

# 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  $0.3\mu\text{m}$ 
  - 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:

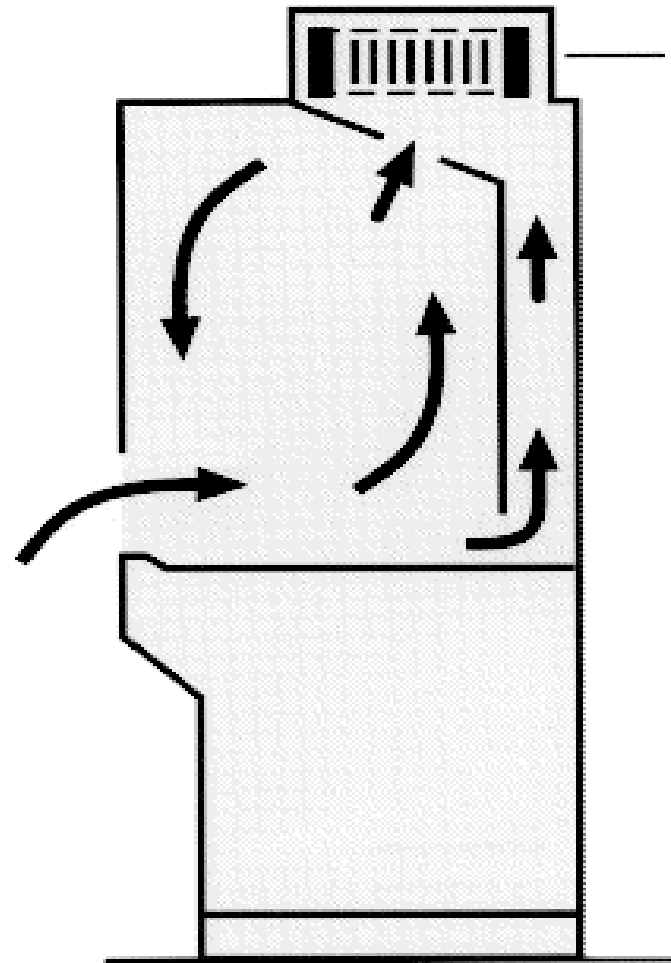
- Should be written on the front panel of the cabinet

OR

- Call EHRS

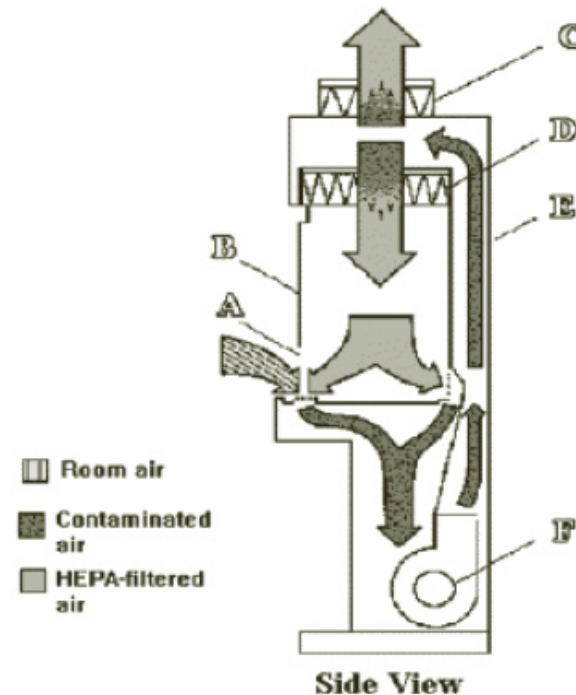
# Class I BSC

- **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



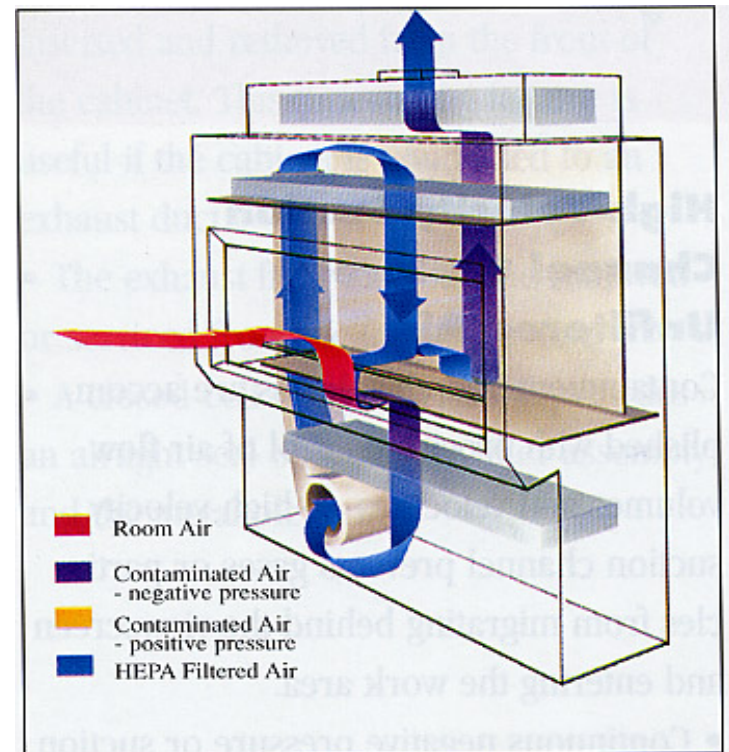
# Class II Recirculating BSCs (Types A1 and A2)

- 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
  - Radionuclides



# 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





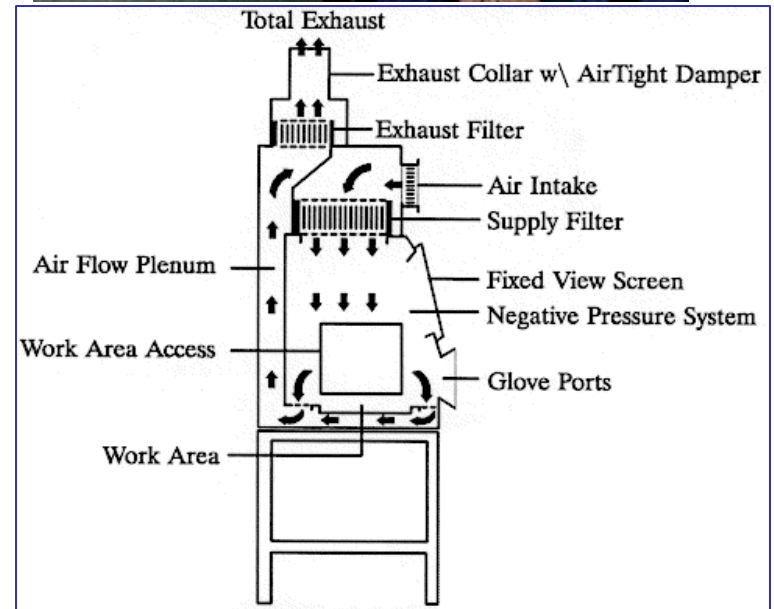
# Class II Total Exhaust BSCs (Type B2)

- 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)
  - Radionuclides



# 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**

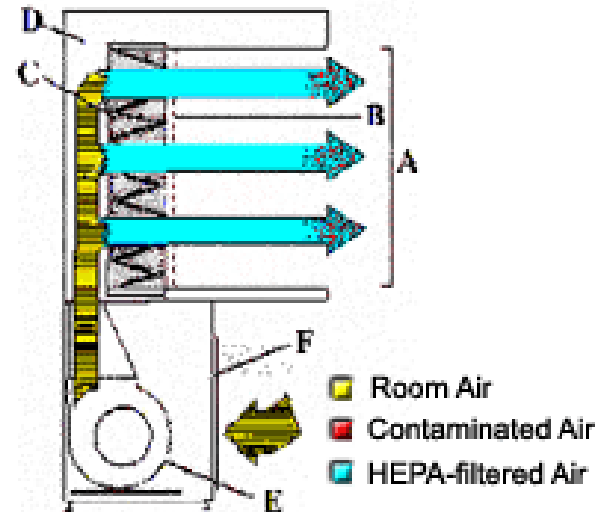
(HEPA-filtered airflow over work surface)

- **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
  - $\geq 10\%$  in magnehelic fluctuation
  - other changes indicating possible problems
- Do not change
  - baffle
  - damper
  - speed control settings
  - exhaust low flow alarm settings (if equipped)



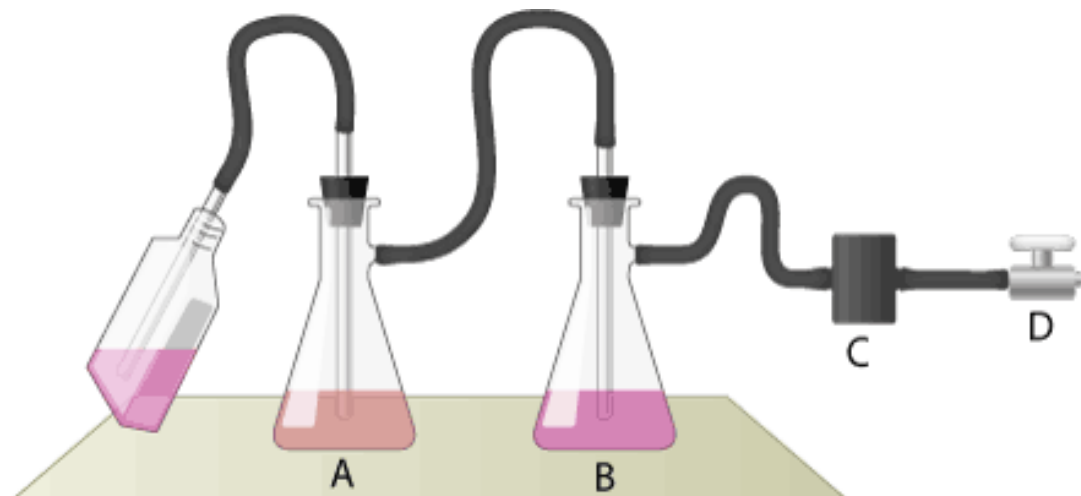
# Before BSC Use

- 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

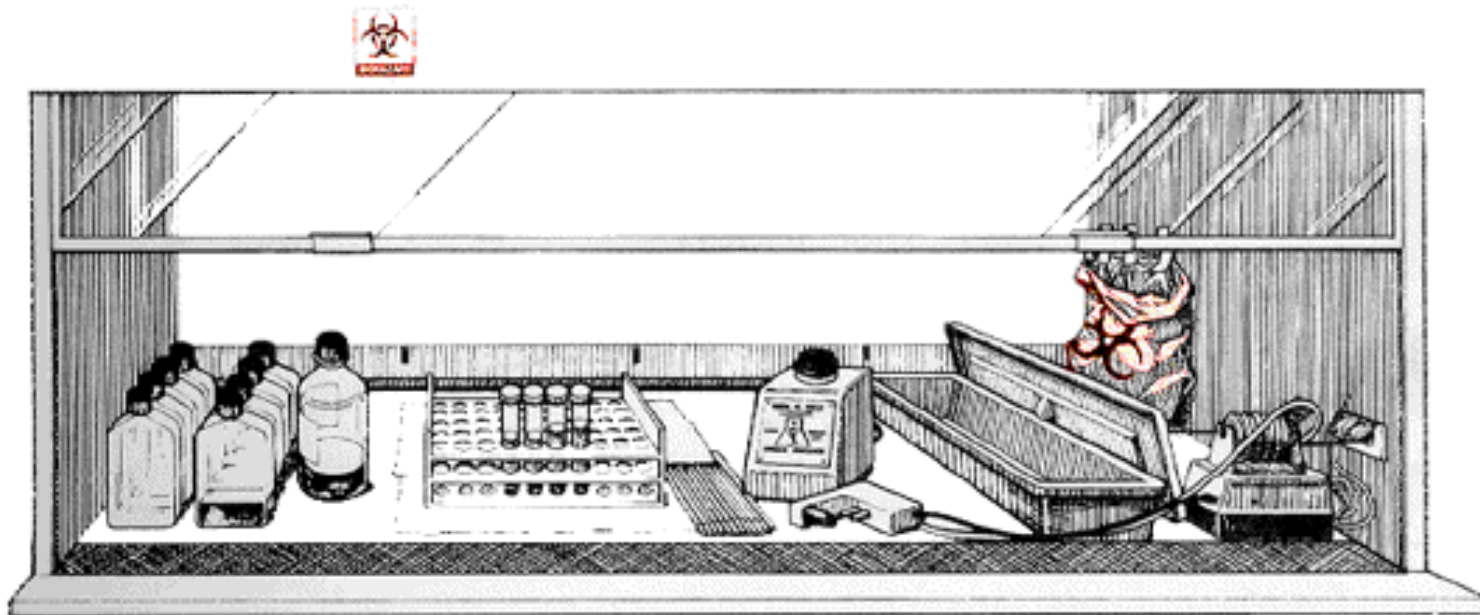


# During BSC Use

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

## Example:

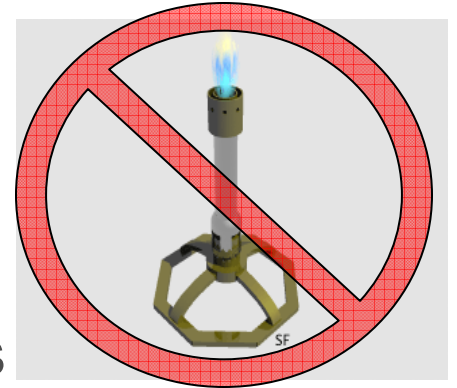
- Sterile cell cultures (left)
- Inoculate cultures (center)
- Contaminated pipettes discarded in shallow pan with disinfectant (right)
- Other contaminated materials placed in biohazard bag (right)





# 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**



**Bactincinerator**



**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 ENVIRONMENT  
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 EHRIS with any questions anytime.



**We are here to help!**

**Phone: 215-898-4453**

**E-mail: [ehrs@ehrs.upenn.edu](mailto:ehrs@ehrs.upenn.edu).**

