature is often referred to as product protection. These basic design concepts have led to the evolution of three classes of BSCs as described in details in the next section.

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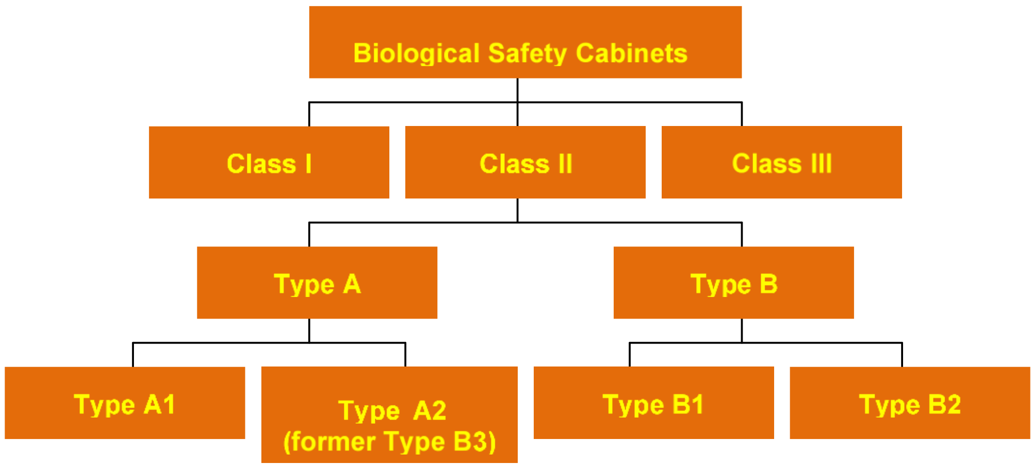
3. Classification of Biological Safety Cabinets (BSCs)

According to international standards (please refer to Section 11 for details), BSCs are categorized into 3 classes, i.e. Class I, II and III as indicated below. Class II BSCs are further grouped into 4 types.



Major differences between these BSCs are listed in the table below.

BSC	Face velocity (m/s)	% of air flow		Exhaust system
		Recirculated	Exhausted	
Class I	0.36	0	100	Hard duct
Class IIA1	0.35-0.51	70	30	Exhaust to room or thimble connection
Class IIA2	0.51	70	30	Exhaust to room or thimble connection
Class IIB1	0.51	30	70	Hard duct
Class IIB2	0.51	0	100	Hard duct
Class III	N/A	0	100	Hard duct

3.1 Class I BSC

Class I BSC was the first recognized BSC and, because of its simple design, it is still in wide use throughout the world.

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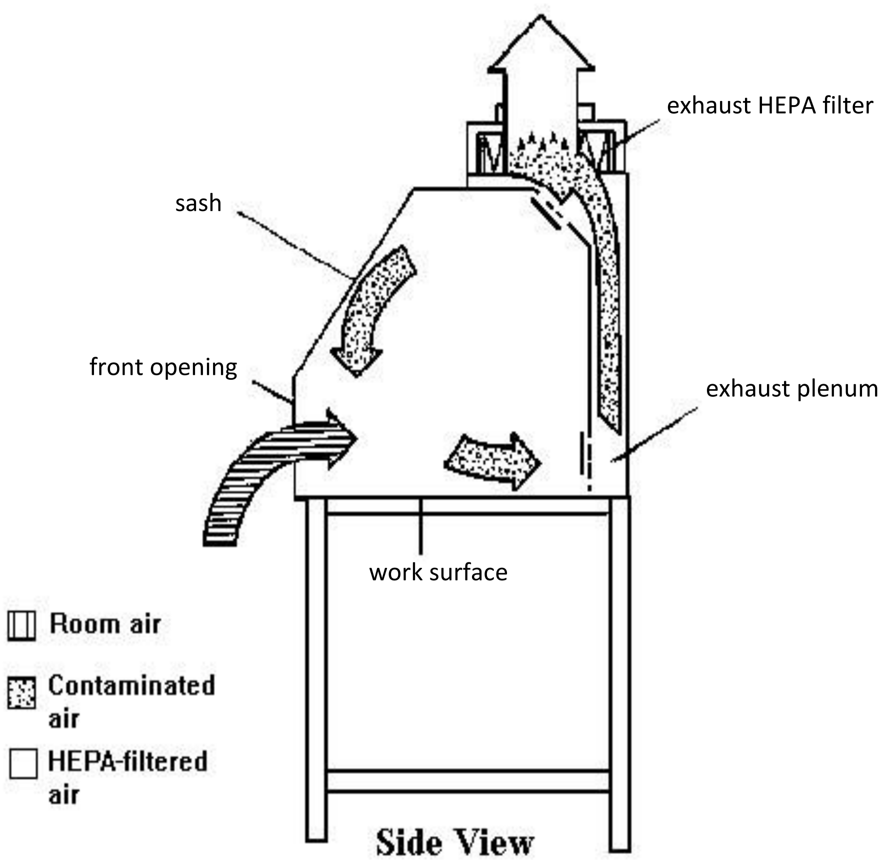

Adopted from WHO Laboratory biosafety manual, 2nd ed.

Class I BSC provides protection to the operator and environment only. It provides no reliable protection to the product (i.e. work inside the cabinet) from contamination because unsterilized room air is drawn over the work surface through the front opening. It is suitable for work with low to moderate risk biological agents (i.e. Risk Groups 1, 2 & 3). It can be used for work with radionuclides and volatile toxic chemicals.

Class I BSC is a partially enclosed ventilated cabinet. An air barrier of downward airflow through the front working opening, across the work space of the cabinet, and out through a HEPA filter, minimizes the escape of airborne aerosols generated within the cabinet.

Room air is drawn in through the front opening at a minimum velocity of 0.38 m/s, passes over the work surface and is discharged from the cabinet through the exhaust duct. The directional flow of air whisks aerosol particles that may be generated on the work surface away from the laboratory worker and into the exhaust duct. The front opening allows the operator's arms to reach the work surface inside the cabinet while he or she observes the work surface through a glass window. The window can also be fully raised to provide access to the work surface for cleaning or other purposes.

The air from the cabinet is exhausted through a HEPA filter:

a) into the laboratory and then to the outside of the building through the building exhaust;
b) to the outside through the building exhaust; or
c) directly to the outside. The HEPA filter may be located in the exhaust plenum of the BSC or in the building exhaust. Some Class I BSCs are equipped with an integral exhaust fan, whereas others rely on the exhaust fan in the building exhaust system.

Operator protection can be affected by any disturbance to the air barrier such as aerosols releasing from high-energy operations like centrifuges, human activity near the cabinet, closing and opening of a nearby room door or air discharges from a ventilation supply grille located near the cabinet.

Class I BSCs are commonly used in laboratories for handling clinical specimens or to enclose equipment (e.g., centrifuges, harvesting equipment, fermenters, etc.) or procedures (e.g. aerating cultures or homogenizing tissues, etc.) with a potential to generate aerosols.

3.2 Class II BSC

As the use of cell and tissue cultures for the propagation of viruses and other purposes grew, it was no longer considered satisfactory for unsterilized room air to pass over the work surface. Class II BSC was designed not only to provide personnel protection but also to protect work surface materials from contaminated room air. It is a partially enclosed ventilated cabinet having inward airflow through the front working opening to minimize the escape of aerosols generated within the cabinet to provide operator protection. A Class II BSC is therefore more susceptible to the effect of operator movement and turbulence within the laboratory than a Class I BSC.

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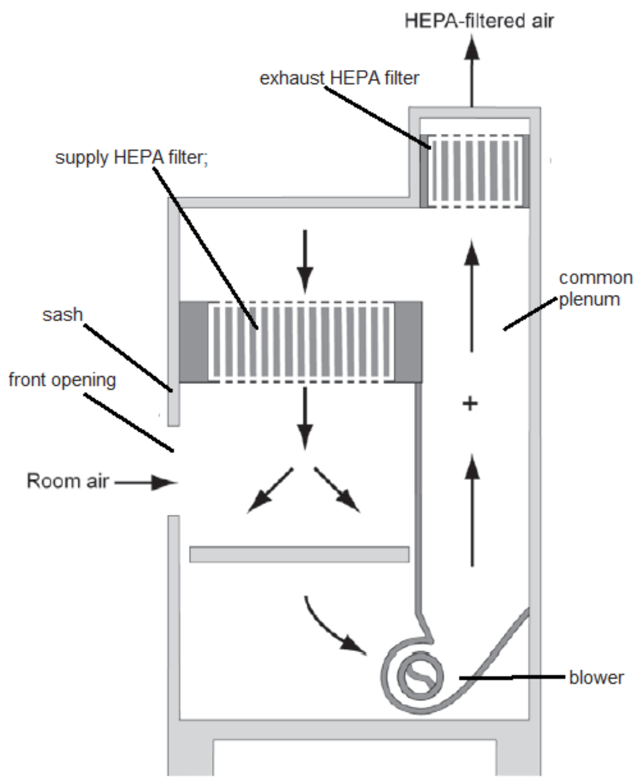
Class II BSC differs from Class I BSC by allowing only HEPA-filtered (sterile) supply air to flow over the work surface. It can be used for working with infectious agents of Risk Groups 2 and 3. It can also be used for working with infectious agents of Risk Group 4 when positive pressure suits are used. Depending on the design features and the percentage of exhausted air, Class II BSC can be further grouped into four types (A1, A2, B1 and B2).

3.2.1 Class II A1 BSC



Adopted from CDC Biosafety in Microbiological and Biomedical laboratories, 5th ed.

Class IIA1 BSC is suitable for work with low to moderate risk biological agents (Risk Group 1, 2 & 3) in the absence of volatile toxic chemicals and volatile radionuclides. It has the following basic features:

a) Minimum average inflow velocity of 0.38 m/s through the front work access opening.
b) HEPA filtered air from the cabinet may exhaust back into the laboratory.
c) Contaminated air, both from the workspace of the cabinet and the room, is drawn in by a fan and is then forced through the downflow supply filter (70%)

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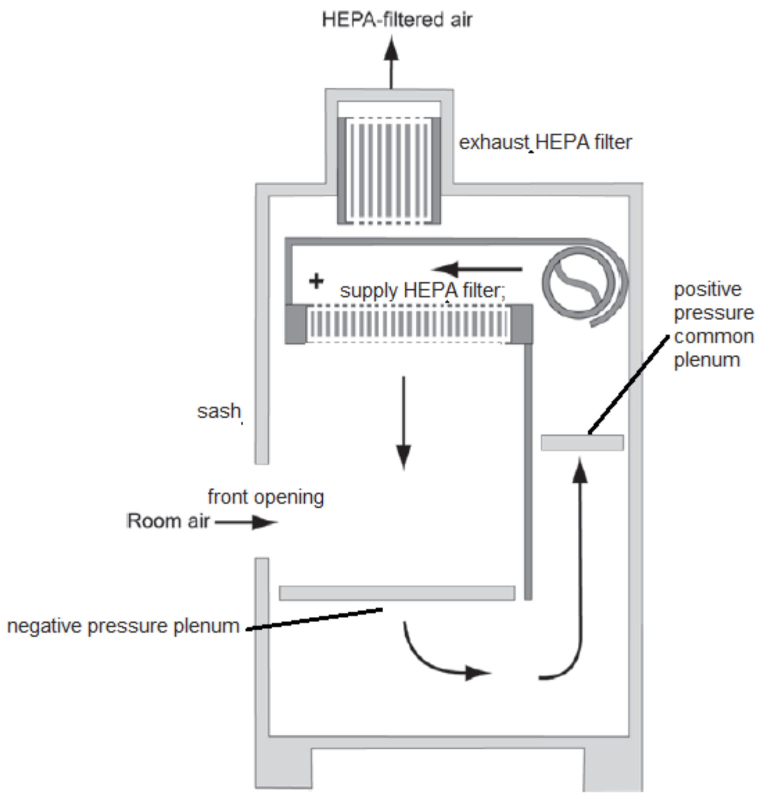
and the exhaust filter (30%). Hence both the HEPA filtered downflow supply air and exhaust air are from a common plenum, which is under positive pressure.

3.2.2 Class II A2 BSC



Adopted from CDC Biosafety in Microbiological and Biomedical laboratories, 5th ed.

Class IIA2 BSC is vented to the outside. It is suitable for work with low to moderate risk (Risk Group 1, 2 and 3) biological agents treated with minute quantities of toxic chemicals and trace quantities of radionuclides that will not interfere with the work if re-circulated in the downflow air. It has the following basic features:

a) A minimum average inflow velocity of 0.5 m/s through the front work opening is maintained.
b) HEPA filtered downflow air on the workspace of the cabinet is a portion of the mixed downflow and inflow air from a common plenum.
c) All exhaust air is discharged to outdoors by an exhaust fan after HEPA filtration.

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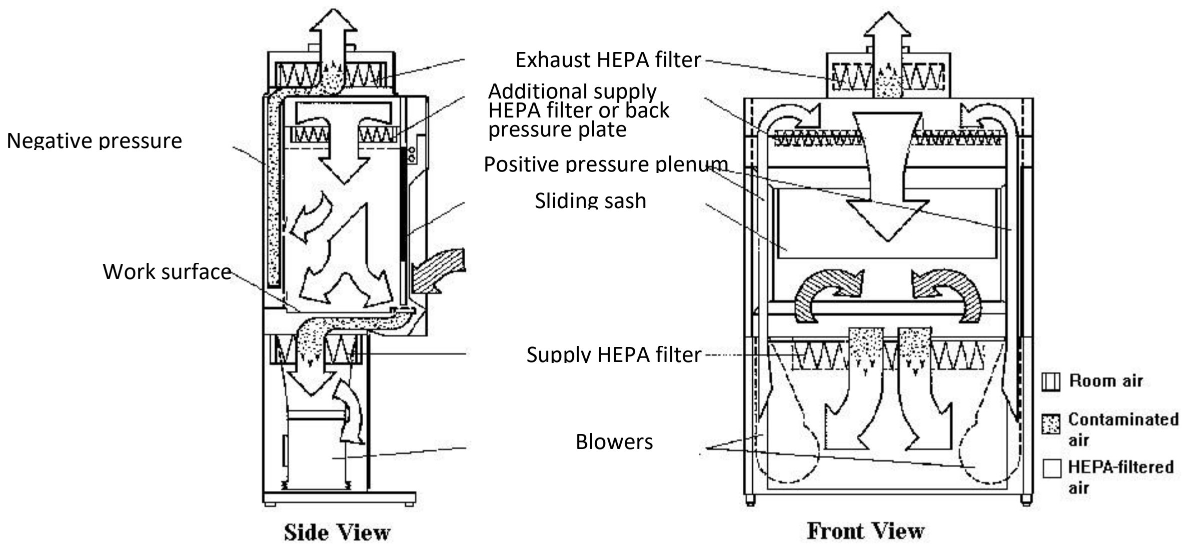
d) All biological contaminated ducts and plenums are under negative pressure, or all positive pressure contaminated plenums within the cabinet are surrounded by a negative air pressure plenum thus ensuring that any leakage from a contaminated plenum will be drawn into the cabinet and not released to the environment.

3.2.3 Class II B1 BSC



Adopted from WHO Laboratory biosafety manual, 2nd ed.

Class IIB1 and IIB2 BSCs are variations of the type IIA1. Class IIB1 BSC is suitable for work with low to moderate risk (Risk Group 1, 2 and 3) biological agents. It may be used with biological agents treated with minute quantities of toxic chemicals and trace amounts of radionuclides if the chemicals or radionuclides will not interfere with the work when re-circulated in the downflow air. Its design features are listed below:

a) Intake air velocity at the front work opening is approximately 0.5 m/s.
b) About 30% of the contaminated air from the workspace together with inflow room air is filtered through the supply HEPA filter and recirculated to the workspace. About 70% of the air from the work space of the cabinet is drawn through a rear grille and exhausted via a dedicated plenum through an HEPA filter to the outdoors.

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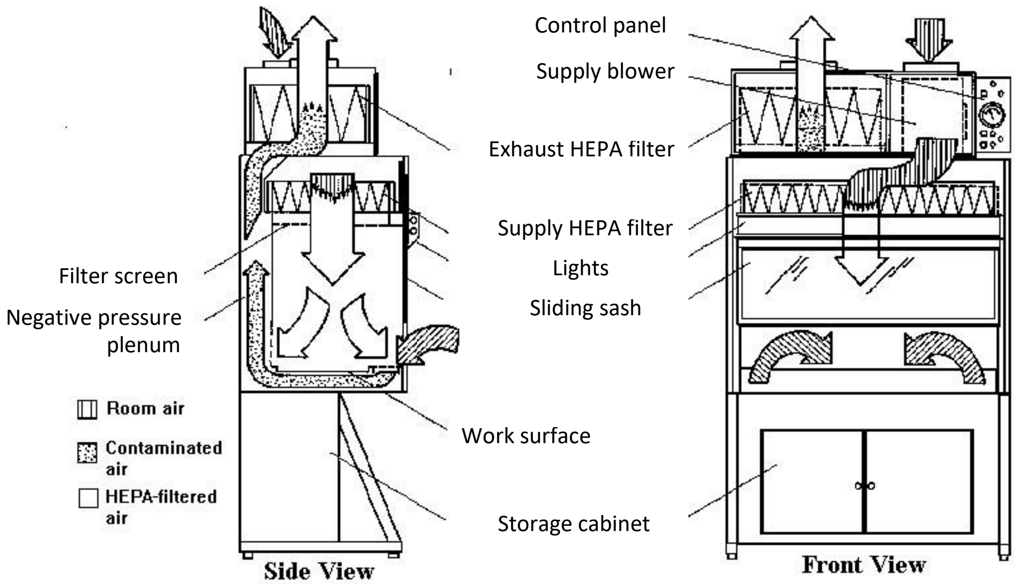
c) Air re-circulated to the workspace of the cabinet is never mixed with the exhaust air from the cabinet.
d) All biological contaminated ducts and plenums are under negative pressure or surrounded by negative pressure ducts and plenums.

3.2.4 Class II B2 BSC



Adopted from WHO Laboratory biosafety manual, 2nd ed.

Class IIB2 BSC is suitable for work with low to moderate risk (Risk Group 1, 2 and 3) biological agents. It may also be used with biological agents treated with toxic chemicals and radionuclides required in the microbiological studies. It has the following basic features:

a) Minimum average inflow air velocity of 0.5 m/s through the front work access opening.
b) No air is re-circulated to the workspace of the cabinet. 100% of air from the workspace of the cabinet is exhausted.
c) All HEPA filtered downflow air is drawn in from the laboratory or from outside by a supply fan. All inflow and downflow air from the workspace of the cabinet is exhausted to the outside after filtration through a HEPA filter by an exhaust fan.

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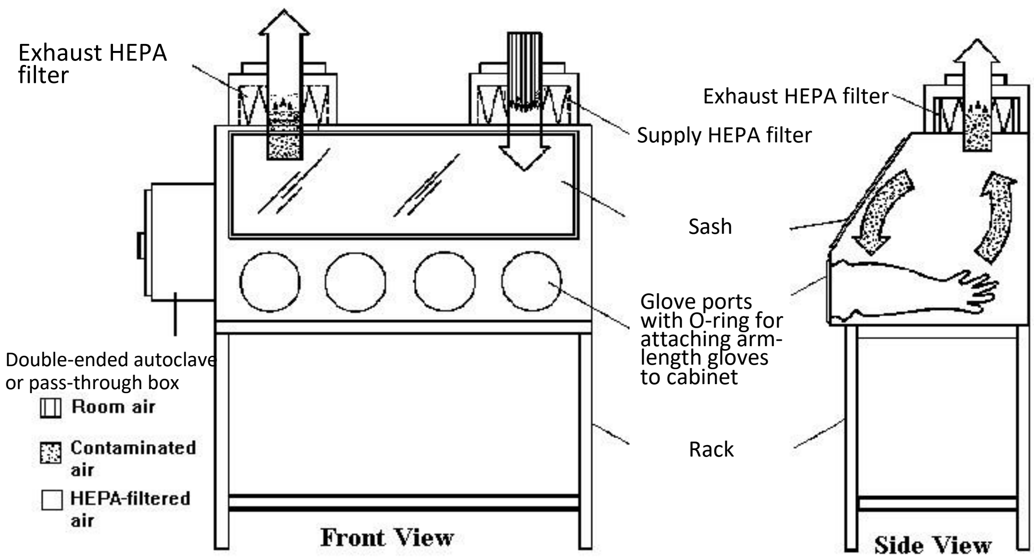
d) All contaminated ducts and plenums are under negative pressure or surrounded by negative pressure ducts and plenums.
e) Interlock system should be installed to prevent the supply fan from operating whenever the exhaust flow is insufficient.

3.3 Class III BSC



Adopted from WHO Laboratory biosafety manual, 2nd ed.

Class III BSC provides the highest level of protection to the operator and the environment. It is suitable for work with high-risk biological agents (Risk Group 3 and 4). A Class III BSC should not be used alone, but should incorporate the necessary equipment and be sited in specially designed laboratory facilities for handling high-risk samples (i.e. containment level 3 or 4). Several Class III cabinets can be joined together in a "line" which is custom-built to provide a larger work area. A Class III BSC in basic laboratory should not be used to handle high-risk samples. It has the following essential features:

a) It is a totally enclosed, ventilated cabinet of gas tight construction. The operator is separated from the work by a physical barrier and operations in the cabinet are conducted through attached long-sleeved rubber gloves.

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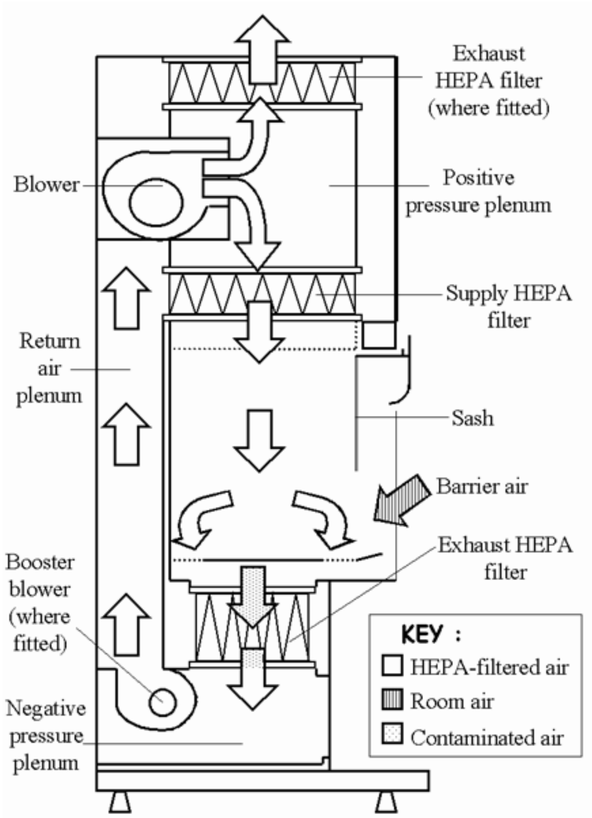
b) The cabinet is maintained under negative air pressure, usually about 0.8 inches of water pressure relative to the laboratory.
c) Air enters through a HEPA filter and is exhausted through two HEPA filters in series.
d) Passage of materials into the cabinet is usually through a sealed airlock, and exit of material may be through an autoclave, a decontamination-type airlock, or a 'dunk-tank' filled with liquid disinfectants
e) Depending on the design of the cabinet, the supply HEPA filter provides particulate-free, but somewhat turbulent airflow within the work environment.
f) Flammable gas should not be used because of explosion hazards.

4. Cytotoxic Drug Safety Cabinet



Adopted from Biological Safety Cabinets Manual of HKU Safety Office.

Cytotoxic Drug Safety Cabinet is also a partially enclosed ventilated cabinet that provides the same operator, product and environment protection as Class II BSCs. In addition, it provides protection to the maintenance staff servicing the fans and internal surfaces of the cabinet. It has the following design features:

a) The inward airflow at the front work opening offers the operator protection while the HEPA filtered laminar air flow on the work space of the cabinet protects the product from contamination.
b) Both the contaminated air from the workspace of the cabinet and the room air from the front work opening mix beneath the work surface and are exhausted through a HEPA filter located directly under the work tray. Hence contaminated air is cleaned first before it reaches the exhaust fan.
c) The fans, plenums and internal surfaces are protected from contamination by the cytotoxic drugs handled in the cabinet.

5. Laminar Flow Clean Bench or Work Station

A laminar flow clean bench or work station provides only product protection but not personnel protection. It is not a biological safety cabinet and therefore not recommended for use in the microbiology laboratories because in some instances it may increase the risk of infection for the user. It is further divided into two types, i.e. horizontal and vertical laminar flow clean benches with features described below.

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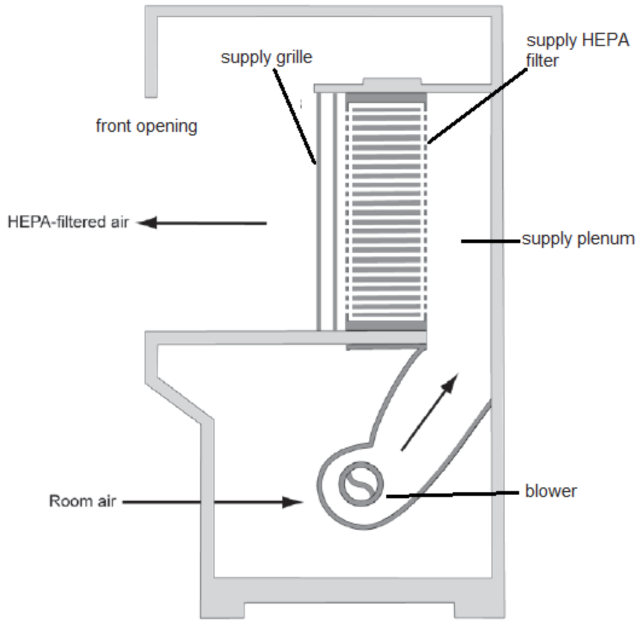
5.1 Horizontal Laminar Flow



Adopted from CDC Biosafety in Microbiological and Biomedical laboratories, 5th ed.

a) It discharges HEPA-filtered air across the work surface towards the user.

b) It should never be used when handling cell culture materials or drug formulations, or when manipulating potentially infectious materials as the operator is exposed to materials being manipulated in the work station. Even sterile or other seemingly innocuous biological materials may contain potentially allergenic substances.

c) A horizontal clean work station should never be used as a substitute for a biological safety cabinet.

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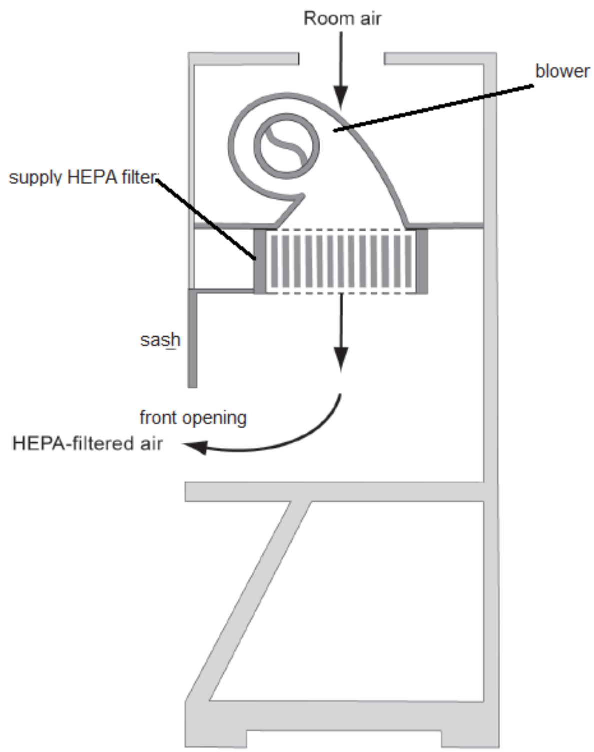
5.2 Vertical Laminar Flow



Adopted from CDC Biosafety in Microbiological and Biomedical laboratories, 5th ed.

While they look like a Class II BSC with a sash, the air is usually discharged into the room under the sash, resulting in the same potential problems as the horizontal laminar flow clean work stations.

6. Criteria for the Selection of BSCs

A BSC should be selected primarily in accordance with the type of protection needed: product protection; personnel protection against Risk Group 1-4 microorganisms; personnel protection against exposure to radionuclides and volatile toxic chemicals; or a combination of these.

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Volatile or toxic chemicals should not be used in BSCs that recirculate exhaust air to the room, i.e. Class I cabinets that are not ducted to building exhaust systems, or Class IIA1 or Class IIA2 cabinets. Class IIB1 cabinets are acceptable for work with minute amounts of volatile chemicals and radionuclides. A Class IIB2 cabinet, also called a total exhaust cabinet, is necessary when significant amounts of radionuclides and volatile chemicals are expected to be used.

Selection of proper BSC should be based on the criteria listed below.

6.1 What needs to be protected?

- Only the material being worked on (product protection)?
- Only the operator and the laboratory (personnel and environmental protection)?
- Or to protect all three (personnel, product, and environmental protection)?

Selection of a BSC is based on the type of protection needed:

Biological Risk Assessed	Protection Provided			BSC Class
	Personnel	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 suit room with suit

6.2 What types of work will be done in a Class II BSC?

One of the most difficult tasks in selecting a BSC is trying to foresee all the different types of work that will be taking place in it. It is critical to decide what things need protection, both now and in the future.

a) Which Risk Groups of biological agents to be handled in the cabinet?
b) In addition to biological hazards, are radioisotopes, toxic chemicals or carcinogenic materials to be used inside the cabinet?

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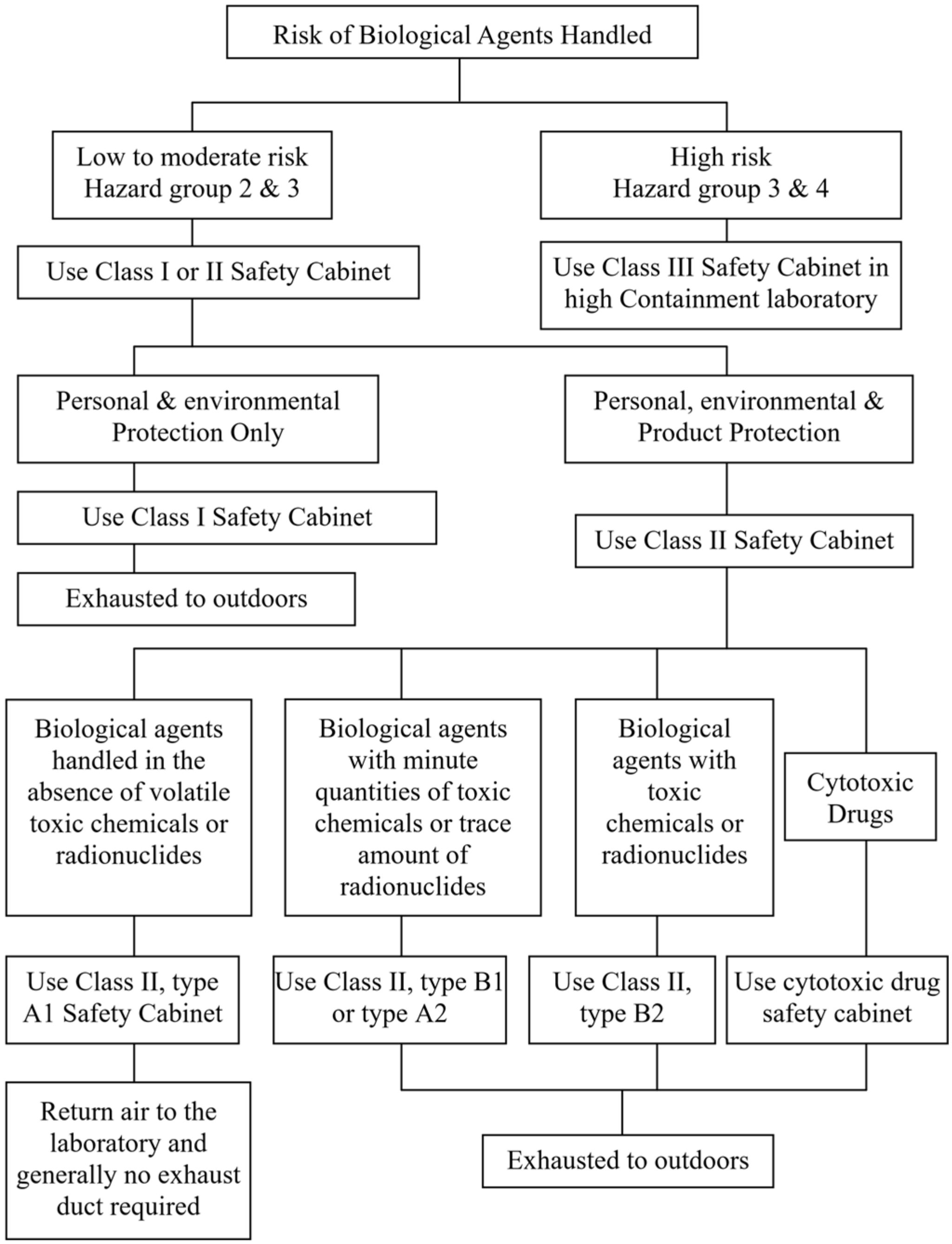

6.3 What types of chemical vapors will be generated in the BSC?

As important as the preceding question, the user should also foresee the types and quantities of chemical vapors that will be generated in the cabinet. Because chemical vapors can freely pass through HEPA filters, both Class I and Class II BSCs must be exhausted out of the laboratory when used with these types of chemicals. For the Class II BSCs, Types B1 and B2 must be directly connected to an external exhaust system in order to operate properly.

a) Class II BSCs typically do not feature explosion-proof electrical components in their work area or internally. Therefore, use of flammable or explosive materials in quantities above their explosive limit is not recommended.
b) Types of chemicals used in cabinet should be considered as some can destroy the filter medium, housings and gaskets causing loss of containment.

7. Safety Requirements for BSCs

a) All corners and angles inside the BSC working space and other normally accessible areas (e.g. during cleaning) likely to come into contact with micro-organisms shall be rounded for proper cleaning. When surfaces inside the working space are examined without magnification by normal or corrected vision, there shall be no cracks or surface defects.
b) Each BSC must have an airflow indicator with audible alarm for incorrect airflow fitted in a position where it is easily visible to the users.
c) If the BSC is to be connected to an external mechanical exhaust system, first examine the location to ensure that it is compatible with the cabinet's exhaust outlet. Sufficient make-up air into the laboratory is required for the exhaust (quite substantial for Class I and Class IIB2 cabinets) and whether the current ventilation design is sufficient for this should be checked.
d) The electrical outlet that the BSC plugs into should have a dedicated circuit breaker. This will prevent the accidental shutdown of the cabinet, should another device overload the circuit.
e) All service lines to the BSC should meet local building codes, and be equipped with an easily accessible external shut-off valve, should disconnection be required.

Work with Risk Group 3 biological agents requires detailed risk assessment to evaluate if the laboratories involved could meet with Biological Safety Level 3 requirements. Currently Risk Group 3 biological agents are not allowed to be handled in the laboratories at the Science Park.

8. Performance Tests for BSCs

a) Primary Test

i. **Down flow Velocity and Volume Test (Class II BSC only):** to measure the velocity of air moving through the cabinet workspace.
ii. **Inflow (Face) Velocity Test:** to determine the calculated or directly measured velocity through the work access opening.
iii. **Airflow Smoke Patterns Tests:** to determine if the airflow along the entire perimeter of the work access opening is inward, if airflow within the work area is downward with no dead spots or refluxing, and if there is refluxing to the outside at the window wiper gasket and side seals.
iv. **HEPA Filter Leak Test:** to determine the integrity of supply and exhaust HEPA filters, filter housing, and filter mounting frames while the cabinet is operated at the nominal set point velocities.
v. **Cabinet Leak Tests:** to determine if exterior surfaces of all plenums, welds, gaskets, and plenum penetrations or seals are free of leaks.
vi. **Containment Test (optional):** to determine the effectiveness of the cabinet in containing aerosols generated inside the cabinet.
vii. **Alarms and Interlocks Test:** to check that the alarms, such as airflow alarms and sash alarms, and interlocks are functional.

b) Secondary Test

i. **Lighting Intensity Test:** to measure the light intensity on the work surface of the cabinet.
ii. **Noise Level Test:** to measure the noise levels produced by the cabinets, as a guide to satisfactory mechanical performance.
iii. **Electrical Leakage and Ground Circuit Resistance and Polarity Tests:** to determine if a potential shock hazard exists.
iv. **UV Lamp Test:** to test the UV lamp if installed to ensure the germicidal efficacy of the light.

9. Installation of BSCs

The protection offered by a BSC can be severely compromised by its inappropriate location. A BSC unit should be located out of the traffic flow, and away from doors, openable windows, air supply registers, fume cupboards or laboratory equipment capable of generating air movement that could disrupt the containment provided by the inflow air at the front work opening. Poor location, room air currents, decreased airflow, leaking filters, raised sashes, crowded work surfaces, and poor user technique compromise the containment capability of a BSC. For installation of a BSC, considerations should be carefully taken on proper siting, clearance and exhaust requirements.

9.1 Siting and Clearance

a) All BSCs should be placed in a laboratory at a location that provides a minimum of:

   i. 6 inches (150 mm) from adjacent walls or columns.
   ii. 6 inches (150 mm) between two BSCs.
   iii. 6 inches (150 mm) space between both sides of the cabinet and 6 inches (150 mm) behind the BSC to allow for service operations.
   iv. 40 inches (1020 mm) of open space in front of the BSC
   v. 60 inches (1520 mm) from opposing walls, bench tops and areas of occasional traffic.
   vi. 20 inches (510 mm) between BSC and bench tops along a perpendicular wall.
   vii. 100 inches (2540 mm) between two BSCs facing each other.
   viii. 60 inches (1520 mm) from behind a doorway.
   ix. 40 inches (1020 mm) from an adjacent doorway swing side.
   x. 6 inches (150 mm) from an adjacent doorway hinge side.

b) BSCs not connected to an exhaust system should have at least 12 inches (300 mm) clearance from the filter face and any overhead obstructions when the cabinet is in its final operating position, to allow for testing of the exhaust HEPA filter. Such clearance is also required if the use of a thermal anemometer exhaust velocity measurement is needed when calculating cabinet inflow velocity.
c) The air curtain created at the front of the cabinet is quite fragile, amounting to a nominal inward and downward velocity of 1 mph. Open windows, air supply registers, portable fans or laboratory equipment that creates air movement (e.g., centrifuges, vacuum pumps) should not be located near the BSC. Similarly, chemical fume cupboards must not be located close to BSCs.
d) For more information about the siting of a BSC, please refer to BS 5726: part 2 (1992) or AS2647 (1994).

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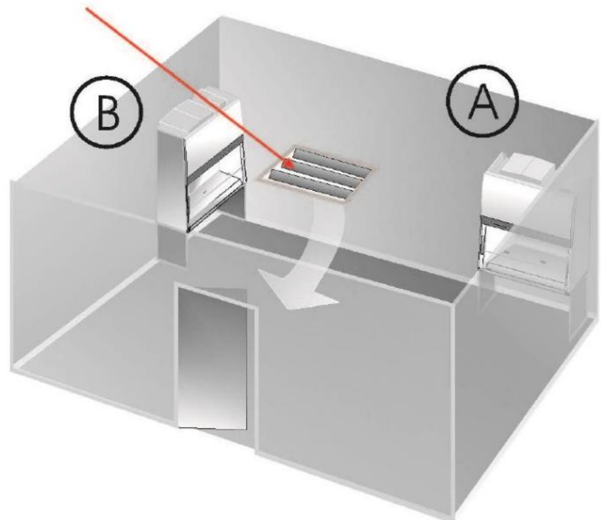
Location A is the preferred location. Location B is an alternate location. The air supply registers directly above or near the cabinet's location should be redirected away from the cabinet face.



Adopted from NSF/ANSI 49 Annex E (2016)

9.2 Exhaust Requirements

a) If the BSC is to be connected to an external mechanical exhaust system for exhaust to outdoors:

i. First examine the location to ensure that it is compatible with the cabinet's exhaust outlet.
ii. It is preferable to exhaust the discharge air by a dedicated extraction system. Ducting should be under negative pressure with an exhaust fan sited at the distal end of the ducting with duct length greater than 2 meters or should be air tight with duct length less than 2 meters.
iii. The discharge should be sited in consideration of the airflow pattern around the building and should be away from the open windows or air intakes of the same and neighboring buildings. The external wind pressure at the exhaust opening up to 250 Pa should not affect the performance of the cabinet.
iv. The cabinet shall be fitted with an automatic anti-blowback system downstream of the filters to prevent air flowing back into the cabinet.
v. There should be sufficient make up air to the room where the cabinets are located.

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b) For Class IIA BSC where exhaust air is re-circulated back to the laboratory, exhaust point such as nearby fume cupboards, open windows should be available for the exhaust of the fumigant after fumigation.

10. Operation and Maintenance

a) Most BSCs are designed to permit operation 24 h/day. Cabinets should be turned on at least 5 min before beginning work and after completion of work to allow the cabinet to "purge", i.e. to allow time for contaminated air to be removed from the cabinet environment.

b) Open flames should be avoided in the near microbe-free environment created inside the BSC. They disrupt the air flow patterns and can be dangerous when volatile, flammable substances are also used. To sterilize bacteriological loops, the use of microburners or electric "furnaces" is preferable to open flames.

c) Ultraviolet lights are not required in BSCs. If they are used, they must be cleaned weekly to remove any dust and dirt that may block the germicidal effectiveness of the light. Ultraviolet light intensity should be checked when the cabinet is recertified to ensure that light emission is appropriate. Ultraviolet lights should be turned off while the room is occupied, to protect eyes and skin from inadvertent exposure.

d) The sash of the cabinet must not be raised when work is in progress in the cabinet.

e) Apparatus and materials in the cabinet during operation should be kept to a minimum.

f) All materials should be placed as far back in the cabinet as practical, toward the rear edge of the work surface and away from the front grille of the cabinet. The front grille must not be blocked with papers or equipment items.

g) Good laboratory practices are still required during the operation in the cabinet. For example, techniques to reduce splatter and aerosol generation will minimize the potential for personnel exposure to infectious materials manipulated within the cabinet.

h) It is recommended by some manufacturers that the cabinet should be left running with its sash shut when it is not in use. If not, it should be run for 5 min in order to purge the atmosphere inside before it is switched off.

i) The inspection certificate of the safety cabinet should be checked to make sure that it is regularly inspected with satisfactory results.

j) All repairs made on BSCs should be made by qualified personnel. Any malfunction in the operation of the BSC should be reported and repaired before the BSC is used again.

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k) HEPA filters, whether part of a building exhaust system or part of a cabinet, will require replacement when they become loaded to the extent that sufficient airflow can no longer be maintained. In most instances, filters must be decontaminated before removal. To contain the formaldehyde gas typically used for microbiological decontamination, exhaust systems containing HEPA filters require airtight dampers to be installed on both the inlet and discharge side of the filter housing. This ensures containment of the gas inside the filter housing during decontamination. Access panel ports in the filter housing also allow for performance testing of the HEPA filter.

10.1 Annual Certification

The operational integrity of a BSC must be validated before it is placed into service and after it has been repaired or relocated. Relocation may break the HEPA filter seals or otherwise damage the filters or the cabinet. Each BSC should be tested and certified at least annually to ensure continued, proper operation. The functional operation and integrity of each BSC should be certified to national or international performance standards at the time of installation and regularly thereafter by qualified personnel, according to the manufacturer's instructions. Evaluation of the effectiveness of cabinet containment should include tests for cabinet integrity, HEPA filter leaks, downflow velocity profile, face velocity, negative pressure/ventilation rate, air flow smoke pattern, and alarms and interlocks. Optional tests for electrical leaks, lighting intensity, ultraviolet light intensity, noise level and vibration may also be conducted.

Maintenance record with test results and dates shall be displayed on each BSC for easy reference.

10.2 Cleaning and Disinfection

All items within BSCs, including equipment, should be surface-decontaminated and removed from the cabinet when work is completed, since residual culture media may provide an opportunity for microbial growth.

The interior surfaces of BSCs should be decontaminated before and after each use. The work surfaces and interior walls should be wiped with a disinfectant that will kill any microorganisms that might be found inside the cabinet. At the end of the work day, the final surface decontamination should include a wipe-down of the work surface, the sides, back and interior of the glass. A solution of bleach or 70% alcohol should be used where effective for target organisms. A second wiping with sterile water is needed when a corrosive disinfectant, such as bleach, is used.

Potentially contaminated materials should not be brought out of the cabinet until they have been surface decontaminated or enclosed in a closable container for transfer to an incubator, autoclave or for other decontamination treatment.

10.3 Decontamination

The most common decontamination method is by fumigation with formaldehyde gas. BSC decontamination should be performed by qualified personnel.

Gas decontamination should be carried out:
a) before maintenance;
b) before certification;
c) before the HEPA filters are changed;
d) before the cabinet is relocated; or
e) when there is a large spill of infectious material in the cabinet.

11. Applicable Standards for BSCs

A BSC installed and used in the laboratories at the Science Park must meet any of the international standards quoted in the followings or other equivalent standards:

a) British Standard BS 5726:
Microbiological safety cabinets. Information to be supplied by the purchaser to the vendor and to the installer, and siting and use of cabinets. Recommendations and guidance

b) National Sanitation Foundation Standard NSF No.49:
Biosafety Cabinetry Certification

c) Australia Standard AS 2252:
Controlled environments Part 5: Cytotoxic drug safety cabinets (CDSC) - Design, construction, installation, testing and use

d) Australia Standard AS 2567:
Laminar flow cytotoxic drug safety cabinets

e) European Standard EN 12469:
Biotechnology - Performance criteria for microbiological safety cabinets