UNIVERSITY OF ALASKA FAIRBANKS
SAFETY SYSTEM POLICY AND PROCEDURE

DOCUMENT NUMBER: 508
ISSUE DATE: SEPTEMBER 1996
SUBJECT: Management Procedure for Laboratory Ventilation

MANAGEMENT PROCEDURE FOR LABORATORY VENTILATION

PURPOSE: The purpose of these standards is to establish minimum requirements and procedures for laboratory ventilation systems.

OBJECTIVE: The objective of these standards is to 1) set forth ventilation requirements which will, in combination with appropriate work practices, achieve safe working environment, 2) provide faculty, staff, and students with a guide, and 3) inform the user of information needed by designers.

SCOPE: These standards set forth the requirements for the design and operation of laboratory ventilation systems on University of Alaska Fairbanks (UAF) facilities. These standards do not apply to the following types of hoods: laminar flow hoods or biological safety cabinets. Wherever these standards conflict with other standards, the more stringent shall govern.

I. ADMINISTRATIVE PROVISIONS

A. Overview - Laboratory ventilation controls are implemented by university management to ensure a safe and healthy environment for students, faculty, employees, and visitors. This management plan specifies the administrative and technical standards for use and testing of laboratory ventilation. The requirements apply to conventional fume hoods and other ventilation systems used for emission control and operator/visitor protection.

B. Responsibility - Unless otherwise stated, deans, directors, or department heads must ensure that the requirements of these standards are complied with at all times. In the plan deans, directors, or department head (or designated officials) are called the "Users."

C. Reporting - Documentation of preventive maintenance, testing, and monitoring, and performance testing of all laboratory hoods shall be provide by UAF Environmental, Health, Safety, and Risk Management (EHS&RM) with copies to System Office of Risk Services on an annual basis. Reporting procedures and forms will be furnished by EHS&RM.

II. REFERENCES

Appropriate standards and codes shall be followed by designers and Users of laboratory ventilation.

III. DEFINITIONS, TERMS, UNITS

A. User - The person responsible for the health and well-being of laboratory employees and visitors; i.e. deans, directors, or department heads, or other designated officials.

B. Laboratory - Typically, a research or development facility; equipped for study, or testing; using potentially hazardous materials.

C. Laboratory Ventilation - As used here, ventilation whose primary responsibility is the control of emissions and exposures; as opposed to HVAC.

IV. TECHNICAL PROVISIONS

A. General Requirements - Each User shall assure the proper selection, operation, use, and maintenance of laboratory ventilation equipment, consistent with guidelines developed by the University of Alaska.

1. Cognizant Person - In each operation, using laboratory ventilation systems, the User will designate a "cognizant person." This person will be responsible for day-to-day safe operation of lab ventilation systems. The Cognizant Person will provide information to the User and coordinate activities with EHS&RM.

2. Permanent Records - Permanent records shall be maintained for each laboratory ventilation system.

3. Laboratory Exhaust Fume Hoods - Adequate laboratory fume hoods shall be used when there is a likelihood of employee exposure to air contaminants generated by a laboratory activity.

4. Volume Flow Rates - The volume flow rate (Q) in a laboratory ventilation system shall be sufficient to control air contaminants generated by the activity.

5. Replacement Air - An air-handling system shall be provided to replace exhausted air.

6. Dilution and Replacement Ventilation - Dilution ventilation shall be provided to control the buildup of fugitive emissions in the laboratory.

7. Exhaust Discharge - Laboratory ventilation exhaust air shall be (1) directed to the atmosphere, (2) discharged so as to avoid re entrainment into building air handling systems, and to avoid hazards to the public.

8. Exhaust Stacks - Exhaust stacks shall meet appropriate Sheet Metal and Air Conditioning Contractors National Association and local codes.

a. Discharge - Exhaust discharge from stacks shall (1) be in a vertical-up position, (2) be ten feet above the adjacent roof line or air intake if within fifty feet, and (3) have a discharge velocity sufficient to avoid down wash during local high winds.

b. Aesthetics - Aesthetics considerations, concerning external appearance of buildings, shall be allowed to overcome the requirements of 8. a.

9. Combining Exhaust Gases - Two or more exhaust systems may be combined into a single manifold and stack if the following conditions are met: (1) mixing of gases will not result in reaction products likely to cause fire or explosion, excessive corrosion, or excessive condensation; and (2) the entire manifold must be maintained under negative pressure at all times.

10. HVAC Systems - HVAC systems shall be designed, constructed, and installed with applicable ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers), SAMA (Scientific Apparatus Makers Association), SMACNA (Sheet Metal and Air Conditioning Contractors National Association), AMCA (Air Movement and Control Association), and local codes.

a. Priority - HVAC systems shall be compatible with, and support, laboratory ventilation systems.

b. Return Systems - HVAC air to laboratory spaces containing laboratory spaces containing laboratory ventilation systems shall not be returned to the air handling system for re circulation unless the following provisions are met: Return air meets the return air requirements of ASHRAE 62, and (1) there are no extremely dangerous or life-threatening materials used in the laboratory, and the concentration of air contaminants generated by a maximum-credible accident will result in exposure concentrations below 20% of appropriate standards; or (2) return air is both treated and monitored to assure return air contaminant concentrations are below 20% of appropriate standards at all times and under all conditions, and a by-pass is provided for diverting contaminated air to the atmosphere, when necessary.

11. Supply Air -

a. Volume - The air handling system shall supply an equal volume of make-up air to that exhausted, unless a differential pressure must be maintained between the laboratory and adjacent spaces.

b. Distribution - Supply air distribution shall be designed, installed and operated to create terminal velocities at the face of a hood, less than 1/2 of the face velocity of the hood.

c. Quality - Supply system air shall meet, at a minimum, the requirements of the latest version of ASHRAE 62, Indoor Air Quality.

d. Direction of Flow - As a general rule, air flow shall be from areas of low hazard to areas of higher hazard, unless the laboratory is used as a Clean Room of Class 10,000 or better. Where

flow from one area to another is critical to emission and exposure control, air flow monitoring devices shall be installed to signal or alarm a malfunction.

12. Preventative Maintenance - The Facility Services Department shall establish a preventive maintenance (PM) program for critical components of laboratory ventilation systems, and shall perform PM on a regularly scheduled basis.

13. Testing and Monitoring – UAF Facilities Services shall conduct testing following guidelines established by UAF EHS&RM.

a. Schedule – UAF Facilities Services shall select and perform testing and monitoring of critical components of laboratory ventilation systems on a regularly scheduled basis and upon request by Users. Each hood will be equipped with a real-time monitor of performance; preferably a hood-static pressure monitoring device. Records of testing shall be maintained.

b. Equipment - All monitoring equipment shall be of an appropriate type for the task and shall be calibrated and operated in accordance with the manufacturers' recommendations.

14. Dampers - Where dampers are used for flow control, or for emergency by-pass, the User shall assure proper settings and operation of damper position, drive linkages, and drive motors. Automatic fire dampers shall not be used in laboratory hood ventilation systems.

15. Room Air Balancing - Air volume flow rate, direction of flow, and pressure differentials shall be designed and maintained to assure proper function of laboratory ventilation systems.

B. Laboratory Exhaust Fume Hoods

1. Materials - Lab fume hoods shall be constructed of non-combustible, non-porous material selected to resist corrosion for the service intended.

2. Selection - Lab fume hoods shall be selected, or constructed, to minimize emissions and exposures.

3. Work Practices - The User shall establish work practices which minimize emissions and exposures.

4. Performance Testing - The User shall select and adopt appropriate performance tests for each hood, and shall conduct performance tests as scheduled. As a minimum, each hood shall be tested following installation and whenever changes are made to the exhaust system.

5. Face Velocities - Each hood shall maintain an average face velocity of 100-125 fpm with no face velocity measurement plus or minus 25% of the average. The User shall select an appropriate average hood face velocity for each hood. Standard hoods (Type S hoods) shall be maintained at 100 fpm. High hazards hoods (Type H hoods) shall be maintained at 125 fpm. Other hoods (Type E hoods, exempt) shall be supplied with face velocities appropriate to use and need.

6. Flow Measuring Device - New and remodeled hoods shall be equipped with a flow-measuring device, i.e., a hood static pressure monitoring device.

7. Approved for Use - In coordination with EHS&RM, each User shall determine performance criteria by which a hood is to be approved for use. Such criteria shall be posted at the hood. Following performance testing, a notice of testing results shall be posted along with a "Use-Approved" notice. Hoods not passing performance tests shall be approved for use only under special conditions, which offers equivalent worker protection and a notice of "Conditional-Approval" shall be posted near the hood. If continued use of the hood puts laboratory workers at unreasonable risk, the hood shall be taken out of service and a "Failed" notice posted.

8. Returning Exhaust Air - Air exhausted from laboratory hoods and other direct contaminant control equipment shall not be returned to the laboratory space.

9. Bypass Hoods - Bypass hoods shall meet all requirements of Paragraph 1 through 8.

a. Face Velocity - As the sash is closed, the average face velocity should never exceed 3X the average face velocity when the sash is in the wide open position.

10. Variable Volume Hoods - Variable volume hoods shall meet all requirements of Paragraphs 1 through 8.

a. Supply Air - Variable volume hoods shall also modulate supply air to maintain the design pressure differential between the lab and adjacent areas, or if the hood exhaust volume exceeds 10% of the supply volume.

11. Auxiliary-Supplied Air Hoods - Auxiliary-supplied air hoods shall not be used unless special energy conditions require its use. Contact EHS&RM for guidance.

a. Conditions of Use - When auxiliary-supplied air hoods are selected and used, the following provisions shall be met: (1) the supply plenum shall be located above the top of the hood and external to the hood, (2) the supply jet shall be uniformly distributed across the width of the hood, and (3) air flow shall be into the hood at the points in the face of the hood.

b. Face Velocity Measurements - The face velocity of the hood shall be determined with the supply air turned off.

12. Perchloric Acid Fume Hoods - The perchloric acid fume hood shall conform to the requirements of NFPA 45.

a. Conditions of Use - Perchloric acid fume hoods shall meet the following provisions: (1) all surfaces of the hood shall be materials which will not react with the acid to form flammable or explosive compounds, (2) the entire hood, duck, fan, and stack surface must be equipped with water wash capabilities, (3) ductwork shall be stainless steel with smooth-welded seams, (4) the system shall not be manifolded, or joined, to other non-perchloric acid exhaust systems.

13. Walk-In Fume Hoods - Walk-in fume hoods shall comply with the requirements of paragraphs 1 through 8, as applicable. The base of the hood shall provide for containment of spills by means of a base contiguous with the sidewalls with a vertical lip of at least one inch height, or equivalent.

14. Glove Box Hoods - The glove box hoods shall comply with the requirements of paragraphs 1 through 8, as applicable.

a. Utilities - Utility valves and switches shall be external and meet appropriate codes. Where internal control is required, additional valves and switches shall be provided.

b. Spills - The glove box shall provide for retaining spilled liquids so that the maximum volume of liquid in the glove box will be retained if spilled.

c. Exhaust Ventilation - Exhaust ventilation shall be provided and shall be capable of maintaining a negative static pressure difference of 0.1 inch w.g., with respect to the room with openings closed, and at least 100 fpm inward face velocity when the largest opening is open, or at the glove port if a glove should fail.

d. Exhaust Air Location - Air exhausted from the glove box should be filtered, or scrubbed, and discharged to the atmosphere.

C. Ductwork

Laboratory ventilation ductwork shall comply with appropriate SMACNA standards. Materials of construction shall be compatible with chemicals to be carried in the airstream. Systems and ductwork shall be designed so as to maintain a negative pressure in the ductwork inside the buildings.

D. Fans

Fans and airmovers shall be selected to provide appropriate flow rates and pressures, and shall be certified by AMCA. Ductwork connected to fans shall avoid "system effect losses", where possible. If not, design shall take into account the system effect loss. Fan wheels and housings shall be constructed of materials compatible with chemicals being transported in the air through the fan.

E. Noise

Fans, ductwork, and air velocities shall be selected which meet noise criteria established by the User, but not to exceed 80 db at laboratory User locations.