

ENVIRONMENTAL HEALTH & RADIATION SAFETY POLICY

Local Exhaust Ventilation - Fume Hoods

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Purpose

To establish selection and installation criteria and safe work practices to ensure that all fume hoods at Temple University are properly selected, installed, and operated in a manner capable of protecting the user from hazardous emissions generated from a broad range of applications. This policy addresses **ducted fume hoods**. Items generally not covered by this policy include biological safety cabinets, flexible duct (i.e. snorkel) exhaust, non-ducted hoods, and associated local exhaust ventilation (LEV) components covered by other policies.

Definitions

- **ACGIH:** American Conference of Governmental Industrial Hygienists.
- **ANSI:** American National Standards Institute.
- **ASHRAE:** American Society of Heating, Refrigerating and Air-Conditioning Engineers.
- **Commissioning Plan:** A process in which a LEV systems performance is identified, verified, and documented before, during, and after design or construction, to assure proper operation and compliance with codes, standards, and intended use.
- **Control Velocity:** The velocity of air at a point in space sufficient to draw contaminants and contaminated air into a hood.
- **Conventional Fume Hood:** A hood designed to provide containment equal or superior to ASHRAE 110 tracer gas ratings at a face velocity of 100 feet per minute.
- **Emission:** A substance (smoke, dust, fume, mist, vapor or gas) whose presence in air is harmful, hazardous, or a nuisance to humans.
- **Face Velocity:** Velocity of the air at the opening of a hood.
- **Flowrate:** Air volume through an exhaust hood over a period of time (e.g. cubic feet per minute).

- **Fume Hood (Hood)**: A shaped opening designed to capture or control hazardous emissions.
- **High-Performance Fume Hood**: A hood designed to provide containment equal or superior to ASHRAE 110 tracer gas ratings at a face velocity of 60 feet per minute.
- **Hood Containment**: The ability of the hood to contain hazardous emissions. This is based on the latest ASHRAE 110- Method of Testing Performance of Laboratory Fume Hoods. Testing is defined as three different scenarios, As Manufactured (AM), As Installed (AI), As Used (AU) with a tracer gas generation rate of 4 liters per minute and average five minute concentration (e.g. 4.0 AM 0.05).
- **Hood Performance Monitor**: A device to provide the hood user with continuous information (visible and audible) about the hood's airflow.
- **LEV**: Local Exhaust Ventilation. A mechanical system for removing contaminated air from a space, comprised of one or more of the following: hood, ductwork, air cleaning equipment, fan, and stack.
- **NFPA**: National Fire Protection Association.
- **Occupational Exposure Limit (OEL)**: A concentration of contaminant in air not to be exceeded in the breathing zone of employees. Published OELs include: Permissible Exposure Limit (PELs; established by OSHA) Workplace Environmental Exposure Levels (WEELs, sponsored by AIHA), Recommended Exposure Limits (RELs, sponsored by NIOSH), and Threshold Limit Value (TLVs; sponsored by ACGIH).
- **Operational Check**: A survey to ensure that the hood is operating at the designed face velocity at the designed sash opening area.
- **OSHA**: Occupational Safety and Health Administration.
- **Sash**: A movable glass panel that acts as a barrier between the User and operation. The sash can be horizontal, vertical, or a combination. Adjusting the sash operating area will affect the hood's flowrate.
- **Sash Stop**: A device to restrict how far a sash can be opened.

Responsibilities

Environmental Health & Radiation Safety (EHRS)

- Policy development.
- Upon notification from PDG, works with PDG, O&M, Supervisors, and Users to assess the chemical properties, work practices, and room design to ensure that the proper hood is selected.
- Upon notification from PDG, EHRS will confirm adequate performance of the hood and approve the hood for use.
- Notifies the Supervisor, Principal Investigator (PI), Department Head, and/or Manager once the hood has been approved for use.
- Performs an operational check of hoods, at least annually, in accordance with this policy and manufacturer recommendations.

- Notifies O&M when a hood is identified as unsafe and/or fails the operational check. Provides O&M with the specified failing criteria.
- Notifies the Supervisor, Principal Investigator (PI), Department Head, and/or Manager on the status of any operational check of any hood under their responsibility.
- Conducts a subsequent operational check on a hood when notified by O&M that adjustments or repairs are complete.
- Maintains a database and records of operational checks.
- Training as requested by the Supervisor, Principal Investigator (PI), Department Head, and/or Manager.
- Provides technical assistance and support as requested.

Operations & Maintenance (O&M)

- Maintains all design, installation and commissioning reports/documentation.
- Establishes a preventive maintenance program for all hoods and performance monitors.
- Upon notification, investigates any reported hood failure and notifies EHRS and affected personnel of the results of the investigation and provides an estimated time for repair.
- Notifies EHRS and affected personnel if clearance of the hood is necessary for any investigation, maintenance, and/or repair and implements lockout procedures.
- Assists PDG with the commissioning of hoods when requested.
- Notifies EHRS and affected personnel once all identified issues on a hood have been investigated and repaired and the hood has been returned to a safe condition.

Project Delivery Group (PDG)

- Coordinates the selection and installation of hoods in accordance with this document, manufacturer instructions, and project design criteria.
- Notifies EHRS and O&M when a project requires the selection and installation of a hood.
- Confirms that hoods were installed per approved shop drawings and accepted in accordance with a Commissioning Plan prior to the transfer of ownership to the users.
- Coordinates the provision of design, installation and commissioning reports/documentation.
- Notifies EHRS once a hood has been properly commissioned and is ready to be used. Refer to EHRS Commissioning Policy.

Supervisors, Principal Investigator (PI), Department Heads, Managers, Designees

- Provides the necessary information to EHRS, PDG, and O&M to assist with hood selection.
- Assists PDG with the commissioning of hoods when requested.
- Confirms that the hood has been commissioned.

- Confirms that each hood has been inspected and approved for use by EHRS prior to using the hood.
- Notifies all hood users under their responsibility on the status of any investigation and/or repair status.
- Notifies EHRS if a hood requires an operational check.
- Notifies EHRS and O&M when a hood is not functioning properly or is unsafe to use.
- Establishes work practices that reduce hazardous emissions and user exposures.

Users

- Will not use a hood until it has been approved, or reapproved, for use by EHRS.
- Confirms that hood has passed the most recent EHRS operational check.
- Will not use a hood that has failed an operational check or is not operating properly.
- Notifies the Supervisor, Principal Investigator (PI), Department Head, Manager, Designee when a hood is not functioning properly or is unsafe to use.
- Will not modify interior or exterior hood components.
- Follows safe work practices as outlined in this policy and site-specific requirements.

Selection and Installation

The following are selection and installation criteria for hoods at Temple University:

General

- Designed to the latest edition of ACGIH *Industrial Ventilation: A Manual of Recommended Practice* and the most current codes, guidelines, standards, and regulations.
- Selected based on an assessment of capture, control, and containment requirements. The assessment will consider chemical properties (e.g. specific gravity, toxicity, capture and control velocities), work practices (e.g. positioning of employees and equipment in the vicinity of the hood, number of users per hood) and room design (e.g. room configuration, air motion in the vicinity of the hood).
- Provides hood containment levels equivalent or superior to ASHRAE 110 tracer gas test ratings of 4.0 AM 0.05. Factory documentation is required.
- An adequate number and type of hood are provided for the anticipated work.
- Operated and maintained to provide control of routine and anticipated hazardous emissions.
- Hoods are not the sole means of room air exhaust. General room exhaust outlets are provided where necessary to maintain minimum air exchange rates and temperature control.
- Fans run continuously without local control from hood location.
- Cup sinks are prohibited unless approved by EHRS.
- Cabinetry or other structures or equipment must not block or reduce effectiveness of supply or exhaust air.

- Storage cabinet bases must meet NFPA and OSHA construction requirements if used to store hazardous materials. Flammable storage cabinets must be vented to the hood and be equipped with a flash arrestor.
- Hoods are labeled to show which fan they are connected to.
- Hoods have a recessed work surface and be able to contain minor spills.
- Utilities for operating and servicing the hood are located outside of the hood.
- Shutoff valves for services, including gas, air, vacuum, and electricity are outside of the hood enclosure in a location where they will be readily accessible in the event of fire in the hood. Shut-off valves are clearly labeled.
- Fume hood interior surfaces are constructed of corrosion resistant, non-porous, non-combustible, smooth and impermeable materials such as type 316 stainless steel, with rounded corners.
- Hood lighting fixtures, if located within the hood interior, meet the requirements of NFPA 70.
- All newly installed or moved hoods are commissioned to ensure proper operation prior to use.

Airflow

- Containment must be verified quantitatively through commissioning using the latest ASHRAE 110 method. Provides hood containment levels equivalent or superior to tracer gas test ratings of 4.0 AI/AU 0.10.
- The airflow rate is sufficient to prevent the buildup of hazardous concentrations, in particular flammable vapors or gases, within the hood.
- The airflow rate coordinates with other air supply and exhaust devices to ensure that ventilation needs are met.
- The average face velocity of a conventional hood is 100 feet per minute (fpm) at an 18" sash height, with a minimum of 80 fpm at any point.
- The average face velocity of a high-performance hood is 70 fpm at an 18" sash height, with a minimum of 56 fpm at any point.
- Face velocities above 150 feet per minute (fpm) are not permitted.

Performance Monitoring

- A real-time hood performance monitor (i.e. face velocity alarm) is provided to alert users of improper exhaust flow.
- The monitor is field calibrated and functional.
- The monitor is capable of alerting the user, via audible and visible alarms, that an alarm condition has been met. It must be visible from the front of the fume hood.
- Hood monitors will be set to alarm when flow is high or low by 20% of the set point value. As an example, a fume hood with a set point of 100 fpm will have a monitor calibrated to alarm at a low point of 80 fpm and a high point of 120 fpm.

- Monitors are calibrated at least annually (or as specified by the manufacturer) or when reported to be malfunctioning.
- Users of the hood are trained on how to read and interpret the monitor condition and know the steps to take when a monitor is in alarm condition.

Sashes

- Sashes are installed on all hoods.
- Vertical sashes are recommended. The operating sash height is 18”.
- Horizontal or combination sashes, if used, do not have panels greater than 16" wide.
- The sash is constructed of a shatter and flame-resistant material, capable of closing the entire front face of the hood.
- A sash stop is used if the sash operating area is less than the sash maximum area. Sash stops are not removed without redesigning the exhaust system.
- If automatic sash closers are used, they will allow manual override of positioning and have the ability to stop travel if obstacles are detected.
- Sashes are not opened more than the sash operating area when hazardous materials are being used in the hood. A label will be affixed to the hood to inform users of the sash operating area.
- Sashes remain stationary when not being adjusted.
- Sashes remain closed when the hood is not in use.
- Defective sashes are repaired or replaced before using the hood with hazardous materials.

Location

- Hoods are located in an area that minimizes disruption of uniform airflow in to the hood, such as in the back of a room.
- Hoods are not located near high-traffic areas, air supply diffusers, large equipment, doors or doorways, and operable windows. Hoods near doors are acceptable if:
 - There is a second safe egress from the room.
 - Traffic past the hood is low.
 - The door is normally closed.
- Hoods are not located opposite workstations or benches where personnel will spend much of their working day.

Perchloric Acid

Perchloric acid is a strong oxidizing acid that reacts violently with organics (wood, plastic) and metals (aluminum). Heated perchloric acid will give off vapors that can condense and form explosive perchlorates within the hood and LEV components. Below are additional

requirements for hoods used in handling concentrated perchloric acid (>72%).

- Constructed of materials that will not react with perchloric acid, typically 316 stainless steel or unplasticized PVC.
- No organic materials, including gaskets, are used in the hood construction unless they are known not to react with perchloric acid or its byproducts.
- The hood interior and associated ductwork, fan, and exhaust stack are equipped with washdown capabilities.
- The work surface is watertight with a minimum 0.5 inch dished front and sides and an integral trough at the rear to collect washdown water.
- The washdown system is activated whenever using perchloric acid.
- The hood is prominently labeled “Perchloric Acid Hood”.

Radioactive Material

Radioactive material can include source material (e.g. isotopes of carbon, hydrogen, iodine, phosphorous, and sulfur) and naturally occurring radioactive material (e.g. uranium). Below are additional requirements for hoods used in handling radioactive materials.

- Constructed of materials that will facilitate decontamination of the hood (e.g. rounded corners).
- The cabinet on which the hood is installed is adequate to support shielding for the radioactive materials being used.
- The hood is prominently labeled for use with radioactive material.

Work Practices and Training

All operations that may generate air contaminants at or above occupational exposure limits are conducted in a working hood. Do not operate a hood unless it is verified to be working. Users must be trained in the proper operation and use of a hood and procedures for reporting malfunctioning hoods. Do not modify interior or exterior hood components.

References

- ANSI Z9.5 Laboratory Ventilation
- ANSI Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems
- ACGIH Industrial Ventilation: A Manual of Recommended Practice