Introduction

Purpose

The purpose of this program is to ensure that the all laboratory ventilation equipment including laboratory fume hoods and cabinets used at Temple University are properly purchased, installed, renovated, operated and maintained in a manner capable of providing protection for faculty, staff, and students who use them. Fume hoods and cabinets are intended to remove bioaeresols, vapors, gases, particulates and dusts of toxic, flammable, corrosive or otherwise dangerous materials.

Applicability

This policy is applicable to all Temple University employees, to all work conducted under the authority of Temple University, and to all equipment and property managed by Temple University. Non-Temple and contractor personnel must follow the provisions of this policy while at Temple University facilities.

Standards & Codes:

The following codes and standards must be followed to ensure that the laboratory ventilation equipment are properly designed, purchased, renovated, installed, operated and maintained in a safe manner. The design and construction, installation and maintenance of laboratory ventilation systems and hood must be conducted by qualified individuals. Please consult with most recent current codes, guidelines, regulations and recommendations.

- ANSI/AIHA Z9.5(most recent edition)-Laboratory Ventilation
- NSF/ANSI-49
- ASRAE Handbook
- Local building codes
- 29 CFR Subpart Z-Toxic and Hazardous Substances
- 29 CFR 1910.1450-Laboratory Standard

Responsibilities

Environmental Health and Radiation Safety Department (EHRS)

The EHRS has the following responsibilities:
- Conduct Hazard Evaluation and assessment as requested by responsible supervisor.
- Training as requested by responsible supervisor.
- Ensure that all periodic face velocity measurements are conducted on hoods
- Provide information to users on guidelines and operating procedures for safe use of hoods
- Label hoods with periodic face velocity stickers, sash arrows, and work practices guide
- Perform a face velocity survey on laboratory fume hoods at the request of a user.
- Report the results of any fume hood survey to the user and relevant safety committee.
- Report unsafe hoods to the user and Facilities Management Department immediately.
- Perform a follow-up airflow survey promptly after appropriate repairs are completed on those fume hoods found unsafe.
• Advice on the selection and installation of new fume hoods and advice on the relocation of existing hoods as requested.
• Place a sign on fume hoods that are considered unsafe due to the airflow survey. The sign will be used to ensure the safety of the user and will remain in place until appropriate repairs are made.
• Maintain a hood database.

Facilities Management must:
• Ensure system capability
• Ensure proper design, installation and commissioning (according to latest edition of ANSI/AIHA Z9.5) of laboratory ventilation systems
• Ensure that performance test as listed in the latest edition of AIHA/ANSI z9.5 are conducted at least annually or whenever a significant change has been made to the operational characteristics of the hood system.
• Conduct preventive and repair maintenance.
• Ensure proper functioning of systems
• Ensure system dependability
• Maintain up-to-date system documentation and records
• Advise on the selection and supervise installation of new and/or rebuilt fume hoods and approve the relocation of existing hoods.
• Follow the routine preventive maintenance, notification, and hood testing procedures described below.
• Monitors the laboratory Ventilation Management plan to ensure compliance.
• Provides EHRS with all required information whenever a hood is introduced, removed or relocated.

Principal Investigators, Supervisors and Managers must:
• Consult with EHRS and Facilities Management and provide adequate documentation before a new hood is ordered, installed, or an existing hood is renovated or relocated.
• Ensure that the laboratory work carried out in the laboratory fume hood is appropriate for the type of hood available and the quality of ventilation present
• Ensure that all Biological Safety Cabinets/Tissue Culture hoods/Laminar Flow hood are certified by a qualified person on at least an annual basis.
• Ensure that performance test as listed in the latest edition of AIHA/ANSI z9.5 is conducted at least annually or whenever a significant change has been made to the operational characteristics of the hood system.
• Ensures that the calibration of airflow alarms/monitoring devices are performed annually or anytime that they are reported to be malfunctioning.
• Ensure that all routine maintenance is followed according to manufacturer’s guidelines on at least an annual basis.
• Immediately report questionable operations of a laboratory fume hood to the EHRS and Facilities Management Departments.
• Post fume hood safety procedures on all fume hoods
• Responsible for ensuring that hoods and ventilation systems are appropriately cleaned and decontaminated prior to repair, maintenance or replacement.
• Serve as the contact person for notification of any fume hood related issues.
• Provide accurate information on any potentially hazardous materials
• Ensure that all hood operators have been trained on how to use hoods safely and effectively.
• Ensure that hood operators know how to respond in the event that hood airflow has been compromised.
• Ensure that all employees under their supervision understand how to find information regarding the shut down of hoods (ex. E-mail messages, postings on hoods, etc...). This item should be checked prior to hood use.
If hoods or exhaust system has been used for perchloric acid heated above ambient temperature, you must inform maintenance personnel and EHRS before any inspection, maintenance, cleaning or any other work is done on any part of the exhaust system or hood interior. The hood and all parts of the exhaust system must be posted.

- Contact EHRS prior to any hoods being taken out of service for repair or maintenance.
- Ensure that hoods are not altered or modified without approval from Facilities Management and EHRS.

**Hood Users**

These workers have the following responsibilities related to activities:
- Attend required training classes.
- Follow proper procedures when using laboratory hoods or biological cabinets.
- Follow the instructions of the PI/supervisor and EHRS.
- Immediately report all suspected or confirmed hood problems (ex. No/low air flow/ cracked glass, light not working, etc.) Immediately to Supervisor and Facilities Management.
- Check for postings and signs that the hood is malfunctioning or out of service. Do not use hoods.
- Comply with the requirements as stated in this policy.

**Laboratory Ventilation Systems**

**General Ventilation Considerations**

- The room should have mechanically generated supply air and exhaust air. All lab rooms shall use 100% outside air and exhaust to the outside. There shall be no return of fume hood and laboratory exhaust back into the building.
- All room air balances shall be conducted by a qualified person in accordance with applicable regulations.
- Mechanical climate control should be provided. Consult latest edition of ASHRAE 55 for thermal comfort requirements.
- Cabinetry or other structures or equipment must not block or reduce effectiveness of supply or exhaust air.
- General laboratories shall have a minimum of 10-air changes/hour.
- Adequate numbers and types of fume hoods shall be installed for anticipated laboratory operations.
- The system shall have at least 25% excess capacity for future expansion.
- Exhaust fans serving teaching hoods shall be separated from exhaust fans serving research hood exhaust whenever possible.
- Laboratories must be maintained under negative pressure in relation to the corridor or other less hazardous areas. Clean rooms requiring positive pressure should have entry vestibules provided with door closing mechanisms so that both doors are not open at the same time. Consult with Fire Marshall for additional information.
- Where appropriate, general ventilation systems should be designed, such that, in the event of an accident, they can be shut down and isolated to contain hazardous materials.
- Dedicated radioisotope, carcinogen, or hot acid (perchloric) fume hoods shall be single ducted.
- The air velocity volume in each duct should be sufficient to prevent condensation or liquid or condonable solids on the walls of the ducts.
- Fume hoods should not be the sole means of room air exhaust. General room exhaust outlets shall be provided where necessary to maintain minimum air exchange rates and temperature control.
- Operable windows should be prohibited in new lab building and should not be used on modifications to existing buildings.
- Local exhaust ventilation (e.g., “snorkels” or “elephant trunks”), other than fume hoods shall be designed to adequately control exposures to hazardous chemicals. An exhausted manifold or manifolds with connection to local exhaust may be provided as needed to collect potentially hazardous exhausts from gas chromatographs, vacuum pumps, lasers, or other equipment which 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.
- Hoods should be labeled to show which fan or ventilation system they are connected to.
- Noise generated by the functioning fume hood within 6 inches of the plane of the sash and by-pass opening in any position shall not exceed 60dBA.
- Air exhausted from laboratory work areas shall not pass unducted through other areas.

**Variable Air Volume (VAV) Systems**

- Variable Air Volume (VAV) systems should be considered to reduce laboratory operating costs (including energy use).
- Pressure independent constant volume or variable column air valves for supply and exhaust shall be provided for pressurization control and continuous air balance control. The air balance shall also be maintained during night setback/unoccupied schedule.

**Negative Pressurization**

- Airflow shall be from low hazard to high hazards areas.
- The laboratory control system shall continuously determine supply airflow, exhaust airflow and be comparing these values, ensure design lab pressurization is maintained. A room offset of 10% of the maximum air value to the room is recommended or 100 cfm, whichever is greater.
- An adequate supply of make up air (90% of exhaust) should be provided to the lab.
- An air lock or vestibule may be necessary in certain high-hazard laboratories or clean rooms to minimize the volume of supply air required for negative pressurization control. These doors should be provided with interlocks so that both doors cannot open at the same time. Consult with Fire Marshall for additional guidance.
- A corridor should not be used as a plenum.

**Manifolding**

- Hood exhaust may be manifolder together. Perchloric/hot acid, radioisotopes, carcinogen, and other hoods, exhausting highly reactive, incompatible or highly toxic materials shall not be manifolder and exhausted directly to the outside. Hoods requiring HEPA filtration or other special exhaust cleaning shall have a dedicated exhaust system.
- For systems with multiple hoods and exhaust fans, adequate redundancy shall be built into the design. This shall be done by providing 75% capacity with the largest exhaust fan out of service, or providing a redundant fan equal to the capacity of the largest unit.
- Class II-Type A and Type B3 biological safety cabinets manifolder with chemical laboratory chemical hoods shall have either
  - A thimble connection or
  - A constant volume control device and an interlock/alarm for these devices shall be installed between the cabinet outlet and the exhaust manifold.
· Fume hood controls shall be arranged so that the shutting down of one fume hood for maintenance will not reduce the exhaust capacity or create an imbalance between exhaust and supply for any other hood manifolded to the same system.
· Fume hood exhaust fans shall not be shut down automatically when a smoke alert signal is detected in the supply air system. Consult with Fire Marshall for additional guidance.

Supply Air Arrangements

· Room air currents at the fume hood should not exceed 20% of the average face velocity to ensure fume hood containment.
· Make up air should be introduced at opposite end of the laboratory room from the fume hood(s) and flow paths for room HVAC shall be kept away from hood locations, to the extent practical.
· Make up air shall be introduced in such a way that negative pressurization is maintained in all laboratory spaces and does not create a disruptive air pattern.
· Cabinetry or other structures or equipment should not block or reduce effectiveness of supply or exhaust air.

Supply systems air should meet the technical requirements of the laboratory work and the requirements of the latest version of the ASHRAE, Standard 62- Ventilation for Acceptable Indoor Air Quality.

Ducting

· Exhaust ductwork shall be fire and corrosion resistant and selected based on its resistance to the primary corrosive present.
· Exhaust ductwork shall be sealed to protect against chemical attack.
· Slope all horizontal ducting down towards the fume hood (recommended guideline: slope equals 1/8 inch to the foot).
· The exhaust ducting shall be grounded to dissipate any static electricity. Lengths of electrically conductive ductwork on both sides of a flex connection or other insulating section in the airflow path shall be electrically grounded.
· No laboratory ventilation system ductwork shall be internally insulated. Sound baffles or external acoustical insulation at the source should be used for noise control.
· Automatic fire dampers shall not be used in laboratory exhaust systems. Fire detection and alarm systems shall not be interlocked to automatically shut down lab hood exhaust fans.

Exhaust Fans and Systems

· Treatment (i.e. filtration, scrubbing, etc.) is not required for laboratory and fume hood exhaust systems except when modeling or use estimates show that airborne levels of hazardous materials (chemical, biological or radiological) would exceed exposure limits at the point of discharge or exceed applicable community exposure levels at ground level.
· Automatic fire dampers shall not be used in laboratory hood exhaust systems. Fire and alarm systems shall not be interlocked to automatically shut down lab hood exhaust fans. Consult with Fire Marshall for additional guidance.
· Exhaust fans shall be oriented in an up-blast orientation.
· Lab ventilation exhaust fans shall be spark-proof and constructed of materials or coated with corrosion resistant materials for the chemicals being vented. V-belt drives shall be conductive.
· Fans shall be provided with:
  o Outboard bearings
  o Shaft seal
  o Access door and
Multiple 150 percent rated belts or direct drive unless approved by a professional engineer.

- Exhaust fans shall be located outside the building at the point of final discharge. Each fan shall be the last element of the system so that the ductwork through the building is under negative pressure.
- Fans shall be installed so they are readily accessible for maintenance and inspection without entering the plenum.
- Vibration isolators shall be sued to mount fans. Flexible connection sections to ductwork, such as neoprene coated glass fiber cloth, shall be used between the fan and its intake duct when such material is compatible with hood chemical use factors.
- Each exhaust fan assembly shall be individually matched (cfm, static pressure, brake horsepower, etc.) to each lab ventilation system.

Building Discharge and Wind Engineering

- Building discharges shall be located and designed in accordance with the latest ASHRAE-Handbook of Fundamentals. Fume hood and other potentially contaminated exhaust shall not be recirculated into the building air supply. Interactions with adjacent buildings and their supply air intake requirements shall be carefully evaluated.
- Fume hood exhaust through the roof should have vertical stacks that terminate at least 10 feet above the roof or two feet above any parapet wall, whichever is greater., unless higher stacks are found to be necessary using the guidance in the latest version of the ASHRAE Handbook of Fundamentals
- The discharge velocity from the stack shall be at least 3000 foot per minute.
- All hood exhaust stacks on the roof shall be 50 feet if possible) downward from any air intakes.
- Wind engineering evaluations shall be conducted for all wind directions striking all walls of a building. Actual height placement shall be confirmed via 3-D modeling in a wind tunnel where building exhaust is likely to have significant ground level impact, or is likely to affect air intake for nearby buildings.
- Engineering generator exhaust shall be considered in the wind engineering study.

Noise

- System design must provide for control of exhaust system noise (combination of fan generated noise and air generated noise) in the lab. Systems must be designed to achieve an acceptable Sound Pressure Level (SPL) frequency spectrum as described in the latest edition HVAC Application handbook

Emergency Power

- Air handlers for chemical fume hoods should be connected to an emergency power station so that fans will automatically restart upon restoration after a power outage. The overall ventilation system shall supply and exhaust at least half of the normal airflow during an electrical power failure.
- Momentary or extended losses of power shall not change or affect any of the control system’s set points, calibration settings, or emergency status. After power returns, the system shall continue operation, exactly as before, without the need for any manual intervention. Alarms shall require manual reset, should they indicate a potentially hazardous condition.

Laboratory Hoods

Hoods- Selection/Types

- General: The following items must be considered when selecting a fume hood:
Operational research needs of the users
- Room size (length x width x height)
- Number of air changes
- Lab heat load
- Types of materials used
- Linear feet of hood needed based on
  - Number of users/hood
  - Frequency of use
  - % time working at hood
  - Size of apparatus to be used in the hood, etc...
- A facility designed for intensive chemical use should have at least 2.5 linear feet of hood per user

- Constant Volume Hoods - These hoods permit a stable air balance between ventilation systems and exhaust by incorporating a bypass feature. If bypass is 100% this allows a constant volume of air to be exhausted through the hood regardless of sash position.
- Variable Air Volume (VAV) fume hoods - These hoods maintain constant face velocities by varying exhaust volumes in response to changes in sash position. Because only the amount of air needed to maintain the specified face velocity is pulled from the room, significant energy savings are possible when the sash is closed. However, these hoods cost more up front and more maintenance and effective sash management is necessary.
- Supply or auxiliary air hoods - These hoods are not permitted, unless an exception is granted by EHRS.

- Ductless Hoods
  - Ductless hoods have limited application because of the wide variety of chemicals used in most labs. Ductless hoods require pre-approval from EHRS. The containment collection efficiency and retention for the air cleaning system used in the ductless hood must be evaluated for each hazardous chemical.
  - Ductless hoods must have signage prominently posted on the outside of the hood to inform operators and maintenance personnel on the allowable chemicals used in the hood, type an limitations of filters in place, filter change out- schedule and that the hood recirculates air into the room.
  - All Ductless hoods will be certified annually by an outside vendor at the departments or units expense. A certification will be placed on the front of the hood.

- Hoods - Perchloric /HOT Acid Hoods
  - Heated perchloric/HOT Acids shall only be used in a laboratory hood specifically designed for its use and identified as “For Perchloric/HOT Acid Operations.” (Exception: Hoods not specifically designed for use with perchloric/HOT acid shall be permitted to be used where the vapors are trapped and scrubbed before they are released into the hood.)
  - Perchloric/HOT acid hoods and exhaust duct work shall be constructed of materials that are acid resistant, non-reactive and impervious to perchloric acid, typically 316 stainless steel or unplasticized PVC.
  - The exhaust fan should be acid resistant and spark resistant. The exhaust fan motor should not be located within the duct work. Drive belts should not be located within the duct work.
  - Ductwork for perchloric/HOT acid hoods and exhaust systems shall take the shortest and straightest path to the outside of the building and shall not be manifolded with other exhaust systems. Horizontal runs shall be as short as possible, with no sharp turns or bends. The duct work shall...
provide a positive drainage slope back into the hood. Ducts shall consist of sealed sections. Flexible connectors shall not be used.

- Sealants, gaskets, and lubricants used with perchloric acid, hot acid hoods, duct work, and exhaust systems shall be acid resistance and non-reactive with perchloric acid.
- A water spray system shall be provided for washing down the hood interior behind the baffle and the entire exhaust system. The hood work surface shall be watertight with a minimum depression of 13 mm (1/4 inch) at the front and sides. An integral trough shall be provided at the rear of the hood to collect the wash-down water.
- Spray wash down nozzles shall be installed in the ducts no more than 5 ft apart. The ductwork shall provide a positive slope back into the hood. Ductwork shall consist of sealed sections and no flexible connectors shall be used.
- The hood surface should have an all welded construction and have accessible rounded corners for cleaning ease.
- The hood baffle shall be removable for inspection and cleaning.
- Each perchloric acid hood must have an individually designated duct and exhaust system.

**Radioactive Material Use**

- Laboratory hoods in which radioactive materials are handled shall be identified with the radiation hazard symbol.
- Fume hoods intended for use which radioactive isotopes must be constructed of stainless steel or other materials that will not be corroded by the chemicals used in the hood.
- The interior of all radioisotope hoods must have coved corners to facilitate decontamination.
- The hood exhaust may require filtration by HEPA or Charcoal HEPA filters. Contact EHRS for additional information.
- Hood used for radioactivity should have sashes with horizontal sliding glass panels mounted in a vertical sash.
- The cabinet on which the hood is installed shall be adequate to support shielding for the radioactive materials to be used.

**BIOSAFETY CABINETS, CLEAN BENCHES & GLOVE BOXES**

- Although chemical hoods, biosafety cabinets and clean benches can look similar, they have very different uses.
  - A chemical hood is designed to contain hazardous vapors and gases and exhaust them outside the building.
  - A clean bench or laminar flow bench is designed to protect biological specimens by bathing the work area with a laminar flow of air free of particulate contamination. Because a clean bench forces air out from the back of the hood, across the work surface and toward the worker it protects only the specimen, not the user. Laminar flow hoods also called clean benches should not be confused with chemical fume hoods. Laminar flow hoods are designed to protect biological specimens and material by bathing the work area with particle free air. The clean benches are not designed to contain hazardous vapors and gasses. As such, flammable and toxic substances must be used in a chemical fume hood, not a laminar flow hood. Clean benches force air out the back of the unit, across the work surface and toward the researcher. The air is re-filtered (of particles only) before being exhausted back into the lab, not to the outside as with a fume hood. Laminar
flow hoods will not be used for materials that would not be ordinarily be used on an open bench.

- All laminar flow hoods will be certified annually by an approved vendor at the department or unit’s expense according to the manufacturer’s specifications. A certification label will be placed on the front of the hood.

- A biosafety cabinet provides biological protection for both specimen and user. A laminar flow of HEPA-filtered air is passed down from the top of the hood and across the work surface, and is exhausted or recirculated without entering a worker’s breathing zone. The air is then re-filtered before being exhausted, usually back into the laboratory. Because all clean benches and most biological safety cabinets exhaust air back into the work area, they cannot safely be used with hazardous gases and vapors. Only Class II Type B2 (total exhaust) Biosafety Cabinets can be used with significant quantities of volatile hazardous chemicals. Please follow the link for additional information on the different types of Biological Safety Cabinets.
  

- Glove Box - This is a sealed enclosure used to confine and contain hazardous materials with operator access through gloved portals or other limited openings (such as a pass-through chamber). It is not a fume hood, and it is not to be used for storage of volatile chemicals. Glove boxes (positive and negative) must meet the type, design and construction requirements of the latest edition of ANSI/AIHA z9.5

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<tr>
<th>Hoods- Specially Designed Systems</th>
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<tr>
<td>o These include walk-in hoods or local exhaust capture hoods (sometimes referred to as &quot;elephant trunks&quot;).</td>
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<tr>
<td>o Walk in Fume hoods must meet the type, design, and construction requirements of the latest edition of ANSI/AIHA z9.5</td>
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<td>o All hoods, including enclosures for operations for which other types of hoods are not suitable (ex. Enclosures for analytical balances, histology processing machines, special mixing stations, evaporation racks) must meet the requirements of the latest edition of ANSI/AIHA z9.5 and the Industrial Ventilation manual</td>
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Hoods-Construction and Installation

- All fume hoods shall meet the requirements listed in this document, latest version of ANSI/AIHA z9.5, latest edition of ACGIH Industrial Ventilation: A Manual for recommended practice and the most current codes, guidelines, and standards and any other applicable regulations and recommendations.
- The fume hood shall be tested prior to leaving the factory and meet the ASHRAE 110- most current Tracer gas test protocol with a rating of 4 AM 0.05. Documentation from the factory is required.
- A quantitative airflow sensor and an audible and visual alarm shall be permanently installed and located so that the display is visible to the user from the front end of the hood. The alarm must be installed by the
fume hood manufacturer. In addition, the alarm shall be calibrated by a qualified person at least annually and whenever damaged.

- Laboratory hoods shall not have an on/off switch located in the laboratory. Exhaust fans shall run continuously without direct local control from labs.
- The work surface of the bench is recessed ½ inches or more below the font edge of the bench and the sides and back of the bench are provided with a seamless vertical lip 0.5 inch in height.
- Variable air volume (VAV) should be used, unless there are sound reasons to not use a VAV hood. In those cases where VAV hoods can not be used, constant air volume hoods with bypass air openings shall be used. All hoods shall be equipped with sash stops on vertical rising sashes allowing the sash height to be set at 18 inches during routine use.
- Where constant air volume hoods are used, the bypass air opening shall not be uncovered until the sash has been lowered to 2/3 of the full opening height. The opening shall progressively uncover as the sash is lowered to its lowest point.
- Connections for exhaust ducts should be provided in the walls or roof of the hood behind the adjustable baffles. The connection(s) should have a flow-cross section sized for a velocity of 200 fpm maximum at the rated volume flow of the hood with the front sash wide open and should be located so that the adjustable baffles are effective in attaining uniform face velocity.
- Interior fume hood surfaces shall be rigid, safe, and be constructed of corrosion resistant, non-porous, non-combustible materials appropriate for the intended use.
- The interiors of hoods shall have smooth and impermeable interior surfaces with rounded corners. Interior surfaces must be free of cracks and crevices to provide for easy cleaning.
- Laboratory hoods shall be provided with a means of containing minor spills.
- Prior to installation of a new hood, an adequate supply of make up air must be provided to the lab.
- A horizontal bottom airfoil inlet at the front of the hood shall be provided.
- The rear and top interior of the hood shall be furnished with baffles to provide at least two, preferable three, slots. Baffles should be continuous across the back of the fume hood. Externally adjustable baffles shall not be used.
- Fans should run continuously without local control from hood location and independently of any time clocks.
- Fume hood controls shall be arranged so that the shutting down of one fume hood for maintenance will not reduce the exhaust capacity or create an imbalance between exhaust and supply for any other hood manifolded to the same system.
- Fume hood exhaust fans shall not be shut down automatically when a smoke alert signal is detected in the supply air system. Consult with Fire Marshall for guidance.
- Light fixtures should be of the fluorescent type and replaceable for outside the hood. Light fixtures should be displaced or covered by a transparent, impact resistant, vapor tight shield to prevent vapor contact. Hood lighting shall be provided by UL listed fixtures. If located within the hood interior, the fixtures shall meet the requirements of all regulations(ex. NFPA 70 (National Electric Code), IBC, etc..) appropriate to hazardous atmospheres.
- The valves, electrical outlets and switches for utilities serving hoods shall be placed at readily accessible locations outside the hood. All shutoff valves shall be clearly labeled. Plumbing (ex. Vacuum lines) should exit the sides of the fume hood and not the bench top.
- Hood electrical switches shall have indicator lights.
- Hoods shall have an individually trapped sink or cup sink, when needed. Backflow preventions or vacuum breakers shall be sued to protect domestic water supplies. Consult local codes for additional guidance.
- Drying ovens shall not be placed under fume hoods.
- Portable non ducted fume hoods, supply or auxiliary hoods are not permitted. Exception shall be reviewed and approved by EHRS.
Hoods-Face Velocities

- The average face velocity of the hood shall produce sufficient capture and containment of hazardous chemicals generated under as used conditions.
- At a minimum, the average air velocity face of a hood intended for standard use shall be set and maintained according to the manufacturer’s guidelines. No individual face velocity measurement shall be more than plus or minus 20% of the average do not flow of the hood nor shall any one measurement be outside the manufacturers set limits.
- Face velocity is not to be used as the only performance indicator.

Hoods-Sashes

- Hoods shall have transparent movable sash constructed of shatter resistant, flame resistant materials and capable of closing the entire front face.
- Vertical rising sashes are required. If horizontal siding sashes are used, sash panels (horizontal sizing) shall be twelve to fifteen inches in width. Approval by EHRS for horizontal siding sashes is required.
- A sash lock (swivel lock) that can be disengaged is required at the maximum operating height of 18 inches.
- A force of five pounds shall be sufficient to move vertical and/or horizontal moving doors and sashes

Hoods- Location

- Fume hoods should be located away from activities or facilities, which produces air currents or turbulence. It should be located away from high traffic areas, air supply diffusers, doors and operable windows.
- Fume hoods should not be adjacent to a single means of access to an exit. Recommended that hoods be located more than 10 feet from any door or doorway.
- Fume hood openings should not be located opposite workstations where personnel will spend much of their working day, such as desks or microscope benches.

Hoods-Casework under Hood

- A Factory Mutual approved, UL listed flammable liquids storage cabinet in compliance with NFP and OSHA regulations shall be installed under the fume hood.
- The cabinet shall be vented to the hood plenum. The cabinet shall be equipped with a flash arrester.

Hoods-Labeling

- Laboratory hoods and special exhaust ventilation systems (SLEV) shall be labeled to indicate intended use (ex. Perchloric Acid Hood)
- A label must be affixed to each hood containing the following information from the last inspection:
  - Certification due date
  - Average face velocity
  - Inspectors initials

Commissioning and Performance Testing
• All newly installed, renovated, or relocated ventilation systems (including hoods) shall be commissioned to ensure proper operation prior to use. All ventilation systems must be commissioned according to the requirements listed in the latest edition of ANSI/AIHA Z9.5. A Professional Engineer shall stamp the test reports.
• Proper operation of fume hoods must be demonstrated by the contractor installing the fume hood or shall be tested by an independent qualified test contractor after installation and meet the test listed in the latest edition of the ASHRAE 110-most current Tracer gas test protocol with a rating of 4 A1 0.1 , Flow Visualization , Velocity Procedure tests and any additional hood specific test as described in the latest edition of ANSI/AIHA Z9.5.
• Routine performance test as outlined in the latest edition of ANSI/AIHA Z9.5 shall be conducted at least annually or whenever a significant change has been made to the operational characteristics of the hood systems.
• Flow Measuring Devices for laboratory chemical hoods, air containment monitors, ventilation monitors shall be calibrated at least annually by a qualified person or whenever damaged.
• The original report must remain on file with Facilities Management. A copy of the report must be forwarded to EHRS and the PI/Department must also retain a copy.
  • Certification of Biosafety Cabinets– Biosafety cabinets should be tested and certified after installation, after relocation and at least annually.
    o A certification sticker must be placed on the outside of each cabinet.
    o Prior to disassembly or relocation the units may need to be decontaminated with gaseous formaldehyde. The National Sanitation Foundation (NSF) has implemented a Biohazards Cabinetry Certification Program at the request of the regulatory community.
    o An NSF Accredited Biohazard Cabinet Field Certifier must perform testing and servicing of biosafety cabinets. A list of Accredited Certifiers is maintained on the NSF Website.
    o For more information about biosafety cabinets or a short list of certification vendors in our region, contact Environmental Health & Radiation Safety at 215-707-2520.
    o Copies of the certification must be forwarded to EHRS

Hood Failure or System Malfunction

• In the event that an airflow alarm or indicator would signal low or no airflow, or that lab personnel recognized that such a condition exists otherwise, the person first recognizing his problem must
  o Immediately stop all work in the hood
  o If possible, stabilize reactions and turn off equipment (i.e. hot plates) or other electric devices
    ▪ The lab and or building must be evacuated if any process or reactions that could create a hazard to the lab or building occupants exist.
  o Close any opened/exposed containers of hazardous materials (if safe to do so)
  o Close the hood sash
  o Immediately report the problem to Facilities Management, Principal Investigator or Manager and EHRS.
  o Notify others in the area and on additional shifts that the hood is not operating and must not be used.
o Post a sign on the hood that boldly states that the hood(s) is/are not functioning and may not be used until repairs or corrections have been made and this sign is removed.
o Do not use the hood until cleared for reuse by Facilities Management and EHRS.

Preventive Maintenance & Repair

- Only appropriately trained personnel of the Facilities Management Department or their designees shall carry out repairs or preventive maintenance.
- Preventive maintenance shall be performed on a regularly scheduled basis. Manufacturer recommendations and those additional recommendations listed in the latest edition of AIHA/ANSI z9.5 shall be followed.
- Facilities Management shall keep a record of any repair or maintenance issue on any hood.
- Operations served by equipment being shut down for inspection, maintenance or repair shall be safely discontinued and secured during such maintenance.
  o Principal Investigators/Supervisors, EHRS and lab workers shall be notified in advance before work is started by Facilities Management. Facilities Management shall inform the PI/Supervisor or Department Chair when work will begin and an estimated time to completion.
  o Principal Investigators/Supervisors is responsible for ensuring that all employees are informed and understand how the information for the hood shut down will be disseminated. The Department chair must be informed when more than one hood will be shut down.
  o The Principal Investigator/Supervisor/Department Chair shall ensure that all material and toxic or otherwise dangerous material on or in the vicinity of the equipment shall be removed or cleaned.
    ▪ The completed Equipment decontamination form shall be signed and forwarded by the PI to EHRS.
    ▪ EHRS will conduct a visual inspection of the piece of equipment.
    ▪ Additional tests and or decontamination may be required at the requestor’s expense.
    ▪ EHRS will post a sign (See Appendix A) and/or “DO NOT USE” tape along with any other special precautions on the hood.
    ▪ The postings shall not be removed until the PI/Supervisor is informed by EHRS and Facilities Management.
  o Facilities Management/Contractors shall implement any permit plans and or Lock-Out/tag-out procedures
  o Facilities Management Personnel/Contractors shall be trained, provided and required to use appropriate PPE. Minimum PPE required is listed below:
    ▪ Work/Latex/N-Dex Gloves
    ▪ Safety Glasses
    ▪ Tyvek Clothing
    ▪ Additional PPE as required
  o Facilities Management will conduct appropriate performance test (as outlined in the latest edition of AIHA/ANSI z9.5 if any changes or repairs were made that could affect the performance of the hoods.
- Perchloric Hood/Fan Maintenance
  o Access to the fan and stack shall be posted and retracted (roped or fenced).
  o Maintenance of perchloric hood systems shall be performed by authorized personnel only.
All parts of the hood/exhaust system shall be posted (“Perchloric Acid System-Authorized Personnel Only”) to ensure that uncontrolled maintenance does not occur.

Complete wash down and decontamination of hood system must be completed prior to any maintenance. Duration and type of wash down will be determined by EHRS.

Only non sparking tools shall be used.

Use only fluorocarbon grease for the lubrication of the fan.

All parts of the system shall be handled carefully (potential explosion from shock or friction from tools)

Maintenance/decontamination/dismantling of perchloric hoods shall be done when the building is unoccupied.

If used for perchloric acid heated above ambient temperature, test shall, be conducted for explosive perchlorates before any maintenance or cleaning is done on any part of the exhaust system within the airstreams or hood interior.

All maintenance personnel working on the perchloric hoods must be trained in the hazards of perchloric acid.

Personal Protective Equipment (PPE) for maintenance personnel who work on Perchloric acid hoods should include:

- Splash/Impact Goggles
- Face Shields
- Gloves(Nitrile, neoprene or PVC)
- Chemically-resistant coveralls

Roof Work

Facilities Management will inform the Department(s) in any building that contains hood exhaust(s) that they intend to conduct work on the roof and of the time frame of the work to be conducted.

Department Chairs will provide Facilities with all pertinent information as related to hood activities. Certain activities may need to be stopped until work is complete.

If the roof work involves airstreams of any part of the hood system, the department chairs and EHRS will be notified.

All hoods affected by the work will need to be temporarily taken out of service as described above

Removing Hoods from Service

The Principal Investigator/Supervisor/Department Chair shall ensure that all material and toxic or otherwise dangerous material on or in the vicinity of the equipment shall be removed or cleaned.

- The completed Equipment decontamination form shall be signed and forwarded by the PI to EHRS.
- EHRS will conduct a visual inspection of the piece of equipment.
- Additional tests and or decontamination may be required at the requestor’s expense.
GUIDELINES FOR MAXIMIZING HOOD SAFETY AND EFFICIENCY

- Conduct all operations that may generate air contaminants at or above the appropriate Threshold Limit Value inside a hood.
- Keep all apparatus at least 6 inches back from the face of the hood. A stripe on the bench surface is a good reminder.
- Users should keep their faces outside the plane of the hood sash.
- Hood sash openings should be kept to a minimum. Hoods are tested (and should be used) with a hood sash opening of 12 inches.
- Do not store chemicals or equipment in the hood.
- Do not use the hood as a waste disposal mechanism.
- Do not store chemicals or apparatus in the hood. Store chemicals in an approved safety storage cabinet.
- Keep the slots in the hood baffle free of obstruction by apparatus or containers.
- Minimize foot traffic past the face of the hood to prevent disruptions in air flow.
- Keep laboratory doors closed when working in the hood.
- Traps, scrubbers or incinerators should be used to prevent toxic and/or noxious materials from being vented into the hood exhaust system.
- Do not place electrical receptacles or other spark sources inside the hood when flammable liquids or gases are present. No permanent electrical receptacles are permitted in the hood.
- Use an appropriate barricade (e.g. a blast shield) if there is a chance of explosion or implosion.
- Remain alert to changes in air flow.
- Do not remove hood sash or panels except when necessary for apparatus set-up; replace the sash or panels before operating.
- Exhaust ports from the hood and supply air vents to the room (Nesbitt units or unit ventilators) should not be blocked.
- Prepare a plan of action in case of an emergency, e.g., a power failure.