HARVARD
Campus Services
ENVIRONMENTAL HEALTH & SAFETY

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, support staff and/or contractors may risk being exposed to residual materials in these "*Contaminated Systems.*"

University 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, support staff/contractors, laboratory occupants, and EHS personnel must fulfill the following responsibilities.

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 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.)

EHS

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

GENERAL SAFETY PROCEDURES

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 EHS as far in advance of the planned work as possible. EHS will survey the work area and/or provide specific recommendations or precautions relating to the work. When in doubt, contact EHS Lab Safety at 6-3797.
- 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 the University Operations Centers at 5-5560.
- 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 EHS 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 (BL-2) laboratories, all BL-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 EHS Lab Safety at 6-3797.

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 the EHS Lab Safety Program at 6-3797 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 EHS Lab Safety at 6-3797 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. Harvard University Personnel are not permitted to wear respiratory protection unless they are enrolled in the University Respiratory Protection Program. For information on the Respiratory Protection Program contact EHS Lab Safety at 63797
- 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 EHS Lab Safety at 6-3797.

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 EHS 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 EHS Hazardous Waste at 6-3322.
- 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 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 EHS Lab Safety at 6-3797.
- 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 refer to Harvard University's Confined Space Program or contact EHS Occupational Safety at 5-2060.
- Obtain Hot Work Permits if required.
- Control energy sources when required using appropriate lock out or tag out procedures. (Refer to Harvard University's Lock Out Tag Out Program or contact EHS Occupational Safety at 5-2060.
- 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 EHS Hazardous Waste line at 6-3322.
- 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.