Fume Hood Program

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I. INTRODUCTION

Laboratory hoods are designed to protect laboratory personnel by capturing or containing contaminants such as chemical vapors, gases, dusts, mists, fumes and preventing their escape into the laboratory environment. Hoods provide physical isolation and containment of chemicals and their reactions. A laboratory hood is a ventilated, enclosed workspace capable of capturing, containing, and exhausting fumes, vapors, and particulate matter generated inside the enclosure. It consists of side, back, and top enclosure panels, a work surface or counter top, access opening called the face, a sash, and an exhaust plenum with a baffle system for regulating airflow. Laminar flow cabinets, biological safety cabinets, and glove boxes are not laboratory hoods.

The purpose of this program is to provide general information regarding the selection, use, installation, design and performance of local exhaust hoods. Local exhaust hoods in laboratory facilities should comply with the most recent edition of INDUSTRIAL VENTILATION published by the American Conference of Governmental Industrial Hygienists (ACGIH), Uniform Mechanical Code, as well as the applicable American Society of Heating, Refrigeration and Air-Condition Engineers (ASHRAE) standards, and National Fire Protection Association (NFPA) codes, NFPA 91, NFPA 45.

II. LABORATORY VENTILATION

A. Chemical Fume Hood Types

1. **Conventional Fume Hood** or constant air volume hood. Equipped with an internal baffle so some of the air sweeps from the hoods base and directs up behind the baffle to the exhaust opening. Face velocity is inversely proportional to sash height.
2. **Bypass Hood** is designed so a fraction of air entering the hood face may pass over the top and bottom of the hood sash. This allows the air velocity near the work surface to stay relatively constant. This protects susceptible experiments and equipment from excessive air speeds which could have detrimental effects. It also allows for less static pressure and frictional resistance to air flow than would a conventional hood. This ensures a constant air volume as the hood sash height is changed.
3. **Auxiliary Hood** is a bypass hood with a direct auxiliary air connection that has not been cooled in the summer or completely heated in the winter. This is an attempt to reduce heating and cooling costs for the institution. Its disadvantage is that it increases maintenance costs due to the requirement of more ductwork, fans, and air tempering facilities.
4. **Self Contained Hoods** pull room air over the work surface and through a filter suitable for the work intended in the hood. This prevents the fan from being contaminated because the air has already has been filtered. Such hoods are desirable in areas where ductwork is not available. Filters usually need to be replaced every 1 to 2 years.

5. **Walk–In Hoods** rest directly on the floor or on a pad on the floor. They are designed to fit around an apparatus which will not fit in a standard hood.
6. **Explosion-proof Hoods** have "explosion-proof" electrical devices. The hood will not contain an explosion but the electrical equipment will not provide a source of ignition.
7. **Perchloric Acid Hoods** are designed for use with perchloric acid and must be equipped with a water wash system for the hood and ductwork.
8. **Radioisotope Hoods** are designed for use with radioactive chemicals and constructed from stainless steel without seams or edges.
9. **Variable Air Volume** (VAV) hood maintains a constant face velocity regardless of sash position. The system continuously measures the amount of air exhausted to maintain a constant face velocity. VAV system increases the ability of the hood to protect the worker from the possibility of exposure to chemical fumes.

B. Specialty Exhaust Systems

1. **Biological Safety Cabinet** is not a laboratory hood and considered to be a special safety enclosure used to handle and contain pathogenic microorganisms. The cabinet is designed to protect the product and also provides limited protection for lab personnel by utilizing an inward airflow away from the employee.
2. **Laminar Flow Cabinets** are not considered laboratory hoods and do not provide any protection for lab personnel and are intended to provide a clean airflow for the product protection. It is typically a ventilated, partially enclosed cabinet with an airflow over the work surface.
3. **Canopy Hoods** have an enclosed horizontal duct suspended above a work area that is too large to be contained in a conventional hood. The disadvantage of the hood is it draws contaminants past the worker's breathing zone.
4. **Glove Box** is used when toxicity, radioactivity or reactivity is too great a hazard for work in a conventional hood. The greatest advantage of the glove box is worker protection.

III. LABORATORY HOOD WORK PRACTICES

Laboratory hoods do not provide absolute containment or personal protection from exposure to hazardous chemicals or materials. The following guidelines describe safe work practices for the use of laboratory hoods.

- Conduct all operations that may generate hazardous air contaminants inside a hood.
- Properly use traps or scrubbers when toxic or noxious vapors are generated.
- Use only materials that are appropriate for the hazard rating of the hood.
- Confirm the exhaust system is operating properly by verifying airflow through the hood.
- Keep hood clean and uncluttered. Wipe up spills immediately.
- Always turn on interior lighting for proper illumination of the work surface.
- Keep all apparatus at least six inches back from the face of the hood.

- Never put your head inside a hood with the potential for exposure to hazardous contaminants.
- Hoods should not be utilized as a waste disposal mechanism for volatile materials.
- Do not use hoods for the storage of chemicals or apparatus.
- Place all heat generating equipment in the rear of the hood to minimize the effect of convection currents on airflow.
- The hood sash is designed to be used as a limited safety shield and should be as low as practical. Maintain the hood sash height no higher than 18 inches and no lower than 12 inches unless specified by the manufacture or authorized by the Lab Supervisor or department head.
- Use an appropriate barricade in front of the hood if there is a chance of explosion or eruption of material. The sash is not an appropriate barrier.
- Place large apparatus to the rear of the hood and raise off the surface two to three inches to allow airflow under the object and into the lower rear exhaust opening. *Maintain a distance of at least one inch from the rear so as not to block the flow of air into baffles.*
- Be aware of occupant traffic and open doors which may interfere with normal hood exhaust.
- Do not place electrical receptacles or other potential electrical spark sources inside the hood when flammable liquids or gases are present. No permanent electrical receptacles are permitted in fume hoods unless approved by the manufacturer.
- Provide adequate maintenance for all hood exhaust systems and building supply air systems.
- Do not block air supply vents or exhausts, and do not remove sash or panels of the fume hood.

IV. LABORATORY HOOD PROCEDURES

- The appropriate sash height will be identified on each laboratory hood system. The sash should not be raised above this height, as it will compromise the safety of lab personnel.
- The average face velocity of the hood determines which chemicals may be used in the hood. Chemicals that are flammable, combustible or have lower toxicity may be used in fume hoods with a face velocity of 80-100 fpm while chemicals with higher toxicity should be used in hoods of 100-120 fpm or where outside influences affect hood performance.
- Work practices and make-up air will affect the performance of laboratory hoods. Face velocity should be about 100 feet per minute at the highest sash height. Working sash height should be no higher than 18 inches and no lower than 12 inches. Face velocities may be as low as 75 feet per minute and as high as 150 feet per minute.
- Airflow indicators should be provided on new or existing hood systems.

V. PROCEDURE FOR TESTING CHEMICAL FUME HOODS

Chemical fume hoods will be inspected upon installation, renovation, when a deficiency is reported or a change has been made to the operating characteristics of the hood. Fume hood tests will be conducted annually by the UNI Environmental, Health and Safety Office and will examine face velocity and the containment capability of each hood.. Inspection of fume hoods consists of two steps.

The first step involves a physical inspection both the inside and outside of the hood. The inspector will be evaluating the following:

1. Use of proper materials designed for that fume hood.
2. Excessive storage of any materials inside the fume hood.
3. General hood cleanliness.
4. Physical damage to the fume hood..
5. Ensure lighting is fully functional.
6. Sash is broken.
7. The ability of the sash to open, close and stay in a stationary position.
8. Fume hood indicator and alarm is properly functioning.

The second step involves evaluating the performance of the hood.

- Smoke emitter candles will be used to check for turbulence and containment capacity of the hood.
- The average face velocity should be confirmed and used to determine the rating of the hood and the appropriate use of the hood.
- A sound level meter will be used to check if noise generated by the hood is below 85 dB.

A. Testing conditions

1. All fume hood tests will be performed in rooms where the ventilation has been properly balanced and where supply and exhaust ventilation is in full operation.
2. Fume hoods being tested will be in the half open or 18" working position.
3. Other fume hoods in the room will have their sashes in the half open position during testing.
4. Hoods being tested should be empty of unnecessary chemicals and equipment.
5. Hood surfaces should be cleaned and decontaminated.
6. Radiation hoods must be cleared for testing by the Radiation Safety Officer
7. The doors to the laboratory should be closed.
8. When adjustments are made to the sashes the ventilation will be allowed to stabilize before testing is done.
9. The hood monitor is calibrated and not in alarm.

B. Microanometer Instructions

1. Press the ON button on the ADM-880C microanometer.
2. Press MODE until the display shows "VELGRID."

3. Press Store until the display shows “STORE ALL.”
4. Place the Velgrid at the fume hood face with the sash half open.
5. Press READ to begin measurement and wait for velocity measurement.
6. Take three measurements per hood.

C. Determination Method of Average Face Velocity

1. Ensure the calibration of the microanometer is current.
2. The hood face should be divided equally into rectangles of approximately 14” wide each. Perform test in center of each rectangle.
3. Record face velocity measurements
4. Average readings to determine the average face velocity. The readings should be between 80-120 fpm (100 fpm optimum) at the half open position.
5. Reading variations should be within ±20% of the average face velocity.

D. Fume Hood Air Flow Testing Procedure

1. Position sash at 18” position.
2. Place smoke candle in small metal can at least ¾ filled with sand with candle portion facing up.
3. Light candle with lighter or match
4. Place candle within 6 inches of hood face around the opening of the hood. Smoke should be contained within the hood.
5. After candle goes out place in metal container filled with sand labeled “Used Smoke Candles.” Throw candles away no earlier than 24 hours after use.

E. Sound Level Measurement

1. Using a properly calibrated sound meter ensure sound level is below 85 dB.
2. Measurement should be taken at approximately eye level just outside of hood face.

F. Conditions Necessary for Passing a Fume Hood Test

1. The Physical Inspection does not reveal conditions or work practices that the inspector deems to be unsafe.
2. Average face velocity with the sash at the half open or 18” position should be between 80-120 fpm. Readings must be no less than 75 fpm or greater than 150 fpm
3. Smoke should be contained within the hood.
4. Sound level measurement should be less than 85 db.
5. Upon successful completion of testing the following label will be place on the upper left hand corner of the hood. The following information should be entered on the label: building and room number, hood designation number, the inspector’s initials, the average face velocity, sound level, circle pass or fail under containment test, sound level measurement, any necessary remarks and date the test was performed.

University of Northern Iowa Safety Office
Laboratory Fume Hood Certification

Building & Room Number_____

Hood Designation #_____

Inspector Initials:_____

Average Face Velocity:_____cfm

Containment Test: Pass/Fail

Sound level_____db

Remarks:

Date of Test___/___/___

6. If a laboratory hood does not pass an annual inspection the hood will be labeled with the following notice pending evaluation and repair. The lab supervisor and department head will be notified of any hood that does not pass inspection.

FUME HOOD IS OUT OF SERVICE

INSPECTION REVEALS AN UNSAFE CONDITION

IDENTIFIED CONDITION

____Sash inoperable
____Broken sash
____Excessive storage to the point airflow is blocked
____turbulence
____hood does not meet air velocity standards
____evidence of spill
____other_____

This hood should not be used until repairs have been completed or unsafe condition has been properly addressed and the unit has been properly re-tested by the Environmental Health and Safety Office to insure standard compliance.

For further information call the EH&S Office at 3-3445.

Face velocities that are below the standard of 80 ft/min will not be able to remove all contaminants found in the hood. Hoods that are above 150 ft/min may cause turbulence around the periphery of the hood and will reduce the capture efficiency of the hood. Please keep hood sash at its lowest position to reduce the possibility of injury.

Building & Room #:	Hood #:
Average Face Velocity:	Comments:
Safety Office Representative	Date:

VI. UNIVERSITY FUME HOOD TESTING SCHEDULE

Fume hood inspections usually take place during the months from May to September so as to reduce interference with laboratory classes. In an effort to reduce interference with ongoing research, departments will be notified one month prior to the beginning of the planned inspections. It will then be the faculty member's responsibility in charge of the individual hoods to set up a time during the next calendar month to have their hoods inspected. If the faculty member fails to set up a time to have their hoods inspected, inspection will take place at the convenience of the inspector from the Environmental Health and Safety Office.

If a department wishes to be inspected at a specific time during the year, the Environmental Health and Safety Office will work with them so the hoods can be inspected at a time that is convenient for members of the department and the inspector.