

FUME HOODS

The fume hood is one of the primary safety engineering controls in the laboratory. As described in the University's Fume Hood Inspection Program, **EHS** will (1) be responsible for the annual inspection and certification of the fume hoods, (2) monitor the preventive maintenance program for the fume hoods and (3) coordinate the approval and placement of new (or used) fume hoods in the laboratory.

The purpose of the fume hood is to remove toxic fumes or contaminants from the breathing zone of the operator. Before using a fume hood, the operator must identify what types of chemicals will be used in this device. There are two basic categories of fume hoods: *General Purpose* and *Special Purpose*. Diagrams outlining the general characteristics of fume hoods can be found in Appendix C.

General Purpose Hoods

These hoods are used for laboratory work with materials that do not require special handling procedures. A general purpose fume hood can be one of four types: (1) *Conventional Hood*, the basic hood with a movable sash and baffle. This hood is generally the least expensive and its performance depends mainly on the position of the sash. (2) *By-Pass Hood*, designed to allow some exhaust air to "by-pass" the face of the hood even when the sash is closed. It is designed for use with sensitive and fragile apparatus and/or instruments. (3) *Auxiliary Air Hood*, designed to introduce outside air into the hood and limit the amount of room air that is exhausted. (4) *Variable Air Volume (VAV) Hood*, designed to regulate the hood exhaust and keep the air velocity at a predetermined level.

Special Purpose Hoods

Certain research activities involve the use of substances which can create dangerous conditions or have clearly defined health hazards. These activities will require specially designed fume hoods to deal with these unique conditions. The most common special purpose fume hoods are: perchloric acid and radioisotope fume hoods.

Perchloric Acid Fume Hoods

Procedures with perchloric acid must never be done in a regular fume hood. Special perchloric acid hoods must be used. These hoods are generally made of non-corrosive materials (stainless steel), and equipped with a water wash down mechanism in the ductwork. Perchloric acid fume hoods must be clearly labeled and used only for perchloric acid or other mineral acids, such as nitric, hydrochloric, and hydrofluoric. **No organic solvents should be stored or used in these hoods.**

When perchloric acid is heated above ambient temperature, vapor is formed which can condense in the ductwork and form explosive perchlorates. After each use, the fume hood operator should wash down the hood and ductwork with water.

Radioisotope Fume Hoods

Any research activity involving chemical radiolabelling must be done in a fume hood appropriate for such activities and must meet the requirements set forth by the University of Miami's Radiation Control Center (RCC). These requirements include, but are not limited to, the following:

- ! Certification by the RCC before radiolabelling procedures begin and at routine intervals thereafter, not to exceed one year.
- ! Establishment of a minimum flow rate of 100 linear feet per minute (lfpm) across the sash opening of the fume hood with a minimum face area (the region between the sash level and the bottom airfoil-see diagram in Appendix C) of four square feet.

- ! Operation twenty-four hours per day, 365 days per year for those hoods used with tritium or radioiodine.
- ! Maintenance of a *Use Log* for each radioisotope fume hood to assure that the established release limits are not exceeded.

Radioisotope fume hoods are *required* for chemical radiolabellings and other procedures where there is a potential release of volatile radioisotopes. For more information concerning the proper use and containment of radioisotopes, contact the RCC.

General Safety Practices With Fume Hoods

- ! Fume hoods are *not* designed for storage. Items (equipment, chemicals, etc.) within the fume hood should be minimized. Remove all items not required for procedures in progress.
- ! A fume hood should be physically inspected before use to make sure that it is functioning properly. A convenient test method is a tissue paper streamer attached to the bottom of the sash.
- ! All work should be conducted no closer than six inches behind the plane of the face (sash opening) of a fume hood.
- ! Any items within a hood must not obstruct the baffle openings or impede air flow at the face of the fume hood.
- ! Fume hoods should be operated with lowered sashes whenever possible.
- ! Baffles must only be adjusted by Physical Plant or other authorized personnel. Laboratory personnel should not manipulate fume hood baffles.

BIOSAFETY CABINETS AND LAMINAR FLOW HOODS

Biosafety Cabinets

The Biological Safety Cabinet (BSC) is another primary engineering control in the laboratory. It is commonly used as a containment and protection device in laboratories working with biological agents. The major functional element of a BSC is its ability to create a near-sterile environment through the use of High Efficiency Particulate Air (HEPA) filters. The size, location, and placement of these filters will determine the class and function of a biological safety cabinet.

There are three different classes of BSCs not directly related to the Biological Safety Levels (BSLs) required for microbiological agent use (see the section on Biosafety). Generally, Class I and Class II cabinets can be used for work at BSLs 1 to 3. Class III cabinets are usually reserved for work at BSL4, although a Class II cabinet can be used at this level if the appropriate personal protective equipment is used.

Class I Biosafety Cabinet

A ventilated cabinet for personnel and environmental protection, with unrecirculated inward airflow away from the operator. The cabinet exhaust air is treated before it is discharged to the outside atmosphere. This cabinet resembles

a chemical fume hood with a filtered exhaust and is suitable for work with low and moderate risk biological agents where no product protection is required.

Class II Biosafety Cabinet

A ventilated cabinet for personnel, product and environmental protection having (1) an open front with inward airflow for user protection, (2) downward HEPA-filtered, laminar airflow for product protection, and (3) HEPA-filtered exhausted air for environmental protection. Class II cabinets are suitable for low- and moderate-risk biological agents.

There are four recognized types of Class II biosafety cabinets that are widely used. These are Class II types: A, B1, B2, and B3. The nature of the particular research operation, the characteristics of a laboratory's exhaust system, and the mandated regulations will determine which type of Class II cabinet can be used. Contact **EHS** for more specific information.

Class III Biosafety Cabinet

A totally enclosed ventilated cabinet of gas-tight construction. Operations in the cabinet are conducted through attached rubber gloves. The cabinet is maintained under negative air pressure of at least 0.5 inches (12.7 mm) water gauge. Supply air is drawn into the cabinet through HEPA filters. The exhaust air is treated by double HEPA filtration. Class III cabinets are suitable for high-risk biological agents and are accompanied by much auxiliary safety equipment.

Laminar Flow Hoods

The term "laminar flow" describes the air purifying action of these hoods because they provide a directed, non-mixing air stream through a HEPA filter. They can also be called "clean benches" because they provide a near-sterile work area. **However these hoods do not provide protection to the operator from contamination and, in fact, can expose the worker to aerosols of allergenic or infectious materials.** Researchers therefore must not confuse these hoods with biological safety cabinets. These hoods must not be used for microbiological work with potential pathogens.

Please consult Appendix C for diagrams of the basic components of laminar flow hoods and biosafety cabinets.

Materials, Designs and Construction

All materials, designs and construction of BSCs and laminar flow hoods shall abide by the **National Sanitation Foundation (NSF) Standard 49**.

Performance, Inspection and Certification

Every new BSC must be performance tested by the manufacturer according to the requirements listed in the **NSF Standard 49** at the point of production. BSCs convertible from one type to another should be performance tested in each mode. Field certification by authorized individuals or companies should include, but not be limited to, the following testing procedures (described in **NSF Standard 49**):

- ! Soap Bubble/Halogen Leak
- ! HEPA Filter Leak
- ! Velocity Profile
- ! Vibration sensitivity
- ! Noise level
- ! Airflow Smoke Patterns

In addition, each BSC must have a certificate of inspection which should include, but not be limited to, the date of

certification, the name of the certifier, and the date for the next inspection. Certification of the biosafety cabinet must be done annually, whenever physically moved, or more often as necessary.

Since laminar flow hoods are not used to provide protection to the operator, these devices can be certified less frequently. Contact **EHS** to obtain a list and information on approved and licensed certifiers.