Local Exhaust Ventilation

University of Tennessee Safety Guide IH-001

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Purpose

The purpose of this document is to provide guidance for the use and testing of local exhaust ventilation (LEV) systems on campus.

Scope and Applicability

This guide applies to all LEV systems that are owned and operated by the University of Tennessee, Knoxville. It addresses LEV used to control exposure to hazardous substances. This includes: biosafety cabinets, glove boxes, histology grossing tables, clean benches, bench-top exhausts and similar local exhaust ventilation.

Abbreviations and Definitions

Abbreviations

AIHA: American Industrial Hygiene Association

ANSI: American National Standards Institute

EHS: Environmental Health and Safety

LEV: Local Exhaust Ventilation

Definitions

Local Exhaust Ventilation (LEV): Engineering control system to reduce exposures to airborne contaminants such as dust, mist, fume, vapor or gas in the workplace.

Roles and Responsibilities

Environmental Health and Safety will:

i. Maintain this written policy and place in the online safety manual
ii. Conduct LEV testing, or assist with the coordination of LEV testing.
iii. Assist departments or individuals to the extent feasible with compliance.
iv. Maintain records as required.
v. Provide training upon request related to LEV use.

Facilities Services shall:

i. Ensure proper design, installation and commissioning (according to latest edition of ANSI/AIHA Z9.5) of LEVs on campus and ensure system capability.
ii. Ensure that performance testing 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 LEV system.
iii. Conduct preventive and repair maintenance.

iv. Maintain up-to-date system documentation and records as required.

Departments that have local exhaust ventilation systems should:

i. Ensure the individuals are trained as appropriate.
ii. Maintain exhaust equipment according to manufacturer's or University guidelines.
iii. Adhere to University policies on obtaining, modifying, or repairing exhaust devices.
iv. Consult with EHS when specific questions arise related to this policy.

Supervisors shall:

i. Ensure that employees are trained in the correct use of the exhaust device.
ii. Maintain exhaust equipment according to manufacturer's or University guidelines.
iii. Adhere to University policies on obtaining, modifying, or repairing exhaust devices.

Staff and students who use Local Exhaust Ventilation Systems shall:

i. Attend training as needed
ii. Use the LEVs in accordance with their design and limitations
iii. Report any problems associated with the LEVs.

Procedures

Local exhaust system is used to control air contaminants by trapping them at or near the source, in contrast to dilution ventilation which lets the contaminant spread throughout the workplace. Local exhaust is generally a far more effective way of controlling highly toxic contaminants before they reach the workers' breathing zones. This type of system is usually the preferred control method if:

- Air contaminants pose serious health risk.
- Large amounts of dusts or fumes are generated.
- Increased heating costs from ventilation in cold weather are a concern.
- Emission sources are few in number.
- Emission sources are near the workers' breathing zones.

Before installing any type of exhaust system, even effort needs to be made to 1. Isolate the contaminant as much as possible, 2. Change processes so that the contaminant exposure is minimized or eliminated, 3. Substitute a less harmful substance to be used in the process.

There are advantages and disadvantages to the use of either dilution ventilation or local exhaust ventilation in terms of costs and effectiveness.

Below is a table which lists all of the types of ventilation and examples of their uses:

Type of Ventilation	*Examples of Use*
General laboratory ventilation	• Nonvolatile chemicals • Nonhazardous materials
Environmental rooms	• Materials that require special environmental controls • Nonhazardous amounts of flammable, toxic, or reactive chemicals.

Type of Ventilation	*Examples of Use*
Laboratory chemical hoods	• Flammable, toxic, or reactive materials • Products or mixtures with uncharacterized hazards
Unventilated storage cabinets	• Flammable liquids • Corrosives • Moderately toxic chemicals
Ventilated storage cabinets	• Highly toxic, hazardous, or odiferous chemicals (if equipped with flame arrestors)
Recirculating biosafety cabinets	• Biological materials • Nanoparticles, as of the date of publication • Biological materials • Nanoparticles, as of the date of publication • Minute amounts of volatile chemicals
Total exhaust biosafety cabinet	• Biological materials • Nanoparticles, as of the date of publication • Minute amounts of volatile chemicals
Glove box	• Positive pressure for specialty environments • Negative pressure for highly toxic materials
Downdraft table	• Perfusions with paraformaldehyde, work with volatile, low to moderately hazardous materials with higher vapor density where access from more than one side is necessary
Elephant trunk	• Local ventilation of a tabletop • Discharge from equipment such as a gas chromatograph
Canopy	• Ventilation of heat, steam, low or nontoxic materials with low vapor density
Ductless laboratory chemical hood	• Materials that are compatible with the filtration system, in controlled quantities and under controlled conditions • Not suitable for particularly hazardous substances

Type of Ventilation	*Examples of Use*
Slot hood	• Local ventilation of higher density materials at the source, such as an acid bath
Ventilated balance enclosure	• Weighing and initial dissolution of highly toxic or potent materials
Bench top ventilated enclosures	• Bench top equipment, such as rotary evaporators

Testing:

Local Exhaust Systems should be tested a minimum of once/year and also at the following times:

- Manufacturer performs containment tests.
- Containment test after installation and prior to initial use
- Annual (at the minimum) face velocity and airflow visualization
- Performance test any time a potential problem is reported
- Containment test after significant changes to the ventilation system (i.e. rebalancing, decommissioning).
- When an employee requests an inspection
- When a procedural change requires a hood classification upgrade
- After major repair work
- After a fume hood is moved

LEVs will be tested annually by EHS, or an authorized company, and will be tested after repairs are made by Facilities Services.

Roof Work

LEV exhaust ducts terminate just above the roofline in many cases. Working near these outlets could potentially expose workers to hazardous chemicals, albeit in extremely dilute concentrations. If maintenance/repair work must be done on the roof of any building containing hood exhaust(s), Facilities must first notify the appropriate supervisor of the work to be performed. If needed, the laboratory manager shall provide to facility and/or contractor staff information regarding chemicals used in their fume hoods. It may be necessary to cease work in fume hoods until roof work is complete.

Personal Monitoring:

If there is concern that an LEV is not providing enough worker protection, personal sampling may be necessary to ensure there is no overexposure. EHS can provide assistance in these cases upon request.

Using Local Exhaust Devices

1. Exhaust devices should not be used for purposes for which their design is not intended, for instance, using perchloric acid in a general purpose lab hood or using hazardous chemicals in a recirculating hood. (Perchloric acid should only be used in a dedicated and approved hood.) Also, laminar flow clean benches which blow HEPA filtered air toward an operator and contain no means for contaminant

capture and exhaust, are not to be used with hazardous materials. Contact EHS for the guidelines and for training on the use, function, and limitations of ventilation devices.

2. Assure that high hazard processes have automatic shutdown controls should exhaust fail. Normally closed pneumatic valves, flow limiting orifices, over pressure or over temperature controls, and other appropriate safety devices may be needed for high hazard experiments and processes.
3. Assure that exhaust devices used for chemical handling (fume hoods, laminar flow chemical hoods, biological safety cabinets) are checked on an annual basis for proper flow. Contact EHS if certification sticker indicates date of inspection greater than one year old. Assure exhaust monitors and alarms, where present, are always functional.
4. Do not alter or tap into exhaust ducts or exhaust devices. Modifications to the exhaust system, including adjusting dampers, penetrating walls or work surfaces, or adding or removing services may only be performed through Facilities Services.
5. Understand any ventilation alarms that are in place in your work area. Train all new employees on proper work practices, meaning of exhaust alarms, and actions to take in the event of an emergency.
6. Contact EHS or Facilities Services if there are changes observed in the exhaust device's performance, including a change in face velocity or inadequate capture of contaminants. Notify your building preventative maintenance contact if you notice excessive noise or vibration.
7. Contact Facilities Services for information on clean air hoods' maintenance, including HEPA filter changing, decontamination and annual certification of biological safety cabinets.

Training and Information

All laboratory personnel should receive training that includes

- How to use the ventilation equipment,
- Familiarity with OSHA regulations concerning ventilation systems
- Role of ventilation in contaminant control
- Consequences of improper use,
- What to do in the event of system failure,
- What to do in the event of a power outage,
- Special considerations or rules for the equipment,
- Significance of signage and postings.
- Position required to be in which working near exhaust hood
- Knowledge of tests and inspection procedures
- How to handle fire in ducts
- How to handle breakdowns which cause hazardous or nuisance conditions

Recordkeeping

All records concerning installation and maintenance of various LEVs on campus will be maintained by Facilities Services and EHS will maintain all annual face velocity testing records for chemical fume hoods, and other LEVs not checked by authorized company.

References

ANSI/AIHA Z9.5-2003, American National Standard for Laboratory Ventilation.

ACGIH's Industrial Ventilation: A Manual for Recommended Practice.

ANSI/ASHRAE 110-1995 Method of Testing Performance of Laboratory Fume Hoods.

Appendices

none

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