NSF/ANSI 49 – 2011

Biosafety Cabinetry: Design, Construction, Performance, and Field Certification
Annex E

NSF International Standard/
American National Standard

This page is intentionally left blank.

Annex E[1]

(informative)

Biosafety Cabinet Selection, Installation, Lifespan and Decommissioning

E.1 Biosafety consultation prior to BSC purchase

A biosafety officer or qualified safety professional should be consulted prior to a BSC purchase. Some institutions have biosafety cabinet purchases approved by the biosafety officer or qualified safety professional after consultation with the user, architect and engineer. Biosafety officers or qualified safety professionals that perform this function should have training and field experience that includes methods used to control biohazards and knowledge of the design, application, and testing of biosafety cabinets.

Issues that may be considered include:

- risk assessment;
- selecting which kind of BSC is required and if it should be exhausted; and
- assessment of the laboratory environment and the proper location of BSCs within it.

E.1.1 If there is a window in the laboratory, it should remain closed at all times. Cabinets should not be located where room ventilation air inlets blow across the front opening or onto the exhaust filter.

E.2 Risk assessment procedure

E.2.1 Risk assessments encompass four main elements:

- hazard identification;
- exposure assessment;
- dose-response assessment; and
- risk characterization, and risk management (job analysis)[2].

E.2.2 Risk assessment team members may include:

- investigator/scientist;
- laboratory staff;
- animal care staff when appropriate;
- animal veterinarian when appropriate; and
- occupational health & biosafety professionals.

[1] The information contained in this Annex is not part of this American National Standard (ANS) and has not been processed in accordance with ANSI's requirements for an ANS. Therefore, this Annex may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the Standard.

[2] Songer, J.R. 1995. Laboratory safety management and the assessment of risk, p. 257-277. *In* D.O. Fleming, J.H. Richardson, J.J. Tulis, and D. Vesley (ed.), *Laboratory Safety: Principles and Practices,* 2nd ed. ASM Press, Washington, DC.

E.2.3 Risk assessment hazards considered:

- animal hazards;
- agent/pathogen/recombinant hazards;
- chemical hazards; and
- radiological hazards.

E.2.4 Agent/pathogen/recombinant's factors associated with risk of disease or injury:

- virulence;
- infectious dose;
- route of infection (portal of entry);
- toxigenicity;
- agent's host range;
- if the agent is endemic or exotic to the environment it is in;
- availability of effective preventive measures; and
- availability of effective treatment.

E.2.5 Factors associated with worker's risk of exposure:

- worker's work activity; diagnostic, research or production scale;
- worker's proficiency, attitude and safety awareness; and
- worker's age, sex, pregnancy, race, immune status and medications.

E.2.6 Risk management plan includes:

- biosafety containment level assignment to the facility and microbiological practices;
- safety equipment;
- engineering controls;
- personal protective equipment;
- work practices – Standard Operating Procedures (SOPs);
- emergency procedures;
- work schedule – calendar; and
- investigation protocols that include all risk management plans.

E.2.7 Investigation protocol review includes:

- committee (IBC/IRB/IACUC) review, as appropriate;
- meetings with workers to discuss approved protocols;
- training;
- dry runs without agent/pathogen/recombinant; and
- regular audits.

E.2.8 Risk management analysis table

Risk Factors	Assessment Level Decrease<	 >Increase
Pathogen Disease Potential		
Known, classified		
Suspected, classified		
Known, unclassified		>>>
Unknown		>>>>
Pathogen Aerosol Potential		
Tissue procedure	<<<	
Culture procedure		>>>
Concentration procedure		>>>>>>
Animal/non-shedder	<<<	
Animal/shedder		>>>>>>
Pathogen Infectious route		
Respiratory		>>>>>>
Mucous membrane		>>>
Parenteral	<<<	
Other	<<<	
Disease Severity		
Moderate		>>
Severe		>>>
Life threatening/lethal		>>>>>>>>
Disease Prophylaxis		
None		>>>>>>>>
Vaccine	<<	
Immune globulin	<<<	
Antibiotics	<<<	
Antivirals	<<<	
Other Factors		
Livestock pathogen		>>>
Poultry pathogen		>>>

E.3 Biosafety cabinet selection

E.3.1 Selecting the proper BSC should be done in two stages; first, select the proper class and type of cabinet required, then decide on the size of the cabinet and options that are needed. The various configurations of Class II BSCs are shown in figures E2, E4 and E5. Deciding which class and type is appropriate can be accomplished by answering the following five questions.

E.3.1.1 What needs to be protected?

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

If all that is needed is product protection, then a Clean Bench, which is not a BSC, may be the unit of choice. Clean Benches use High Efficiency Particulate Air (HEPA or ULPA) filter(s) to remove particulates from room air. This filtered, particulate-free air then flows through an enclosed work area, in a horizontal or vertical direction. These devices bathe the materials inside in filtered air, and then the air is typically discharged into the laboratory. While these devices protect the product from airborne contaminants, any aerosol generated in the work area will be discharged into the laboratory. As such, they cannot be used with toxic or biohazardous materials.

For personnel and environmental protection only, the Class I enclosure offers a simple and economical solution. Room air sweeps around the operator and through the work area. This contaminated air is then HEPA or ULPA- filtered and discharged into the laboratory or exhausted outside of the building via an exhaust system. The Class I will protect the operator and the lab, however, because room air constantly washes over the work area, the product is exposed to airborne contaminants.

Personnel, environmental, and product protection can be had most efficiently by a Class II Biosafety Cabinet. The inflow of air around the operator provides personnel protection. HEPA- or ULPA-filtered air flowing downward through the work area provides product protection, and protects the laboratory from biohazardous particulates.

E.3.1.2 What are all of the different types of work to be done in the cabinet?

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. All too often users purchase a Clean Bench or Class I device for current applications, only to find these devices are unsuitable as their work requirements change.

E.3.1.3 What types and quantities of chemical vapors will be generated in the BSC?

As important as the preceding question, the user must also foresee the types and quantities of chemical vapors that will be generated in the cabinet. Because chemical vapors can freely pass through HEPA or ULPA 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 hard ducted to an external exhaust system in order to operate properly; Types A1 and A2 can be converted to operate in either a ducted or recirculating mode, depending on the users' requirements. The airflow patterns of Types A1, A2, B1 and B2 Biosafety Cabinets are shown in figures E2, E4 and E5, respectively.

E.3.1.4 If the unit requires an exhaust system, is there an appropriate location for the cabinet and its ductwork?

If a BSC is going to recirculate its HEPA- or ULPA-filtered air back into the laboratory, then the user has some freedom as to where the unit can be installed, provided it is out of major traffic areas, and there are no other air handling devices in the area, as shown in figure E1.

When connected to a hard ducted exhaust system, however, the location of the cabinet becomes dependent on the location of the exhaust system. The exhaust duct must be placed so it can penetrate ceilings and floors without disturbing other ventilation or plumbing systems. The exhaust system must also be designed to minimize excessive lengths and elbows. The exhaust system configurations of Type A and Type B BSCs are shown in figures E3 and E6, respectively. Hard ducting Type A cabinets is not acceptable and shall only be exhausted through a properly designed and fitted exhaust canopy.

E.3.1.5 If the volume of air being removed by the BSC's exhaust system is reduced, or eliminated, due to malfunction, what is its effect on BSC performance, and what is preferred by the user?

For a Type A BSC fitted with a properly designed canopy connection, reduction or elimination of the exhaust air should not significantly affect the airflow patterns within the BSC. Personnel and product protection of the BSC will remain unchanged; however, chemical vapors generated in the BSC will be exhausted into the laboratory via the openings or slots in the canopy.

For a Type B BSC, any reduction or elimination of the exhaust air will directly impact the inflow velocity, and thus the personnel protection offered by the BSC. Reduction of exhaust airflow will reduce the inflow, jeopardizing personnel protection. Loss of the exhaust airflow will eliminate the inflow of air into the front of the BSC, negating personnel protection, and allowing materials in the work area of the BSC to escape into the laboratory.

Table E.3.1.6 Characteristics of Type A1 and A2 BSCs

	Type A1 (figure E2)	Type A2 (figure E2)
Intended Purpose	Routine microbiological work. Not appropriate for work generating chemical vapors. If working with malodorous products, the unit may be canopy-connected to external exhaust for odor control.	Routine microbiological work. Work generating minute quantities of chemical vapors required as an adjunct to microbiological research, if the BSC is canopy-connected to external exhaust. Any vapor generated must not interfere with the work when recirculated in the downflow air.
Airflow Pattern	Room air is drawn in through the sash opening, protecting the operator. HEPA- or ULPA- filtered air flows down through the work area, protecting the product. Both bodies of air flow through a common plenum to the cabinet blower(s). A portion flows out of the cabinet via an Exhaust HEPA or ULPA filter, and the remainder recirculates through a Supply HEPA or ULPA filter before flowing down through the work area.	Room air is drawn in through the sash opening, protecting the operator. HEPA –or ULPA- filtered air flows down through the work area, protecting the product. Both bodies of air flow through a common plenum to the cabinet blower(s). A portion flows out of the cabinet via an Exhaust HEPA or ULPA filter, and the remainder recirculates through a Supply HEPA or ULPA filter before flowing down through the work area.
Air Recirculation	Varies by model; typically 70%	Varies by model; typically 70%
Inflow	Minimum 75 FPM Average	Minimum 100 FPM Average
Downflow	Varies by model, typically 50-80 FPM average	Varies by model, typically 50-80 FPM average
Biological Containment	All NSF-Listed BSCs must pass the same Biological Containment Tests.	All NSF-Listed BSCs must pass the same Biological Containment Tests.
Exhaust System	Canopy connection as needed.	Canopy connection as needed.
Exhaust System Type	Due to the superior ability to handle external exhaust variation, canopy connected Type A BSCs may be ganged into a multiple-cabinet exhaust system, if all BSCs are balanced properly.	Due to the superior ability to handle external exhaust variation, canopy connected Type A BSCs may be ganged into a multiple-cabinet exhaust system, if all BSCs are balanced properly.
Exhaust System Function	To convey the BSC exhaust air, plus an additional volume required by the canopy through the ductwork.	To convey the BSC exhaust air, plus an additional volume required by the canopy through the ductwork.
Exhaust System Volume	Greater than Type B1. Less than Type B2.	Greater than Type B1. Less than Type B2.
Exhaust System Negative Static Pressure at BSC	Typically 0.1 – 0.5 inches H_2O.	Typically 0.1 – 0.5 inches H_2O.
Exhaust System Reserve Capacity	Static pressure requirements will not change as the cabinet filters load.	Static pressure requirements will not change as the cabinet filters load.
Cabinet Flexibility	Can be connected or disconnected from exhaust system as needs change.	Can be connected or disconnected from exhaust system as needs change.
Cabinet Cost	Less than Type B	Less than Type B
Installation Cost	Much less than Type B if recirculating; slightly less than Type B if canopy-connected.	Much less than Type B if recirculating; slightly less than Type B if canopy-connected.
Operation Cost		
Electrical Cost (BSC Only)	Equal to Type B1 Slightly greater than Type B2	Equal to Type B1 Slightly greater than Type B2
Tempered Air Loss	If recirculating in lab; none. If canopy-connected, typically 100 CFM/foot of BSC width or less.	If recirculating in lab; none. If canopy-connected, typically 100 CFM/foot of BSC width or less.

Table E.3.1.7 Characteristics of Type B1 and Type B2 BSCs

	Type B1 (figure E4)	Type B2 (figure E5)
Intended Purpose	Type B1 cabinets may be used for routine microbiological work generating minute quantities of chemical vapors required as an adjunct to microbiological studies, if work is done in the directly exhausted portion of the cabinet, or if the vapors will not interfere with the work when recirculated in the downflow air.	Type B2 cabinets may be used for routine microbiological work generating chemical vapors required as an adjunct to microbiological studies.
Airflow Pattern	Room air is drawn in through the sash opening, protecting the operator. HEPA- or ULPA- filtered air flows down through the work area, protecting the product. The room air, and a portion of downflow air in the front of the work area is recirculated through a supply HEPA or ULPA filter before flowing down through the work area. The air in the rear of the work area flows out of the cabinet via an Exhaust HEPA or ULPA filter.	Room air is drawn in through the sash opening, protecting the operator. HEPA- or ULPA-filtered room air flows down through the work area, protecting the product. Both bodies of air are drawn out of the cabinet via an Exhaust HEPA or ULPA filter.
Air Recirculation	Varies by model; typically 50%	None
Inflow	Minimum 100 FPM Average	Minimum 100 FPM Average
Downflow	Varies by model, typically 50-80 FPM average	Varies by model, typically 50-80 FPM average
Biological Containment	All NSF-Listed BSCs must pass the same Biological Containment Tests.	All NSF-Listed BSCs must pass the same Biological Containment Tests.
Exhaust System	Required.	Required.
Exhaust System Type	Should have dedicated ductwork and exhaust blower for each BSC.	Should have dedicated ductwork and exhaust blower for each BSC.
Exhaust System Function	Must pull exhaust air through the Cabinet's Exhaust HEPA or ULPA filter and then through ductwork.	Must pull exhaust air through the Cabinet's Exhaust HEPA or ULPA filter and then through ductwork.
Exhaust System Volume	B1 is approximately 20% less than a Type A.	B2 exhausts 100% or more air than any other Type.
Exhaust System Negative Static Pressure at BSC	Typically 1.5 inches H_2O minimum.	Typically 1.5 inches H_2O minimum.
Exhaust System Reserve Capacity	Static pressure requirements may increase up to 0.3 inches H_2O as exhaust HEPA or ULPA filter loads.	Static pressure requirements may increase up to 0.7 inches H_2O as exhaust HEPA or ULPA filter loads.
Cabinet Flexibility	Must be permanently connected to an exhaust system to function properly.	Must be permanently connected to an exhaust system to function properly.
Cabinet Cost	More expensive than Type A	More expensive than Type A
Installation Cost	Similar to a canopy connected Type A.	Most expensive. Higher exhaust volumes may require larger ductwork and higher capacity exhaust fan.
Operation Cost		
Electrical Cost (BSC Only)	Equal to Type A	Less than a Type A
Tempered Air Loss	Less than a canopy connected Type A. Typically 50-100 CFM/foot of BSC width.	Typically 175 CFM/foot of BSC width.

E.3.2 BSC size

Having decided which class and type of BSC is the best, the user should now decide on the size of the unit and its options. Typical workspace widths are three, four five and six feet. Outside dimensions are approximately 3.5, 4.5, 5.5 and 6.5 feet. In deciding which size is best, the user should mark out an area of benchtop equal to the inside (work area) dimensions of the model they are interested in. The user(s) should perform several "dry runs" of their procedures in this area. If the user can work in this defined space, than the cabinet is the proper size, if not, the user may want to try working in the dimensions of the next larger model. If the user does decide on a larger model, however, be sure that the BSC can be transported to and installed in the laboratory through the existing freight elevators, hallways and doors. It is important to remember that BSC widths typically refer to the internal work area. The external width of the BSC may be significantly wider.

E.3.3 BSC options

E.3.3.1 Service valves

Service valves allow inert gases, air or vacuum lines to be plumbed into the BSC. Many models allow for the easy installation of these valves in the field, however, it is generally less expensive and easier to have the required number of valves installed when the unit is ordered. Although many users connect natural gas to a service valve in the cabinet, this practice should be avoided if possible, because open flames in a Class II BSC disrupts the airflow, and there is the possibility of a buildup of flammable gas in BSCs that recirculate their air.

E.3.3.2 Electrical outlets

Most BSCs have electrical outlets installed in the work area as standard equipment. Specialized outlets, such as Ground Fault Circuit Interrupters (GFCIs) should be installed and tested by the cabinet manufacturer.

Typically the outlets in the work area are limited in their amperage rating. This is due to the amperage requirements of the BSC's motor, lighting, and other electrical components.

Variations in line voltage from the laboratory wall outlet may affect the cabinet airflows. A voltage regulator may need to be installed in order to reduce the potential of variations in airflows.

E.3.3.3 Ultraviolet lighting

Germicidal (or UV) Lamps are often installed as an adjunct to surface disinfection. UV lighting is not recommended in Biosafety cabinetry. While their usefulness is a subject for debate among users and manufacturers, they should be installed and tested by the manufacturer during assembly of the unit.

E.3.3.4 IV bar

Because intravenous (IV) bars or rods have a significant impact on the airflows in the work area, always use the IV bar recommended by the manufacturer.

E.3.3.5 Base stands

Base Stands or supports should also be considered at the time of specification. Some models of cabinets can weigh up to 900 pounds (408 Kg). The BSC must be attached to a manufacturer recommended base stand or a structure rated to support the unit's weight. All base stands have a maximum height specified by the manufacturer to prevent overturning of the BSC; this maximum should never be exceeded.

E.3.3.6 Mobile installations

Mobile Base Stands with and without lift capability have been used when the BSC is operated in multiple locations in the same or adjoining laboratories. Proper cabinet operation should be confirmed by airflow smoke pattern tests at each site of use. If the cabinet is relocated to another facility, or subjected to excessive shock and/or vibration during moving, the BSC should be recertified to ensure it is functioning in a proper manner.

E.4 Prior to the purchase

E.4.1 Consultation

Investigators should consult with a biosafety officer or qualified safety professional and request a risk assessment of the proposed investigation to ensure that an appropriate BSC is used for the work. Purchase of NSF 49 listed Class II biosafety cabinets is recommended, but alternative containment equipment may be suggested for special tasks.

E.4.2 Site assessment

The investigator should thoroughly examine the intended installation site to ensure it will meet the requirements for proper cabinet operation.

E.4.2.1 Location of the BSC

The cabinet should be located away from traffic patterns, doors, fans, ventilation registers, fume hoods and any other air-handling device that could disrupt its airflow patterns. All windows in the room should be closed. Figure E1 shows the preferred location for the cabinet.

E.4.2.2 Clearances

BSCs not connected to an exhaust system should have at least 6 inches (15 cm) clearance from any overhead obstructions when the cabinet is in its final operating position, to allow for testing of the Exhaust HEPA/ULPA filter. A clearance of at least 6 inches (15 cm) should be maintained on both sides of the cabinet, as well as 12 inches (30 cm) behind the unit, to allow for service operations if necessary.

E.4.2.3 Exhaust requirements

If the BSC is to be connected to an exhaust system, first examine the location to ensure that it is compatible with the cabinet’s exhaust outlet. The area directly above the cabinet’s exhaust outlet should be clear of structural elements, water and utility lines, or other fixed obstructions. There should be enough clearance to allow for the passage of a 10 inch (25 cm) or 12 inch (30 cm) diameter duct. Avoid cabinet locations that require either an elbow directly on top of the cabinet’s exhaust connection or an excessive number of elbows to clear other items.

E.4.2.4 Electrical requirements

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.

Some larger cabinet models, when operated at 115 Volts, will require a circuit rated for 20 Amp service. As the electrical plugs and sockets for 115 Volt, 15 and 20 Amp ratings are different configurations; the user should confirm that the site outlet socket matches the BSC plug

> NOTE - Some cabinets do not operate properly when connected to a ground fault circuit interrupter (GFCI). Consult with the BSC manufacturer about compatibility of their model with a GFCI outlet, if one is present.

E.4.2.5 Service line requirements

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.

E.4.2.5.1 Connecting service valves to flammable materials

> NOTE - The use of flammable gases or solvents should be avoided in a BSC. Open flames in the cabinet will disrupt the airflow in the cabinet and may damage the HEPA/ULPA filters. Flammable gases or solvents may reach explosive concentrations in recirculating cabinets or ductwork. If the user feels that their procedure requires the use of an open flame or flammable materials they should contact their institution's safety office.

E.4.2.5.2 Connecting service valves to high pressure service

The use of air or gases under high pressure should be avoided as they may seriously disrupt the airflow patterns in the cabinet.

E.4.2.5.3 Connecting service valves to a central (House) vacuum

If service valves are to be connected to a central (House) vacuum source, appropriate devices, such as disinfectant traps and/or in-line filters should be installed to prevent contamination of the vacuum system.

E.4.2.6 Roof exhaust systems

Roof exhaust systems serving biosafety cabinets should have a stack that extends straight upward at least 10 ft (3 m) above the roof surface or have a stack with a smaller diameter trailing end to produce higher velocity flow to avoid re-entrainment by the building, and should be increased in elevation when necessary to avoid the influence of surrounding structures. Raincaps or any other structure that deflects the straight upward flow of the discharged air should be avoided. No precipitation can enter the stack when air is being exhausted at normal stack velocities. To take care of precipitation during periods when system is shut off, a 1 in (2.5 cm) hole can be drilled in the lowest point of the fan casing and the water allowed to drain onto the roof. It is recommended that roof exhaust fans be energized by direct-connected electric motors to avoid failures caused by slipping and breaking of belts. Another advantage of direct-connected fans is the ability to use the motor non-function to activate an alarm in the laboratory, whereas when a malfunctioning belted fan is employed, the motor can be operating when the fan is idle. A diagram illustrating a recommended roof exhaust facility is shown in Annex E, figure E7.

E.4.3 Pre-purchase checklist

The investigator should notify building management to arrange for a feasibility assessment of laboratory alterations and BSC location. The investigator and biosafety officer or qualified safety professional should discuss the following points about the BSC and its delivery:

- ensure all arrangements are planned in advance of the BSCs arrival;

- get a written price quote for the entire package, including the BSC Model number, optional equipment, canopy exhaust connection, etc. Work out the details about shipping and delivery with the manufacturer's representative at the time of purchase;

- determine the costs for shipping and delivery because there may be additional costs depending on the location and level of difficulty of delivery;

- ensure that the sales representative clarifies in writing what is included in "shipping and delivery". Does it include delivery of the BSC to the receiving dock of the building or to the laboratory? Does it include BSC set-up in the work area, and removal of cartoning/crating materials?

– if not covered in the purchase price, the customer will have to get facility personnel, or hire moving contractors to uncrate and move the BSC;

– ensure the corridor pathways are clear for delivery to the laboratory,

– will the BSC fit through door jams?

– will the BSC travel around sharp, narrow corridors and corners?

– will the elevators in the building accommodate the BSC?

– does the BSC have to be brought up steps?

– the moving contractor should be advised that the BSC shall be lifted onto its stand or leg extensions (working position) with a hydraulic lift;

– responsibility for removal and proper disposal of all packing materials must be established.

E.5 Inspection

E.5.1 When the BSC arrives, inspect it carefully. Compare the invoice with the delivered equipment. Check for any damage or missing materials and report them immediately to the proper carrier and the BSC supplier regardless of how insignificant they may first appear. Be careful of sharp crating material and let the loading dock personnel help check for damage.

E.5.2 Arrange for certification after the BSC is installed. Building operations personnel may be needed to connect the BSC to laboratory plumbing, electrical, and supply/exhaust air ventilation systems.

E.6 Moving a permanently installed biosafety cabinet

E.6.1 It is a common practice to move permanently installed BSCs to other locations within a laboratory or to other laboratories. Despite the apparent simplicity of the job, there are certain conditions that must be met prior to moving this equipment. BSCs should not be moved without consultation with a biosafety officer or qualified safety professional.

E.6.2 Existing BSCs and ancillary equipment, such as canopy connection exhaust ducting, gas, electric and vacuum connections, should be cleared for maintenance by a biosafety officer or qualified safety professional prior to disassembly. Depending on circumstances of the move, (i.e., cabinet use, new location, etc.), BSCs may be required to be space decontaminated. After a BSC is moved, it should be certified according to applicable performance standards.

E.7 Lifespan of BSCs

The current lifespan of a Biosafety Cabinet is approximately 15 years. Use of modern day Biosafety Cabinets (BSC’s) began in the early 1970’s with BSC’s that were manufactured to the NIH-03-112C Standard and subsequently the NSF/ANSI 49. BSC’s manufactured in the 70’s, 80’s and early 90’s have provided over 15 years of service. Several considerations should be made of BSCs in this age group.

– Will the BSC need extensive service? (i.e. HEPA/ULPA filter replacement, blower/motor replacement, will the electrical wire harnesses need replacement? etc.).

– Can an older BSC be commissioned after it has been in storage or purchased as a resale?

– Will original test reports be available or will the BSC be commissioned to current NSF Standards?

After 15 years, replacement parts may or may not be available due to electrical or mechanical changes at the factory or industrial part suppliers. For example, magnetic ballasts and T12 fluorescent bulbs will no be available after the year 2010. In addition, today's BSCs have evolved through the years with many improvements in containment, ergonomics, serviceability, and energy efficiency. That should be considered in a repair versus replacement decision.

E.8 Decommissioning process

E.8.1 No biosafety cabinet should be sent to a landfill or a recycling facility as a BSC, it should be disassembled per requirements contained in this section.

E.8.2. Decontamination and PPE

E.8.2.1 After a review of the BSC hazard use, the cabinet may be considered chemically contaminated and requiring special decontamination procedures, not the standard gaseous sterilization. Follow paragraph E.10.2.3.

E.8.2.2 All decommissioned BSCs used with pathogens should be space decontaminated.

E.8.2.3 BSCs to be decommissioned that were used with chemical agents should have a hazard review made to determine whether special decontamination practices and PPE should be followed.

E.8.2.4 For those BSCs used with biological agents that may not be inactivated via formaldehyde, the filters should be incinerated and 10% bleach or other appropriate disinfectant applied to all remaining contaminated surfaces. Obtain prior approval of the Facility Safety Officer.

E.8.2.5.1 PPE should be used as directed by the Facility Safety Officer or the biosafety safety officer.

E.8.3 Metal parts

E.8.3.1 All metal parts of less than 30 pounds (13 kg) per item should be removed from the lab and taken to an appropriate metal recycling container.

E.8.3.2. Metal parts in excess of 30 pounds (13 kg), including the unit chassis, should be taken to a designated area in the facility to be picked up by a commercial recycling vender.

E.8.4 Glass windows

E.8.4.1 All glass safety windows and sashes should be taken to the designated glass container. Remove all parts that are not press fit or glued to the glass edges or surfaces.

E.8.5 Wiring

E.8.5.1 All accessible wiring should be taken to a wiring recycling container.

E.8.6 Electrical ballasts

E.8.6.1 All lamp ballasts should be taken to the ballast collection center at the institution.

E.8.7 Lamps

E.8.7.1 All fluorescent lamps should be taken to the lamp container area at the institution.

E.8.7.2 All ultraviolet lamps should be handled as mercury-containing waste.

E.8.8 Labels

E.8.8.1 All warning, identification and certification labels should be removed and destroyed.

E.8.9 Used HEPA/ULPA filters

E.8.9.1 HEPA/ULPA filters that have been decontaminated are often burned in an incinerator. This disposal method is also effective for HEPA/ULPA filters containing toxic chemicals. Factors to be considered when incinerating filters include, but are not limited to, composition of the waste, feed rate, combustion temperature and dwell time in the primary chamber.

E.8.9.2 HEPA/ULPA filters may be placed in heavy plastic bags, such as those used to bag-out filters from contaminated filter housings. The bagged filters can be chemically decontaminated in situ by cutting small holes in the bag and delivering appropriate disinfectant or neutralizing agent by inserting a garden-type spray through the hole and spraying the filter media. The holes can be sealed with duct tape and shipped to an incinerator or sanitary landfill. This chemical method may be appropriate for filters containing agents (i.e. toxic chemicals) that cannot be inactivated by the usual space decontamination procedures.

E.8.9.3 Decontaminated HEPA/ULPA filters may be safety buried in a sanitary landfill because they no longer pose a hazard.

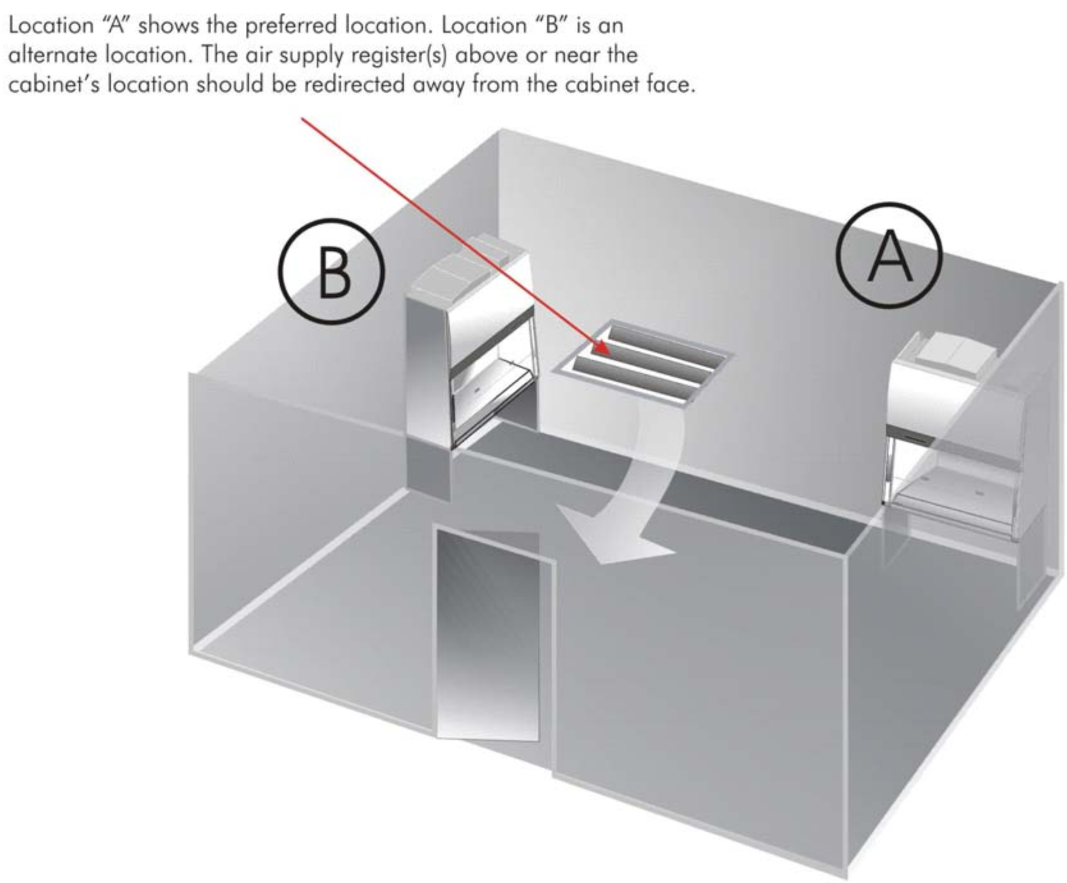

Figure E1 – Suggested Laboratory Locations for Class II Biosafety Cabinets

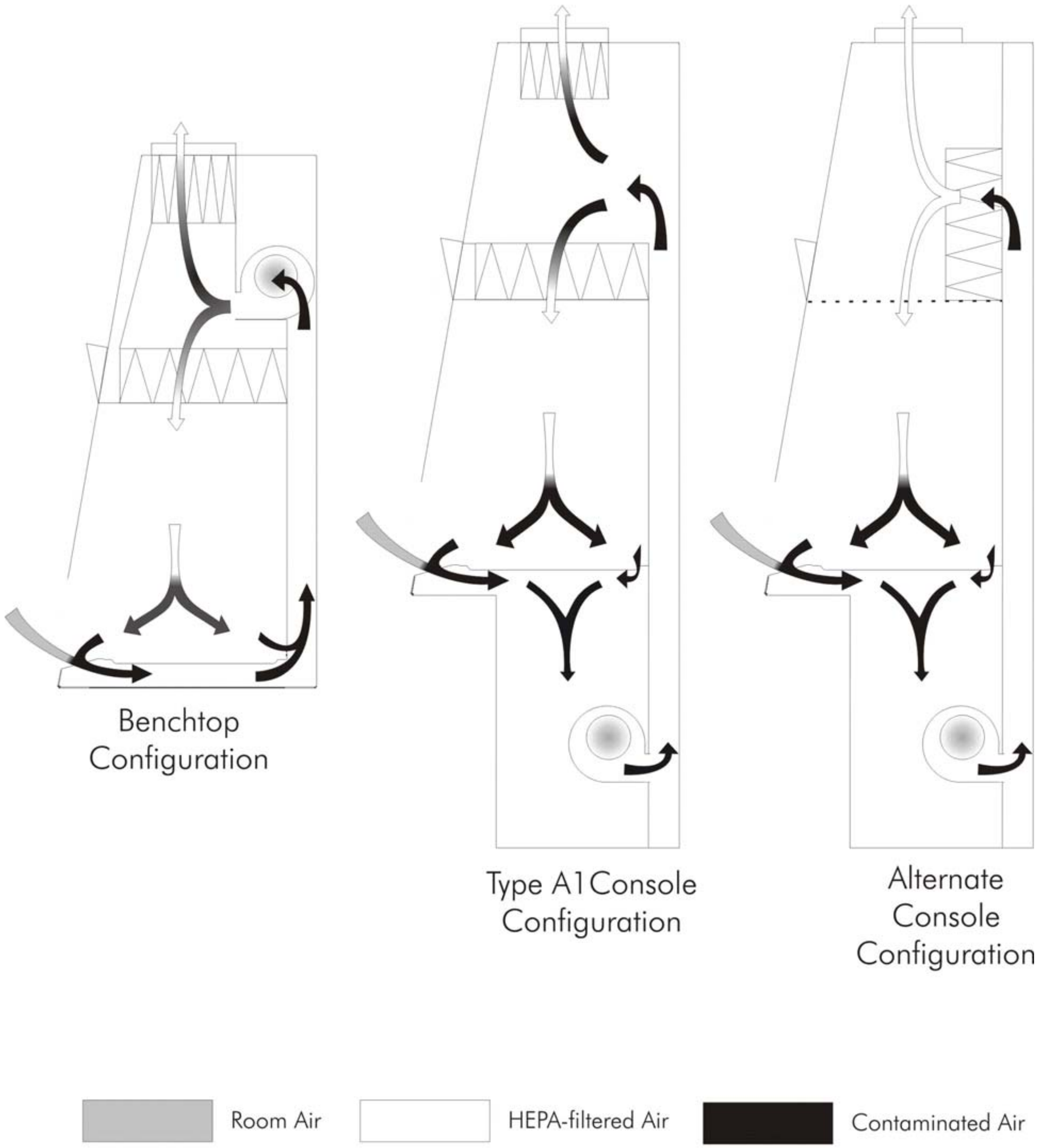

Figure E2 - Airflow Patterns for Class II Type A1 and A2 BSCs

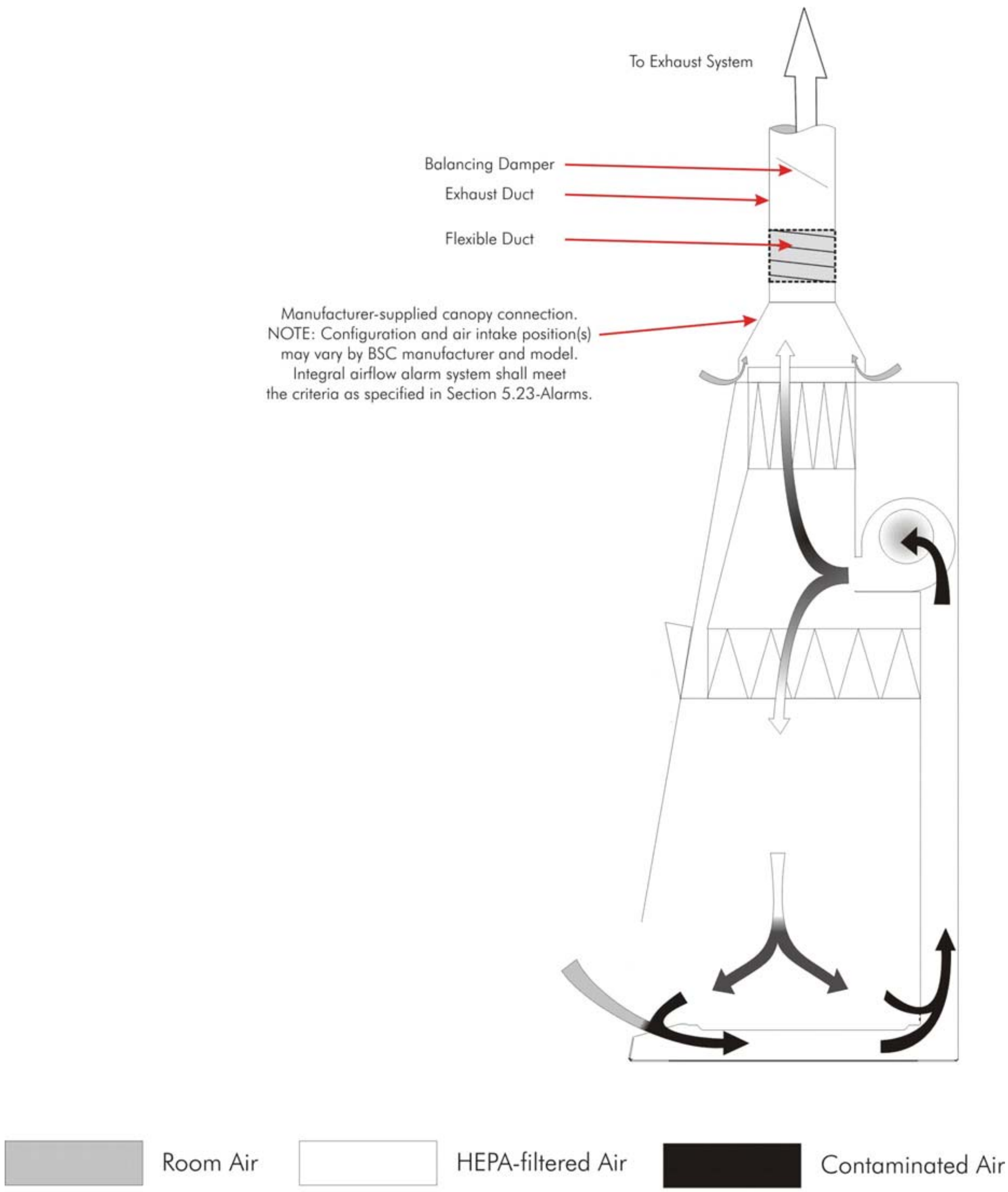

Figure E3 - Suggested Type A exhaust system

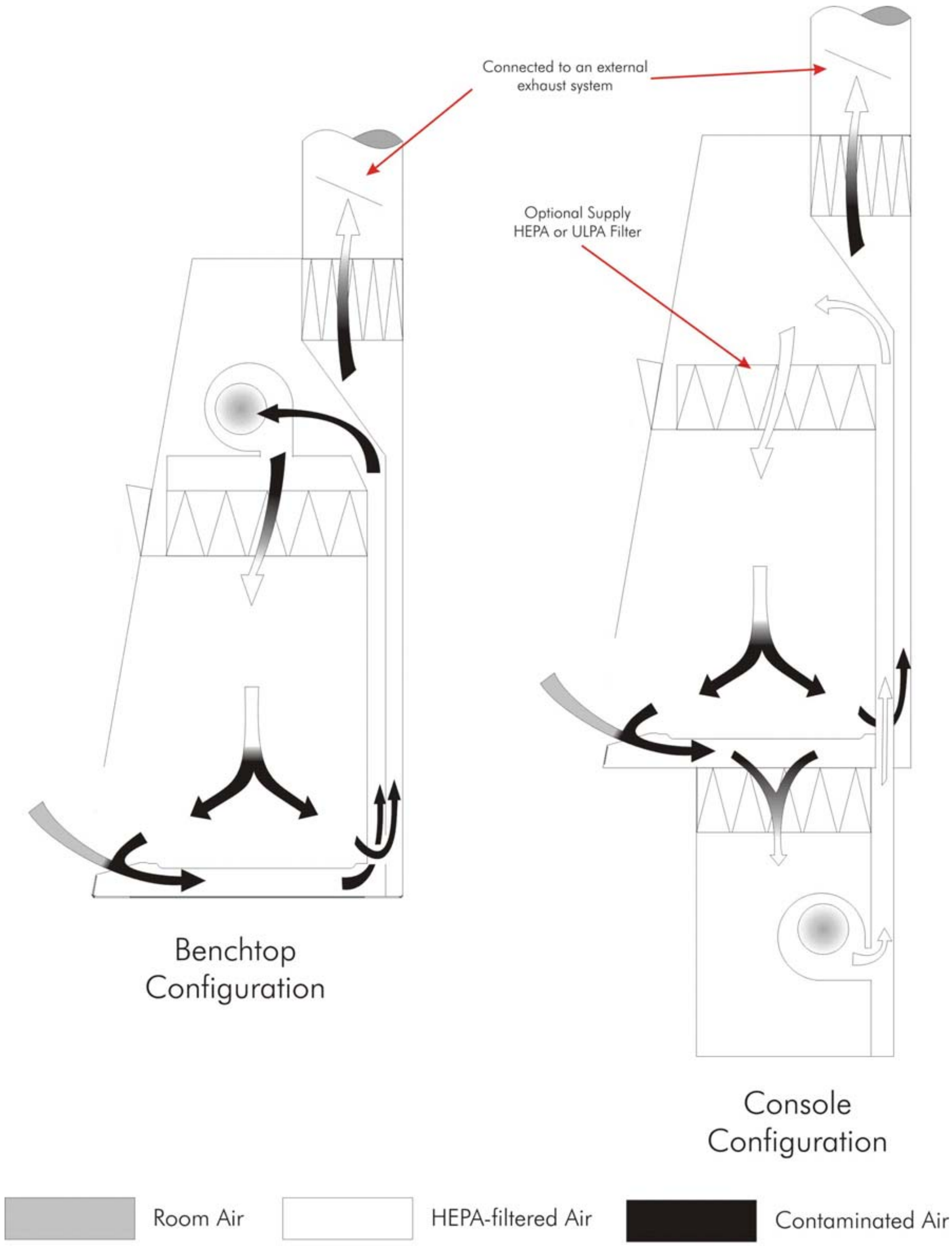

Figure E4 - Airflow Patterns for Class II Type B1BSCs

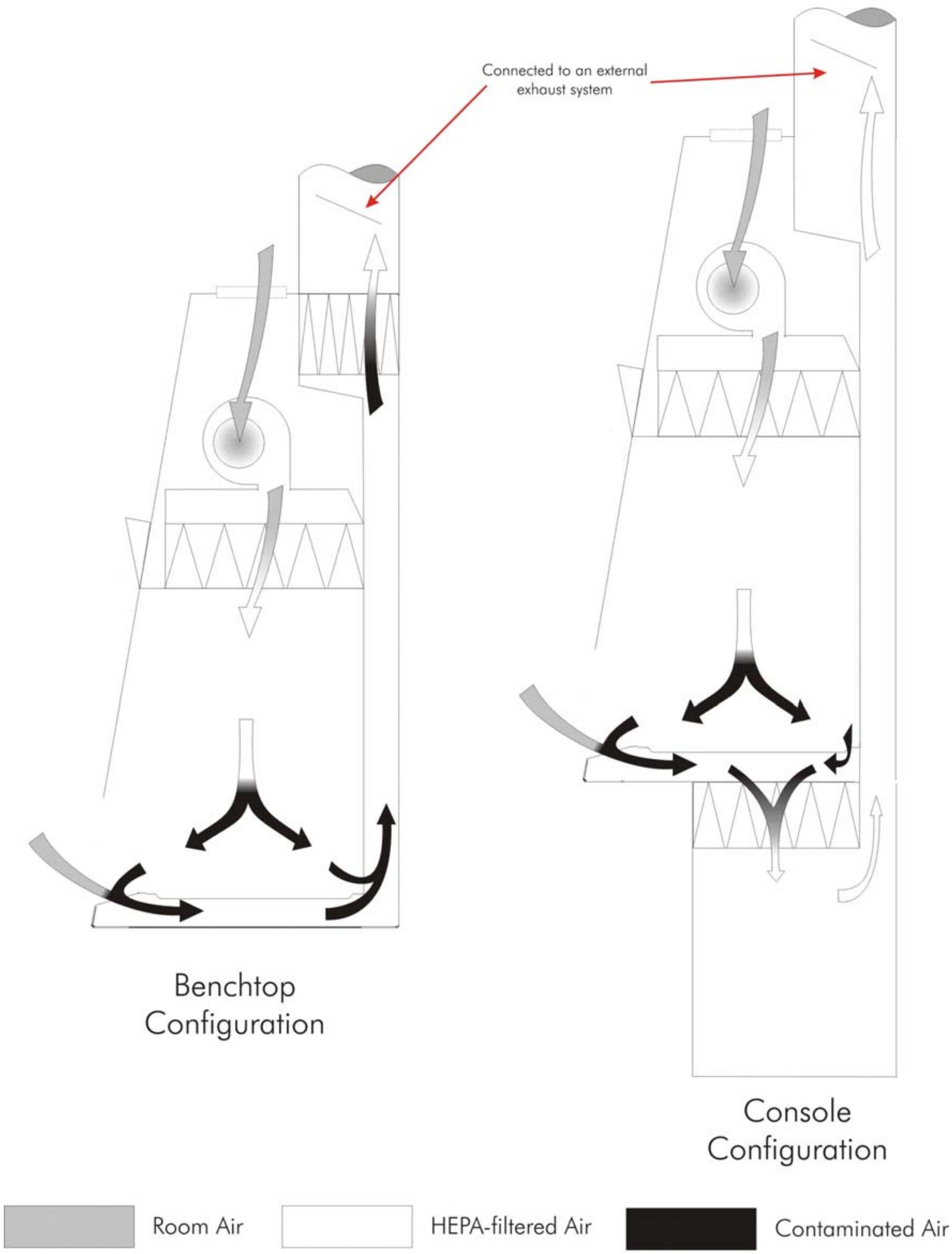

Figure E5 - Airflow Patterns for Class II Type B2 BSCs

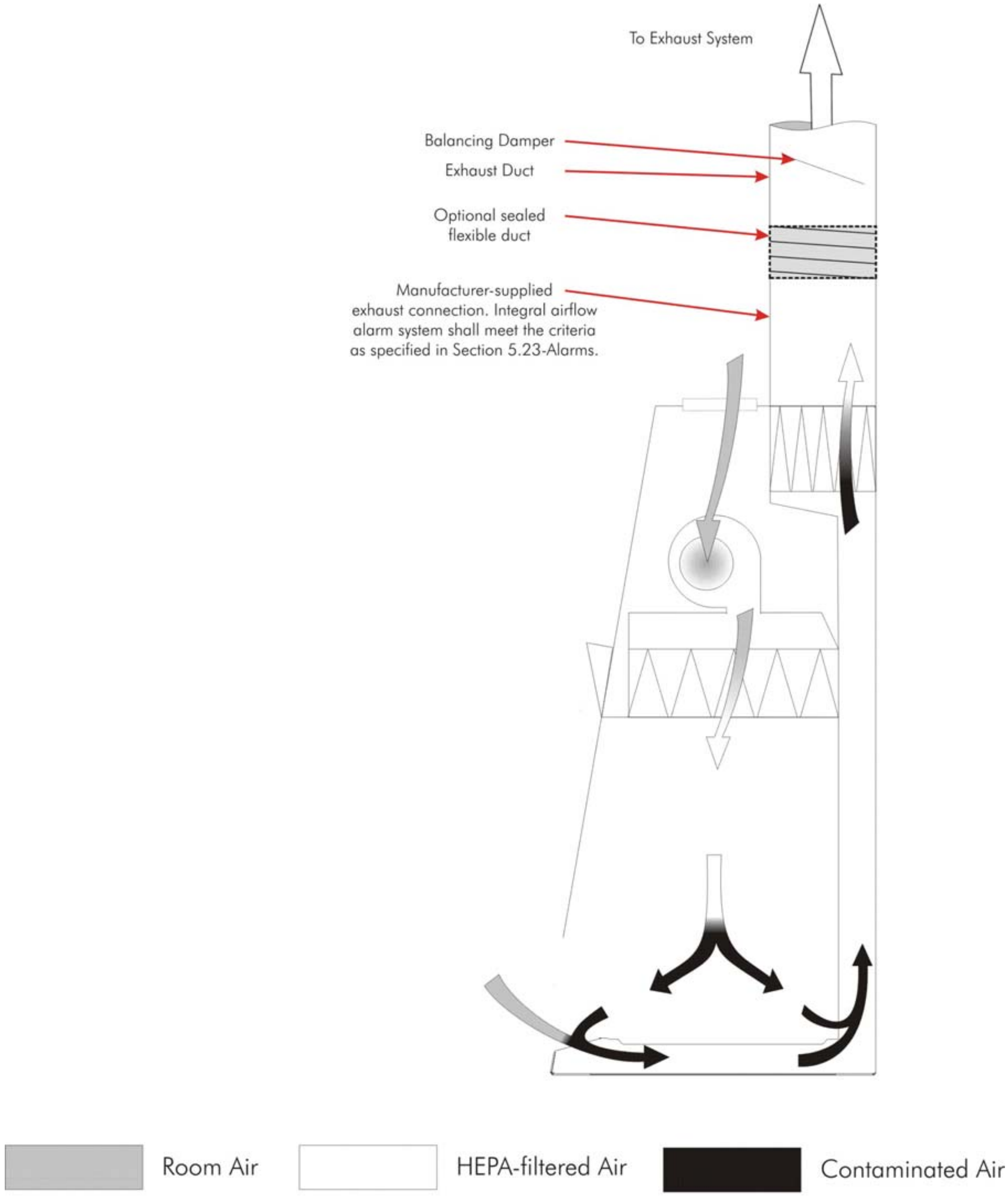

Figure E6 - Suggested Type B exhaust system

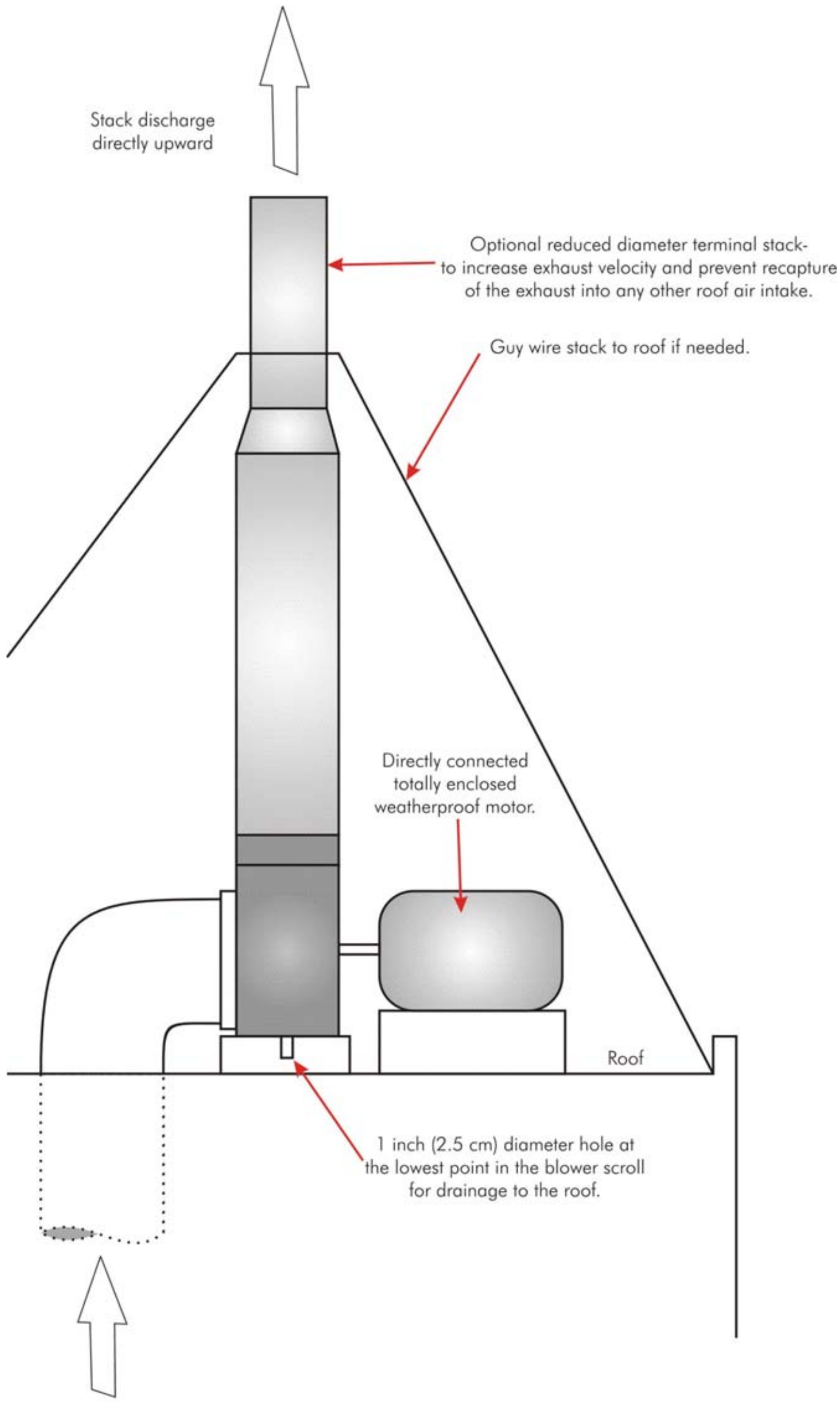

Figure E7 - Exhaust Stack and Blower.

SPES HOMINUM

***THE HOPE OF MANKIND** rests in the ability of man to define and seek out the environment which will permit him to live with fellow creatures of the earth, in health, in peace, and in mutual respect.*