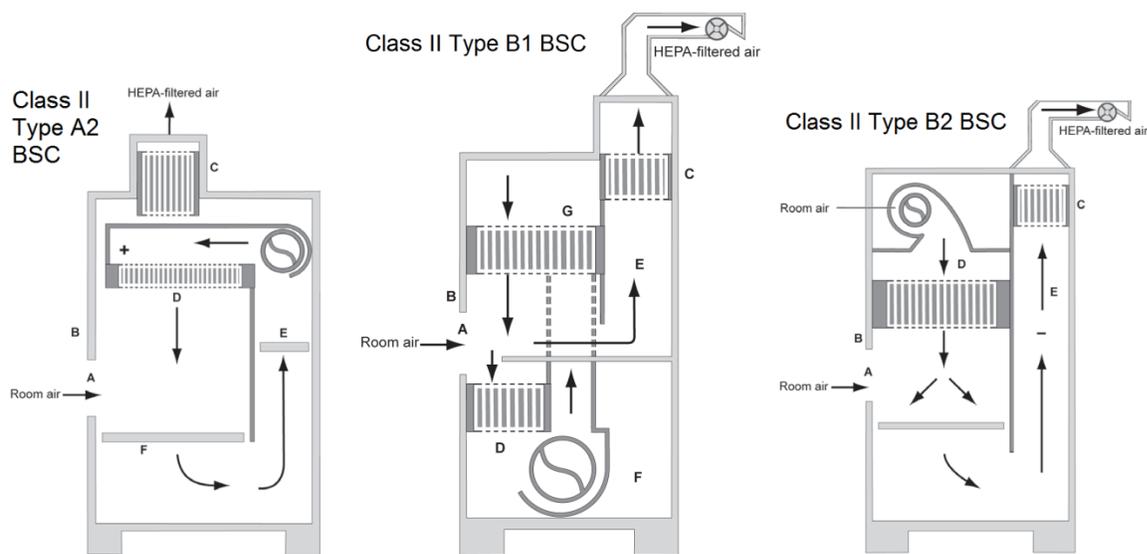


## Biosafety Technical Bulletin: Choosing the Appropriate Laboratory Engineering Controls for Infectious and/or Chemical Hazards

Engineering controls are the first line of defense against hazards in laboratories and animal facilities. These hazards include but are not limited to: viruses, bacteria, nanoparticles, toxic substances, corrosives, noxious fumes, and radioactive materials.

Combinations of hazards require engineering controls that provide protection against each hazard. Detailed guidelines for engineering control selection may be found in the [NCI at Frederick Safety and Environmental Compliance Manual](#). Contact Radiation Safety at 301-846-5730 for use of radiologicals.

- **Infectious hazards must be contained by a physical barrier such as a HEPA filter.**(1)
  - Manipulating infectious material in a Chemical Fume Hood (CFH) without a HEPA filter is unsafe.
- **Volatile hazards must be exhausted to the external environment.**(2)
  - Isoflurane use in a Class II Type A2 Biosafety Cabinet (BSC) without an external exhaust is unsafe.
  - Flammables used in BSCs must not exceed 10% of the potential Lower Explosive Limit.(3)
- **Solid/powder drugs and chemicals may be either contained or exhausted.**(1, 2)
  - Small quantities may be manipulated in a recirculating BSC.
  - Large quantities must be manipulated in an exhausted control.
  - An exhausted engineering control is always preferred.(3)
- **Engineering Controls are only effective when used properly.**
  - [ISM-144: Effective Use of Biological Safety Cabinets \(BSCs\)](#) (5)
  - [ISM-143: Proper Use of Chemical Fume Hoods](#) (5)



	Volatile	Non Volatile
Infectious	Exhaust + Containment	Containment
Non Infectious	Exhaust	Exhaust or Containment

**Exhaust + Containment:**

Class II Type B1 and B2 BSCs.  
 Class II Type A2 BSCs with hard duct connected external exhaust.

**Containment without exhaust:**

Class II Type A2 BSCs.  
 Class I BSCs (or equivalent Special Purpose Hoods with HEPA filtered exhaust, etc.)

**Exhaust without containment:**

Chemical Fume Hoods.

**Exhaust or Containment:**

Any of the previously listed engineering controls.

'Special Purpose Hoods' such as necropsy or benchtop hoods must be approved by EHS for each specific hazard. (4)

1. NIH. Biosafety in Microbiological and Biomedical Laboratories. In: HHS, editor. 5th ed2009.
2. NRC. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards: Updated Version. 2011.
3. NSF/ANSI. Biosafety Cabinetry: Design, Construction, Performance, and Field Certification. 2012.
4. NCI-F EHS. NCI at Frederick [Safety and Environmental Compliance Manual -Laboratory Ventilation Management Program](#). 2013.
5. <https://ncifrederick.cancer.gov/Ehs/Forms.aspx>