Fume Hood Program

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1. PROGRAM DESCRIPTION

The Fume Hood Program provides a system for complying with the requirements of the applicable regulatory standards. This program defines the procedures for:

- Testing the face velocity/inward flow;
- Indicating the proper working sash height;
- Evaluating the various components of a fume hood;
- Reporting deficiencies and repair requests;
- Commissioning newly installed fume hoods, as part of new construction or renovation;
- Certifying existing fume hoods that have been modified;
- UCR fume hood user training in:
    - General hood purpose
    - Safe use of the hood and its features
    - How to confirm when the hood last received its performance test
    - How to confirm the last performance test met regulatory requirements
    - Airflow characteristics
    - Potential for turbulent airflow and escape of hazardous substances from the hood
    - Checking the quantitative airflow monitor or alarm system

2. SCOPE

When laboratory fume hoods are used to prevent harmful exposure to hazardous substances, such hoods shall conform to all applicable provisions in Cal-OSHA Title 8, Section 5154.1, Cal-OSHA Title 8, Section 5209, and other applicable provisions outline in this UCR Fume Hood Program Document. Biological Safety Cabinets are not covered by this program.

3. DEFINITION

Laboratory-Type Hood: A device enclosed except for necessary exhaust purposes on three sides and top and bottom, designed to draw air inward by means of mechanical ventilation, operated with insertion of only the hands and arms of the user, and used to control exposure to hazardous substances. These devices are also known as laboratory fume hoods.

4. RESPONSIBILTIES

UCR Environmental Health and Safety

UCR, through the administration of the EH&S office, shall be responsible for the establishment, implementation, and maintenance of a written fume hood program. The EH&S office shall:

- Facilitate and coordinate testing of fume hoods;

- Report deficiencies found during the EH&S-facilitated survey and produce repair requests;
- Develop and provide training for the fume hood users;
- Review fume hood commissioning reports.

The program shall be updated as necessary to reflect changes in workplace conditions that affect fume hood use.

Principal Investigators (PIs)/Managers/Supervisors:

UCR PI/supervisors/department chairs shall be responsible for ensuring the proper use of the fume hood, following the UCR Chemical Hygiene Plan, observing laboratory safe practices, and implementing worksite-specific procedures. These measures are intended to minimize, reduce, or eliminate UCR personnel exposures and may include administrative controls, or the use of personal protective equipment. EH&S shall work collaboratively with the affected UCR department to develop worksite-specific procedures. The affected department shall be responsible for implementing and maintaining the work site specific procedures.

Laboratory Personnel/Employee/Fume Hood User:

UCR personnel shall be responsible for:

- Using the fume hood correctly;
- Participating in required Chemical Hygiene Training and Laboratory Safety Training;
- Following the Chemical Hygiene Plan, laboratory safe practices, and worksite-specific procedures;
- Reporting any fume hood in need of repair found during daily use

5. PROGRAM COMPONENT

Fume Hood Testing Protocol:

Fume hood testing shall be performed annually, or bi-annually for fume hoods used for regulated carcinogens as specified in Cal-OSHA Title 8, Section 5209. The face velocity shall be measured with the sash placed at the designated, proper working height (typically no higher than 18 inches or less as indicated by a sash stop and/or an affixed sticker that indicates the proper working height) using a calibrated, NIST traceable hot wire anemometer. Smoke visualization test shall also be performed to evaluate containment capability and turbulence using The Qualitative Smoke Visualization Rating Chart (Appendix B). The fume hood shall be tested as is.

The “pass criteria” shall comply with 8 CCR 5154.1 (c)(1), and other applicable standards as appropriate, such as 8 CCR 5209 (b)(11).

All fume hoods shall be tested in accordance with the procedures outlined within the “Fume Hood Inspections SOP” (Appendix E).

The following information shall be collected and recorded in the EH&S Hoods Application:

- Fume hood location
- Fume hood make and model
- Inspection date
- Sash height as found

- Fume hood sash condition (i.e. working order/good condition/glass cracked)
- airflow monitor/alarm status
- smoke test status

All tested fume hoods shall bear a "fume hood sticker" (Appendix A) that contains the following information:

- Proper working sash height
- Face velocity (an "Out of Service" sign must be posted on the hood, plainly visible, if the hood fails to pass.)
- Inspector initials
- Date of inspection

Reporting Deficiencies and Repair Requests:

The following must be conducted when fume hoods do not meet the "pass criteria":

- Post an "Out of Service" notice sign (Appendix D) on the hood in a plainly visible location which prohibits the use of the hood until the hood is serviced and the flow rate is verified.
- Submit a work order to Facilities Services with laboratory contact included.
    - Work order request process outlined in "Fume Hood Inspections SOP" (Appendix E)
- Fume hood must not be used until deficiencies are corrected.
- All hazardous materials must be removed from the fume hood and properly store in approved areas.
    - Coordinate with EH&S Hazardous Waste Supervisor as applicable
- All surfaces of the fume hood must be decontaminated prior to repair work conducted by Facilities Services.
- Notify laboratory personnel upon discovery of failed fume hood.

Newly Installed Fume Hoods (New Construction or Renovation) changes that may affect fume hood performance:

Commissioning testing is required for all newly installed fume hoods, as part of new construction or renovation, or when changes are made to the laboratory, its building, and/or the mechanical systems, or to the fume hood itself that may impact the fume hood's performance. The testing shall include elements specified in the Fume Hood Testing Protocol of this program, as well as ANSI/ASHRAE 110-1995 tracer gas testing pursuant to 8 CCR 5154.1 (c)(2). This testing must be performed prior to use of the fume hood.

If an existing fume hood or a new fume hood is equipped with an automatic occupant sensor system to reduce face velocity when an employee is not in the general area, the fume hood must be tested in accordance with the Fume Hood Testing Protocol of this program, as well as ANSI/ASHRAE 110-1995 tracer gas testing pursuant to 8 CCR 5154.1 (c)(2). This testing must be performed prior to use of the fume hood.

6. REPORTING REQUIREMENTS

Fume hood testing requests are made by contacting the UCR EH&S Office at 951-827-5528 or emailing ehs@ucr.edu. Fume hood testing requests may also be made through the Incident Reporting System found on the UCR EH&S webpage (https://ehs.ucr.edu/)

Fume hood repair requests are made by contacting the Facilities Services Service Desk at 951-827-4214. Or emailing facilities@ucr.edu.

7. COMPETENCY ASSESSMENT AND TRAINING REQUIREMENTS

Fume hood user training is provided in the UC Laboratory Safety Fundamentals Course (LMS Course Code RI-ESCUR0001-CERT). This course is required every 3 years for all laboratory personnel working in spaces where fume hoods are present and may be used. All fume hood users shall receive training in the following elements:

- General hood purpose
- Safe use of the hood and its features
- How to confirm when the hood last received its performance test
- How to confirm the last performance test met the requirements of Cal-OSHA Title 8, Section 5154.1
- Airflow characteristics
- Potential for turbulent airflow and escape of hazardous substances from the hood
- Checking the quantitative airflow monitor or alarm system
- Primary engineering control method for potential exposures
- Containment method for unanticipated fires/explosions/splashes
- Fume hood components
- Capture efficiency and optimum velocity
- Types of fume hoods
- Work practices/correct use
- Keep sash closed when not in use

User competency is assessed during the online training.

8. INFORMATION AND EXTERNAL REFERENCES

Appendix A - Fume Hood Sticker
Appendix B - Qualitative Smoke Visualization Rating Chart
Appendix C - Fume Hood Commissioning and Performance Testing
Appendix D - Out of Service Notice Sign
Appendix E - Fume Hood Inspections SOP
Appendix F - Potentially-Contaminated Laboratory Systems Work Guidelines

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Title 8 California Code of Regulations Section 5154.1. “Ventilation Requirements for Laboratory-Type HoodOperations.”

Title 8 California Code of Regulations Section 5209. “Regulated Carcinogens”

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

ANSI Z9.5- 2003 Laboratory Ventilation

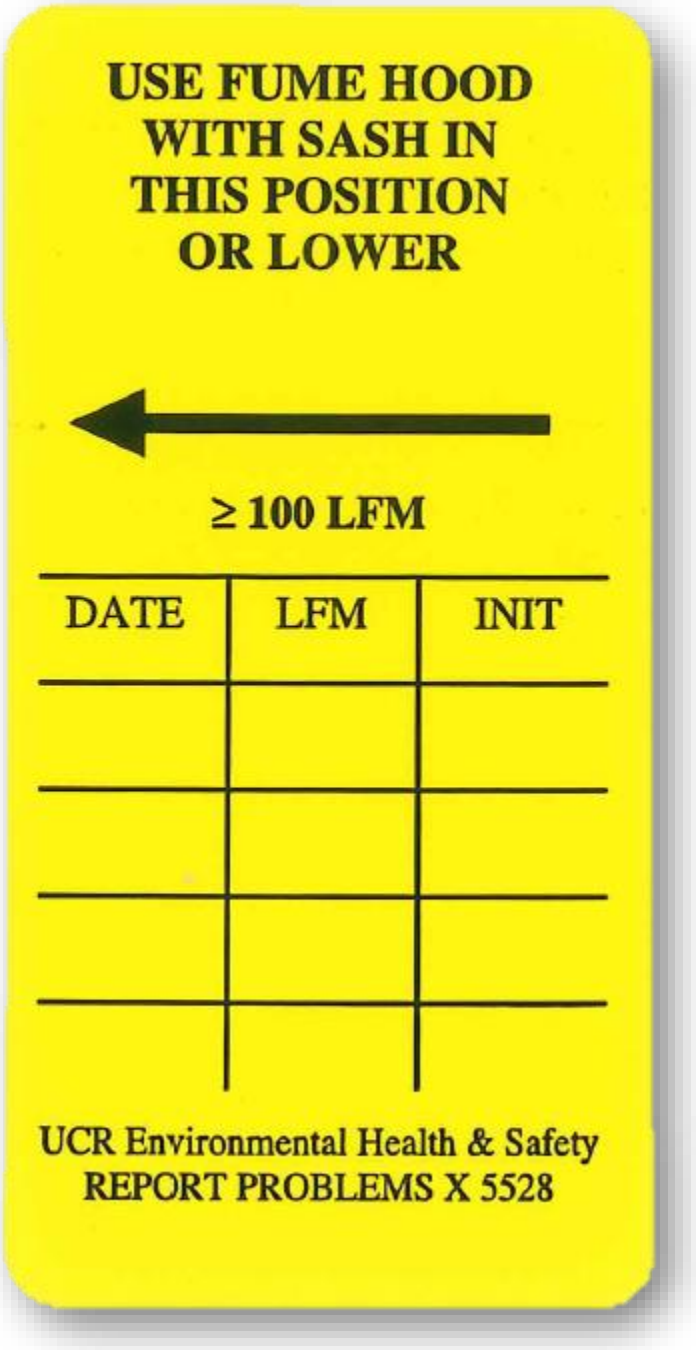
University of California Laboratory Safety Design Manual: https://lsdm.ucop.edu/

UCR EH&S Web Page (Incident Reporting System): https://ehs.ucr.edu/

UCR Chemical Hygiene Plan: https://ehs.ucr.edu/laboratory/CHP/currentchps

UCR EH&S Hoods Application: https://ehsapps.ucr.edu/ehshoods/index.php

APPENDIX A
FUME HOOD STICKER



APPENDIX B
QUALITATIVE SMOKE VISUALIZATION RATING CHART

RATING	DESCRIPTION
FAIL	• Smoke was visually observed escaping from the hood
POOR (Low Pass)	• Reverse flow of smoke is evident within six inches of the plane of the sash when generated at least six inches behind the plane of the sash. • Lazy flow into hood along openings. • Slow capture and clearance- greater than two minutes for clearance. • Observed potential for escape.
FAIR (Pass)	• Some reverse flow in hood not within six inches of opening. • Smoke is captured and clears readily from interior of hood-less than two minutes. • No visible escape.
GOOD (High Pass)	• Good capture and relatively quick clearance- approximately one minute or less. • No reverse flow regions. • No lazy flow. • No visible escape.

*Based on criteria developed by ECT, April 2009

APPENDIX C
FUME HOOD COMMISSIONING AND PERFORMANCE TESTING

A fume hood commissioning and performance testing process are critical in ensuring the proper function of a laboratory ventilation system. When fume hoods are installed as part of new construction they will be certified by a Test and Balance (TaB) service as part of the building commissioning process. Fume hoods installed as part of a laboratory renovation project will also be certified by a TaB service.

The following excerpt from the University of California EH&S Laboratory Safety Design Manual and the UCR PD&C Construction Specifications provide important points to include in a commissioning process:

A written commissioning plan shall accompany design documents and be approved by the commissioning authority in advance of construction activities. The commissioning plan, along with the other project documents, shall be available to all potential suppliers and contractors prior to bid. The commissioning plan shall address the operation of the entire ventilation system where the hoods, laboratories, and associated exhaust and air supply ventilation systems are considered subsystems. The plan shall include, in addition to written procedures to verify or validate the proper operation of all system components:

- Laboratory Chemical Hood Specification and Performance Tests
- Preoccupancy Hood and Ventilation System Commissioning Tests
- Preoccupancy Laboratory Commissioning Tests

Preliminary and final commissioning documents shall be issued to the appropriate parties by the University representative. The documents shall include:

- Design Flow Specifications
- Laboratory and System Drawings for Final System Design
- Copy of Test and Balance Report
- Commissioning Test Data
- List of Ventilation System Deficiencies uncovered and the details of how (and if) they were satisfactorily resolved

Operational deficiencies and other problems uncovered by the commissioning process shall be communicated to the responsible party (i.e., installer, subcontractor, etc.) for prompt correction.

Before performing laboratory fume hood testing, measure, adjust and record the supply airflow and airflow patterns of each supply air outlet that is located in the same room as the hood.
Adjust the air outlet flow pattern to minimize turbulence and to achieve the desired airflow patterns at the face and inside the hood. Verify that adequate makeup air is available to achieve the indicated flow of the hood.
The volumetric flow exhausted from a laboratory chemical hood shall be determined by measuring the flow in the exhaust duct, using industry-approved methods.

Fume Hood General Balancing Requirements:

Fume hoods shall be balanced with an inward flow, to a minimum of 100 feet per minute (fpm) face velocity across the opening, with a minimum of 70 fpm at any point.

Fume hoods equipped with automatic controls and occupancy sensors, shall be balanced for the controls system "unoccupied mode" (no employee working in the vicinity of the fume hood opening) to 60 fpm when all of the conditions of California Title 8 General Industrial Safety Order are met.

Measure, adjust, and record the airflow of each laboratory fume hood by duct Pitot-tube traverse with the laboratory fume hood sash in the design open position.

- For laboratory fume hoods installed in variable exhaust systems, measure, adjust, and record the hood exhaust airflow at maximum and at minimum airflow conditions.
- For laboratory fume hoods designed with integral makeup air, measure, adjust, and record the exhaust and makeup airflow.
- For laboratory fume hoods that are connected to centralized exhaust systems using automatic dampers, adjust the damper controller to obtain the indicated exhaust airflow.

After balancing is complete, do the following:

Measure and record the static pressure at the hood duct connection with the hood operating at indicated airflow.

Measure and record the face velocity across the open sash face area. Measure the face velocity at each point in a grid pattern. Perform measurements at a maximum of 12 inches between points and between any point and the perimeter of the opening.

1. For laboratory fume hoods designed to maintain a constant face velocity at varying sash positions, also measure and record the face velocity at 50 and 25 percent of the design open sash position.
2. Calculate and report the average face velocity by averaging all velocity measurements.
3. Calculate and report the exhaust airflow by multiplying the calculated average face velocity by the sash open area. Compare this quantity with the exhaust airflow measured by duct Pitot-tube traverse. Report differences.
4. If the average face velocity is less than the indicated face velocity, retest the average face velocity and adjust hood baffles, fan drives, and other parts of the system to provide the indicated average face velocity.

Check each laboratory fume hood for the capture and containment of smoke by using a hand-held emitting device. Observe the capture and containment of smoke flow pattern across the open face and inside the hood. Make adjustments necessary to achieve the desired results.

With the room and laboratory fume hoods operating at indicated conditions, perform an "as installed" performance test of the laboratory fume hood according to ANSI/ASHRAE 110-1995 Method of Testing Performance of Laboratory Fume Hoods, modified. Test each laboratory fume hood in occupied mode, unoccupied mode, and at minimum flow mode and document the test results.

ANSI/ASHRAE 110-1995 Testing

Tests demonstrating proper operation and performance of the fume hood will be conducted after installation and prior to use of the hood according to
ANSI/ASHRAE 110-1995 “Method of Testing Performance of Laboratory Fume Hoods” as required by CCR Title 8, 5154.1. All tests shall be conducted at a design opening sash height of 18 inches.

ASHRAE 110-1995 testing would be performed using sulfur hexafluoride as the tracer gas or in accordance with UC variance file No. 09-V-141 granted on April 21, 2011 that allows the use of nitrous oxide at a tracer gas source rate of 5.5 lpm.

The ANSI/ASHRAE 110-1995 testing would be performed upon commissioning and when required by CCR Title 8, 5154.1. Testing would also occur if a fume hood was not maintaining capture as indicated by face velocity and/or smoke visualization testing even after repair, or if there are any major changes to laboratory rooms or ventilation systems that could impact hood performance.

Each hood should have a label indicating the date of the most current tracer gas test and the date the next test is due. The records of tracer gas tests and velocity verifications should be maintained for 5 years.

OUT OF SERVICE NOTICE

UCR Environmental Health & Safety has determined that this fume hood does not meet the proper ventilation requirements for safe usage.

☐**Condition requiring Facilities Services (EH&S will contact Facilities Services):**

- ☐**High Flow**
- ☐**Low/No Flow**
- ☐**Other:_____**

☐**Condition requiring lab user correction (Correct and contact EH&S <u>prior</u> to use):**

- ☐**Excessive/Improper Storage**
- ☐**Other:_____**

- **DO NOT ATTEMPT TO USE THIS HOOD**
- **DO NOT HANDLE ANY CHEMICALS INSIDE HOOD**
- **DO NOT STORE ANY CONTAINERS INSIDE HOOD**

For further assistance regarding this notice, call UCR Environmental Health & Safety at: 951-827-5528

_____ _____

EH&S Rep **Date**

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APPENDIX E

FUMEHOOD INSPECTIONS

STANDARD OPERATING PROCEDURE (SOP)

Internal Document

Contents

A. PURPOSE

All fume hoods are subjected to an annual inspection to determine whether it is still operating correctly. The purpose of this document is to guide EH&S staff on how to inspect fume hoods once a year to maintain safety. Inactive and archived fume hoods will not be inspected, only active fume hoods will be.

B. ADMINISTRATIVE ACCESS

Website: https://ehsapps.ucr.edu/ehshoods/

- Username: UCR NetID
- Password: UCR NetID Password

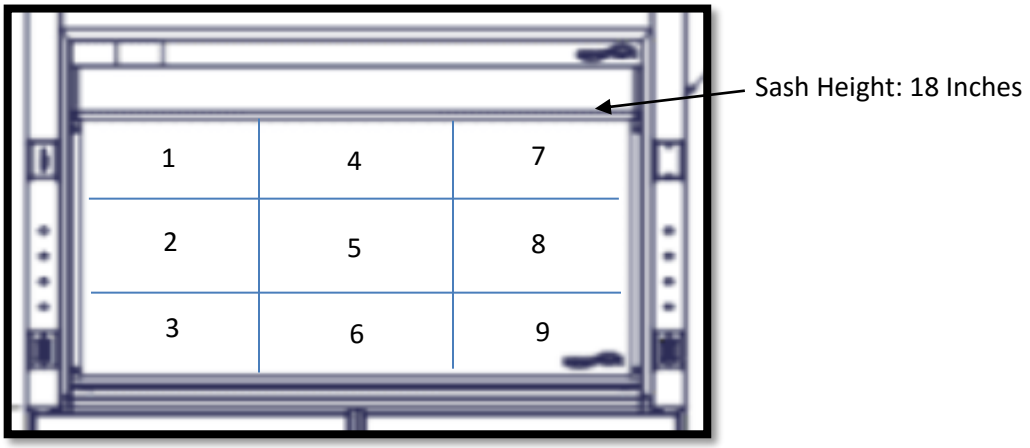
C. INSPECTION PROCESS

Fume hoods are inspected in the order of the last inspection date annually. The order will usually be building by building, however anomalies occur due to various fume hoods getting a delayed inspection due to repairs by facilities.

1. Bring appropriate equipment and PPE.
    a. Wear PPE during the inspection. Make sure to remove PPE whenever exiting the building.
        i. Lab coat.
        ii. Safety goggles.
        iii. Closed toed shoes.
        iv. Gloves.
        v. Long pants.
    b. Equipment for inspection.
        i. Smoke tube.
        ii. List of fume hoods to inspect on a clipboard.
        iii. TSI 9565-P Meter (multimeter) and necessary Probe.
        iv. Interior keys to access all the rooms.
        v. Yellow arrow, record stickers, and pen.
        vi. ATTENTION/CAUTION signs and tape.
        vii. “OUT OF SERVICE NOTICE” documents
2. Find the room.
    a. Knock on the door to determine whether anyone is present
        i. If someone opens the door, introduce yourself and inform them about your annual fume hood inspection.

ii. If no one opens the door, open it yourself with the keys and enter the room cautiously, since various chemicals could be lying around or experiments could be in process.

3. Identify the exact fume hood and begin testing.
   a. Fume hoods are usually labelled from the left to the right side of the room.
   b. Position the sash so that the fume hood opening is 18 inches.
   c. Note if large equipment or bulky items are placed in the hood. If they are, they must be elevated approximately 2 inches above the surface of the hood table top so that air may pass beneath them. They should also be placed towards the back of the hood. Large items near the face of the hood may cause excessive air turbulence and variations in face velocity.
      i. If large equipment or bulky items are not properly placed, or cause air turbulence and variations in face velocity (as shown by smoke test and/or multi meter readings) the fume hood fails the test and must be taken out of service until the bulky items can be removed or properly placed (see "Troubleshooting" section, below)
   d. Note if the quantitative airflow monitor alarm is functioning properly.
      i. If the quantitative airflow monitor alarm is not working, not showing the proper face velocity, or is alarming, the fume hood fails the test and must be taken out of service until it is repaired (see "Troubleshooting" section, below)
   e. Use a Smoke Tube or Smoke Generating Device (i.e. Wizard Stick) as a qualitative assessment.
      i. Position the sash so that the fume hood opening is 18 inches.
      ii. Puff smoke around the opening of the hood (around the right, left, top, bottom, and center). No smoke should come out of the hood.
         1. If smoke comes out of the hood, the hood fails the test and must be taken out of service until it is repaired (see "Troubleshooting" section, below)
   f. Set up the multimeter by attaching the Probe onto the bottom of the TSI 9565-P Meter in order to conduct the quantitative assessment.
      i. Turn the multimeter on by pressing the power button.
      ii. Make sure you are logging data into the correct "Test Number" by selecting "Menu>Data Logging>Choose Test".
      iii. Make sure to change the "Test Number" for <u>every different fume hood</u>.
   g. Divide the fume hood opening into nine squares, as shown in the diagram below.
      i. For each fume hood, you will need to record three (3) evenly spaced readings from top to bottom in the left column, middle column, and right column. This will give a total of nine (9) readings per fume hood.



h. Insert the probe into the middle of each of the 9 squares of the fume hood, parallel to the sash, to obtain readings.
    i. Press the "↲" (enter) button to conduct a reading. Save it unless there is a reason to believe the reading is faulty.
    ii. Once the readings are completed, hit "Stats" and it will display the average flow rate.
        1. The average face velocity with a sash opening of 18 inches must be over 100 feet per minute (fpm) or the fume hood fails the test and must be taken out of service until it is repaired (see "Troubleshooting" section, below)
    iii. Record the date, average flow rate, and your initials on the yellow record sticker on the fume hood.
    iv. Take notes of what Test Number each fume hood is logged as on the list of fume hoods.
i. REMINDER: Before moving onto the next fume hood, remember to change the Data Logging Test Number.
j. Turn off the multi meter.
    i. To turn it off, hold the power button for three (3) seconds.

4. Go to the EH&S Hoods Application: https://ehsapps.ucr.edu/ehshoods/inspection.php
    a. Click Add new Inspection
    b. Select fume hood.
    c. Select inspection date.
    d. Pass/Fail the alarm status (quantitative airflow monitor), smoke test status, and fume hood sash condition.
    e. Set sash height at 18 inches.
    f. Type in the data points.
        i. Take the average of readings 1-3 (left column) for data point 1, average of readings 4-6 (middle column) for data point 2, and the average of readings 7-9 (right column) for data point 3.
    g. Submit.

D. TROUBLESHOOTING

1. If the fume hood average flow rate is under 100 fpm, or any other issues such as a broken quantitative airflow monitor alarm or a failed smoke test.
    a. Take the fume hood out of order.
        i. Attach an "OUT OF SERVICE NOTICE" sign on the front on the fume hood.
            1. File location of notice: \\Prodfs1.fboad.ucr.edu\EHS\Industrial Hygiene\ventilation\2020 Fume Hood Program
        ii. Include the reason for test fail on the Notice
        iii. Sign and put the date on the notice.
    b. Go to https://facilities.ucr.edu/requests
        i. Submit Service Request.
        ii. Request for Maintenance/Repairs.
        iii. Select the site, building, floor and room.
        iv. Type a brief request title and description of work.
    c. Usually it takes facilities around a week to fix the fume hood
        i. To see whether they have fixed it or not, click review request.
    d. Once the status of the request is closed, return to the fume hood and re-inspect it.
        i. There is a possibility where the request is simply closed but the fume hood wasn't actually fixed. In that case, make another request for maintenance/repairs.

2. If the fume hood fails due to a condition requiring lab user correction (i.e. excessive/improper storage, baffles/vent ports blocked)
    a. Take the fume hood out of order.
        i. Attach an “OUT OF SERVICE NOTICE” sign on the front on the fume hood.
            1. File location of notice: \\Prodfs1.fboad.ucr.edu\EHS\Industrial Hygiene\ventilation\2020 Fume Hood Program
        ii. Include the reason for test fail on the Notice
        iii. Sign and put the date on the notice
    b. Notify the lab user/PI of the issue causing the fume hood to fail. Advise them to correct the issue and contact EH&S prior to use.

APPENDIX F

Potentially-Contaminated Laboratory Systems Work Guidelines

INTRODUCTION

The laboratory environment contains many mechanical systems such as local exhaust ventilation (fume hood and associated equipment), vacuum, and waste neutralization systems. These systems may come into contact with chemical, biological, and radioactive agents. When these systems require maintenance or repair, facilities personnel, support staff and/or contractors may risk being exposed to residual materials in these "*Contaminated Systems*."

University facilities personnel, support staff and contractors who are required to conduct repair and maintenance activities must communicate with laboratory personnel before beginning work. Advance project planning and effective communication will help to ensure that everyone involved understands all the potential hazardous implications of the work, and can take appropriate steps to reduce potential risks.

This document assigns responsibilities to facilities personnel, support staff, and laboratory occupants involved in maintenance, repair, or replacement of potentially contaminated systems. The document also provides generalized safety procedures at various phases of the work. Standard operating procedures (SOPs) for working on specific laboratory systems are available in the Appendices.

SCOPE

These guidelines apply to any maintenance, repair, or replacement of potentially contaminated laboratory systems. These activities include, but are not limited to:

- Replacing sinks or associated piping
- Servicing traps
- Servicing the fume hood or biosafety cabinets
- Changing or replacing UV bulbs in biosafety cabinets
- Installation or servicing of cables, telephones, computers, etc.
- Servicing fume hood ductwork, fans, or motors
- Servicing central vacuum systems
- Servicing central neutralization systems

RESPONSIBILITIES

In order to minimize risks associated with these activities, facilities personnel, support staff/contractors, laboratory occupants, and EH&S personnel must fulfill the following responsibilities.

Facilities Personnel, Support Staff & Contractors

- Inform lab supervisors and occupants prior to beginning the work.

- Verify that the lab has removed all hazardous materials and conditions prior to starting work.
- Perform all work as required by the general safety procedures and standard operating procedures, if applicable.
- Advise the lab regarding any issues or concerns prior to starting work.

Laboratory Occupants

- Remove chemical, biological, and safety hazards from the affected area prior to work.
- Make maintenance and service staff aware of special conditions that require extra protection as specified in the general safety procedures.
- Heed all notification and obey all restrictions on the use of areas or equipment during maintenance, repair or replacement of potentially contaminated laboratory systems.
- Provide any necessary technical assistance to facilities personnel, support staff or contractors during service activities (such as clearing materials from an additional part of the lab, assisting with small spill clean-up, etc.)

EH&S

- Develop guidance documents and standard operating procedures (SOPs) for working on contaminated systems.
- Provide technical expertise on hazard identification and abatement as requested.

GENERAL SAFETY PROCEDURES

Facilities Personnel, Support Staff

- Inform lab supervisor about the type of work you will be performing, the affected work area and equipment, and the approximate duration of the work.
- Make sure the lab supervisor has removed chemical, biological and safety hazards from the affected work areas before you start. Your work area may include hoods, sinks, cabinets, benches, bench tops floors and or equipment.
- Notify the occupants of all affected areas immediately before beginning work. Post warning signs on equipment, such as sinks or hoods, which may be affected. Be sure to remove the signs when the work is finished.
- Obey all applicable lock-out/tag-out procedures.
- Working with some potentially contaminated equipment and/or surfaces such as sink traps or fume hood ductwork may require special procedures. These procedures may require radiation surveys or other hazard evaluations. They may also require use of protective equipment such as chemical resistant gloves, splash goggles and/or respirators. Always follow these procedures carefully. If information provided by the user indicate that exposure to hazardous materials may occur, contact EH&S as far in advance of the planned work as possible. EH&S will survey the work area and/or provide specific recommendations or precautions relating to the work. When in doubt, contact EH&S at **951-827-5528**.
- Do not touch, move or handle containers of any chemicals and materials in a laboratory. Assume unmarked containers are holding hazardous material. Ask for assistance from lab personnel.

- If the content of any laboratory container is spilled, do not touch or attempt to clean it up. Contact the nearest lab worker and leave the area until it safe to reenter. If lab personnel are not available, leave the area (closing the door behind you), and call EH&S at **951-827-5528** or UCPD at **951-827-5222** after normal business hours.
- Pay attention to signage and hazard warning labels. Restrict your activity to your work areas.
- Do not eat or drink while working in a laboratory. Wash your hands when you leave the lab area.

Laboratory Occupants

- Contact EH&S before ANY service involving fume hoods where perchloric acid has been used.
- Wherever practical, active experiments should be halted during service taking place in the lab.
- Remove all chemical, biological, and safety hazards from the affected work areas prior to work.
- Clean and decontaminate all equipment, bench tops, and other lab areas with which the support and maintenance staff will reasonably contact during the activity.
- Advise workers of any potentially contaminated systems that require additional protective measures for service well in advance of the start of work. (e.g. the possibility of explosive azides in sink traps where plumbers may be cutting.)
- Survey areas where radioisotopes have been used prior to service. If contamination is found, clean the work surface until acceptable contamination levels are achieved. Any surfaces with fixed contamination must be covered and shielded to background levels. Any coverings used, (i.e. plastic film, plexiglass) must be secured so that the material cannot move.
- Surfaces must be wiped down with a disinfectant if biological materials are used. For Biosafety Level 2 (BSL-2) laboratories, all BSL-2 materials must be placed into storage before workers enter laboratory.
- Assist workers with moving chemicals or other laboratory materials if necessary during the course of work. Workers should not be permitted to move, handle, or touch laboratory materials (chemical, biological, or radiological agents.)
- Provide assistance in the event of a chemical spill in the lab during the course of work. Assistance includes cleaning up small-scale spills or contacting the appropriate emergency contacts for larger spills.

APPENDICES

APPENDIX A1: SPECIFIC PROCEDURES

Contaminated Local Exhaust Systems

Background

Many types of local exhaust ventilation can be found in University research and teaching laboratories, including chemical fume hoods, canopy hoods, slot hoods, snorkels (elephant trunks), tabletop fume extractors, biological safety cabinets, and general exhaust systems for isolation rooms. Work on these systems may include repairs to duct work, changing exhaust fans, or changing exhaust filters. Routine service work includes repairs and demolition activities.

Although most hazardous material used in laboratories will not readily collect in exhaust systems, it is prudent to assume inside surfaces may be contaminants with potentially hazardous materials and take appropriate protective measures to reduce personal exposure risks. If there is any question about the degree of hazard contact EH&S at **951-827-5528**.

Preparation for Work

Hazard Determination

Lab occupants and facilities must provide any available information regarding historic chemical usage in areas served by local exhaust ventilation, particularly regarding the following:

- If records indicate the use **perchloric acid** or **radioactive materials** in a fume hood or area served by another type of local exhaust ventilation, contact EH&S at **951-827-5528** for a more detailed evaluation.
- The general procedures described in this document should adequately control any risk associated with working on exhaust systems used for control of common laboratory chemicals. Contact EH&S at **951-827-5528** if there is reason to believe that highly toxic chemicals were used, or you need assistance.
- Laboratory personnel using **biohazards** should be disinfecting work areas as part of their ongoing lab procedures. However, a cleaning and disinfection of exterior surfaces should be performed just prior to facilities work. If biological contamination is suspected on the interior of the ductwork, work practices should be used to seal each section of ductwork before and as it is removed to prevent release of bioaerosols. (See "Doing the Work" section.)
- Older exhaust systems may have components with asbestos-containing-materials, such fume hoods with interior panels and working surfaces made of transite, outer Galbestos duct covering (used to minimize heat exchange and to dampen sound), or some types of vibration dampers. Nearby building materials may also contain asbestos (ceiling tiles, wallboard/joint compound, pipe insulation, etc.). If any suspect materials are present, they must be tested to determine whether or not they are asbestos-containing. Testing by an industrial hygiene consultant can be scheduled by building facilities. None of these suspect materials should

be disturbed until testing verifies they do not contain asbestos. Asbestos-containing materials can only be removed by a licensed asbestos abatement contractor.

Notifications

In addition to following all notification in the Guidelines for Working on Potentially Contaminated Laboratory Systems, building facilities should:

- Post a shutdown notice at all locations serviced by any exhaust system that is inoperative.

Preparation of work site

- Ensure that laboratory personnel have followed all safety precautions and preparatory measures described in the Responsibilities - Laboratory Occupants section the Guidelines for Working on Potentially Contaminated Laboratory Systems.
- If the work activities may result in the release of dust or metal fragments, cover the work area with a tarp/drop cloth to minimize any required clean up.
- If hot work is needed, obtain a permit from the Fire Marshal's Office and be sure the appropriate "Hot Work" safety requirements are followed.
- Follow Lockout-Tagout requirements as appropriate.

Doing the Work

Personal Protective Equipment

- **Gloves**: Tear-resistant gloves are needed when working with sheet metal. Vinyl, neoprene, leather or rubber gloves may be needed for some activities.
- **Eye protection**: Side shield safety glasses are to be worn while using any hand tool or power tool. Safety goggles may be necessary if aerosols or vapors are generated.
- **Respirator**: If work will create potential exposure to particulates or aerosols, an evaluation should be done to determine the need for respiratory protection. UCR Personnel are not permitted to wear respiratory protection unless they are enrolled in the Respiratory Protection Program. For information on the Respiratory Protection Program contact EH&S at **951-827-5528 or ehsih@ucr.edu**.
- **Other**: Disposable coveralls, hardhats, hearing protection, and other personal protective equipment may be required. If you have any questions regarding the need for additional PPE contact EH&S at **951-827-5528**.

Work Practices

- Avoid the generation of airborne particulates/vapors whenever possible. A light spray of water helps prevent the generation of aerosols.
- When the interiors of ducts contain significant amounts of dust and debris, as each section of duct is removed, the ends should be sealed with plastic film or cardboard, and duct tape.

- If unforeseen problems are encountered during the work, inform your supervisor so appropriate steps can be taken.

Clean up

Clean up work site

- Wash down the area if appropriate. In general, only wet cleaning methods should be used.
- Gather up tarps or drop cloths and clean up area. Don't leave your waste behind for the occupants.

Waste Disposal

- Special disposal requirements are usually not necessary for hood components and ductwork, unless special conditions indicate potential hazardous waste sources. If EH&S determines the material in a duct to be Hazardous Waste, special directions shall be given concerning waste disposal on a case by case basis prior to the commencement of the work. If you have any questions regarding hazardous waste contact EH&S Hazardous Waste **951-827-5528**.
- Reusable gloves, drop cloths, and/or coveralls may be rinsed or laundered and reused. Disposable or damaged personal protective equipment can be disposed of as regular trash.

Personal Hygiene

- Wash hands after service activities.

* These Guidelines are based upon materials developed by the Health & Safety Department at Harvard University and Cornell University.

APPENDIX A2: SPECIFIC PROCEDURES

Contaminated Laboratory Vacuum Systems

Background

This guideline has been developed to minimize potential chemical exposure to employees while performing installation, repair or maintenance work on laboratory vacuum systems. Vacuum systems are used frequently in laboratory research. Their use is associated with several types of laboratory equipment and processes including:

- Vacuum ovens
- Gel dryers
- Solvent degassing
- Freeze dryers
- Filtration
- Desiccators
- Vacuum concentrators
- Rotary evaporators.

In some cases these applications may require the venting of small amounts of hazardous laboratory chemicals. Ideally, highly toxic materials are identified and appropriate traps are used to remove the contamination at the point of use. Unfortunately, this is not always the case so hazardous materials are occasionally drawn through the system.

Once in the vacuum system most volatile contaminants pass through and are exhausted. However, in some cases chemical residues may contaminate parts of the vacuum system. Three potential sites of contamination may occur:

- The **sealing liquid** in liquid sealed pumps (except dry pumps)
- **Solid internal surfaces** within the pump and/or piping system
- The **water** in the air-receiving tanks (in larger systems)

Contamination of the sealing liquid can occur because the liquid (often oil) has direct contact with any contaminant passing through the vacuum system. Depending on the chemistry of the sealing liquid and the contaminant, chemical residues or a byproduct of a chemical reaction between the two may be present. Contamination of hard surfaces within the system is less likely, but under some conditions surfaces could become contaminated as a result of the condensation of liquids or gases, adsorption, or the settling of aerosols within the system. Finally, water in the air-receiving tank on larger systems could potentially become contaminated because the vented material passes through the air space above the water.

As a result of this contamination, facilities personnel could potentially be exposed to small amounts of a variety of hazardous materials, during removal, maintenance or reconfiguration of vacuum systems.

The following guidelines have been developed to minimize risk when working on laboratory vacuum systems:

Preparation for Work

Hazard Determination

- For small vacuum systems using portable pumps, it may be possible to identify specific hazardous chemicals entering the system as part of a risk assessment. Facilities personnel should always confer with laboratory personnel regarding the uses of vacuum systems and the extent that traps or other control devices have been used. If the history of usage indicates that a dangerous material has been used in the system and may have potentially left residue or hazardous byproducts, contact EH&S at **951-827-5528**.
- In many cases chemical specific information will not be available, especially for work on larger central vacuum systems with many end users. In cases where work is conducted on central vacuum systems, or where the use of the vacuum system is unknown, assume that the system components are contaminated with chemical residues.

Notifications

- Follow all notification procedures described in the Guidelines for Working on Potentially Contaminated Laboratory Systems.
- Special notification procedures for central vacuum: Several locations may share the same vacuum system. Post a shutdown notice at all affected locations.

Preparation of Work Area

- Ensure that laboratory personnel have followed all safety precautions and preparatory measures described in reference appropriate part of summary document here.
- Clean visibly contaminated surfaces before working on them. Use a vacuum if there is significant particulate contamination is present.
- If any work is to be performed in a confined space contact EH&S at **951-827-5528**.
- Obtain Hot Work Permits if required.
- Control energy sources when required using appropriate lock out or tag out procedures. (Contact EH&S at **951-827-5528**).
- Close appropriate valves to isolate effected parts of the system.
- Where possible, purge the system with clean air before beginning work.
- Ensure there is proper ventilation to the work area, particularly when working in small areas.

Doing the Work

Personal Protective Equipment

- Latex or nitrile gloves are adequate for most applications. Specialty gloves may be needed if extreme contamination is present.

- If cutting or other work generates dusts, safety glasses with side shields are indicated. If work generates mists or the possibility of liquid splash, goggles are indicated.

Work Practices

- Break existing lines using the least disruptive methods (e.g. avoid sawing lines if tubing cutters can be used.) After removing seal all open ends with caps or plastic film.
- If applicable, remove sealing liquid carefully. Avoid splashing or excessive pouring. Place in a sealed container. Liquid should be containerized and disposed of as a hazardous waste (see below). Smaller vacuum pumps or systems can be drained in laboratory hoods to avoid exposure.
- When soldering existing lines, avoid exposure by connecting fittings and piping before soldering (i.e. avoid working at open ends, if possible).
- When draining water from air-receiving tanks, use direct hose connections, wherever possible. Run hoses directly to receiving container or drain. Avoid pouring and splashing as much as possible.
- Handle all materials carefully. Avoid rough handling that may dislodge chemical residues adhered to surfaces.

Cleanup

Clean up work site

- Wash down the area if appropriate. In general, only wet cleaning methods should be used.
- Gather up tarps or drop cloths and clean up area.

Waste Disposal

- Sealing liquid that is removed during the course of service must be disposed of as a hazardous waste. If you have any questions regarding hazardous waste contact EH&S at **951-827-5528**.
- Reusable gloves, drop cloths, and/or coveralls may be rinsed or laundered and reused. Disposable or damaged personal protective equipment can be disposed of as regular trash.

Personal Hygiene

- Wash hands after service activities.