UNIVERSITY of WASHINGTON

Laboratory Safety Design Guide

LABORATORY VENTILATION

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Environmental Health and Safety
UNIVERSITY OF WASHINGTON

Section 3
LABORATORY VENTILATION

Contents

A. Scope

The purpose of laboratory ventilation is to help provide a safe environment for scientific research and teaching. The expectation is that the design team will design using a combination of general laboratory ventilation, fume hood exhaust systems, and other local exhaust ventilation (LEV) to contain emissions within the laboratory, depending on the specific needs of the laboratory. This guide provides minimum requirements; more stringent requirements may be necessary depending on the specific laboratory function or contaminants generated.

B. General Laboratory Ventilation

1. All laboratories shall have mechanical ventilation.
2. All laboratory rooms shall use 100% outside air and exhaust to the outside.
3. Design the air change rate for each laboratory room to provide the following:
    a. Adequate make-up air for LEV including fume hoods and bio-safety cabinets.
    b. Adequate tempering for personal comfort and laboratory requirements
4. Document designed air change rate (ACH) for each laboratory space.
5. Document how the design, including location of supply diffusers, exhaust grilles, and LEV optimizes ventilation effectiveness, including the capture and removal of emissions and mixing of air. Refer to "Determination of Laboratory Airflow Rates" to better understand the University's expectations.
6. Combined general and fume hood exhaust systems are preferred where their application can provide reduced cost and energy use without compromising safety or system integrity. The following should be included unless alternate design strategies are approved:*
    a. Use 316 stainless steel duct material except for general exhaust branch upstream of the combined duct
    b. Use pressure independent air terminal units for balancing as needed

    * For clarification, see *RWDI/ECT paper* "Combined General and Fume Hood Exhaust and Duct Velocities"
7. Fume hoods should not be the sole means of room air exhaust.
8. Provide excess capacity for equipment aging and future expansion.
9. Design for noise levels of 55 dBA or less.
10. Do not provide operable windows.
11. Direction of airflow should be from low hazard to high hazard areas.
12. Design to maintain negative pressure relative to adjacent non-lab areas. Provide an offset of 10% or 100 cfm per door to the corridor – whichever is greater.

13. Provide adequate makeup air (90% of the exhaust).
14. Locate casework and equipment so as not to interfere with ventilation.
15. Do not line duct with insulation
16. Ventilate and alarm cold rooms meant for human occupancy.

C. Fume Hood Exhaust System Design Criteria (FHES)

1. Design to incorporate user needs, room configuration and general ventilation.
2. The FHES shall contain and remove fumes generated within the hood.
3. Design with adequate space for hood service and utility connections.
4. Constant volume and variable volume systems are acceptable.
5. Design VAV diversity, typically 80%, around needs and practices of facility.
6. Minimize diffuser cross-drafts to less than 30% of the hood's target face velocity.
7. Located hood at least 6 feet from door.
8. For perchloric FHES, provide dedicated fan, duct and wash-down system.
9. Locate perchloric hood on building's top floor to minimize duct.
10. For radioisotope FEHS, provide a dedicated fan and duct.
11. For acid digestion, FEHS must be made of fiberglass reinforced plastic or material with similar acid resistance.
12. FHES for research shall not have local on/off or high/low control.
13. Under hood storage units shall comply with Chapter 6 of this Design Guide.
14. Ductless hoods are not permitted. Exceptions may be granted for single-process applications if approved by EH&S.
15. Design face velocities for a target sash height of 18 inches
16. For standard FHES, provide a face velocity of 100 fpm +/- 10%.
17. For low velocity FHES, provide a face velocity of 70 fpm +/- 10%
18. Design for noise levels of 65 dBA or less measured per ANSI SI.4-1971 at a point three foot in front of the sash at a height of five feet from the floor.
19. Provide constant volume (CV) hoods with an air bypass that limits the maximum face velocity to 300 lfm at a sash height of 6 inches.
20. Provide variable air volume (VAV) hoods with an exhaust minimum of 25 cfm/ft^2 of work surface area through air bypass.
21. Locate controls for hood utilities outside the hood
22. Hood lighting and other fixed electrical equipment within the hood shall be explosion proof.
23. Light fixture lamps shall be accessible from outside the hood.

24. For cup sinks, choose model with lip at least ¼ inch above the work surface.
25. Provide each fume hood with an audible and visible alarm that activate whenever the face velocity drops below 80 lfm for standard hoods and 56 fpm for low velocity hoods.
26. Equip water faucets with a vacuum breaker located outside the hood.
27. For hoods located in basements, provide an approved, automatic fire suppression system.
28. If this is not a University owned facility, see Appendix A for further design details of the FHES. If it is a University owned facility, refer to the FDI.

D. Fume Hood Exhaust System Testing

1. Measure FHES face velocities per ASHRAE 110 part 6.
2. Provide information on instrumentation including calibration dates and results.
3. Measure the velocity of cross drafts.
4. Once criteria above are met, provide test results to EH&S.
5. After review of test results, EH&S will test the hood to confirm adequate performance, label it appropriately, and approve for use.
6. If this is not a University owned facility, see Appendix A for testing details of the FHES ducts. If it is a University owned facility, refer to the FDI.

E. Local Exhaust Ventilation

1. Design local exhaust ventilation (LEV) systems per ACGIH Industrial Ventilation Manual or other professionally recognized design criteria.