

CHEMICAL HYGIENE PLAN

Building: Chemistry Bldg #91

Room(s): B0208, B0208B

Remark: The Facility was relocated from the room(s): B0130A, B0128 -- B0124, B0117 {B0128 and B0124 are connected together as one room.} to the current rooms B0208, B0208B in April-June, 2021.

Department of Chemistry and Biochemistry
University of Maryland, College Park

Updated on April 5, 2022
(Director: Fu Chen)

Approved as UM Policy September 1994
Revised April 2002
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Revised Dec, 2005
(Previous Director: Yiu-Fai Lam)
Remark: these versions were for old rooms.

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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, Sustainability and Risk 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, Sustainability and Risk and Departmental Compliance Officer.
3. Biological and Chemical Hygiene (BACH) Committee shall:
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, Sustainability and Risk to any Department requesting guidance or training to satisfy implementation of this policy.

Emergency Telephone Numbers

UM Emergency (FIRE - POLICE - RESCUE) - 24 hour # 911

CALL IMMEDIATELY FOR ANY EMERGENCY INCLUDING
INJURED OR SICK PERSON, CHEMICAL SPILL OR FIRE

Environmental Safety (Main Office) (301) 405-3960
(Industrial Hygiene, Hazardous Waste Management,
Fire Protection, Hazard Communication, Safety
Education)

Chemical Hygiene Officer (301) 405-2070
(Program Consultation and Administration)

Biological Safety (301) 405-3975
(Biological Safety, Regulated Pathogen Consultation)

Radiation Safety (301) 405-1396
(Health Physics, Radioactive Materials Procurement)

University Health Center Occupational Health (301) 405-2887
(Medical Consultation and Evaluation)

Workers' Compensation Office (301) 405-5466

Facilities Management Work Control (301) 405-2222
(Repair of Facility Equipment Deficiencies, e.g.,
fume hoods, emergency eyewashes, ventilation, etc.)

Laboratory Supervisor(s):	Business-hours #	After-hours #	email
<u>Fu Chen</u>	<u>301-405-1869</u>	<u>319-333-5904</u>	<u>fchen127@umd.edu</u>

Laboratory Personnel:	Business-hours #	After-hours #	email
<u>Bin Chen</u>	<u>301-405-1870</u>	<u>248-802-0837</u>	<u>bchen1@umd.edu</u>

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.).

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 ESSR web page:

<https://essr.umd.edu/about/risk-management/workers-compensation>

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 (<https://ntp.niehs.nih.gov/whatwestudy/assessments/cancer/roc/index.html> 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, Sustainability and Risk (ESSR):
 1. Web Page (<https://essr.umd.edu/about/occupational-safety-health/hazard-communication/safety-data-sheets>)
 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:
<https://wwwn.cdc.gov/TSP/ToxFAQs/ToxFAQsLanding.aspx>
3. National Toxicology Program (Chemistry Library or ESSR):
<https://ntp.niehs.nih.gov/>
4. International Agency for Research on Cancer (Chemistry Library or ESSR):
<https://www.iarc.who.int/>
5. ESSR 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:
<https://essr.umd.edu/about/research-safety/laboratory-safety/chemical-safety>

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, Sustainability and Risk or through the OSHA website at:

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 ESSR 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, Sustainability and Risk. 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, Sustainability and Risk or through special arrangement with ESSR. An on-line Chemical Hygiene training course is also available to UM laboratory employees at the following website:

<https://essr.umd.edu/services/training>

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, Sustainability and Risk 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, Sustainability and Risk 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, Sustainability and Risk.

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 PELs) 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, Sustainability and Risk 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, Sustainability and Risk 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:
<https://www.atf.gov/explosives/docs/report/publication-federal-explosives-laws-and-regulations-atf-p-54007/download>
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 (301-405-2222) and/or the Department of Environmental Safety, Sustainability and Risk (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: <https://research.umd.edu/resources/research-compliance/institutional-animal-care-and-use-committee-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:
<https://research.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 following website:
<https://essr.umd.edu/about/research-safety/biological-safety/infectious-agents>
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, Sustainability and Risk. Additional information may be obtained by calling (301) 405-3163.

9. The information about Respiratory Protection Program Administrator may be obtained by calling (301) 405-3980 or from the following website:
<https://essr.umd.edu/about/occupational-safety-health/respiratory-protection>

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 information by the Department of Environmental Safety, Sustainability and Risk is available at: <https://essr.umd.edu/about/research-safety/laboratory-safety>. The information 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 all sufficient information to prevent injury and protect the environment is included. 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 UMD 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, Sustainability and Risk. 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, Sustainability and Risk 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, Sustainability and Risk 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: _____
_____none_____
- _____
- _____
- _____

Prior approval to be obtained from: _____

2. Circumstance: _____
- _____
- _____
- _____

Prior approval to be obtained from: _____

3. Circumstance: _____
- _____
- _____
- _____

Prior approval to be obtained from: _____

4. Circumstance: _____

Prior approval to be obtained from: _____

5. Circumstance: _____

Prior approval to be obtained from: _____

6. Circumstance: _____

Prior approval to be obtained from: _____

7. Circumstance: _____

Prior approval to be obtained from: _____

Appendix III

Standard Operating Procedures

Next five pages

LAB-SPECIFIC Standard Operation Procedures (SOP)

Last Update and revision: April 9, 2022
Fu Chen

Appendix III file name: CHP_SOP.doc

Magnetic Resonance Facilities, NMR,
Department of Chemistry and Biochemistry, UMD.
Internet Web page: <https://blog.umd.edu/nmr/>

Lab locations and Brief Description of function:

Room B0208B {NMR preparation lab}.

- **NMR electronic repair and calibration sample preparation room.**
- The major usage of the lab is for repairing small electronic modules of NMR spectrometers in the facilities.
- Occasionally (less than 10% of the usage), limited amount of chemicals are used to prepare NMR samples for calibration purposes with the spectrometers.
- The quantities of chemicals, typically less than 0.05 gram (solid) or 0.55 ml (liquid), are dissolved in appropriate solvent (final volume less than 1.25 ml). The solution is transferred into glass sample tube for NMR analyses.
- No chemical synthesis is allowed in the room.
- Only authorized persons under the supervision of the staff members are allowed to prepare samples in this lab.

Room B0208 {NMR Lab}.

WARNING: Strong Magnetic Field areas. Person with heart pacer and/or metal implants should not enter the labs. Visitor are must be escorted by staff members or Faculty members who are familiar with the special settings of magnetic fields.

<https://blog.umd.edu/nmr/safety/>

- No chemicals synthesis and sample preparation are carried out in these Labs.
- The labs house five (4 solution & 1 solid-state) NMR spectrometers for analyses of chemicals (contained with NMR sample tubes and insulated from electronics). NMR analyses is a non-invasive electronic analytical procedure, produces **no toxic waste**.
- Users prepare their NMR samples in their own research labs, with appropriate SOB from their labs.
- Special magnetic field safety procedure (for Room B0208) is given clients or visitors, who enter the labs. Information is also available in the NMR web page (listed above) and also included in this SOP document.

Standard Operation Procedures

All laboratory workers are responsible for being familiar with all the provisions of this document. Any laboratory worker can and should request additional information if confronted with a handling, exposure, or disposal situation for which he or she is uncertain about the proper procedures. All new laboratory workers will be provided with a copy of the approved Chemical Hygiene Plan and given an orientation to the laboratory by Dr. Fu Chen or staff members.

Handling of chemicals:

1. Information collection prior to the use of chemicals:
 - a. All laboratory workers carrying out NMR sample preparation with chemicals are expected to be familiar with proper procedures for handling, storage, and disposal of the chemicals or solutions.
 - b. Chemical properties and their related safety information are available from a variety of resources, including, but not limited to the followings:
 - i. Laboratory Safety at UMD <https://essr.umd.edu/about/research-safety/laboratory-safety>
 - ii. Waste Disposal Guidelines (posted in labs), U. of Maryland.
 - iii. Emergency Response Guide lines (posted in labs), U. of Maryland.
 - iv. MSDS information from manufacturers and suppliers:
<http://www.sigmaaldrich.com/united-kingdom.html>
<http://www.fisher.co.uk/>
<http://www.acros.be>
<http://www.alfa.com/>
<https://uk.vwr.com/app/Home>
 - v. This document, titled as Chemical Hygiene Plan for the NMR facilities.
2. Always purchase the minimum amount necessary to maintain operations. Chemical containers with missing or defaced labels or that violates appropriate packaging regulations should not be accepted.
3. Chemicals utilized in the laboratory must be appropriate for the laboratory's ventilation system.
4. Always wear goggles or safety glasses with side shields and appropriate lab coat and gloves, when handling chemicals.
5. Many cancer-causing chemical (carcinogens) as well as numerous cancer suspect agents are under strict governmental control. Detailed lists of these controlled substances are contained in the above mentioned safety references. Similar considerations apply to the use of known or suspected mutagens or teratogens.
6. Read and follow the next session for personal protective equipment when handling chemicals.

Emergency equipment, special lab. setting and personal protective equipment:

1. There are three well-marked Emergency Exits in B0208: two are above the two entrance doors facing hallway and one is above the emergency exit door in the wall facing outside.
2. Power failure backup and motion sensing floodlights are activated in the NMR labs.
3. Strong magnetic fields exist always-even when electric power in the building fails or being turned off.
4. Two emergency showers are located near the entrance doors in B0208 and two eyewashes are near the sinks in B0208 and B0208B.
5. Two fire extinguishers are located in B0208: one is near the entrance door and one is outside

- of office B0208A. Two fire extinguishers are located at both ends of the hallway outside of B0208. In case of Fire, call 911 Emergency Fire Department first.
6. Don't try to distinguish fire all by yourself. **Read Accident Procedure** in this document for more details.
 7. Two First-Aid Kits are near the sinks/eyewashes in B0208 and B0208B.
 8. Chemical Spill response kits are available in each lab, located near the entrance exit.
 9. The followings are applicable to NMR repair & sample preparation Room B0208B:
 - a. Each laboratory research should have available appropriate disposable or reusable gloves for use as needed. Each lab also has available heavy-duty rubber gloves or insulates gloves as required for special procedures as handling cryogenes refills.
 - b. Nitrile-latex gloves are relatively more chemical and abrasion resistance as compared to latex only gloves.
 - c. All laboratory workers are required to wear safety glasses and appropriate lab coats, when preparing NMR samples in Room B0208B. The glasses are located near the eyewash in the B0208B.
 7. All laboratory workers are required to wear appropriate safety mask when handling any volatile organic solvents or chemicals. They are available in NMR repair & sample preparation room B0208B or can be purchased in the Chemistry Department stockroom.

Chemical Storage and Disposals:

1. Chemicals should not be stored on high shelves and large bottles should be stored no more than two feet from floor level.
2. No chemicals should be stored on the floor.
3. Chemicals shall be segregated by compatibility and dated.
4. Chemical storage areas must be labeled as to their contents and dated.
5. Storage of chemicals at the lab bench or other work areas shall be kept to a minimum.
6. Any unused chemicals should be stored in the Fire Protected Yellow Metal Cabinet, located in Room B0208B.
7. Any chemical mixture shall be assumed to be as toxic as its most toxic component.
8. Substances of unknown toxicity shall be assumed to be toxic and disposed correspondingly.
9. All waste disposal containers must be kept closed when not in use and must be placed in an appropriate secondary containment tray. Full ACS names and volume of the disposal chemicals should be recorded in the Green Tags, attached to the Waste Disposal containers.

Transporting Chemicals:

1. Carry glass containers in specially designed bottle carriers or a leak resistant, unbreakable secondary container.
2. When transporting chemicals on a cart, use a cart that is suitable for the load and one that has high edges to contain leaks or spills.
3. When possible, transport chemicals in freight elevators to avoid the possibility of exposing people on passenger elevators.
4. Liquid nitrogen is to be transported and stored ONLY with Non-magnetic specially designed container, properly vented and insulated that no pressure can be built up from the boil-offs. The container should have safety pressure automatic vent and rupture-able disks to prevent excessive pressure build-up.
5. The integrity of the hose for refilling liquid nitrogen must be checked every time before use, and the hoses need to be replaced once a year.

Compressed Gas Cylinders:

1. Special hardware is needed for handling materials under pressure. Cylinders pose mechanical, physical and/or health hazards, depending on the compressed gas in the cylinder.
2. Always use appropriate gauges, fittings and materials compatible with the particular gas being handled.
3. Only nitrogen, air and helium gasses cylinders are allowed into the lab B0208.
4. Only staff can transport and store the compressed gasses cylinders in the labs. Use an appropriate cart to move cylinders.
5. Cylinders can only be located in designated areas at least ten feet away from the Superconducting magnets. The restriction includes the pathway in which the cylinder and its cart travel from the entrance door into the NMR labs.
6. Cylinders must be secured in an upright position at all times. Use suitable racks, straps, chains, or stands to support cylinders against an immovable object, such as a bench or a wall, during use and storage.
7. Do not allow cylinders to fall or lean against one another.
8. Always wear goggles or safety glasses with side shields when handling compressed gases.

Special Precaution Cryogenic Liquefied Gases

(Only Liquid nitrogen and helium are allowed in the NMR LABS).

1. Liquid nitrogen and liquid helium are transported and stored in special, insulated containers, **Non-magnetic**, specially designed to keep them from strong attracting force by the strong magnetic fields.
2. The containers must be properly vented, insulated from heat, and daily inspected when in use, to ensure that pressure no higher than > 22 psi from the boil-offs. The automatic safety pressure vent is to be inspected every use for any icing or blockage.
3. Cryogenic liquid will freeze, destroy skin tissues on contact, resulting serious burn. Appropriate gloves and safety glasses with side shields should always be worn when handling these materials.

Accident Procedures: chemical spill controls

1. On chemical spill, use appropriate procedure to contain and clean up the chemicals according to the chemical properties of the chemicals, as outline in this Chemical Hygiene Plan and references therein.
2. Chemical Spill response kits are available in each lab, located near the entrance exit. The kits are also available from the Chemistry Department stockroom. They are only good for small-scale spill, such as NMR sample breakage.
3. All chemical spills, if any, should be reported to staff members and to the Department pending on the extent of the spills.
4. In case of uncontrollable spill in large scale, that produces toxic chemicals and/or vapor. Call 911 and contract Campus Emergency Department 301-405-3333. Evacuate from the area of the accident.
5. In case of Fire, pull building fire alarm and call 911 Fire Rescue right away. Don't try alone to distinguish the fire by yourself.
6. Study and refer to Appendix I of this Document for details on Fire Emergencies Procedure.

--END of SOP for NMR facilities

Appendix IV

Chemical Inventory

See the file: NMR Chemicals Cabinet Inventory_20220407.xlsx