

# UConn

## Hazardous Materials Exhaust System Procedures

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Hazardous Materials Exhaust System Procedures	
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<b>Applies To:</b>	Employees, students, and others conducting maintenance on hazardous material exhaust systems or working in proximity to exhaust outlets from these systems.
<b>Contact:</b>	EHS, Occupational Health & Safety, 860-486-3613; <a href="mailto:ehs@uconn.edu">ehs@uconn.edu</a>

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# Hazardous Materials Exhaust System Procedures

## I. Purpose

The Hazardous Materials Exhaust System Procedures have been developed to protect employees from health and safety hazards while performing work on roofs within 25 feet of exhaust fan outlets or on other exhaust systems (e.g., canopy hoods, fume hoods, spray booths, etc.) designed to remove hazardous materials from the workplace.

## II. Scope

These procedures apply to faculty, staff, students and visitors performing maintenance, repair, or other work on hazardous materials exhaust systems or in proximity to the exhaust outlet of these systems at the Storrs campus, the School of Law, and the regional campuses, except UConn Health. They do not apply to the use of hazardous materials exhaust systems for their stated function such as conducting research work within a fume hood.

## III. Policy Statement

As stated in the University's [Health and Safety Policy](#), the University of Connecticut (UConn) is committed to providing a healthful and safe environment for all activities under its jurisdiction and complying with federal and state health and safety standards. As such, all maintenance on or other work in proximity to exhaust outlets of hazardous material exhaust systems at UConn must be in accordance with these procedures.

## IV. Enforcement

Violations of this program may result in appropriate disciplinary measures in accordance with University Laws and By-Laws, [General Rules of Conduct](#), applicable collective bargaining agreements, and the [Student Code](#).

## V. Definitions

**Functional Magnetic Resonance Imaging (fMRI)** – a non-invasive brain imaging scanner that uses strong magnetic fields for imaging.

**High Efficiency Particulate Air (HEPA)** – used to describe filters for respirators, air purifiers, and exhaust systems that are at least 99.97% efficient at removing particles of 0.3 micrometers in diameter.

**HuskySMS** – the University’s safety management system powered by SciShield.

**Manifold** – exhaust system design connecting several exhaust systems to a common exhaust duct and centralized exhaust fan for cost and energy reduction goals.

**Metal Organic Chemical Vapor Deposition (MOCVD)** – a method used to deposit a thin layer of atoms onto a semiconductor wafer and involves the production of hazardous by-products.

**Non-volatile** – a substance that does not readily evaporate at normal temperature.

**Permit-Required Confined Space** – a confined space that has one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere;
- Contains a material with the potential for engulfing an entrant;
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls, or a floor which slopes downward and tapers to a smaller cross-section; or
- Contains any other recognized serious safety or health hazard.

See the University’s [Confined Space Program](#) for additional information.

**Quench** – the sudden release of liquid helium, a cryogenic liquid, to deactivate the strong magnetic field associated with the fMRI scanner. This release of helium can be intentional or accidental (e.g., a malfunction of the unit) and can lead to the displacement of oxygen in the air leading to asphyxiation and unconsciousness without warning as well as burns upon skin contact.

**Volatile** – a substance that readily evaporates at normal temperature.

## **VI. Responsibilities**

### **A. Maintenance Supervisors**

1. Ensure employees have completed the Hazardous Materials Exhaust System Procedures training as well as other applicable training assigned in HuskySMS (e.g., Hazard Communication, Personal Protective Equipment, Lockout/Tagout, etc.)
2. Notify affected laboratory personnel or the workshop supervisors and the Building & Emergency Contacts (i.e. [BEC List](#) ) in advance of any maintenance activities on exhaust systems or in proximity to the outlet of an exhaust system that requires the shut down or other modifications to the system. Coordinate as needed.
3. Ensure at least two people service hazardous materials exhaust systems or conduct other work in proximity to exhaust system stacks or outlets that are less than 7 feet in height.
4. Ensure employees follow the *Hazardous Materials Exhaust System Procedures* for working on or near hazardous materials exhaust systems, including any special instructions for servicing.
5. Ensure employees wear appropriate personal protective equipment (PPE).
  - a. Consider PPE needs for the work activities to be completed (e.g., drilling, cutting, cleaning, filter replacements, etc.) as well as the potential exposure to exhaust system contaminants.
  - b. Ensure employees are current with respirator requirements and are physically able to wear a respirator when necessary.
6. Contact EHS for hazard review, as necessary.

### **B. Maintenance Employees**

1. Complete necessary training programs assigned in HuskySMS (e.g., Hazardous Materials Exhaust System Procedures, Hazard Communication, Personal Protective Equipment, Lockout/Tagout, etc.).
2. If required to wear a respirator, complete and stay current with all respirator requirements in the [Respirator Program](#), including the medical evaluation, training, fit testing, usage, inspection, and decontamination requirements.
3. Observe all postings at rooftop access points.
4. Know and comply with the *Hazardous Materials Exhaust System Procedures*, including system specific procedures.

5. Notify affected laboratory personnel or the workshop supervisor and Building & Emergency Contacts (i.e., [BEC List](#)) in advance of any maintenance activities on or near an exhaust system that requires the shut down or other modifications to the system. Coordinate as needed.
6. Inspect work areas (e.g., cabinets underneath fume hoods, areas near local exhaust ventilation systems, etc.) and ensure areas are free of spills or odors prior to shut down and maintenance activities. Ensure areas are cleaned by room occupants prior to servicing.
7. Ensure at least two people service hazardous materials exhaust systems or conduct other work in proximity to exhaust system stacks that are less than 7 feet in height.
8. Wear appropriate personal protective equipment (PPE), as required. Consider PPE needs for the work activities to be completed (e.g., drilling, cutting, cleaning, etc.) as well as the potential exposure to exhaust system contaminants.

#### **C. Laboratory, Research, Studio, or Other Workplace Personnel**

1. Operate exhaust systems in accordance with manufacturer's instructions, including servicing or maintenance.
2. Cease all activities in an exhaust system when notified that maintenance activities are scheduled to take place.
3. Ensure removal of all hazardous materials from a fume hood, spray booth, or other exhaust system prior to maintenance work, including any materials stored in vented cabinets under the fume hood, if applicable.
4. Clean/decontaminate fume hoods and other exhaust systems when work is required (e.g., when sensors, lamps, or baffles need maintenance).
5. Do not operate exhaust systems, use hazardous chemicals, or conduct research or processes when systems are labeled and locked out by Facilities Operations or other maintenance personnel.
6. Notify [EHS](#) whenever hazardous substances or highly hazardous processes will be utilized or generated that would require limiting roof access (e.g., using heated perchloric acid, hydrofluoric acid, explosive materials, acute toxicants, etc.).

#### **D. Project Representatives and Project Managers Overseeing Contractors**

1. Ensure contractors comply with all OSHA regulations (e.g., Lockout/Tagout, Confined Space Entry, etc.) and requirements in the [Contractor EHS Manual](#).
2. Ensure contractors use their own Confined Space Entry Permits, if confined space entry is required.

3. Inform contractors of the chemical and other risks associated with internal components of systems and to observe all postings at rooftop access.
4. Notify affected laboratory personnel or the workplace supervisor and the Building & Emergency Contacts (i.e., [BEC List](#)) in advance of any contractor activities on or near an exhaust systems that necessitates shut down or restricted usage of the of system. Coordinate as needed.
5. Ensure the exhaust system is prepared as described in these *Hazardous Materials Exhaust System Procedures* and signage is applied prior to contractor activities.

#### **E. EHS**

1. Develop, implement, and review the *Hazardous Materials Exhaust System Procedures*, and update as necessary.
2. Provide training on the *Hazardous Materials Exhaust System Procedures* and related training topics and maintain training records.
3. Provide consultation on exhaust procedures, workplace controls, and personal protective equipment upon request.

## **VII. Personal Protective Equipment**

Personal Protective Equipment (PPE) is required for **all work** that presents health or physical hazards to workers, if those hazards cannot be mitigated using engineering or administrative controls. Supervisors and employees must assess the hazards prior to the work to determine the appropriate PPE for the job. The [Workplace Hazard Assessment Form](#) can be used by supervisors to pick out appropriate PPE for specific tasks. In addition to potential chemical hazards within the exhaust systems, other hazards being introduced to the work areas during the servicing (e.g., exposure from drilling, cutting, welding or using maintenance products) must be considered.

#### **A. Eye Protection**

- Goggles – the preferred level of protection from impact, particulates, and chemical splashes. They cover the entire eye socket and are necessary for chemical use, cutting, grinding, sanding, etc.
- Safety Glasses – minimum level of protection – provide impact protection only from front and sides and do not cover the entire eye socket. They are not suitable for chemical use, heavy particulates, work above the head, etc.



## B. Hand, Body, Foot Protection

- Work gloves – minimum level of impact and abrasion protection but provide no protection against chemical hazards.
- Chemical resistant gloves (e.g., nitrile, neoprene, etc.) – provide protection against chemical hazards, work on internal components of exhausts systems (such as chemical fume hoods), etc.
- Impact-resistant shoes or boots – provide protection from falling or rolling objects. No open-toed shoes.
- Disposable coveralls and boot covers depending upon nature of work – typically required when servicing internal parts of systems, filter changes, etc.

## C. Respiratory Protection

The primary method for controlling exposure to respiratory hazards in the workplace must be through engineering controls such as ventilation, enclosure of an operation, or substitution with less toxic materials. When other controls measures are not feasible, respirators must be used. All respirator usage must comply with the University's [Respirator Program](#).

Half-face elastomeric respirators with a P100/multi-gas cartridge may be required for the following activities if there is an absence of other controls.

- Work that creates dust or other aerosols.
- Changing filters within air handling systems for hazardous materials exhaust, such as heat recovery units or spray booths.
- Using hazardous chemicals that require respirators when servicing exhaust systems.
- Heating internal components of exhaust systems, such as during welding or cutting.
- Work within 25 feet of active exhaust stacks less than 7 feet in height.

In addition, basic hygiene practices such as washing with soap and water after any work should always be used. For further information on PPE selection and use, including respiratory protection, email [EHS Occupational Health and Safety](#) or call 860-486-3613.

## VIII. Maintenance Procedures

### A. General Safety Procedures

Prior to working on any hazardous materials exhaust system/fan, workers must:

1. Notify area representatives (e.g., principal investigator, studio or workshop supervisor, users of exhaust system, etc.) of the affected room(s) as well as the Building & Emergency Contact (i.e., [BEC List](#)).
2. Notify [EHS Biological Health and Safety](#) if a biosafety cabinet (BSC) needs servicing or repairs. If properly used and maintained, there should be no biological hazards downstream of the HEPA filter on BSC's, whether the BSC is ducted or not.
3. Notify [EHS Radiation Safety](#) prior to work *inside hoods* labeled for radioactive materials for assessment and clearance. Since radioactive materials used in labs are non-volatile, the internal components (e.g., exhaust fans and ducts) of these fume hoods, except for the radiological hood at the Main Accumulation Area (MAA), present minimal risks to workers.
4. Ensure that the occupants have shut down experiments or processes and closed and removed all hazardous materials from fume hoods, vented cabinets beneath fume hoods (if applicable), or other exhaust systems.
5. If servicing needs to be done within the fume hood, ensure users have cleaned the inside of the hood. If the interior has not been cleaned, do not service the device.
6. Inspect the hoods, underlying vented cabinets (if applicable), and other exhaust systems for spills prior to work. Contact EHS if spills are identified.
7. Place service [signs](#) on the fume hood cabinets and other exhaust systems to notify room occupants that the system is out of service.
8. Flush fume hoods and other exhaust systems for a minimum of 4 hours.
9. Shut down, lock, and tag out the system/fan in accordance with the University's [Lockout/Tagout Program](#).
10. If the exhaust system is manifolded with other exhaust systems, shut down and lock out **all** systems. If it is not feasible, respiratory protection is required.
11. Observe all postings at rooftop access points about additional PPE or precautions, as required.
12. Wear appropriate personal protective equipment (PPE). Some **internal** components have potential for chemical hazards.
13. Place any waste generated (e.g., spent filters, cleaning materials, contaminated PPE, etc.) in sealed bags or containers, properly label, and dispose of through [EHS](#).

14. Follow Post Work Completion Procedures
  - a. Conduct the procedures in the [Lockout/Tagout Program](#), ensuring that all locks and tags are removed before equipment is put back into service.
  - b. Notify room and/or area representatives, including BEC List contacts, that the work is complete and that normal operations of the system may resume.
15. Remove Warning signs.

## **B. Work Within Heat Recovery Units**

Several buildings (e.g., Engineering and Science Building, Chemistry, Agricultural Biotechnology Laboratory, Pharmacy, etc.) have manifolded exhaust systems for the purpose of heat recovery. Filters are in place to filter exhaust air and protect the coils. These units are [Permit-Required Confined Spaces](#) due to confinement hazards. Negative pressure within the units prevents doors from opening until ventilation systems are shut down and locked out. Once the systems are shut down and locked out, the confinement hazard is mitigated and the space is no longer a Permit-Required Confined Space, unless other hazards are introduced during servicing, such as welding.

1. Clean Side Activities (e.g., Belt Changes and Other Maintenance Activities)
  - a. Prior to entry, follow General Safety Procedures, to notify occupants in **all** affected laboratories.
  - b. Lock out and tag the ventilation system to prevent air from being introduced from the laboratory hoods and personnel being trapped in the exhaust system if the ventilation is restarted.
  - c. EHS recommends using a Confined Space Entry Permit to document the downgrade from permit-required confined space to a confined space.
  - d. As a prudent measure, gloves, safety glasses and Tyvek suits should be worn, at a minimum, during work on the clean side.
  - e. Additional PPE may be necessary based upon hazards introduced during work activities (e.g., solvents used for maintenance, welding, soldering, etc.). Contact EHS prior to introducing new products or activities.
  - f. Follow [post-work completion procedures](#).
2. Dirty Side Activities (e.g., Filter Changes and Other Maintenance Activities)
  - a. Prior to entry, follow the General Safety Procedures to notify occupants in **all** affected laboratories.
  - b. Lock out and tag the ventilation system to prevent air from being introduced

from the laboratory hoods and personnel being trapped in the exhaust system if the ventilation is restarted.

- c. EHS recommends using a Confined Space Entry Permit to document the downgrade from permit-required confined space to a confined space. PPE must be increased, at a minimum, to include goggles, respiratory protection, chemical resistant gloves, Tyvek suits, etc.
- d. Place any wastes in sealed bags or containers, properly label, and dispose of through [EHS](#).
- e. Once completed, follow the [post-work completion procedures](#).

### **C. Roof Work Near Exhaust Systems**

Most fume hood exhaust stacks are located at roof level. Stacks exhaust the air away from the building envelope. Hazardous chemicals used in most research labs are small quantities, thus chemicals present in the exhaust are usually in dilute concentrations in relation to the volume of air moving through the system. At a minimum, stacks should be extended to 7 feet above the roof. If rooftop access is necessary and work will be in proximity (less than 25 feet) to an active exhaust stack, consider the following:

1. If the adjacent stack is at least 7 feet in height, proceed using the appropriate personal protective equipment for the job task.
2. If the adjacent stack is less than 7 feet in height, that exhaust system must be locked and tagged out, following the General Safety Procedures.
3. If the adjacent stack is less than 7 feet in height and cannot be shut down and locked out, respiratory protection must be worn, in addition to the PPE necessary for the job task. All efforts must be made to lockout out the system before work near an active exhaust is considered and respiratory protection is worn. Respiratory protection is not a substitute for locking out the exhaust system. Minimal level of respiratory protection is a half-face elastomeric respirator with a P100/multi-gas cartridge.

## **IX. Special Building Instructions**

### **A. Environmental Health and Safety Building**

Prior to accessing the roof *for any reason*, [EHS Radiation Safety](#) (860-486-3613) must be contacted to grant clearance. Radiation Safety must confirm that no radiological hazards are present prior to accessing the roof since meter calibrations using a radioactive source are routinely conducted in the Radiation Laboratory which could affect rooftop

work. There is no hazardous materials exhaust system associated with this activity and the access point to the rooftop is posted accordingly.

## **B. Main Accumulation Area (MAA)**

Prior to accessing the roof, both the [EHS Chemical Health and Safety](#) and [EHS Radiation Safety](#) groups must be notified (860-486-3613). Some fume hoods in the MAA are used for radioactive materials and other fume hoods are used for the analysis and bulking of hazardous wastes.

The access points to the rooftop are posted accordingly.

- If work will be performed inside the radiation fume hood, or on other internal components, it must be assessed by EHS Radiation Safety prior to work (486-3613)
- If work will be performed inside the chemical fume hood, or on other internal components, it must be assessed by EHS MAA personnel prior to work.
- Follow [General Safety Procedures](#) for work on internal components once both clearances are received.

## **C. Bronwell Building**

Due to potential use of the MOCVD reactor in Bronwell Room 113, steps must be taken to lock out the reactor and hydrogen supply prior to roof access, in accordance with the [Lockout/Tagout Program](#). Signs concerning roof access requirements are posted on the ladder and roof hatch.

1. When the reactor is NOT in operation, laboratory personnel trained in Lockout/Tagout must:
  - a. Lock and tag the hydrogen supply valve (located above reactor)
  - b. Lock and tag the computer terminal access door for the reactor.
  - c. Place keys from those locks into a group lockout box.
  - d. Lock and tagout the group lockout box itself with a red lockout lock and completed DANGER tag and place the lockout box at the reactor's computer terminal.
2. Anyone requiring roof access (Facilities Operations, University Safety, UPDC,

contractors, etc.) must:

- a. Check out restricted roof hatch access key from Facilities Operations Center.
- b. Verify that hydrogen supply valve and computer terminal access door are locked out and keys are in group lockbox. If these conditions are not met, do not access the roof.
- c. Add their own lock and tag to each group lockout box in room 113, securing the keys in the boxes from being accessed by laboratory personnel and preventing reactor operation while personnel are on the roof.
- d. Follow [General Safety Procedures](#) while conducting work on the exhaust systems on the roof or working in proximity to other exhaust systems.
- e. After leaving the roof, remove the lock and tag from the group lockout box.
- f. Return the roof hatch access key to the Facilities Operations Center.

#### **D. Science 1 Research Center - Perchloric Acid Hood**

A perchloric acid fume hood is in room 1042 of the Science 1 Research Center. When concentrated perchloric acid is heated, it can form shock sensitive perchloric crystals in the ductwork that may explode upon contact. To prevent this from occurring, the hood is equipped with a washdown system to prevent the buildup of perchlorates in the exhaust system. The system and ductwork are labeled at the rooftop, PHEF-1.

Contact EHS prior to any work on the perchloric acid hood in Room 1042 of Science 1 or the exhaust system on the roof. EHS will determine if changes in perchloric acid use necessitate additional safety measures.

Once permission to proceed is received from EHS, individuals must activate the washdown function at the panel within the laboratory prior to servicing the system and follow the [General Safety Procedures](#).

Maintenance employees must review and follow the manufacturer's operation and maintenance manual to ensure the parts and materials being repaired or replaced are compatible with perchloric acid.

#### **E. Science 1 Research Center – Hydrofluoric Acid Hoods**

Hydrofluoric acid is a clear, colorless inorganic acid that is highly toxic with severe health risks. It is available for use in three labs in the Science 1 Research Center (i.e., Rooms

1031, 1033, and 1037). The systems and ductwork on the roof are labeled HF-LEF-1 and HF-LEF-2, and HF-LEF-3.

Contact EHS prior to any work on the hydrofluoric acid fume hoods or their associated exhaust systems on the roof. EHS will determine if activities involving hydrofluoric acid necessitate additional safety measures beyond the General Safety Procedures.

#### **F. Central Warehouse Firing Range Exhaust System**

Due to potential exposure to lead, work inside the exhaust system that services the indoor firing range at Central Warehouse (including changing of the filters) requires the use of respiratory protection with a P100 (HEPA) filter, employee exposure monitoring, training, proper engineering and work practice controls, HEPA vacuums, and proper waste disposal (e.g., filters, drop cloths, HEPA vacuum contents, PPE, etc.). Contact [EHS Occupational Health and Safety](#) (860-486-3613) prior to any work on this system. Any contractors utilized for this work must be notified of the hazards and comply with pertinent federal and state regulations regarding both the service and disposal.

#### **G. Phillips Communication Science Building**

A functional magnetic resonance imaging (fMRI) unit for measuring and mapping brain activity is present in the Phillips Communication Sciences Building. fMRI scanners use strong magnetic fields in the resonance process and maintain the magnetic field even if power is lost. Liquid helium, a refrigerated gas that may displace oxygen and cause rapid suffocation and frostbite upon contact, is used to supercool and maintain the strong magnetic field.

During emergencies, such as an unintended metal object causing bodily injury to a person during a scan, individuals are trained to press an emergency button to quickly release this magnetic field. Additionally, if there is a malfunction with the fMRI scanner, the system can 'quench' suddenly without warning. Once the quench occurs, liquid helium will be suddenly released to the environment. A quench is only initiated during emergencies or a malfunction, since doing so can cause permanent damage to the magnet and fMRI scanner.

Since a quench can occur at any time, scheduling work after-hours work does not eliminate the risk of working around the quench stack. To minimize the risk of cold

burns and asphyxiation, access to the quench vent must be restricted by 10 feet on each side and below the vent, and 20 feet above the vent. There is a guardrail system and signage to prevent access to the restricted area. Work within the guardrail system is strictly prohibited at all times. Should a quench occur, all activity on other parts of the roof must cease and workers must leave the roof immediately.

#### H. Animal Care Services Areas

Notify and coordinate with [Animal Care Services](#) (ACS) prior to any work involving maintenance or shutdown of exhaust systems associated with animal care spaces or the need to enter animal care areas. Follow all PPE requirements to enter areas within ACS facilities.

#### X. SERVICE SIGN

