The Safe Use of Biological Safety Cabinets

Laboratory Training Module
by Environmental Health and Radiation Safety (EHRS)
Biological Safety Cabinets (BSCs)

• What is a Biological Safety Cabinet (BSC)?
  • Primary containment for working safely with infectious materials
  • Containment for biological aerosol generating procedures

• Designed to provide protection to:
  • Personnel
  • Product
  • Environment
HEPA Filter

• BSC’s have High Efficiency Particulate Air (HEPA) filters in their exhaust and/or supply systems

• Minimum filter efficiency = 99.97% removal at 0.3µm
  • BUT, particles both larger and smaller are removed with even greater efficiency!!!

• Filter construction:
  • Folded cellulose/borosilicate
  • Metal/wood frame
  • Epoxy/polyurethane sealants
Types of BSCs

3 Classifications of Biological Safety Cabinets:
- Class I
- Class II – most commonly used at Penn
- Class III (glove box)

If you are not sure which kind you have:
- Should be written on the front panel of the cabinet
- Call EHRS
Class I BSC

- **Personnel Protection**: Yes
  (inward airflow through sash opening)

- **Product Protection**: No
  (draws unfiltered laboratory air directly over work surface)

- **Environmental protection**: Yes
  (HEPA filtration of exhaust air)

- Suitable for work with agents in Risk Groups 1, 2 or 3
  - When NO product protection is required
Class II BSC

- **Personnel Protection:** Yes (inward airflow through sash opening)

- **Product Protection:** Yes (downward HEPA-filtered laminar airflow over work surface)

- **Environmental protection:** Yes (HEPA filtration of exhaust air)

- Appropriate for use with biohazardous materials and cell cultures
Class II Recirculating BSCs
(Types A1 and A2)

• Recirculates 70% of HEPA filtered air to work surface
• Exhausts 30% of HEPA filtered air to lab

• Use for work with:
  • Biohazardous (or potentially infectious) materials
  • Cell culture

• DO NOT use for work with:
  • Volatile toxic chemicals
    ▪ Vapors may build up presenting fire hazard
    ▪ Vapors will be recirculated into room
  • Radionucleotides
Class II Hybrid BSCs (Type B1)

- Recirculates 30% of airflow to **FRONT** part of work surface
- Exhausts 70% airflow via building exhaust system from **BACK** part of work surface

- Use for work with
  - Biohazardous (potentially infectious) materials

- May work with the following in the **BACK** (exhausted) part of surface
  - Volatile toxic chemicals
  - Tracer amounts of radionucleotides
  - Contact EHRS before initiating work

![Diagram of Class II Hybrid BSCs](image-url)
Class II Total Exhaust BSCs  
(Type B2)

- Hard ducted to building exhaust system
  - 100% of airflow (HEPA filtered) exhausted to outside

- Use for work with:
  - Biohazardous (or potentially infectious) materials
  - Handling cytotoxic or hazardous drugs
  - Volatile toxic chemicals (moderate amounts)
  - Radionucleotides
Class III BSC (Glove Box)

- **Personnel Protection:** Yes
  (work is performed through glove ports)

- **Product Protection:** Yes
  (gas-tight absolute containment enclosure)

- **Environmental protection:** Yes
  (exhaust and supply air is HEPA filtered)

- Commonly used at BSL 3 or 4*
  *There are no Level 4 facilities available on Penn’s campus
Clean Benches are NOT BSCs

**Use of clean benches for biomedical procedures is not allowed at Penn.**

- **Personnel Protection:**  No
  (air inside cabinet blown directly out at user)

- **Product Protection:**  Yes
  (HEPA-filtered airflow over work surface)

- **Environmental protection:**  No
  (no filtration of exhaust air)

- MUST NOT be used with:
  - Biohazardous (or potentially infectious) materials (including cell culture)
  - Chemicals
  - Radionucleotides
Before BSC Use

• Ensure window sash is at proper operating height (approx. 8-10 in.)

• Turn on blower and fluorescent light at least 15 min. prior to use

• Wipe down surfaces with appropriate disinfectant
Before BSC Use

• Monitor the BSC’s alarms, pressure gauges or flow indicators for any major fluctuations
  • ≥10% in magnehelic fluctuation
  • other changes indicating possible problems

• Do not change
  • baffle
  • damper
  • speed control settings
  • exhaust low flow alarm settings (if equipped)
Before BSC Use

• Protect vacuum system from aerosolized microorganisms

• Use configuration below and place in secondary containment (in case of spills)
  In-line HEPA filter (C) protects the Vacuum system (D)

Available from Fisher Scientific
During BSC Use

- Keep front, side, and rear air grilles clear
  - Obstructions disturb airflow compromising product and personnel protection

- Load only the materials required for the procedure
  - Cabinet is not made for storage of equipment or supplies

- Avoid frequent motions in and out of cabinet
  - Disrupts airflow
During BSC Use

• Arrange work surface from “clean” to “dirty” from left to right (or front to back)

Example:

• Sterile cell cultures (left)
• Inoculate cultures (center)
• Contaminated pipettes discarded in shallow pan with disinfectant (right)
• Other contaminated materials placed in biohazard bag (right)
No Open Flames in BSC

- **DO NOT** use open flames inside the cabinet
  - Not needed in the near microbe-free environment of BSC
  - Creates turbulence disrupting air patterns
  - Heat may damage HEPA filters or cause fire

Alternatives to continuous open flame Bunsen Burners:

- **Touch-o-Matic burner**
- **Bacticinerator**
- **Glass Bead Sterilizer**
- **Fuego SCS Safety Enhanced Laboratory Gas Burners**
Risk of fire from using open flames in BSC

Fire in a Biosafety Cabinet
During BSC Use

• If a spill occurs in cabinet during use:
  • Keep BSC running to contain aerosols
  • Cover spill with disinfectant soaked towels
  • Allow 20 min. contact time
  • Dispose of clean-up or other contaminated material in biohazard waste

• If spill overflows into catch basin under cabinet surface:
  • Ensure drain valve is closed
  • Pour disinfectant onto surface and through grilles
  • Allow 20-30 min. contact time
  • Soak up surface with paper towels
  • Connect flexible tubing to drain valve
  • Drain basin into disinfectant filled drain pan
  • Dispose of exposed materials in biohazard waste
After BSC Use

• Leave BSC blower running for at least 15 min. after use

• Wipe down cabinet surfaces with appropriate disinfectant

• UV lights are not necessary in BSCs
  • Only effective if cleaned weekly to remove dust/dirt AND checked periodically with a meter
  • MUST turn off when room is occupied to protect eyes and skin
Maintenance/Certification

• BSCs must be tested and certified *annually* or if:
  • A new cabinet is being installed
  • A cabinet has been moved
  • A cabinet is in need of troubleshooting or repairs

• **ALL** maintenance and certification conducted by an approved university-wide vendor
  • Never attempt repairs yourself
  • **DO NOT** contract with another vendor
Maintenance/Certification

• EHRS maintains a detailed inventory of BSCs on campus

• Contact a biosafety officer if you:
  • Plan to purchase a new BSC
  • Plan to move a BSC
  • Need help selecting a location for your BSC
  • Are encountering difficulties with scheduling or work completion
REMEMBER:

Biosafety Cabinets will only protect YOU, your PRODUCTS, and the EVIRONMENT if used properly!

So:
DO NOT use if out of certification
DO NOT clutter grilles
DO NOT overcrowd cabinet
DO NOT put head inside cabinet
DO NOT disrupt airflow with quick motions

DO follow practices/procedures outlined in training
DO feel free to contact EHRS with any questions anytime.

We are here to help!

Phone: 215-898-4453
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