# Proper Use and Care of the Biosafety Cabinet

In today's complex and efficient laboratory, in order to provide an optimum environment for biohazardous work, special emphasis must be placed on controlling that environment. Environmental controls have been acknowledged as a basic requirement for personnel and product protection. One of the primary means to control the laboratory environment is by controlling the method, amount, and direction of ventilation in the area. The risk of exposure to laboratory workers can be minimized by the proper selection and use of ventilated containment equipment. The main purpose of containment is to control aerosols and vapors, but in a much broader sense, consideration of safety equipment should serve to effectively isolate the user from the hazardous material being processed. Protecting the material from personnel is also a concern in some instances. One of the primary ways to achieve these objectives is with the biological safety cabinet (BSC).

There are three types of biological safety cabinets used in microbiological laboratories (Class 1, Class 2, and Class 3). Open fronted Class 1 and Class 2 biological safety cabinets are primary barriers, which offer significant levels of protection to laboratory workers and to the environment when used with good microbiological techniques. The Class 2 biological safety cabinet also provides protection from contamination of the materials (e.g., cell cultures, stocks) being manipulated inside the cabinet.

Since the bulk of biological safety cabinets at UAB fall into the Class 2 category the rest of this discussion will center around the proper use and care of this type. If you have a unit that is either a Class 1 or Class 3, please contact OH&S for additional information.

The Class 2 biological safety cabinet is designed with an inward air flow at a velocity to protect personnel (75-100 liner feet per minute), high efficiency particulate air (HEPA) filtered down-flow for product protection and HEPA filtered exhaust for environmental protection. See Figure 1.

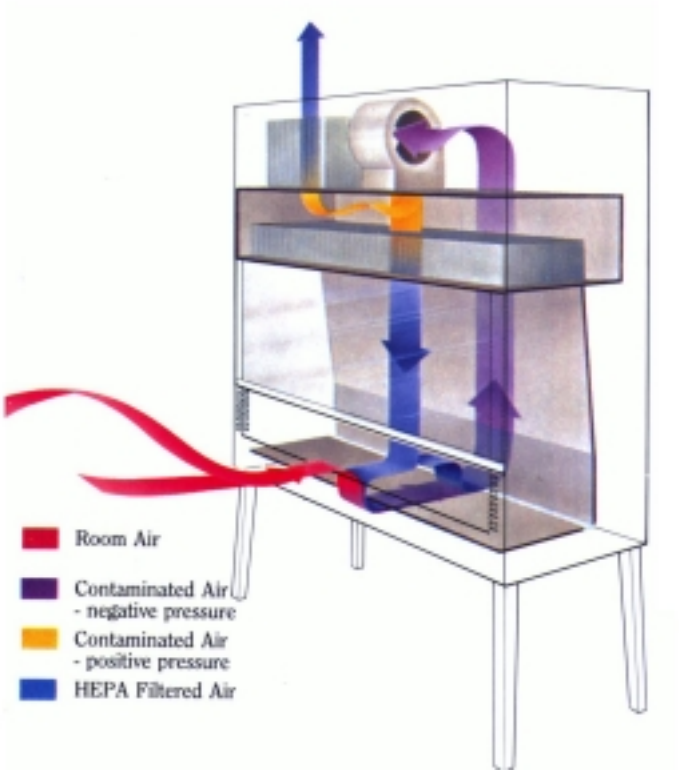


Fig.1

Design, construction, and performance standards for Class 2 BSCs, as well as a list of products that meet these standards, have been developed by and are available from the National Sanitation Foundation, Ann Arbor, Michigan. Utilization of this standard and list should be the first step in selection and procurement of a Class 2 BSC.

Class 2 BSCs are classified into two types (A and B) based on construction, airflow dynamics, and exhaust systems. Basically, Type A cabinets are suitable for work in the absence of volatile or toxic chemicals and radionuclides, since air is recirculated within the cabinet and is configured so that exhaust air returns into the laboratory space. Type B BSCs are ducted to the outdoors by means of a duct system and consequently can be approved for use with certain volatile or toxic chemicals and radionuclides.

HEPA filters are the heart of the BSC. The US Army developed this special type of filtration shortly after World War 2. It was originally developed to provide protection of troops when engaged with lethal or incapacitating gas. What was found was that the filter was useless against gas but was incredibly efficient at particulate filtration. The Army then quantified the

efficiency to be 99.97-99.99% efficient at 0.3 micrometers (0.3 μm is considered to be the most difficult size to filter). Care should be taken when cleaning the BSC to avoid wetting the HEPAs with disinfecting agents.

Class 2 BSCs must be tested and certified *in situ* at the time of installation within the laboratory, at any time the BSC is moved, and at least annually thereafter. Certification at locations other than the final site may attest to the performance capability of the individual cabinet or model but does not supersede the critical certification prior to use in the laboratory.

As with any other piece of laboratory equipment, personnel must be trained in the proper use of the BSC. Of particular note are activities that may disrupt the inward directional airflow. Care must be taken to avoid blocking the front intake grills with paper and supplies. It is crucial that this area be unobstructed. Repeated insertion and withdrawal of the worker's arms into and out of the work chamber, opening and closing doors to the laboratory or isolation cubicle, improper placement or operation of materials or equipment within the work chamber, or brisk walking past the BSC while it is in use have been demonstrated to cause the escape of aerosolized particles from within the cabinet. Airflow from fans, room air supply louvers and other air moving devices can disrupt the airflow pattern at the face of the cabinet. Strict adherence to recommended practices for the use of BSCs and their proper placement in the laboratory are as important in attaining the maximum containment capability of the equipment as is the mechanical performance of the equipment itself.

From time to time it may become necessary to decontaminate the BSC. Decontamination involves the use of paraformaldehyde gas. Paraformaldehyde is a hazardous substance and should only be used by trained personnel wearing proper respiratory protection. The Department of Occupational Health and Safety's certification team has extensive experience in using this material and have been properly fit tested for respirator use. Some of the circumstances that require paraformaldehyde decontamination includes: necessary repairs that involve removing potentially contaminated sections of the equipment, moving the equipment from one location to another, and if the cabinet is suspected of contaminating work when all other sources have been eliminated.

The following are tips and techniques that will make your use of the BSC more efficient and safe.

**Operating Instructions (in order):**

- Start the unit allowing it to operate for 5 minutes
- Wipe the unit down with a suitable disinfectant - if you use alcohol verify that no open flames are nearby).
- Place supplies in cabinet - to avoid arm movements in and out of the cabinet, plan your work and place all the supplies you will need for that particular experiment in the cabinet, making sure not to over crowd the work area.
- Use proper work techniques – work clean side to dirty side.
- Do not use open flames in the BSC. They create turbulence that disrupts the pattern of air supplied to the work surface. Use disposable sterile loops when possible. If absolutely necessary, small electric "furnaces" for decontaminating bacteriological loops and needles, or touch-plate microburners equipped with a pilot light providing a flame on demand may be used.
- After the work is complete allow the unit to purge for 5 minutes then wipe down again with suitable disinfectant- it is especially important that you turn off microburners or "furnaces" before this disinfection process.
- Shut the unit down.

**Techniques to avoid contamination of yourself and your work:**

- Always wear personnel protective equipment such as gloves and lab coat.
- Place materials in BSC before work starts.
- Work on center line of the work surface - this imaginary line is where the laminar down flow of air separates and is theoretically the best area to minimize contamination.
- If necessary use slow and deliberate motions into and out of the BSC.
- Keep front grills clear of any obstructions.

**Points to consider:**

- Adjust seat height so that the bottom edge of the sash is level with your underarms.

- If you use a UV light, be sure to wipe it down once per week (with light off). UV lights must be turned off when the room is occupied to protect eyes and skin from UV exposure.
- Always wear gloves to avoid contamination.
- Avoid resting arms on the front edge of the unit unless your unit is equipped with an armrest.

If you have any questions regarding the safe use and selection of biological safety cabinets or certification issues please contact the Department of Occupational Health and Safety at 934-2487.