General Laboratory Ventilation Design Issues

All laboratory spaces shall have mechanically generated and conditioned supply and exhaust air. All lab rooms shall exhaust 100% to the outside. There shall be no return of fume hood and laboratory exhaust back into the building.

Air exhausted from a clean room may be HEPA filtered and resupplied to that same clean room provided that the recirculated air does not contain volatile hazardous materials.

UC Practice
Prudent Practices in the Laboratory, Sections 8.C and 8.D
24 CCR, Part 3, 505.3

Special laboratory chemical hoods, as well as other devices equipped with ventilation to protect workers, the public, or the environment, shall be designed in accordance with ANSI/AIHA Z9.2 and ACGIH’s Industrial Ventilation: A Manual of Recommended Practice.

ANSI Z9.5 4.3

Sufficient exhaust air shall be provided to assure the removal of hazardous airborne materials. In general, hazardous operations should be enclosed in fume hoods or other exhausted enclosures. The total volume of exhaust air shall be a minimum of 1 cfm/square foot of floor area. When fume hoods are installed, they must operate continuously and may not be controlled by switches.

When air is exhausted from a laboratory in a volume that exceeds 1 cfm/square foot (for example, in a room with multiple fume hoods), the exhaust volume may be reduced during periods when the room is unoccupied, provided that sufficient volume is maintained to exhaust hazardous materials, and the reduced volume does not fall below 1 cfm/square foot.
Historically, the measurement “air changes per hour (ach)” has been used as a design criterion for laboratory ventilation, with recommended values between 6 and 12 ach. This is not an appropriate concept for designing contaminant control systems, as it implies that general laboratory ventilation will be utilized to remove contaminants. Contaminants must be controlled at the source. 1 cfm/square foot of floor area is equivalent to 6 ach for a room with a 10-foot ceiling. Lacking other information, floor area is a rough surrogate for intensity of activity.

UC Practice
ASHRAE Handbook of Fundamentals, Chapter 13
NFPA Article 80
Prudent Practices in the Laboratory, Section 8.C.11

Laboratory exhaust systems should be designed with at least 25% excess capacity for future expansion.

Avoid generation of excessive noise in laboratory ventilation systems. Fan location and noise treatment shall provide for sound pressure level (SPL) in conformance with local ambient noise criteria. Noise generated by the functioning fume hood within 6 inches of the plane of the sash and bypass opening in any position shall not exceed 60 dBA. The noise level in the general laboratory space should not exceed 55 dBA, which is consistent with good office design, to allow for easy verbal communication.

The primary references for acoustic design criteria and methods will be found in ASHRAE publications such as the ASHRAE 1997 Handbook of Fundamentals, and from the ASHRAE 1999 HVAC Applications.

UC Practice
ANSI Z9.5 5.1.3

The airflow velocity in each duct shall be sufficient to prevent settlement of liquid or condensable solids on the walls of the ducts. A duct velocity of 1,000 fpm seems to be adequate to prevent condensation in fume hood ducts without excessive noise. However, higher velocities are needed to entrain solids.

Exhaust from hoods used for teaching should be routed to blowers different from those used to exhaust air from research areas.

This allows energy savings for those times when the teaching labs are not being used.

UC Practice

Operable windows in laboratories are not permitted. Drafts from open windows can seriously disrupt fume hood containment, and open windows destroy negative pressure containment that should be provided in laboratories (see the 'Negative Pressurization' section of this chapter for more information).

Flexible local exhaust devices (e.g., snorkels? or elephant trunks?) shall be designed to adequately control exposures to hazardous chemicals. An exhausted manifold or manifolds with connections to a local exhaust may be provided as needed to collect potentially hazardous exhausts from gas chromatographs, vacuum pumps, excimer lasers, atomic absorption instruments, or other equipment that can produce potentially hazardous air pollutants. The contaminant source needs to be enclosed as much as possible, consistent with operational needs, to maximize control effectiveness and minimize air handling difficulties and costs.

Enclosure minimizes the volume of airflow needed to attain any desired degree of contaminant control. This reduces fan size, motor horsepower, makeup air volume, and makeup air-conditioning costs.


Fume hoods shall not be located adjacent to an exit.

A fire, explosion, or chemical release, any one of which may start in a fume hood, can block an exit, rendering it impassible. Pedestrian traffic can also interfere with the functioning of a hood.

NFPA 45, Chapter 6-9.2
NFPA 45, Chapter 3-4.1(d)

Hoods shall be labeled to show the fan or ventilation system to which they are connected.