

# CHEMICAL HYGIENE PLAN

Building: Chemical and Nuclear Engineering (Building 090)

Room(s): 2201, 2235, 2231/2233 (same room)

Department: Chemical and Biomolecular Engineering

Principal Investigator: K. Y. Choi, Professor 301-405-1907

Approved as UM Policy September 1994

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## **UM Policy on Occupational Exposure to Hazardous Chemicals in Laboratories**

**Approved by the President September 19, 1994**

### **A. Purpose.**

This is a statement of official University policy to establish the process for compliance with the Occupational Safety and Health Administration (OSHA) regulation "Occupational Exposure to Hazardous Chemicals in Laboratories."

### **B. Policy.**

The University is dedicated to providing safe and healthful laboratory facilities for students and employees, and complying with federal and state occupational health and safety standards. Laboratory administrators, managers, faculty, staff and students all share responsibility for minimizing their exposure to hazardous chemical substances which, for purposes of this policy, shall be defined as chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.

The Chemical Hygiene Plan shall be implemented for all facilities at the University of Maryland, College Park, where hazardous chemicals are handled or used under all of the following conditions: (i) chemical manipulations are performed in containers designed to be easily and safely manipulated by one person; (ii) multiple chemical procedures or chemicals are used; and (iii) demonstrably effective laboratory practices and equipment are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

The Chemical Hygiene Plan shall be reviewed and evaluated for its effectiveness at least annually, and updated as necessary.

### **C. Responsibilities.**

#### **1. Department of Environmental Safety shall:**

- (a) Appoint a Chemical Hygiene Officer to develop and coordinate administration of the UM Chemical Hygiene Plan (CHP);
- (b) Prepare the CHP with annual review and revisions as needed;
- (c) Distribute the CHP to each affected department for each Laboratory Supervisor or Principal Investigator (LS/PI);
- (d) Provide consultation, worksite monitoring (sampling), advisory assistance and information concerning use of hazardous materials;
- (e) Investigate, document and report to the BACH Committee, significant chemical exposure or contamination incidents;
- (f) Collect and dispose of hazardous, radioactive and other regulated wastes;
- (g) Direct periodic laboratory safety audits to determine regulatory compliance, and recommend action to correct conditions generating release of toxic chemicals;
- (h) Provide training to all laboratory workers concerning:
  - (1) Provisions of the Chemical Hygiene Plan;
  - (2) Physical and health hazards of chemicals in the work area;
  - (3) Measures to protect employees from chemical hazards;
  - (4) Signs and symptoms associated with hazardous chemical exposure;

- (5) Location of reference materials on the hazards, safe handling, storage and disposal of laboratory chemicals;
  - (6) The contents of the OSHA standard and its appendices;
  - (7) The permissible exposure limits (PELs) for OSHA regulated substances or recommended exposure limits if no PEL is listed; and
  - (8) The methods and observations used to detect the presence or release of a hazardous chemical.
2. Laboratory Supervisors/Principal Investigators (LS/PI) shall:
    - (a) Implement all provisions of the Chemical Hygiene Plan for laboratory facilities under their control;
    - (b) Develop and maintain a customized Chemical Hygiene Plan for laboratory operations under their control to include:
      - (1) Alphabetized inventory of all hazardous chemical substances,
      - (2) Written Standard Operating Procedures to address safety and health issues associated with work practices, protective equipment, in laboratory facilities under their control;
      - (3) Identification of occurrences or operations that may be encountered by laboratory employees and that require that the LS/PI be advised (prior approval).
    - (c) Prepare and implement laboratory-specific Standard Operating Procedures (SOPs) to include work practices, protective equipment, engineering controls, emergency procedures and waste disposal procedures;
    - (d) Demarcate and indicate on SOP all areas designated for the use of particularly hazardous chemicals (i.e., select carcinogens, reproductive toxins and acute toxins);
    - (e) Train laboratory workers regarding the specific practices and provisions contained in the laboratory SOP;
    - (f) Ensure that all lab employees have access to Material Safety Data Sheets for hazardous chemicals that are purchased or otherwise acquired for use in the lab facility;
    - (g) Ensure that all necessary personal protective equipment is available and used by lab employees;
    - (h) Notify the designated UM contact points when any of the University of Maryland prior notification conditions are anticipated;
    - (i) Comply with necessary documentation requirements; and
    - (j) Submit a current copy of their Chemical Hygiene Plan(s) including all required components to the Department of Environmental Safety and Departmental Compliance Officer.
  3. Biological and Chemical Hygiene (BACH) Committee shall:
    - (a) Review and approve all aspects of the Chemical Hygiene Plan and provide technical guidance for implementation of campus policy concerning chemical and biological safety.
  4. University Health Center shall:
    - (a) Coordinate and direct all required or recommended medical surveillance programs;
    - (b) Provide medical consultations and examinations for laboratory workers who have been overexposed, or suspect overexposure, to hazardous chemical substances; and
    - (c) Maintain medical records relating to consultations, examinations and medical surveillance as required by law.
  5. Departmental and College Compliance Officers shall:
    - (a) Assist Environmental Safety and laboratory supervisors with implementation of the Chemical Hygiene Program; and
    - (b) Maintain current copies of Chemical Hygiene Plans.
  6. Department Chairs and College Deans shall:

- (a) Require implementation of the Chemical Hygiene Program for affected laboratories under their control.
- 7. Individual Researchers and Laboratory Users shall:
  - (a) Adhere to the requirements of the Chemical Hygiene Plan and SOPs;
  - (b) Complete all safety training requirements and comply with documentation procedures;
  - (c) Notify the PI/LM if any prior notification situations or occurrences are anticipated; and
  - (d) Report all workplace injuries, chemical exposure incidents or unsafe conditions to their LS/PI as soon as possible.

D. Information

Assistance will be provided by the Department of Environmental Safety to any Department requesting guidance or training to satisfy implementation of this policy.

## Emergency Telephone Numbers

UM Emergency (FIRE - POLICE - RESCUE) - 24 hour # CALL IMMEDIATELY FOR ANY EMERGENCY INCLUDING INJURED OR SICK PERSON, CHEMICAL SPILL OR FIRE		911
Environmental Safety (Main Office) (Industrial Hygiene, Hazardous Waste Management, Fire Protection, Hazard Communication, Safety Education)		(301) 405-3960
Chemical Hygiene Officer (Program Consultation and Administration)		(301) 405-3980
Biological Safety (Biological Safety, Regulated Pathogen Consultation)		(301) 405-3960
Radiation Safety (Health Physics, Radioactive Materials Procurement)		(301) 405-3985
University Health Center Occupational Health (Medical Consultation and Evaluation)		(301) 314-8172
Workers' Compensation Office		(301) 405-5466
Facilities Management Work Control (Repair of Facility Equipment Deficiencies, e.g., fume hoods, emergency eyewashes, ventilation, etc.)		(301) 405-2222
Laboratory Supervisor(s):		
Kyu Yong Choi, Professor	Business-hours #	301 405 1907
	After-hours #	301 714 1337
Laboratory Personnel:		
In Hak Baick (Grad Student)	Business-hours #	301 405 1922
	After-hours #	513 218 9603
Sang Yool Lee (Grad Student)	Business-hours #	301 405 1922
	After-hours #	301 789 4438
Yun Ju Jung (Grad Student)	Business-hours #	301 405 1922
	After-hours #	301 741 5721

## Standard Operating Procedures (SOPs)

A comprehensive health and safety program should include documents that provide descriptions of standard methods or operations used within the facility. They should describe in clear and precise language the means and methods to be used by laboratory workers to minimize the risk of hazardous exposure while using hazardous chemicals. These documents, commonly referred to as standard operating procedures (SOPs), should be followed by all laboratory employees.

The LS/PI is responsible for preparation of lab-specific SOP documents for attachment to the CHP. The LS/PI is responsible for determining the adequacy of the SOPs prepared. The lab-specific SOPs shall be incorporated in the on-site copy of the Chemical Hygiene Plan and placed in a designated location within the laboratory for immediate access by employees.

A good SOP is one that is clearly stated and realistic in scope. A laboratory LS/PI should prepare SOPs for all routine and repetitive operations as well as for general laboratory operations. The format of all SOPs should be consistent and should incorporate:

1. Facility name, department and section affected by or using the procedure;
2. Subject;
3. Issue date of the original document or current revision;
4. Any indication that revisions replace an earlier procedure;
6. Signature or initials of the SOP preparer as well as any reviewing authority; and
7. Concise instructions for safe and healthful performance of laboratory activities and procedures.

SOPs should indicate the measures that will be used to reduce or prevent employee exposure to hazardous chemicals, including engineering controls, hygiene practices, and the use and maintenance of personal protective equipment.

SOPs should include provisions for additional employee protection for work with particularly hazardous substances, including select carcinogens, reproductive toxins, and substances which have a high degree of acute toxicity. (See "Identification of Hazardous Materials, below.") Where appropriate, these additional measures should include:

1. Establishment of a designated area;
2. Use of containment devices such as fume hoods or glove boxes;
3. Procedures for safe removal of contaminated waste; and
4. Procedures for site and personal decontamination.

SOPs shall also indicate circumstances under which certain laboratory procedures, operations or activities require prior approval from the LS/PI before implementation (e.g., use of radioactive materials, bench top manipulation of volatile carcinogenic solvents without use of engineering controls, night or weekend work performed alone, reagent substitutions, etc.). Examples of SOPs are available on the DES website at: <http://www.umd.edu/des/ls/index.html>

## Medical Consultation and Examinations

Employees who work with hazardous chemicals in the laboratory should be referred for medical consultation, examination, and/or surveillance (as appropriate to the circumstances) whenever:

1. An employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory;
2. An event takes place in the work area to create a likelihood of hazardous exposure; or
3. Exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the Permissible Exposure Limit) for an OSHA-regulated substance for which there are exposure monitoring and medical surveillance requirements. (See "Exposure Monitoring" section, below.)

Examples of events or circumstances which might result in hazardous exposure include:

1. A spill or leak which rapidly releases a hazardous chemical in an uncontrolled manner;
2. Direct skin or eye contact with a hazardous chemical;
3. Symptoms such as headache, rash, nausea, tearing, irritation or redness of eyes, irritation of nose or throat, dizziness, loss of motor dexterity or judgement which disappear when the employee is removed from the exposure area and which reappear when the employee returns to working with the same hazardous chemical;
4. Two or more employees in the same laboratory work area exhibit similar symptoms; or
5. Exposure monitoring indicates exposures above regulated or recommended limits.

The University has established procedures for responding to job-related injuries. These procedures should be followed in the event of hazardous exposure due to the use of hazardous chemicals in the laboratory. Instructions and forms for reporting injuries and chemical exposures are available through the DES web page, which may be located at the following address: [http://www.umd.edu/des/risk\\_comm/wcomp/](http://www.umd.edu/des/risk_comm/wcomp/)

In the event of life-threatening injuries or illnesses, the UM Emergency Dispatcher should be immediately notified. All injury or illness occurring as a result of work activities should be reported to the Workers' Compensation Office, immediately after the incident occurs or the injury is treated. All incidents of hazardous exposure, including their disposition, should be reported to the Chemical Hygiene Officer.

The following information should be provided at the time that an employee is referred for medical consultation and/or examination:

1. Identity of the chemical(s) to which the employee may have been exposed;
2. Description of the conditions under which the exposure occurred, including any quantitative exposure data, if available; and
3. A description of the signs and symptoms of exposure that the employee experienced, if any.

A written report must be provided to the employer from any physician to whom the employee is referred for medical consultation or examination in connection with hazardous exposure. The physician's report(s) should indicate ONLY the specific findings of diagnoses related to occupational exposure and should include the following information:

1. Any recommendation for further medical follow-up;
2. The results of the medical examination and any associated test(s);
3. Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous workplace; and



4. A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.

As indicated above, all incidents of hazardous exposure (including disposition) should be reported to, and documented by, the Chemical Hygiene Officer (CHO). If no further assessment of the incident is deemed necessary, the reason for that decision should be included in the documentation. If the event is determined to require investigation, a formal exposure assessment will be initiated by the CHO. The purpose of an exposure assessment is not to determine whether there was a failure to follow proper procedures, but to identify the hazardous chemical(s) involved and determine whether an exposure might have caused harm to an employee. An exposure assessment may include the following items:

1. Interviews with the employee and complainant (if different);
2. Obtaining the following information:
  - the names of chemicals which may be involved
  - other chemicals used by the employee
  - all chemicals used by others in the immediate area
  - other chemicals stored in the immediate area
  - symptoms exhibited or claimed by the employee
  - comparison of symptoms with those referenced in the Material Safety Data Sheet for each involved chemical
  - observation of control measures and personal protective equipment in use during the event
  - notation of any on-site exposure monitoring performed previous to or during event
3. Monitoring or sampling the air in the area for suspect chemicals; and
4. Determination of whether the current control measures were adequate during the time of the incident.

## Identification of Hazardous Materials

A hazardous chemical is defined by the OSHA laboratory standard as "a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees." Hazardous chemicals include carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system and agents which damage the lungs, skin, eyes or mucous membranes.

Laboratory supervisors have certain responsibilities for the management of these hazardous chemicals, including:

1. Inventory of all hazardous chemical substances which are used in their laboratories, and attaching the inventory to this CHP;
2. Maintenance of the labels on incoming containers of hazardous chemicals to ensure that they are not removed or defaced;
3. Maintenance of any Material Safety Data Sheets (MSDSs) that are received with incoming shipments of hazardous chemicals, and ensuring that the MSDSs are readily accessible to laboratory employees; and
4. Determination of whether chemical substances which are developed in the laboratory are hazardous chemicals within the definition of this CHP. If the chemical substance is a byproduct for which the composition is unknown, the substance should be deemed to be a hazardous chemical.

Laboratory supervisors also are responsible for identifying the following hazardous chemicals which are required to be used in an area specially designated for such use:

1. Select carcinogens: Any substance which meets one of the following criteria:
  - it is regulated by OSHA as a carcinogen;
  - it is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (latest edition);
  - it is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer (IARC) Monographs (latest edition); or
  - it is listed in either Group 2A or 2B by the IARC, or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with criteria specified in the OSHA laboratory standard.
2. Reproductive toxins: Chemicals which affect the reproductive capabilities, including chemicals which are mutagenic and teratogenic;
3. Acute toxins; and
4. Unknowns: Chemicals which are synthesized in the laboratory and which are byproducts for which the composition is unknown.

Information concerning the health effects of chemical substances can be located in the following reference sources:

1. Material Safety Data Sheets (MSDS). MSDSs are available through:
  - (A) The Department of Environmental Safety (DES):
    1. Web Page (<http://www.umd.edu/des>),
    2. Telephone (301-405-3960), or
    3. After normal hours through UM Emergency Dispatcher at 911), and

- (B) the vendor, manufacturer or distributor. (A MSDS must be provided at the time of initial purchase by the vendor, manufacturer or distributor without charge. A nominal fee may be assessed for additional copies.)
2. Registry of Toxic Effects of Chemical Substances (available through the DES Web Page: (<http://www.umd.edu/des/os/ccinfo/index.html>))
  3. National Toxicology Program (Chemistry Library or DES)
  4. International Agency for Research on Cancer (Chemistry Library or DES)
  5. DES maintains an Internet database of the Select Carcinogens as well as chemical substances that may be considered acute and reproductive toxins. This list may be accessed at: [www.umd.edu/des/lis](http://www.umd.edu/des/lis). Use of any of the following materials may be subject to specific occupational safety and health standards as shown:
- |   |                  |
|---|------------------|
| Asbestos, tremolite, anthophyllite and actinolite       | 29 CFR 1910.1001 |
| 4-Nitrobiphenyl   | .1003            |
| alpha-Naphthylamine                                     | .1004            |
| 4,4'-Methylene bis(2-chloroaniline)                     | .1005            |
| Methyl chloromethyl ether                               | .1006            |
| 3,3'-Dichlorobenzidine (and salts)                      | .1007            |
| bis-Chloromethyl ether                                  | .1008            |
| beta-Naphthylamine                                      | .1009            |
| Benzidine   | .1010            |
| 4-Aminodiphenyl   | .1011            |
| Ethyleneimine   | .1012            |
| beta-Propiolactone                                      | .1013            |
| 2-Acetylaminofluorene                                   | .1014            |
| 4-Dimethylaminoazobenzene                               | .1015            |
| N-Nitrosodimethylamine                                  | .1016            |
| Vinyl Chloride  | .1017            |
| Arsenic (inorganic)                                     | .1018            |
| Lead  | .1025            |
| Cadmium   | .1027            |
| Benzene   | .1028            |
| Cotton dust   | .1043            |
| 1,2-Dibromo-3-chloropropane                             | .1044            |
| Acrylonitrile   | .1045            |
| Ethylene oxide  | .1047            |
| Formaldehyde  | .1048            |
| 4,4'-Methylenedianiline                                 | .1050            |
| Methylene Chloride                                      | .1052            |
| Non-Asbestiform tremolite, anthophyllite and actinolite | .1101            |

These standards are not replaced by the Occupational Exposure to Hazardous Chemicals in Laboratories standard. Users of these materials are expected to adhere to the provisions of all applicable substance-specific standards if employee exposure routinely exceeds the OSHA-mandated permissible exposure limit (or Action Level, if specified). Copies of these standards may be obtained from the Department of Environmental Safety or through the OSHA website at: [www.osha.gov](http://www.osha.gov)

## Information and Training

All UM employees must assume an active role in maintaining a safe working environment by reporting any problems or noncompliance with policies to the LS/PI. All employees should fully utilize any information provided during formal and informal training sessions. Any staff member who does not understand a policy or procedure should consult the LS/PI, departmental safety committee or DES for clarification.

All employees shall be provided with information and training regarding the hazards of the chemicals in their work area. Employees shall be informed of:

1. The contents of the OSHA standard and its appendices;
2. The location and availability of the CHP;
3. The permissible exposure limits (PELs) for OSHA regulated substances or recommended exposure limits if no PEL is listed;
4. The methods and observations used to detect the presence or release of a hazardous chemical;
5. The physical and health hazards of chemicals in the work area;
6. The measures employees can take to protect themselves from chemical hazards, including specific procedures (SOPs) to be used;
7. Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and
8. The location of known reference material on the hazards, safe handling, storage, and disposal of chemicals found in the laboratory.

Distribution of training materials to LS/PIs and members of departmental safety committees is coordinated through the Department of Environmental Safety. Training of laboratory workers in general laboratory safety and the provisions of the OSHA laboratory standard's requirements shall be conducted by UM Chemical Hygiene Officer (or designee) during training sessions scheduled through the Department of Environmental Safety or through special arrangement with DES. An on-line Chemical Hygiene training course is also available to UM laboratory employees at the following website: <http://des.umd.edu/TrainingClass/index.cfm>.

The LS/PI shall be responsible for training of all supervised laboratory employees as to specific operations, safety equipment, emergency procedures, SOPs and chemical use which apply to the laboratory facilities. Documentation of general laboratory safety and CHP training conducted by the Department of Environmental Safety shall be maintained within each department and by the Department of Personnel Services as part of the employee's permanent record. Documentation of laboratory-specific training provided by the LS/PI shall be maintained within each department and laboratory.

## Exposure Monitoring

OSHA has established "Permissible Exposure Limits" (PELs) for laboratory employees' exposures to certain regulated substances. Exposure levels must be determined and monitored under certain circumstances. A medical surveillance program has been established for certain specified employees whose work assignments involve regular and frequent handling of toxicologically significant quantities of a chemical. In addition, the Department of Environmental Safety is responsible for making determinations regarding the requirements for area and/or personal exposure monitoring in specific circumstances.

PELs are specified in the OSHA regulation 29 CFR 1910, Subpart Z Toxic and Hazardous Substances. In addition, PELs are usually indicated on the MSDSs, and can be obtained from the Department of Environmental Safety. These limits are defined as:

- Eight-hour time weighted average (TWA): The average concentration to which an employee may be exposed to a particular chemical for up to eight hours per day, five days per week.
- Short Term Exposure Limit (STEL): The average concentration to which an employee may be exposed to a particular chemical for up to fifteen minutes per day.
- Ceiling (C): The maximum concentration to which an employee may be exposed to a particular chemical at any time.

Often, a notation of "Skin" is printed with an exposure limit. This indicates that skin absorption of that chemical occurs readily which would contribute to an employee's overall exposure. Employee exposure to dermal absorption of chemical substances can often be monitored through the use of biological testing.

Employee exposure should be monitored in the following circumstances:

1. Initially, where there is reason to believe that exposure levels to any chemical substance regulated by a standard routinely exceed the action level (or in the absence of an action level, the PEL) for an OSHA-regulated substance for which there are exposure monitoring and medical surveillance requirements; and
2. Periodically, where the initial monitoring discloses employee exposure over the action level (or in absence of an action level, the PEL).

The general training provided by the Department of Environmental Safety will include information regarding the identification of situations where employee exposure might exceed the PEL, TLV or STEL. TLVs (Threshold Limit Values) are eight-hour time-weighted average inhalation exposure limits recommended by the American Conference of Governmental Industrial Hygienists. The Department of Environmental Safety will perform area and/or personal exposure monitoring at the request of any LS/PI or laboratory worker. The employee will be provided written notification of monitoring results, within 15 working days after receipt of monitoring results by the University.

Where initial monitoring discloses employee exposure over the action level (or in the absence of an action level, the PEL), the affected employee must be provided with personal protective equipment, unless engineering controls are available as a feasible means of controlling exposure. The LS/PI is responsible for ensuring that appropriate protective equipment is available to laboratory employees.

Monitoring will be terminated when appropriate in accordance with the relevant standard.

## Prior Approvals

The Principal Investigators/Laboratory Supervisors (LS/PI) is responsible for providing institutional notifications as defined below:

1. Any purchase, possession or use of explosive materials (as defined by the US Department of Alcohol, Tobacco & Firearms) must be approved by the UM Fire Marshal (301-405-3970). A comprehensive list of explosive materials may be accessed from the ATF Website at: [http://www.atf.treas.gov/pub/fire-explo\\_pub/listofexp.htm](http://www.atf.treas.gov/pub/fire-explo_pub/listofexp.htm)
2. Any modification to a chemical fume hood or other laboratory local exhaust system must be reviewed and approved by the Department of Facilities Management (301-405-0255) and/or the Department of Environmental Safety (405-3960) before it may be used as a means to control exposure to hazardous materials.
3. Any use of hazardous chemicals that may present a hazardous condition due to inadequate ventilation must be reviewed and approved by the Chemical Hygiene Officer prior to initiation of the operation.
4. Any research involving animals must be reviewed and approved by the Institutional Animal Care and Use Committee. Additional information is available at the following Website: <http://www.umresearch.umd.edu/IACUC/>
5. Any possession or use of radioactive materials or radiation-producing devices must be reviewed and approved by the Radiation Safety Officer. Additional information may be obtained by calling (301) 405-3985.
6. Any research work involving human subjects must be reviewed and approved by the Institutional Review Board. Additional information is available at the following Website: [www.umresearch.umd.edu/IRB](http://www.umresearch.umd.edu/IRB)
7. Any purchase, possession or use of etiologic agents must be reviewed and approved by the UM Biosafety Officer. Additional information may be obtained by calling (301) 405-3975 or from the website: <http://www.umd.edu/des/biosafety/infectious/index.html>
8. Treatment (e.g., neutralization) or drain disposal of any hazardous waste must be reviewed and approved by the Environmental Affairs section of the Department of Environmental Safety. Additional information may be obtained by calling (301) 405-3163.
9. Any use of respirators must be reviewed and approved by the UM Respiratory Protection Program Administrator. Additional information may be obtained by calling (301) 405-3980 or from the following website: <http://www.umd.edu/des/os/respirator/index.html>
10. The use of extremely toxic gases must be reviewed and approved by the Chemical Hygiene Officer prior to initiation of work. These gases include:
  - Arsine and gaseous derivatives
  - Chloropicrin in gas mixtures
  - Cyanogen chloride
  - Cyanogen
  - Diborane
  - Germane
  - Hexaethyltetraphosphate
  - Hydrogen cyanide
  - Hydrogen selenide
  - Nitric oxide
  - Nitrogen dioxide
  - Nitrogen Tetroxide

Phosgene  
Phosphine

Laboratory employees are responsible for obtaining approval from the LS/PI if any of the following operations will occur:

1. Laboratory operations that will be left unattended.
2. Modification of any established laboratory procedure.
3. Modification to laboratory chemical inventory.
4. Continuation of any laboratory procedure if unexpected results occur.
5. Use of Particularly Hazardous Materials in locations where no engineering controls (e.g., fume hood) are to be used.
6. Any operation for which employees are not aware of the hazards nor are confident in their ability to be adequately protected.

The LS/PI is also required to evaluate these specific laboratory operations and include in Appendix II any additional conditions that require prior approval.

## Laboratory Safety Guide and References

The Laboratory Safety Guide is a separate document prepared and distributed by the Department of Environmental Safety (<http://www.umd.edu/des/ls/index.html>).

The Guide was assembled to assist laboratory supervisors and workers in their daily operations at UM and to provide a means to lessen employee exposure to hazardous materials and operations. It can supply much of the information needed to provide laboratory workers a safe working environment. However, laboratory workers should not assume that this guide will supply sufficient information to prevent injury and protect the environment. The nature of the work that is performed in many research and testing laboratories increases the necessity for safety planning and awareness. The Principal Investigator and other faculty often have special expertise in the unique or specific experimental processes used in laboratories under their control, and the prepared SOP may supersede general laboratory safety guidelines. Recommended reference sources concerning safe operations in laboratories include:

CRC Handbook of Laboratory Safety  
CRC Press, Inc.

Guide for Safety in the Chemical Laboratory  
Van Nostrand Reinhold Company

Improving Safety in the Chemical Laboratory  
John Wiley and Sons

Prudent Practices for Handling Hazardous Chemicals in Laboratories  
National Academy Press

Safe Storage of Laboratory Chemicals  
John Wiley and Sons

Safety in Academic Chemistry Laboratories  
American Chemical Society



## Appendix I

### **X-7.00(A) UM POLICY CONCERNING FIRE EMERGENCIES APPROVED BY THE PRESIDENT MARCH 6, 1993**

A. Purpose. This is a statement of official University policy for the reporting of fire emergencies and for the evacuation of campus buildings during fire emergencies, in compliance with local, state, and federal regulations.

B. Policy. A fire emergency exists whenever:

1. A building fire evacuation alarm is sounding;
2. An uncontrolled fire or imminent fire hazard occurs in any building or area of the campus;
3. There is the presence of smoke, or the odor of burning;
4. There is spontaneous or abnormal heating of any material, an uncontrolled release of combustible or toxic gas or other material, or a flammable liquid spill.

C. Procedures. Campus Buildings shall be immediately and totally evacuated whenever the building evacuation alarm is sounding.

1. Upon discovery of evidence that a fire emergency exists, an individual shall accomplish, or cause to be accomplished, the following actions:
  - (a) SOUND AN ALARM. Activate the building fire alarm in buildings equipped with a manual fire alarm system. Shout a warning and knock on doors as you evacuate in buildings not equipped with a fire alarm.
  - (b) SHUT OFF ALL MACHINERY AND EQUIPMENT IN YOUR AREA.
  - (c) LEAVE THE BUILDING AT ONCE.
  - (d) CALL THE FIRE DEPARTMENT FROM A SAFE PLACE.
    - (1) On-Campus phones DIAL 911
    - (2) Off-Campus phones and campus pay phones DIAL 911
    - (3) Use Campus emergency phones;  
Indoors - Yellow wall phones with red "EMERGENCY" markings (some corridors)  
Outdoors - Yellow phone boxes with red "EMERGENCY" markings, under blue lights.
    - (4) When the emergency operator answers, ask for the fire department, give as much specific information as possible. State that you are from UMCP and include the proper name of the building and room number, floor, or other specific area. Do not hang up until released by the dispatcher. A PHONE CALL MUST BE MADE! ALL BUILDING FIRE ALARMS DO NOT NOTIFY THE FIRE DEPARTMENT.
  - (e) MEET THE FIRE DEPARTMENT OUTSIDE AND DIRECT THEM TO THE EMERGENCY.
  - (f) ALL FIRES, EVEN IF EXTINGUISHED OR FOUND EXTINGUISHED, MUST BE REPORTED.
  - (g) ALL FIRE ALARMS, EVEN IF SUSPECTED TO BE FALSE OR ACCIDENTAL, MUST BE REPORTED TO THE FIRE DEPARTMENT.
2. The evacuation procedures shall be as follows:
  - (a) It shall be the responsibility of every person to immediately leave a University building whenever the fire alarm is activated or a fire emergency exists.  
All students, faculty, and staff are required to leave the building and remain outside until the emergency is over. No one shall restrict or impede the evacuation.

- (b) Department heads are expected to review annually fire prevention and fire survival information with faculty and staff, or to schedule such a presentation with the Department of Environmental Safety. Such information is available from the Department for use and distribution.
  - 3. Whenever it is brought to the attention of the staff of residential buildings, or departmental personnel, that the fire alarm or sprinkler system is inoperable or has been placed out of service, a firewatch shall be established.
    - (a) Responsible personnel (residential staff, safety committee, etc.) shall be assigned to the firewatch.
    - (b) The entire building shall be toured at least one time during each hour of the firewatch.
    - (c) The emergency dispatcher (405-3555) shall be notified each hour that the watch has been performed.
    - (d) The firewatch shall be maintained at all times that the building is occupied until the fire protection system is repaired.
  - 4. INTERRUPTION OF FIRE ALARM:
    - (a) No person may shut off any fire protection or alarm system during a fire emergency incident without the permission of the fire department officer in charge.
    - (b) No person may shut off any fire protection or alarm system during a bomb threat emergency without the permission of the police officer in charge.
    - (c) It shall be the responsibility of the Department of Facilities Management Department to reset or repair any fire protection or alarm system after an emergency incident when notified by the fire or police department in charge. The Department of Facilities Management shall inspect each such system immediately after every emergency incident and place the system in serviceable condition.
    - (d) The fire and police departments may reset an alarm system only if there is no damage to the system and when it is within their technical capabilities to do so.
    - (e) Any person desiring to interrupt service to any fire protection or alarm system must obtain permission from the Department of Facilities Management, Work Control Center (405-2222) which shall notify the fire and police departments of every such interruption.
    - (f) Fire or police department must request the Facilities Management to repair or rest a fire protection system, via the Work Control Center (405-2222).
  - 5. INFORMATION RELEASE TO MEDIA AND THE PUBLIC: All information regarding University fires will be released through the Department of Environmental Safety in cooperation with the Public Information Office. No other University agency or employee may release official statements regarding the cause, origin, or nature of campus fires.
- D. Information: Assistance will be provided by the Department of Environmental Safety to any Department requiring help and advice in its implementation of this UM policy.

## Appendix II

### Prior Approval Criteria

The LS/PI shall indicate any circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the LS/PI (or designee) before implementation. If no circumstances are identified, the LS/PI shall write "none" in the first provided space. Additional pages may be added as determined necessary by the LS/PI.

1. Circumstance: In Vivo / Animal Model Studies

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Prior approval to be obtained from: PI as well as IACUC

2. Circumstance: Vacuum work

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Prior approval to be obtained from: PI

3. Circumstance: Work with radioactive materials

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Prior approval to be obtained from: PI as well as Radiation Safety Officer

4. Circumstance: \_\_\_\_\_

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Prior approval to be obtained from: \_\_\_\_\_

5. Circumstance: \_\_\_\_\_

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Prior approval to be obtained from: \_\_\_\_\_

6. Circumstance: \_\_\_\_\_

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Prior approval to be obtained from: \_\_\_\_\_

7. Circumstance: \_\_\_\_\_

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Prior approval to be obtained from: \_\_\_\_\_

**Appendix III**  
**Standard Operating Procedures**  
**(to be attached by Laboratory Supervisor)**

PLEASE SEE LABORATORY WEB SITE FOR COMPLETE LISTING OF MSDS AND SOP

[http://www.chbe.umd.edu/~choi/index\\_files/Page763.htm](http://www.chbe.umd.edu/~choi/index_files/Page763.htm)

## Appendix IV

### Chemical Inventory and Material Safety Data

(to be attached by Laboratory Supervisor)

#### AAPER Alcohol

- Acetone - [MSDS](#)
- Ethyl Alcohol USP 200 Proof - [MSDS](#)

#### Airgas

- Carbon Dioxide - [MSDS](#)
- Ethylene - [MSDS](#)
- Hydrogen - [MSDS](#)
- Nitrogen - [MSDS](#)
- Propane - [MSDS](#)
- Argon - [MSDS](#)

#### Akzo Nobel

- MMAO-3A in Toluene - [MSDS](#)

#### Atofina

- LUPEROX 223M75 - [MSDS](#)
- LUPEROX 233M75 - [MSDS](#)
- LUPEROX 256 - [MSDS](#)
- LUPEROX 533M75 - [MSDS](#)
- LUPEROX 665M50 - [MSDS](#)
- LUPEROX LP - [MSDS](#)
- LUPEROX P - [MSDS](#)

#### Drierite

- Drierite - [MSDS](#)

#### Fisher

- Acetonitrile - [MSDS](#)
- Calcium Chloride - [MSDS](#)
- Chloroform - [MSDS](#)
- Copper(i) Oxide - [MSDS](#)
- Dichloromethane - [MSDS](#)
- Ethyl acetate - [MSDS](#)
- Ethylene glycol - [MSDS](#)
- Heptane - [MSDS](#)
- Methanol - [MSDS](#)

- Molecular Sieves - [MSDS](#)
- Potassium Permanganate - [MSDS](#)
- Sodium Carbonate - [MSDS](#)
- Sodium Chloride - [MSDS](#)
- Sodium dodecyl sulfate - [MSDS](#)
- Sodium Hydroxide Solution 0.01 N to 1 N - [MSDS](#)
- Toluene - [MSDS](#)
- Water, Demineralized - [MSDS](#)
- Zinc sulfate heptahydrate - [MSDS](#)

J. T. Baker

- 1,1,1,3,3,3-Hexafluoro-2-propanol - [MSDS](#)
- ACETONITRILE - [MSDS](#)
- AMMONIUM SULFATE - [MSDS](#)
- BENZOPHENONE - [MSDS](#)
- CYCLOHEXANE - [MSDS](#)
- ETHYL ACETATE - [MSDS](#)
- ETHYLENE GLYCOL - [MSDS](#)
- HYDROCHLORIC ACID, 33 - 40% - [MSDS](#)
- MAGNESIUM SULFATE ANHYDROUS - [MSDS](#)
- MANGANOUS CARBONATE - [MSDS](#)
- METHYL ALCOHOL - [MSDS](#)
- NITRIC ACID - [MSDS](#)
- PHENOL, CRYSTALS - [MSDS](#)
- POLYVINYL ALCOHOL - [MSDS](#)
- POTASSIUM CHLORIDE - [MSDS](#)
- SODIUM HYDROXIDE - [MSDS](#)
- Tetrahydrofuran - [MSDS](#)

Pharmco

- Ethanolpure200proof - [MSDS](#)

Rohm and Haas

- Methyl methacrylate - [MSDS](#)

Sigma-Aldrich

- 1,1,2,2-TETRACHLOROETHANE - [MSDS](#)
- 1,3,5-TRIOXANE - [MSDS](#)
- 1,4-BENZOQUINONE - [MSDS](#)
- 1,4-BUTANEDIOL - [MSDS](#)
- 1-HEXADECANOL - [MSDS](#)
- 1-PROPANOL - [MSDS](#)
- 2,2,4-TRIMETHYLPENTANE - [MSDS](#)
- 2,2'-AZOBISISOBUTYRONITRILE - [MSDS](#)

- 2,2-DIETHOXYACETOPHENONE - [MSDS](#)
- 2,2-Dimethoxy-2-phenylacetophenone- [MSDS](#)
- 2,6-DI-TERT-BUTYL-4-METHYLPHENOL - [MSDS](#)
- 2-BUTANONE - [MSDS](#)
- 2-Hydroxyethyl ether - [MSDS](#)
- 2-Methyl-2-propanol - [MSDS](#)
- 4-METHOXYPHENOL - [MSDS](#)
- 4-METHYLSTYRENE - [MSDS](#)
- 4-TERT-BUTYLPHENOL - [MSDS](#)
- 18-CROWN-6 - [MSDS](#)
- ACACIA, POWDER - [MSDS](#)
- ACETIC ACID - [MSDS](#)
- ANTIMONY(III) OXIDE - [MSDS](#)
- BENZENE - [MSDS](#)
- BENZOYL PEROXIDE - [MSDS](#)
- BENZYL ALCOHOL, ANHYDROUS - [MSDS](#)
- BIBENZYL - [MSDS](#)
- BIS(TRIMETHYLSILYL)TRIFLUOROACETAMIDE - [MSDS](#)
- BISPHENOL A - [MSDS](#)
- BUTYL ACRYLATE - [MSDS](#)
- CARBOXYMETHYL CELLULOSE, SODIUM - [MSDS](#)
- CHLOROBENZENE - [MSDS](#)
- CHLOROFORM - [MSDS](#)
- CHROMIUM(VI) OXIDE - [MSDS](#)
- CRESOL RED - [MSDS](#)
- CRYSTAL VIOLET ACS REAGENT - [MSDS](#)
- DI(ETHYLENE GLYCOL) - [MSDS](#)
- DIBENZO-18-CROWN-6 - [MSDS](#)
- DIPHENYL CARBONATE - [MSDS](#)
- DODECYL SULFATE, SODIUM SALT - [MSDS](#)
- ETHYL ACETATE - [MSDS](#)
- ETHYL ACRYLATE - [MSDS](#)
- ETHYLBENZENE - [MSDS](#)
- HEPTANE - [MSDS](#)
- HEXADECANE ANHYDROUS - [MSDS](#)
- HEXANE - [MSDS](#)
- HEXAMETHYLENETETRAMINE - [MSDS](#)
- HEXANE - [MSDS](#)
- HYDROQUINONE - [MSDS](#)
- HYDROGEN PEROXIDE - [MSDS](#)
- HYDROXYETHYL CELLULOSE - [MSDS](#)
- INHIBITOR REMOVER - [MSDS](#)
- ISOPHTHALIC ACID - [MSDS](#)
- ISOPROPYL ALCOHOL - [MSDS](#)



- LITHIUM HYDROXIDE MONOHYDRATE - [MSDS](#)
- MANGANESE(II) ACETATE TETRAHYDRATE - [MSDS](#)
- M-CRESOL - [MSDS](#)
- METHYL ORANGE - [MSDS](#)
- METHYLENE BLUE TRIHYDRATE - [MSDS](#)
- N,N-DIMETHYL-4-NITROSOANILINE - [MSDS](#)
- N,N-DIMETHYLFORMAMIDE - [MSDS](#)
- NORBORNENE - [MSDS](#)
- PHENOL - [MSDS](#)
- PHENOL RED - [MSDS](#)
- POLY(METHYL METHACRYLATE) - [MSDS](#)
- POLY(VINYL ACETATE) - [MSDS](#)
- POLY(VINYL ALCOHOL) - [MSDS](#)
- POLYOXYETHYLENE 23 LAURYL ETHER - [MSDS](#)
- POLYSTYRENE - [MSDS](#)
- POLYSTYRENE, SECONDARY STANDARD - [MSDS](#)
- POTASSIUM HYDROGENPHTHALATE - [MSDS](#)
- POTASSIUM IODIDE - [MSDS](#)
- POTASSIUM PERSULFATE - [MSDS](#)
- SODIUM HYDROGENCARBONATE - [MSDS](#)
- SODIUM IODIDE - [MSDS](#)
- SODIUM SULFITE - [MSDS](#)
- SODIUM THIOSULFATE - [MSDS](#)
- SODIUM, CUBE - [MSDS](#)
- STYRENE - [MSDS](#)
- TEREPHTHALIC ACID - [MSDS](#)
- TERT-BUTANOL - [MSDS](#)
- TERT-BUTYL PEROXYBENZOATE - [MSDS](#)
- TETRAHYDROFURAN - [MSDS](#)
- TRICHLORO(CYCLOPENTADIENYL)TITANIUM - [MSDS](#)
- TRIFLUOROACETIC ACID - [MSDS](#)
- VINYL ACETATE - [MSDS](#)
- XYLENES - [MSDS](#)
- ZINC ACETATE DIHYDRATE - [MSDS](#)
- ZINC CHLORIDE - [MSDS](#)
- ZINC OXIDE - [MSDS](#)

Therminol

- THERMINOLr XP - [MSDS](#)

VWR

- Cresol red - [MSDS](#)
- Thymol Blue Indicator - [MSDS](#)