

Policy Statement

The following procedures were developed to protect Facilities & Services (F&S) personnel and University laboratory occupants from potential exposure to hazardous materials during the servicing of laboratory exhaust systems.

Scope

This policy applies to all work that requires servicing or dismantling of laboratory exhaust equipment, entering or removing duct work, entering the fan housing, changing filters, shutting off fans or any other maintenance that requires any portion of the body entering the inside of an exhaust system.

Special precautions are usually not required when servicing equipment that is outside of laboratory exhaust equipment and/or outside of the potentially contaminated air stream. For example, belts and pulleys may be serviced, vibration isolators may be adjusted and lamps may be replaced on many pieces of laboratory exhaust equipment without entering the interior of the equipment or exhaust duct.

Program Components

1. Responsibilities
2. Definitions of Laboratory Exhaust Equipment
3. Procedures for Maintenance of Laboratory Exhaust Equipment and/or Associated Exhaust System

Attachment 1 – Maintenance Notice

Attachment 2 – Maintenance of Laboratory Exhaust Systems - Hazard Assessment Checklist

Attachment 3 – Maintenance of Laboratory Exhaust Systems - Process Flow Chart

Attachment 4 – “De-energized Chemical Fume Hood” and “Associated Exhaust Fan for De-Energized Chemical Fume Hood” signs

1. Responsibilities

Facilities & Services (F&S) Maintenance/Construction Division

- When service requires that laboratory exhaust equipment or associated exhaust system be shut down, F&S personnel must communicate to the Unit Coordinator the need for service and obtain permission to shut down the equipment and/or associated exhaust system. In addition, communicate to the Unit Coordinator the time and duration of the shut down.
- F&S personnel must not shut down laboratory exhaust equipment or local exhaust systems without permission from an authorized person and until all hazardous materials in the laboratory exhaust equipment and adjacent work area are secure, except in emergency situations.
- Before an exhaust system will be shut down, F&S personnel must complete and post a “Maintenance Notice” in a conspicuous place on the laboratory exhaust equipment being serviced. If the exhaust system being serviced provides ventilation for an entire room, the “Maintenance Notice” should be placed on the door to the room. For multi-room manifolded systems a “Maintenance Notice” should be placed on the door of each affected laboratory. A copy of the maintenance notice is included in Attachment 1.
- F&S personnel shall not alter, move or remove laboratory chemicals or equipment.
- F&S personnel must perform work in a manner consistent with established F&S safety procedures and wear the appropriate personal protective equipment.
- Contact the Division of Research Safety (DRS), Chemical Safety Section (CSS) at 333-2755 at the beginning of the project to discuss disposal of the hazardous wastes, hazardous substances, or special wastes generated as a result of the maintenance work.
- Prepare a chemical waste disposal sheet for wastes generated during maintenance of laboratory

- exhaust equipment. Submit chemical waste disposal sheet to DRS at least two weeks prior to disposal date for subsequent characterization and disposal. Longer lead-times may be necessary if waste characterization sampling is required.
- Complete designated sections of the Hazard Assessment Checklist (checklist) included as Attachment 2.

Division of Safety and Compliance (S&C)

- Serve as liaison between the F&S Maintenance Division and DRS to promote the use of appropriate hazard mitigation measures.
- Serve as liaison between F&S Maintenance Division and Unit personnel for worker safety.
- Maintain this SOP, and associated checklists and notices.
- Perform hazard assessments of the work areas at the request of F&S Maintenance/Construction Division and/or based on the Hazard Assessment Checklist.
- Complete designated section of the checklist included as Attachment 2.

Division of Research Safety (DRS)

- Provide consultation to S&C regarding biological, chemical, and radiological hazards associated with laboratory exhaust system maintenance work.
- Perform radiological surveys if radiological materials were used in the laboratory exhaust equipment prior to the initiation of maintenance work.
- Attend meetings, as needed, between F&S Maintenance/Construction Division, S&C, and requesting Units regarding worker safety as it relates to biological, chemical, and/or radiological hazards.
- Provide waste characterization and disposal services upon receipt of a chemical waste disposal sheet from F&S Maintenance/Construction Division for waste generated during maintenance activities or receipt of a chemical waste disposal sheet from the Unit Coordinator for waste generated during cleaning of laboratory exhaust equipment.

Unit Coordinator (Building Contact/Laboratory Contact)

- Submit a work request to F&S Maintenance/Construction Division when laboratory exhaust equipment is suspected of functioning improperly.
- When work must be done inside of the exhaust system, the Unit Coordinator must work with the laboratory supervisor and other laboratory users to confirm that hazardous materials are secure and will not be used for the duration of the service work. Clean the interior of the laboratory exhaust equipment with soap and water or other appropriate cleaning agent.
- Prepare a chemical waste disposal sheet for wastes generated during cleaning of the laboratory exhaust equipment. Submit chemical waste disposal sheet to DRS at least two weeks prior to disposal date for subsequent characterization and disposal. Longer lead-times may be necessary if waste characterization sampling is required.
- Complete designated sections of the checklist included as Attachment 2.
- The Unit Coordinator must work with the laboratory supervisor and other laboratory users to provide a work area in the laboratory that is cleared of laboratory chemicals and equipment. F&S personnel shall not alter, move, or remove laboratory chemicals or equipment.
- Notify laboratory users when multiple pieces of laboratory exhaust equipment located in more than one room must be shut off and control the use of the equipment during the shut down.
- Notify the F&S Maintenance Division when all steps have been taken to remove hazardous chemicals and provide a safe working environment for maintenance personnel.
- If a chemical fume hood is to be de-energized (mothballed), contact DRS and S&C to perform a

laboratory inspection to ensure that this is an appropriate step. Prior to de-energization, the CFH must be emptied of all contents and interior surfaces must be cleaned with soap and water or other appropriate cleaning agent. Sashes shall remain completely closed following de-energization.

2. Definitions of Laboratory Exhaust Equipment

This section provides definitions for various types of laboratory exhaust equipment that may be encountered at the University. Hazards associated with each type of equipment will be assessed by S&C in cooperation with DRS following receipt of the checklist. Mitigating measures will be provided to the F&S Maintenance/Construction Division in the Hazard Review and Recommendations section of the checklist. The checklist is included as Attachment 2.

Chemical Fume Hood. OSHA defines a chemical fume hood (laboratory-type hood) as a device located in a laboratory, enclosure on five sides with a movable sash or fixed partial enclosed on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms. Types of chemical fume hoods that can be found on campus include standard, bypass, variable air volume, teaching, walk-in, and other specialty hoods defined below. On campus, toxic and volatile chemicals are used in chemical fume hoods.

Radioisotope Hood. ASHRAE defines a radioisotope hood as a standard hood with special integral work surface linings impermeable to radioactive materials, and structure strong enough to support lead shielding bricks. The interior must be constructed to prevent radioactive material buildup and allow complete cleaning. On campus, radioisotope hoods and other exhaust system components and lab equipment can be identified by the presence of radioisotope labels, door signs and/or by asking the lab supervisor or PI. Labs that use radioisotopes are required to label fume hoods, equipment and isotope work areas with radiation signage. The Division of Research Safety's Radiation Safety Section (RSS) maintains a list of all labs on campus that are registered to use radioisotopes. Contact RSS at 333-2755 for details. An example of the radiation signage follows:



Note: All radioactive labeling must be removed or defaced before removing any exhaust or laboratory equipment from a laboratory.

Perchloric Acid Hood. ASHRAE defines a perchloric acid hood as a standard hood with special integral work surfaces, coved corners, and non-organic lining materials. To alleviate a potential explosive hazard caused by heating perchloric acid above ambient temperatures, the exhaust system must be equipped with an internal water washdown and drainage system, and the ductwork must be constructed of smooth, impervious, cleanable materials that are resistant to acid attack. On campus, several standard chemical fume hoods have been used for work involving the heating of perchloric acid. Perchloric acid hoods, standard chemical fume hoods, and associated exhaust systems used for work involving the heating of perchloric acid pose an explosive hazard.

Ductless Fume Hood. SEFA defines a ductless fume hood as an enclosure designed for the handling of contaminants/products that generate pollutants, which limits the propagation toward the operator/user

and other personnel of such contaminated air pollutants. Typically, a ductless fume hood is not attached to any external conduit or exhaust; rather it is equipped with its own filtration system that recirculates the air back into the laboratory. A ductless fume hood is only suitable for use with chemicals with which it was manufactured.

Laminar Flow Bench. A laminar flow bench is a piece of laboratory exhaust equipment that is used to protect the product within the flow bench and/or the operator. Air from the laboratory can be pulled into the flow bench from either the open working face or through HEPA filters. Air can be exhausted through filters back into the laboratory, through the open working face back into the laboratory, or via ducting to the outside. Laminar flow benches are located throughout the campus in laboratories and clean rooms.

Exhausting Laminar Flow Bench. An exhausting laminar flow bench is a piece of laboratory exhaust equipment that is used to protect the products within the clean bench and the operator. Air is pulled through HEPA filters and blown across the face opening creating a clean air wall. The clean air from the clean air wall is pulled into the flow bench and exhausted out of the building. The product is protected from particulates and other contaminants by using clean air and the user is protected by having contaminants exhaust out of the building rather than into the laboratory. Exhausting laminar flow benches are known to be used in the Materials Research Laboratory but may exist in other buildings as well.

Wet Bench. A wet bench is a piece of laboratory exhaust equipment that is used for wet etching and cleaning of "wafers" and devices in the production of semi conductors. Acids and solvents are typical hazardous chemicals used in wet benches. Wet benches can be found on campus in the Micro and Nanotechnology Laboratory. Many wet benches on campus have been mistaken for chemical fume hoods.

Biological Safety Cabinet. According to the Center for Disease Control, biological safety cabinets are the primary means of containment developed for working safely with infectious microorganisms. They are designed to provide personnel, environmental and product protection when appropriate practices and procedures are followed. Three kinds of biological safety cabinets, designated as Class I, II and III have been developed to meet varying research and clinical needs. High efficiency particulate air (HEPA) filters or ultra-low penetration air (ULPA) filters are used in the exhaust and/or supply systems of biological safety cabinets. On campus, hoods and other exhaust system components and lab equipment that are used for infectious or potentially infectious biological materials can be identified by the presence of biohazard labels, door signs and/or by asking the lab supervisor or PI. Labs that use infectious or potentially infectious biological materials are required to label biological safety cabinets, hoods, equipment and work areas with biohazard signage. The Division of Research Safety's Biological Safety Section (BSS) maintains a list of all labs on campus that are registered to use infectious or potentially infectious biological materials. Contact BSS at 333-2755 for details. An example of the biohazard signage follows:



Note: All biohazard labeling must be removed or defaced before removing any exhaust or laboratory equipment from a laboratory.

Energy Recovery System. An energy recovery system is used to recover sensible and/or latent energy from a building's exhaust streams. Energy recovery systems (coil and energy wheel systems) on campus are being used on a more frequent basis to recover energy from laboratory exhaust streams. Any hazards that exist in the laboratory exhaust equipment could potentially exist in the exhaust portion of an energy recovery system. Supplied air units must be used while cleaning energy recovery system components in the exhaust stream. Contact S&C at 265-9828 to schedule supplied air training.

3. Procedures for Maintenance of Laboratory Exhaust Equipment and/or Associated Exhaust System

Procedures are shown graphically on the flow chart located in Attachment 3.

- When laboratory exhaust equipment and/or associated exhaust system components require maintenance (either from improper operation or requested maintenance such as painting), the Unit Coordinator or designee shall complete an online work order.
- The F&S Maintenance/Construction Division will have personnel from the appropriate shop perform a brief inspection and functionality test of the equipment and post a "Maintenance Notice" in a conspicuous location on the laboratory exhaust equipment or on the door to the laboratory or laboratories if it is multi-room manifolded system.
- The Maintenance Shop Foreman/Construction Manager will complete the "Project Information" section of the checklist and email the checklist to the Unit Coordinator or designee. The Maintenance Shop Foreman/Construction Manager will also contact DRS, Chemical Safety Section (CSS) to discuss potential waste management needs.
- The Unit Coordinator or designee will complete the "Research Information" and "Hazard Information" sections of the checklist in cooperation with current and former principal investigators (PI). Upon completion of these sections email the checklist back to the Maintenance Shop Foreman/Construction Manager.
- The Maintenance Shop Foreman/Construction Manager will forward the checklist to S&C Occupational Safety and Health Section (OSHS) for review.
- S&C OSHS will complete the "Hazard Review and Recommendations" section of the checklist with assistance from DRS. It may be necessary for S&C OSHS, DRS, or an outside contractor to conduct field or laboratory tests and/or surveys to determine appropriate mitigation and worker protection measures. Upon completion of this section, S&C will email the checklist back to the Maintenance Shop Foreman/Construction Manager. S&C and DRS will inspect and test as necessary to determine hazards.
- The Maintenance Shop Foreman/Construction Manager will review the completed checklist, sign and date the checklist verifying acknowledgement of the hazards and appropriate mitigation measures, and communicate the identified work practices and safety measures with the maintenance personnel performing the work.
- The Maintenance Shop Foreman/Construction Manager will contact the Unit Coordinator or designee to set a firm schedule for maintenance work and coordinate the necessary steps required to complete shutdown. Among the issues to consider include the quantity of affected equipment, the number of affected laboratories, and the need to access the interior of equipment or system components.
Note: F&S will not service laboratory exhaust equipment that contains chemicals or has visible residues on interior surfaces. The Unit must remove chemicals and clean interior surfaces of the equipment base storage cabinets if work inside the cabinets is necessary.
- The Maintenance Shop Foreman/Construction Manager will submit an outage request form through the F&S service office.

- The Unit Coordinator or designee will work with the affected PI(s) and other laboratory users to remove chemicals located in laboratory exhaust equipment, clean the interior of the laboratory exhaust equipment with soap and water or other appropriate cleaning agent, and prevent the use of the affected laboratory exhaust equipment and associated exhaust system, as agreed upon during the conversation with the Maintenance Shop Foreman/Construction Manager.
- The Unit Coordinator or designee will sign and date each posted “Maintenance Notice” and notify the Maintenance Shop Foreman/Construction Manager once they have verified that laboratory personnel have completed the agreed upon actions.
- F&S maintenance/construction personnel will apply Lock Out / Tag Out protocols, as necessary.
- If an exhaust fan to be worked on is located near hood exhaust stacks in which the height from the top of the stack to the working surface is less than 10 feet then the adjacent fans must also be turned off. If this is not possible, F&S maintenance/construction personnel must contact S&C to determine the appropriate PPE.
- Once the service is completed, F&S personnel will perform an airflow check with a calibrated (e.g., Shortridge) hand-held portable meter on affected chemical fume hoods to verify that they are functioning according to University standards. A chemical fume hood face velocity sticker will be applied to each tested fume hood.
- All posted “Maintenance Notices” will be removed once the laboratory exhaust equipment and system components have been returned to normal operating conditions.
- If the laboratory exhaust equipment and/or associated system could not be repaired or if chemical fume hood face velocities did not meet University standards, F&S maintenance/construction personnel or the Maintenance Shop Foreman/Construction Manager will communicate the identified issues and options for repair to the Unit Coordinator. Based on this conversation a revised maintenance schedule will be determined and the “Maintenance Notice” will be updated to reflect the new maintenance schedule and remain posted on all affected equipment and/or laboratory doors.
- CFHs that are de-energized (mothballed) must be emptied of all contents and the interior surfaces cleaned using soap and water or other appropriate cleaning agent. When de-energization is complete, maintenance personnel will install a sign on the sash of the CFH and another sign placed on the associated exhaust fan or exhaust fan shut-off switch. A copy of the sign to be placed on the sash is included in Attachment 4.

F&S will be servicing this piece of laboratory exhaust equipment on:

Start Date: _____ End Date: _____

Building: _____ Room Number: _____

Time: _____

DO NOT USE this piece of laboratory exhaust equipment!

If you need to speak to the F&S personnel servicing your hood please call:

Name: _____ Phone: _____

Before maintenance work can begin the Unit Coordinator or their designee must attest to the below statement.

I have verified that all chemicals and other hazardous materials have been removed from the laboratory exhaust equipment and the interior surfaces of the equipment have been cleaned according to the recommendations on the Maintenance of Laboratory Exhaust Systems Hazard Assessment Checklist.

Name: _____ Signature: _____ Date: _____ Phone: _____

In an emergency contact the UIPD at 9-911.

Attachment 2
Maintenance of Laboratory Exhaust Systems
Hazard Assessment Checklist

The following checklist is to be completed when requesting maintenance on laboratory exhaust systems. This will provide Facilities & Services the confirmation that known potential hazards present in the area have been recognized prior to maintenance activities. For additional information see Standard Operating Procedures for Servicing Laboratory Exhaust Systems.

Project Information (To Be Completed by Shop Foreman/Construction Manager)	
Building #: _____	Building Name: _____ Room #: _____
Projected Start Date: _____	Duration: _____ F&S Contact: _____
Email: _____	Phone: _____ Pager: _____
Description of Maintenance: _____	
Date Submitted to Unit: _____ Date Return Receipt Requested: _____	
Research Information (To Be Completed by Unit Coordinator)	
Unit Contact: _____	Email: _____ Phone: _____
Current PI: _____	Email: _____ Phone: _____
Current Use of Exhaust System: _____	
Previous PI: _____	Email: _____ Phone: _____
Previous Use of Exhaust System: _____	
Date Completed: _____ Additional Information: _____	
Note: A list of Unit responsibilities is included on page 2.	
Hazard Information (To Be Completed by Unit Coordinator)	
1. Is there a Chemical Fume Hood or other piece of Laboratory Exhaust Equipment being affected by this maintenance? <input type="checkbox"/> Yes <input type="checkbox"/> No	
If yes, Describe: _____	
2. Are (were) any infectious or potentially infectious organisms used or stored in this equipment and/or exhaust system? <input type="checkbox"/> Yes <input type="checkbox"/> No	
3. Are (were) hazardous chemicals used or stored in this equipment and/or exhaust system? <input type="checkbox"/> Yes <input type="checkbox"/> No	
4. Are (were) radioactive materials used or stored in this equipment and/or exhaust system? <input type="checkbox"/> Yes <input type="checkbox"/> No	
If yes to 2, 3, or 4, Please List: _____	
If yes, the interior surfaces of affected chemical fume hoods or other laboratory exhaust equipment may require cleaning with soap and water and/or other appropriate cleaning agent prior to work beginning pending necessary surveys and/or testing.	

Attachment 2
Maintenance of Laboratory Exhaust Systems
Hazard Assessment Checklist

5. Was/Is **perchloric acid** being used in this equipment and/or exhaust system? Yes No
 If yes, Was/Is it being heated above ambient temperatures? Yes No

6. Are experiments currently taking place or are chemicals being stored in affected chemical fume hoods or other laboratory exhaust equipment? Yes No
 If yes, all experiments must cease for the duration of the maintenance work and stored chemicals must be secured and sealed.
 If yes and the interior of the chemical fume hood or laboratory exhaust equipment must be accessed, all items must be removed from inside affected chemical fume hoods or other laboratory exhaust equipment prior to work beginning.

Hazard Review and Recommendations (To Be Completed by Safety and Compliance Based on Consultation with the Division of Research Safety)

Recommendations for Infectious Organisms: _____
 Recommendations for Hazardous Chemicals: _____
 Recommendations for Radioactive Materials: _____
 Tested for Perchlorates? Yes No Test Results: _____
 Recommendations for Perchlorates: _____
 Recommended PPE and other Precautions: _____

Reviewed By: _____ Date: _____

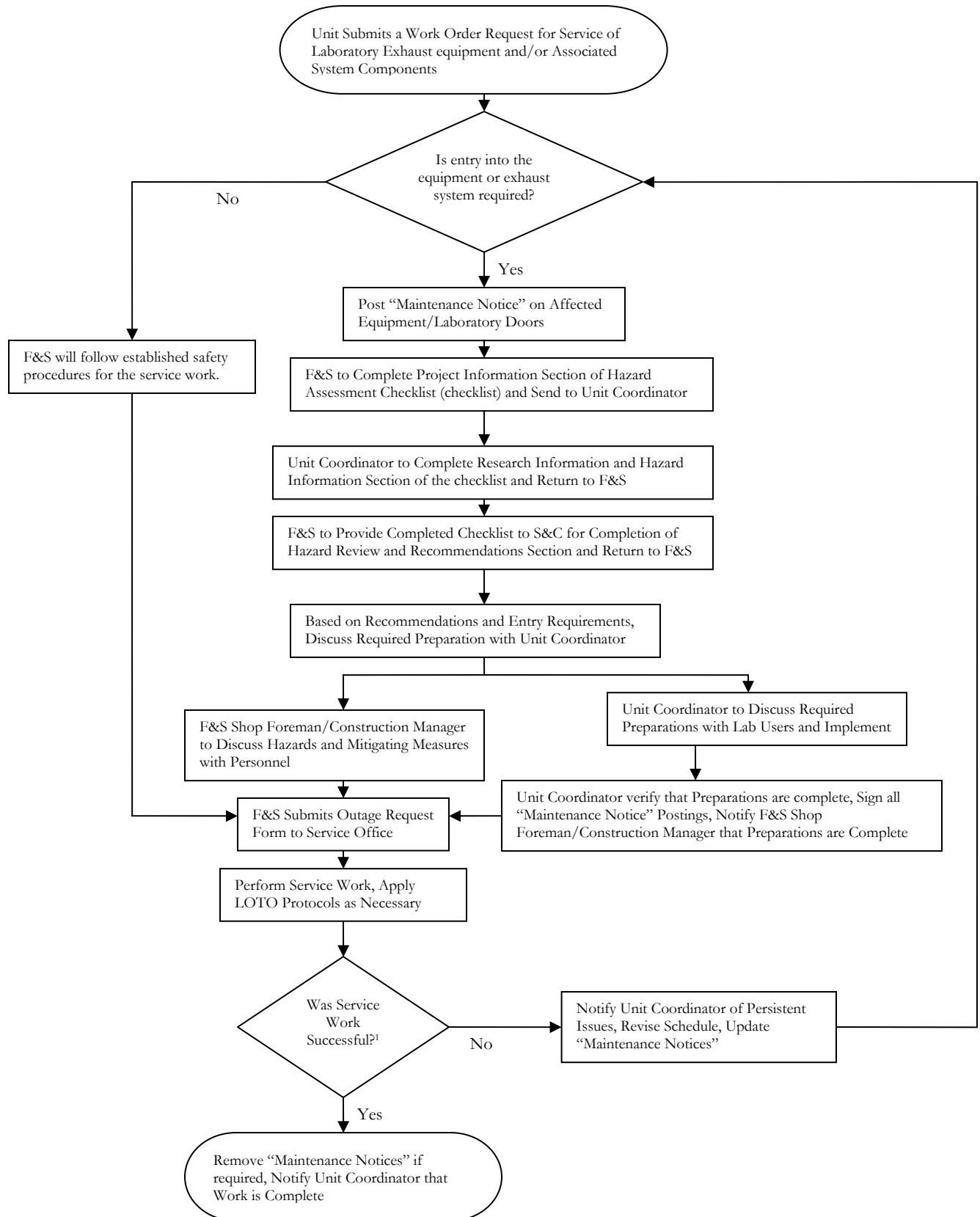
Confirmation of Hazards and Recommendations (To Be Completed by Shop Foreman/Construction Manager)

Shop Foreman/Construction Manager: _____ Date: _____

Responsibilities of Requesting Unit:

- Submit a work request to F&S Maintenance/Construction Division when laboratory exhaust equipment is suspected of functioning improperly.
- When work must be done inside of the exhaust system, the Unit Coordinator must work with the laboratory supervisor and other laboratory users to confirm that hazardous materials are secure and will not be used for the duration of the service work. Clean the interior of the laboratory exhaust equipment with soap and water or other appropriate cleaning agent.
- Prepare a chemical waste disposal sheet for wastes generated during cleaning of the laboratory exhaust equipment. Submit chemical waste disposal sheet to DRS at least two weeks prior to disposal date for subsequent characterization and disposal. Longer lead-times may be necessary if waste characterization sampling is required.
- Complete designated sections of this checklist.
- The Unit Coordinator must work with the laboratory supervisor and other laboratory users to provide a work area in the laboratory that is cleared of laboratory chemicals and equipment. F&S personnel shall not alter, move, or remove laboratory chemicals or equipment.
- Notify laboratory users when multiple pieces of laboratory exhaust equipment located in more than one room must be shut off and control the use of the equipment during the shut down.
- Notify the F&S Maintenance Division when all steps have been taken to remove hazardous chemicals and provide a safe working environment for maintenance personnel.
- If a chemical fume hood is to be de-energized (mothballed), contact DRS and S&C to perform a laboratory inspection to ensure that this is an appropriate step. Prior to de-energization, the CFH must be emptied of all contents and interior surfaces must be cleaned with soap and water or other appropriate cleaning agent. Sashes shall remain completely closed following de-energization.

Attachment 3 Maintenance of Laboratory Exhaust Systems Process Flow Chart



DANGER: DO NOT USE

**This Chemical Fume Hood has
been De-energized to Conserve
Energy.**

To Restore to Normal Operation Contact:
Departmental Facilities and Operations Staff to Place a
Work Order with the F&S Maintenance Division
&
Division of Safety and Compliance at 265-9828

DANGER: DO NOT RE-ENERGIZE

**The Associated Chemical Fume Hood has
been De-Energized to Conserve Energy.**

**To Restore to Normal Operation Contact:
Departmental Facilities and Operations Staff to Place a
Work Order with the F&S Maintenance Division
&
Division of Safety and Compliance at 265-9828**