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CHEMICAL HYGIENE PLAN

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EXECUTIVE SUMMARY

The University of Maryland Biotechnology Institute maintains campuses in Baltimore, Shady Grove and College Park Maryland. The campuses (Units) are named the Center for Advanced Research in Biotechnology (CARB), the Center of Biosystems Research (CBR), the Center of Marine Biotechnology (COMB), and the Medical Biotechnology Center (MBC). The units are biotechnology research facilities that consist of many laboratories using a wide range of chemicals. Any facility with a laboratory using hazardous chemicals must prepare a Chemical Hygiene Plan (CHP), in accordance with federal and state occupational safety and health regulations. This document represents a Chemical Hygiene Plan for UMBI's Units, and contains procedures for the safe use and management of hazardous chemicals applicable to most laboratories within the facility.

Federal agency policies enforce compliance with research, safety, health & environmental management by withdrawal of research funding, civil penalties to institutions & civil prosecution of individuals. The Chemical Hygiene Plan is a compliance document required by the U.S. and State of Maryland Occupational Safety and Health regulations to protect the health and safety of lab personnel. The Plan must address specific criteria contained in the regulations and include site-specific procedures tailored to a facility's activities and chemicals used. The purpose of a facility's Plan is to ensure that all personnel who work with hazardous chemicals in the laboratory are duly informed of the workplace risks posed by the chemicals and of the proper methods for using, storing, and disposing of these materials.

Every employee working in the laboratory must obtain training on the Chemical Hygiene Plan, and the training must be documented and included in the employee personnel files. The Safety Officer designee provides the training and updates the Plan annually. The Plan will be distributed to every Principal Investigator (PI) at UMBI's Units, who is responsible for ensuring that their chemical inventory is attached within the Plan (as Appendix B), and that the Plan is maintained in a central location within their lab.

The UMBI Chemical Hygiene Plan is a modification of the plan prepared by CARB's Safety Officer with the assistance of members of two lab safety committees at CARB. The Chemical Hygiene Plan serves several purposes. As a compliance document, it provides detailed safety procedures to guide and assist lab personnel. As a safety guide, it is also a resource for lab personnel when they need additional information on chemicals, methods of compliance, related regulations, and compliance tools. These resources are provided in the Appendices, or online through other websites. The Plan also sets out certain responsibilities for different personnel groups to facilitate implementation of the Plan. Most of the responsibilities apply to the Safety Officer or designee to develop and update the Plan, and give staff training.

The rest of the Plan consists of detailed procedures for the identification, use, storage, and disposal of hazardous materials used at this facility. The purpose of the procedures is to ensure that personnel understand the potential hazards of materials they work with, and the best work practices to prevent a chemical release or emergency. The CHP procedures are applicable to most activities typical to a molecular biology lab. However, certain labs at COMB and MBC will need to develop additional procedures for activities unique to their endeavors.

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I. PURPOSE AND PROCEDURE

A. PURPOSE

This Plan establishes the process for laboratory safety and compliance with the Occupational Safety and Health Administration (OSHA) regulation "Occupational Exposure to Hazardous Chemicals in Laboratories." This document represents the Chemical Hygiene Plan for UMBI, and satisfies the federal and State of Maryland requirement that any facility operating a laboratory must prepare and maintain onsite a written Chemical Hygiene Plan to protect lab employees from exposure to hazardous chemicals in research, educational, and diagnostic laboratories. The purpose of a site-specific Chemical Hygiene Plan is to provide employees working in the facility's laboratories with safety and health procedures to ensure that their exposure to hazardous materials/chemicals is maintained as low as reasonably achievable.

B. STATEMENT OF PROCEDURE

University of Maryland Biotechnology Institute (UMBI) Units comply with all UMBI policies. This document meets the intent of UMBI's IV-2.30 (A) UMBI POLICY ON HEALTH AND SAFETY TRAINING. That policy states that UMBI will comply with federal and state health, safety and research standards and guidelines and requires that the safety and health standards be conveyed to all applicable personnel through a comprehensive training program. UMBI is dedicated to provide safe and healthful laboratory facilities for all laboratory personnel, and to comply 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 biological and chemical substances which, for purposes of this procedure, shall be defined as toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which are carcinogens, 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 in all UMBI laboratories 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 exposure to hazardous agents.

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

C. APPLICABLE REGULATIONS

The Chemical Hygiene Plan is based on federal and state regulations for occupational exposure to hazardous chemicals in laboratories, provided in 29 CFR 1910.1450 and 29 CFR 1910.1200. Accordingly, the Plan addresses all of the components of a federally mandated Chemical Hygiene Plan to provide lab personnel with the necessary resources for a comprehensive and effective safety document.

D. SUMMARY OF CHEMICAL HYGIENE PLAN

The Plan addresses safety procedures and general guidance for all UMBI Principal Investigators and Laboratory Personnel who work within a research laboratory. The Chemical Hygiene Plan is a documentation of policies and procedures for chemical management within the laboratory environment. Accordingly, it specifies procedures for identifying, handling and disposing of hazardous chemicals used in the laboratory, what to do in the event of an emergency, information on when and how to conduct exposure monitoring, when to obtain approval for specific safety equipment, as well as methods for the safe handling of specific high hazard materials. The Plan contains a list of references and safety guides for specific situations that may involve the release of a hazardous chemical.

The general requirements for a Chemical Hygiene Plan are summarized in Section III. This section serves to identify the required components of an SOP that complies with the regulations. Section IV contains a detailed description of safety procedures for *most* laboratory activities at UMBI. Those laboratories that conduct research activities significantly different from the molecular biology labs shall prepare additional procedures to reflect their lab-specific operations. All labs at UMBI have adopted this Plan as a general set of procedures to guide their day-to-day activities. Three groups conduct research substantially different from the other labs, and will supplement the Plan with additional SOPs for those other activities. These three groups are:

- o xxxxxxxxxxxxxxxxxxxx Group
- o xxxxxxxxxxxxxxxxxxxx Group

E. RESPONSIBILITIES.

The Chemical Hygiene Plan defines a series of duties or responsibilities to specific personnel that potentially impact safety standards in the laboratories. These include: the Director, the Lab Safety Committee; Safety Officer; the Radiation Officer; Facilities staff; Principal Investigators; Laboratory Staff; and Students. The responsibilities for these groups are described below.

1. The *Director* shall:
 - (a) Authorize a Laboratory Safety Committee within the Unit;
 - (b) Maintain a Safety Officer to serve as the Chemical Hygiene Officer for the Unit;
 - (c) Authorize the Safety Officer to provide training to all relevant personnel.
 - (d) Authorize the Safety Officer to monitor activities in the labs to ensure that safety procedures are followed and that lab conditions allow for a safe work environment for lab personnel.

2. The *Unit Laboratory Safety Committee* shall:
 - (a) Meet routinely to discuss health and safety issues at the unit;
 - (b) Provide technical assistance to the unit's Safety Officer on lab safety policy and procedures;
 - (c) Identify and recommend prudent practices and precautions that should be adopted to minimize hazardous exposures in the handling of laboratory biological agents and chemicals;
 - (d) Peer review SOPs as necessary.

3. The *Safety Officer* shall:

- (a) Prepare and implement the Chemical Hygiene Plan in collaboration with the UMBI Research Compliance Officer;
- (b) Maintain a log of Material Safety Data Sheets for the unit;
- (c) Perform regular chemical hygiene and laboratory safety inspections;
- (d) Monitor conditions and safety equipment throughout the labs;
- (a) Provide training to laboratory personnel, Principal Investigators, and students, regarding the Plan, and document the training;
- (b) Ensure the Plan is fully implemented and kept up-to-date;
- (c) Assist Principal Investigators to develop appropriate safety precautions for new projects and procedures;
- (d) Ensure that the laboratories have proper safety signage and are properly equipped with emergency response and first aid equipment;
- (e) Provide consultation, worksite monitoring (sampling), advisory assistance and information concerning use of hazardous materials;
- (f) Conduct and document lab safety audits;
- (g) Report any technical deficiencies of laboratory equipment to the Facilities group;
- (h) Monitor collection and disposal of hazardous, radioactive and other regulated wastes generated within the laboratories;
- (i) Maintain all paperwork and recordkeeping required for compliance with Chemical Hygiene Plan;
- (j) Assist the UMBI Research Compliance Officer with investigation of any personnel exposure to hazardous chemicals and document incident, accident investigation, and incident response;
- (k) Document all incidents of noncompliance with the Plan, and provide written notice to the Principal Investigator and lab personnel including notification to the Research Compliance Officer if incident is not promptly corrected or sufficiently addressed.

4. Each *Principal Investigator (PI)* shall:

- (a) Comply with the provisions of the Chemical Hygiene Plan, and ensure that lab personnel meet the procedures developed for their lab;
- (b) Review or develop standard operating procedures for their laboratory, as appropriate;
- (c) Identify and label hazardous materials used in the lab;
- (d) Provide chemical Material Safety Data Sheets to Safety Officer;
- (e) Ensure that lab personnel attend training on the Chemical Hygiene Plan and related procedures;
- (f) Attend training on the Chemical Hygiene Plan;
- (g) Notify the Safety Officer in the event of an emergency situation within their laboratory.
- (h) Notify the Safety Officer of new lab personnel that require training;
- (i) Notify the Safety Officer of any conditions in their lab that pose a safety concern to personnel;
- (j) Consult with the Safety Officer in the use of a new toxic chemical or procedure that could pose potential harm or exposure to laboratory personnel;
- (k) Notify the Safety Officer regarding the need for safety supplies or equipment;
- (l) Notify the Safety Officer in the event of an emergency situation within their laboratory;

- (m) Ensure that they or their laboratory personnel complete the three-part Incident Report in the event of an accidental release or spill of a hazardous chemical in the lab.
5. *All Laboratory Staff (Post/Docs, Research Scientists, etc.) shall:*
- (a) Comply with the contents of the Chemical Hygiene Plan and the laboratory-specific SOPs;
 - (b) Attend training on the Chemical Hygiene Plan;
 - (c) Handle all chemicals safely as prescribed in the Plan, and wear personal protective equipment when working in the laboratory;
 - (d) Use all laboratory equipment in a safe manner as prescribed in the Plan, or under safe management practices;
 - (e) Consult with the Safety Officer in the use of extremely hazardous substances or if a new activity may prompt use of special personnel protective equipment;
 - (f) Notify the Safety Officer if they notice any unsafe conditions or safety violations within the lab;
 - (g) Notify the Safety Officer as well as their PI in the event of an emergency situation within their laboratory.
6. *The Facilities Maintenance Staff shall:*
- (a) Ensure that laboratory equipment including ventilation units, chemical fume hoods, autoclaves, and biosafety cabinets, is properly operating to maintain safe conditions for lab employees;
 - (b) Ensure that emergency response equipment (fire extinguishers, emergency eyewash/shower stalls) are maintained, routinely checked and properly working, and to document the routine checks;
 - (c) Assist with the upkeep of laboratory safety equipment including signage, response supplies, and general housekeeping activities.
7. *The Radiation Safety Officer shall:*
- (a) Review authorization files to ensure that all requirements for implementing the radiation safety program are met;
 - (b) Examine posting and labeling of radioactivity use in authorized locations;
 - (c) Examine availability of proper instrumentation to conduct authorized activities
 - (d) Conduct monthly wipe tests in areas where radioisotopes are used;
 - (e) Monitor and distribute/collect radiation badges and rings to authorized personnel;
 - (f) Ensure compliance with federal regulations;
 - (g) Oversee collection and disposal of radioactive waste materials.
8. *Students/Interns shall:*
- (a) Receive lab safety training prior to working in the lab;
 - (b) Handle all chemicals in a safe manner and wear personal protective equipment when working in the laboratory;
 - (c) Defer to lab personnel in the event of a chemical release or spill;
 - (d) Work closely with assigned lab personnel or PI when handling hazardous chemicals;
 - (e) Notify the assigned lab personnel or Principal Investigator if they notice any unsafe conditions or safety violations within the lab.

F. PLAN DEVELOPMENT AND IMPLEMENTATION

The Unit's Safety Officer is the designated Chemical Hygiene Officer, and is responsible for implementing and training personnel on the contents of the Chemical Hygiene Plan. Further assistance on the preparation of the Chemical Hygiene Plan can be obtained from the UMBI Research Compliance Officer.

II. EMERGENCY CONTACT NUMBERS

Please refer to your Unit's Emergency Response Guide available from the Unit's administrative office, the UMBI Research Compliance Officer and the UMBI Emergency Website <http://www.umbi.umd.edu/research-development/emergencyguides.php>

III – STANDARD OPERATING PROCEDURES (SOPS)

General Guidance & Information

A. SUMMARY

The OSHA regulations for laboratories require that Chemical Hygiene Plans provide specific instructions to provide employee protection in the laboratory. Included in this is preparation of Standard Operating Procedures (SOPs) "relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals." The SOPs can be stand-alone documents or added to the Chemical Hygiene Plan. All laboratory employees and students should follow the detailed instructions contained in a laboratory's written SOPs.

This section provides an overview of the OSHA requirement for preparing an SOP. Refer to Section IV for a set of SOPs that are applicable to most laboratory activities at CARB. Principal Investigators (PIs) should review the SOPs in Section IV and determine if there are other situations requiring an SOP to ensure worker safety.

Note: This document is for general guidance only. Refer to Appendix C for a generic SOP template that can be used for developing procedures specific to a laboratory, process or chemical use.

B. RESPONSIBILITY FOR PREPARING ADDITIONAL SOP

The Principal Investigator (PI) is responsible for ensuring that the SOPs provided in Section IV address the activities and situation in their labs. If the SOP is not adequate, the PI should develop alternate or additional SOPs for those situations that are not addressed in this Plan. The Lab Safety Committee and Safety Officer are responsible for determining the adequacy of the SOPs prepared. New SOPs for a specific lab can be included in that lab's Chemical Hygiene Plan, as an attachment, and added to the training for that specific group.

C. PURPOSE OF SOP

The purpose of a written SOP for each lab is to provide faculty and staff with a definitive set of procedures that should be followed whenever activities in the laboratory involve the use of hazardous materials, chemicals, or equipment. The intent is to ensure that a process is in place so that an experiment is well thought out and addresses relevant health and safety issues.

D. FORMAT AND CONTENT OF SOP

SOPs should be developed for work involving hazardous chemicals as well as for use of any equipment or operation that may pose a physical hazard. The format of all SOPs should be consistent and should provide the following:

- Chemical involved and associated risks
- Procedures for safe use
- Use of engineering controls
- Personal protective equipment
- Spill response measures
- Waste disposal procedures

The SOPs must also indicate circumstances under which certain laboratory procedures, operations or activities require prior approval from the Lab Safety Committee 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.).

The SOP should be dated, signed by the PI, and added to the lab's Chemical Hygiene Plan. A SOP Template is provided as Appendix C.

IV. STANDARD OPERATING PROCEDURES FOR LABORATORIES

The information below describes specific Standard Operating Procedures (SOPs) developed for research activities at UMBI. These are applicable for most situations or types of research conducted at UMBI. If a lab uses chemicals, biological agents, or practices of potential risk that are unique to their lab, they should develop an SOP for the safe use of that material or instrument, etc., and insert that lab-specific SOP into their copy of the Chemical Hygiene Plan. All labs should follow basic lab safety procedures. Two versions of a chemical safety checklist are provided at Appendix E. Refer also to Appendix C for a template on preparing an SOP.

A. HAZARDOUS CHEMICAL IDENTIFICATION

OSHA defines a hazardous chemical 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 the following:

- Carcinogens
- Toxic or highly toxic agents (see Part B, below)
- Reproductive toxins
- Irritants
- Corrosives
- Flammable or Ignitable materials
- Reactive chemicals (see Part B, below)
- Other chemicals such as sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system;
- Any agent that can damage the lungs, skin, eyes or mucous membranes.

Laboratory supervisors (PIs) have certain responsibilities for the use and management of the hazardous chemicals used within their laboratory. They should:

- (a) Conduct an Inventory of all hazardous chemical substances used in their laboratories;

- (b) Obtain all Material Safety Data Sheets (MSDS) that are included with incoming shipments of hazardous substances;
- (c) Ensure that the MSDSs are readily accessible to lab personnel;
- (d) Have available a copy of the Chemical Hygiene Plan (CHP) within the lab;
- (e) Attach a copy of the Inventory to the CHP;
- (f) Ensure that lab personnel receive training on the CHP;
- (g) Instruct lab personnel to keep all chemical containers labeled and to label all vessels where chemicals are used.
- (h) Provide a copy of all MSDSs they receive to the Safety Officer;

B. USE OF TOXIC OR EXTREMELY HAZARDOUS CHEMICALS

Certain chemicals pose a higher risk to laboratory personnel either because of increased toxicity or for their potential to cause immediate health risks. Many chemicals used in the laboratory can cause chronic health risk (long-term) health risk whose effects may not be immediately known. These will be identified on the MSDS and chemical container for having a health risk of 3 or 4.

Carcinogens – many chemicals considered toxic fall into the following categories:

- (a) A select carcinogen. Any substance, which meets one of the following criteria:
 - It is regulated by OSHA as a carcinogen (see Appendix H);
 - 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.
- (b) A reproductive toxin: Chemicals that affect the reproductive capabilities, including chemicals that are mutagenic and teratogenic;
- (c) An acute toxin; or,
- (d) A Byproduct or “Unknown” - Chemicals that are synthesized in the laboratory and that are byproducts for which the composition or hazards are unknown

Always work with these chemicals within a chemical fume hood and follow safe procedures for fume hood use. If it is not possible to work with the chemicals in a fume hood, check the Material Safety Data Sheet for the required Protective Personal Equipment (PPE) to use, to prevent exposure to the material. At a minimum, always wear safety goggles, gloves, and a lab coat. If a respirator is required, contact the Safety Officer to arrange for respirator fit-testing and monitoring.

Explosive Peroxides - Some chemicals are considered extremely hazardous due to their potential to form explosive peroxides when exposed to air, or may autopolymerize due to accumulation of peroxides when exposed to air. It is critical to minimize quantities of these materials in the laboratory, and dispose of unused materials before they present an explosion risk. Contact the Safety Officer for assistance and disposal for any unopened chemicals.

The following chemicals can form explosive peroxides on concentration (e.g., after evaporation). Containers should be dated when opened and disposed with the assistance of the Safety Officer after **twelve months**:

- Acetal
- Acetaldehyde
- Benzyl alcohol
- 2-Butanol
- Cumene
- Cyclohexanol
- 2-Cyclohexen1-ol
- Cyclohexene
- Decahydronaphthalene
- Diacetylene
- Dicyclopentadiene
- Diethylene glycoldimethyl ether
- Dioxanes
- Ethylene glycoldimethyl ether
- Ethyl ether
- Glyme
- 4-Heptanol
- 2-Hexanol
- Methylacetylene
- 3-Methyl-1-butanol
- Methylcyclopentane
- Methyl isobutyl ketone
- 4-Methyl-2-pentanol
- 2-Penten-1-ol
- 4-Penten-1-ol
- 1-Phenylethanol
- 2-Phenylethanol
- 2-Propanol
- Tetrahydrofuran
- Tetrahydronaphthalene
- Vinyl ethers
- Other secondary alcohols

The following chemicals can form explosive levels of peroxides without concentrating. Containers should be dated when opened and disposed with the assistance of the Safety Officer after **three months**:

- Butadiene
- Chloroprene
- Divinylacetylene
- Isopropyl Ether
- Tetrafluoroethylene
- Vinylidene chloride

The following chemicals may autopolymerize due to peroxide accumulation after exposure to air. Containers of these inhibited chemicals should be dated when opened and disposed through the Safety Officer after twelve months. These reagents are typically produced with inhibitors to prevent dangerous polymerization reactions. If

these chemicals are synthesized in the laboratory and are uninhibited, storage is safe for no more than **twenty-four hours**:

- Acrylic acid
- Acrylonitrile
- Butadiene
- Chloroprene
- Chlorotrifluoroethylene
- Methyl methacrylate
- Styrene
- Tetrafluoroethylene
- Vinyl acetate
- Vinyl acetylene
- Vinyl chloride
- Vinyl pyridine
- Vinylidene chloride

C. CHEMICAL ACQUISITION AND STORAGE

No chemical container should be accepted without adequate identifying label information. The label should include, at a minimum, the substance name, hazard warnings, and identification of the manufacturer or distributor. It should also contain a date of manufacture, particularly if it has a shelf-life or could cause peroxides.

Before use of any new material, the PI and lab supervisors should conduct a hazard review. Always review the hazards associated with exposure to the chemical from the MSDS, before use, and determine all safety procedures, required PPE, and disposal methods. Before a hazardous material is used, information on proper handling, storage, and disposal will be made available to those who have potential exposure. MSDS information may be obtained at:

UMCP DES Website

<http://www.des.umd.edu/os/rtk/msds/index.html>

or

UMB EHS Website

<http://www.ehs.umaryland.edu/waste/index.cfm>

D. CHEMICAL INVENTORY

Every PI should maintain a list of the chemicals used in their lab. An inventory helps to identify the materials maintained onsite, and the associated hazards present in the lab. Appendix A provides a template and related information for preparing a chemical inventory. When the inventory is prepared, it should be included within the Chemical Hygiene Plan, as Appendix B. The purchase, transfer, or use of any chemical that is not on the existing inventory for the laboratory should have prior approval from the lab PI prior to purchase or use. (Refer to Section V for additional information on activities that require 'prior approval.') There are different ways to plan for creating a chemical inventory. This can include assigning the task to a specific lab personnel; creating an online database using chemical inventory software, or setting up a system to correlate chemical purchases with the current inventory. Be sure to update the inventory when acquiring new chemicals.

Air, water and bulk samples obtained by lab staff do not have to be included in the inventory of hazardous chemicals, provided they are safely maintained and identified in a separate log in the lab. That way, they are still included for purposes of emergency

planning. Also, Gastec Detector Tubes and dry cell batteries are not considered hazardous and do not need to be included.

E. SAFE CHEMICAL HANDLING PROCEDURES

Know as much about the chemical you are handling. Read the label on the container, MSDS, literature in the library, or internet. Do not use any chemical material if you are unaware of the hazards associated with all avenues of exposure. Always wear proper personal protective equipment including gloves and safety glasses, and wash hands thoroughly after their use.

- (a) *Labels*. All chemical containers must have a legible, firmly attached label showing the contents of the container. Labels on incoming containers of hazardous chemicals must not be removed or defaced. Any labels that are damaged must be immediately replaced with labels containing the same identification, warning and source information.
- (b) *Safe Storage*. All chemicals must be stored in a manner that best prevents exposure or contamination from the chemical. Dry chemicals may be stored on shelves above the lab work station. Liquid chemicals that are flammable should be stored in a flammable storage cabinet. Liquid or dry chemicals that are corrosive must be stored in a corrosive storage cabinet. In addition, they should be stored in compatible containers that should be kept closed when not in use. Check for recommended storage requirements in the MSDS. See information specific to hazard class, below.
- (c) *Refrigerators*. Do not store flammables or combustible liquids in the lab refrigerator. Refrigerators or freezers used for flammable chemical storage must be specifically approved for such use.
- (d) *Compatible Materials*. Check to ensure that chemicals are stored with other compatible chemicals. Incompatible chemicals must be segregated by class. A good table listing compatible and incompatible is: <http://www.des.umd.edu/hw/rest/incomp.html>.
- (e) *Keep Inventory Current*. Periodic inventories should be conducted by the PI and all unneeded items should be identified, discarded, returned to storage or processed for hazardous waste disposal. Be sure to update the inventory when these changes are made.
- (f) *Byproducts*. Chemical substances (or by-products) developed in the laboratory are assumed to be hazardous in the absence of other information. Should a laboratory produce a chemical substance for distribution outside of UMBI Units, MSDS and labeling provisions per the OSHA Hazard Communication Standard apply. A MSDS must be developed by the lab PI to accompany the substance during transport. Currently, UMBI Units do not produce any chemicals nor do they distribute any.
- (g) *Flammable Liquids*
 - 1. Hazards.
 - Vapor can form an ignitable mixture in air.
 - Many flammable liquids are solvents and are potentially hazardous by inhalation.
 - Skin contact should be avoided, irritation or skin absorption are possible with some chemicals in this group.
 - Damage to the eyes range from irritation to severe damage.

2. Storage

- Storage of flammable/combustible liquids in excess of 10 gallons must be in an approved flammable cabinet. At UMBI, these are often under chemical fume hoods. If the storage space under the fume hoods is insufficient for the volume of flammable liquids used or maintained in the lab, contact the Safety Officer for assistance in identifying other storage options or purchasing an additional flammable storage cabinet.

3. Controls

- Work in a chemical fume hood as much as possible. Contact the Safety Officer if materials will be transferred from drums into smaller containers to assure that proper anti-static measures are implemented.
- All spills must be cleaned up immediately and the spill area properly decontaminated.
- Emergency showers and eyewashes should be used when skin or eye contact occurs. Get first aid attention immediately.

(h) Corrosive Chemicals

1. Hazards

- Contact with the skin, eyes, respiratory, or digestive tract causes severe irritation, tissue damage, or burns. Burns may not be readily apparent after exposure to some acids (e.g., hydrofluoric).

2. Storage

- Corrosive chemicals must be stored in a corrosive storage cabinet that has the special lining.
- Store concentrated acids and bases in appropriate drip trays or plastic carriers if used frequently.
- Concentrated acids and bases should be transported in a plastic carrier.
- Oxidizing acids (nitric, sulfuric, perchloric) must be stored away from organic chemicals, paper, wood, or other flammables.
- Drip-tray residue must be removed daily.

3. Controls

- The following safety equipment shall be used when handling corrosive chemicals: (specify equipment)
 - Nitrile gloves
 - Safety glasses or goggles
 - Cloth lab coat
- In case of splashing to skin: Flush affected area with large amounts of water for at least 15 minutes. Remove contaminated clothing and discard during flushing process. Seek medical attention.
- Never add water to concentrated mineral acids or bases.

(i) Reactive Chemicals

1. Hazards

- Chemicals that react vigorously when exposed to certain elements including moisture, air, or other substances, as well as chemicals that are shock sensitive.
- Always identify the type(s) of reactive material and specific environment that could cause a reaction.

2. Storage

- Store in cool and dry location.
- Refer to MSDS for specific storage requirements. Maintain MSDS near material.
- Segregate from other chemicals.

- Never return excess chemicals to original container.
 - Date all containers – some chemicals can form peroxides after a certain period.
 - Examine containers frequently and dispose of any containers (as a hazardous waste) if they exhibit salt buildup.
3. Controls
- Conduct a hazard assessment to identify special use and handling techniques, fire safety (including need for Class D fire extinguishers), storage needs, potential for peroxide formation, and waste disposal.
 - Always use reactive chemicals in a chemical fume hood or glovebox or in an area with special ventilation.
 - Identify and obtain all required spill response equipment prior to use.
 - Always use with required PPE. This will include lab coats and closed-toe shoes, safety glasses, and proper gloves. Nitrile gloves may be acceptable but some other more protective gloves may be required – check with the Safety Officer on proper glove selection. Also wear a face shield if there is a risk of explosion, splash hazard or a highly exothermic reaction.
 - Read the container label and follow special hazard instructions contained in the MSDS.
 - Use only in a fume hood unless specifically authorized otherwise by the laboratory supervisor or principal investigator. Use a fume hood with the sash in lowest possible position.
 - If reactives are spilled, alert all personnel in area to leave. Do not handle a large spill – turn off all ignition sources, vacate the laboratory and call emergency contact number.
4. Examples
- a. Water sensitive:
 - Alkali metals (sodium, potassium, etc.)
 - Phosphorus pentoxide
 - b. Pyrophoric Materials – readily oxidize and can spontaneously combust:
 - Metal powders
 - c. Shock sensitive:
 - Hydrogen peroxide
 - Perchlorate salts

(j) Compressed Gases

1. Hazards
 - Compressed gases contain gas under extreme pressure. Sudden release of this energy can cause serious injury and physical damage. Compressed gases may also be flammable, toxic, or corrosive.
2. Storage
 - Compressed gases must be stored in the upright position with caps in place and secured with a strap, chain, base stand, or rack. Laboratory personnel who are trained in proper cylinder handling procedures are the only staff authorized to connect, disconnect, or transport gas cylinders. Lab personnel who handle gas cylinders for their laboratory should receive authorization from the PI prior to taking on this activity. Otherwise, lab staff must notify the Facilities personnel when they require a cylinder replacement.
 - Storage of quantities of flammable compressed gases requires segregation of cylinders and specific storage methods.
 - separate oxygen from fuel gases
 - proper use of regulators and gauges

- properly labeled cylinders
- cylinders must be properly secured during transport and stationary use
- cylinder delivery issues (like left free standing in a hallway) must be established
- static testing of cylinders

3. Controls

- o Transport only with cap in place on suitable carrier.
- o Use only appropriate fittings and regulators.
- o Each gas type has special fittings.
- o Do not permit gases of one type to contaminate another type.
- o Use check valves and/or regulators.
- o Always open valves slowly and cautiously.
- o Do not let cylinder go completely empty.
- o Return "empty" cylinders to storage, clearly marked.

4. Examples

- o CO²
- o Argon
- o Liquid Nitrogen

(k) Carcinogens, Mutagens, and Teratogens

1. Exposures. Exposures can potentially induce carcinogenesis, mutagenesis, and adverse reproductive outcomes.

2. Storage

- o Store toxic chemicals in safety storage cabinets, including the flammable cabinets.
- o Purchase in small quantities only, and maintain the minimum quantity necessary.

3. Controls

- o Work within a fume hood.
- o If working outside a fume hood, contact the Safety Officer for possible need of respirator.
- o Wear protective clothing.

4. Examples

- o Benzene
- o Vinyl chloride
- o Acetonitrile

(l) Toxic Metals

1. Hazards

- o Toxic by inhalation, ingestion, or skin absorption.

2. Storage

- o The minimum quantity necessary should be kept on hand.
- o Store in specially designated area.

3. Controls

- o Work only in fume hood, or contact Safety Officer if respirator required.
- o Spills should be cleaned up immediately and decontaminated. Contact Safety Officer for assistance.
- o Designate a specific area (and label) for work with hazardous or carcinogenic chemicals.

4. Examples

- o Lead
- o Mercury
- o Cadmium

F. RISKS FROM LABORATORY EQUIPMENT

In addition to chemicals, other materials within a laboratory environment can pose a safety and health risk to workers. These materials can include the use of sharps, Bunsen burners, and sterilizing equipment. Other equipment may pose a safety hazard if they do not function properly. Below are some examples of materials or equipment commonly found in a laboratory setting that can cause a safety concern from misuse or malfunction.

1. Sharps and Razors – Two of the major risks when using sharps are accidental injection and the creation of aerosols. The best way to prevent injury from sharps or razors is to minimize their use. Dispose of them immediately after contact or use and place in the sharps disposal container. Do not put sharps or razors into the trash. Remember not to empty the contents of the sharps disposal container, remove its lid, or overfill it. Contact the Safety Officer when the sharps containers become $\frac{3}{4}$ full.
2. Gas Burners – Never leave unattended. Do not use near flammable chemicals or materials.
3. Autoclaves – All staff that use the autoclaves must be trained by their supervisor in the proper procedures and settings for decontamination. When used properly, autoclaves should pose a low safety risk, provided proper personal protective equipment is worn, especially when opening the door after a run. However, they can pose a physical hazard from heat and steam, so care must be taken when opening an autoclave door. Contact the lab supervisor or PI if there are concerns that the autoclave is not working properly, so that they can contact Facilities or the floor autoclave contact for further assistance.
4. Chemical Fume hoods – Lab staff are required to work in fume hoods when using toxic chemicals. The fume hoods are a safety device and do not pose a safety risk unless they are not functioning properly. Do not use a fume hood for chemical storage, and when working in a fume hood limit the materials within the work area so that the airflow is not impeded.
5. DNA/RNA Synthesizer – This device may use many hazardous chemicals including acetonitrile, and staff working at or near the synthesizer should wear respiratory protection.
6. Chemical Synthesis – Experiments involving chemicals that create new agents or compounds should be evaluated for possible health effects. It is recommended that the PI prepare an SOP for any chemical synthesis activities and include a risk assessment for the chemicals used and new ones created.
7. Nuclear Magnetic Resonance Equipment – The NMR equipment contains a strong magnetic field and should be used only by trained personnel. Ferrous metal can be drawn to the magnet at high speed and medical devices (such as pacemakers) can become inactivated. NMRs also require the use of liquid helium or nitrogen in cylinders. Should these cylinders leak, all personnel should leave the area since these gases can quickly replace the oxygen in the room and pose an immediate risk of asphyxiation to personnel.
8. X-Ray Machines – Machines that generate electromagnetic radiation in the frequency range of x-rays are restricted to personnel trained in their use. The machines pose no risk of radiation when they are not in use. However, when in use, personnel must ensure that they follow the strict safety procedures to ensure that their hands or other body parts do not come into range of the x-ray beams.
9. Other Equipment – Many other types of equipment are commonly used that, when functioning properly, should not pose a safety risk. However, they must be

maintained and inspected annually, or as required, so that the engineering controls can work. Testing of lab equipment is conducted or scheduled by department or facilities personnel on a set schedule. These types of equipment can include:

- Centrifuges
- Biosafety Cabinets
- Bioreactors
- Flash Evaporators
- Emergency eyewash and safety showers
- Vacuum pumps

G. EMPLOYEE TRAINING

All laboratory employees must be trained on the hazards of chemicals present in their work area. The purpose of the training program is to assure that all individuals at risk are adequately informed about the provisions of the Chemical Hygiene Plan so that they are fully notified about potential risks and hazards of the chemicals they are working with, and the proper procedures for preventing any exposure or harm. The Safety Officer and the PI are responsible for assuring all lab employees are appropriately trained on the contents of the Chemical Hygiene Plan

CHP training should be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present. It must also be provided prior to assignments involving new exposure situations. The training shall be arranged by the Safety Officer, and be documented. All students must also receive lab safety training that incorporates the procedures of the CHP, as part of their orientation.

The training program should include the following information:

- Reference to the OSHA standards. A good summary can be found at:
<http://www.osha.gov/SLTC/laboratories/standards.htm>
- The location and availability of the Chemical Hygiene Plan
- All applicable SOP specific to their lab activities
- The permissible exposure limits (PEL) for OSHA-regulated substances or recommended exposure limits if no PEL is listed, if there is concern that they may be exposed to harmful chemicals at unsafe levels
- The methods and observations used to detect the presence or release of a hazardous substance
- The potential hazards of all materials present in the laboratory
- Safe management methods for the use of hazardous materials in the lab
- Procedures for responding to emergencies and releases of chemicals
- The location of emergency response equipment and fire controls in the lab
- Who to notify in the event of a release or emergency

All lab safety training is documented and placed in the employee records, to verify that the training was provided. This training must be repeated when new chemicals or equipment are introduced into the lab that present further risks. A table of training requirements is posted on the UMBI Website under Safety & Compliance where individuals can determine what type of training they should have, and if they are due for an update, or refresher training.

H. VENTILATION

A key safety feature for work in a laboratory setting is proper ventilation, and laboratories are designed for specific airflow settings. Laboratory ventilation must provide fresh airflow

into the laboratory and out to the exterior of the building (lab under negative pressure) through chemical fume hoods, canopy-connected biosafety cabinets or room exhausts. Fire code requirements include keeping all lab doors closed, except when being used for entrance and egress.

All reactions that produce unpleasant and/or potentially hazardous fumes, vapors, or gases should be contained within chemical fume hoods or canopy-connected biosafety cabinets. Noticeable fumes or vapors should be reported to the lab supervisor, facilities, or the Safety Officer. When the ventilation system is working properly, there should be no chemical odors or vapors, so the presence of odors may indicate a malfunction in the ventilation system.

I. EMERGENCY RESPONSE EQUIPMENT AND SPILL CONTROLS

(a) Equipment

Each laboratory employee shall be familiar with the location of emergency response equipment provided for their lab. They must also be informed and trained on the proper methods or procedures when using this equipment.

- Fire alarms
- Safety showers
- Eyewash stations
- First aid kits
- Biological spill kits
- Chemical spill kits
- Radiological spill kits
- Emergency shut-off valves for equipment
- Location of telephone and emergency numbers

Employees will be informed about this equipment through lab safety training. Training does NOT include use of the fire extinguishers. All training must be documented by the Safety Officer, and be added to the employee's personnel file. All employees receive fire safety training based on procedures contained in the Unit's Fire Response and Evacuation Plan.

It is the responsibility of the Facilities Department to conduct quarterly inspection of the fire sprinklers and annual tests of the alarms throughout the building, and to ensure that fire extinguishers are maintained and inspected. They must also ensure that the safety showers are routinely checked to make sure they work properly with sufficient water flow. It is the responsibility of the Safety Officer to check the content of spill kits.

(b) Procedures

All UMBI personnel must be trained on the facility's procedures for responding to an emergency. Prevention is necessary to ensure that emergencies do not occur. No emergency plan will do all things for all emergency situations. Preventive measures include: employee training, facility inspection programs, and engineering design of hazardous materials processes. Laboratory risks include accidents or injuries, chemical releases, release of radioactive or infectious aerosols, fires, explosions or other emergency situations. Refer to the Unit's Emergency Response Guide, posted within each lab.

Section II contains a quick list of contact information in the event of a major release or life-threatening emergency. Lab personnel at UMBI know the risks of the materials and equipment with which they work. Therefore, lab personnel are best able to determine the degree of danger that an emergency “situation” may cause. It is necessary for personnel to understand the circumstances that constitute a “major “emergency that would require them to seek immediate professional assistance. These include:

- A medical emergency
- Life threatening incident involving fire
- Life threatening incident involving the release of a hazardous material

In any situation where an employee has called 911, they should provide certain information including the type of emergency (fire, chemical release, etc.), its location, and the building. The principal investigator or laboratory supervisor and building security should also be notified.

If the emergency does not fall into the “major” category, 911 should not be called. However, the principal investigator or laboratory supervisor and the Safety Officer should be notified. Follow the procedures below for minor spills and releases of hazardous materials in the lab, and call the Safety Officer for assistance.

(c) Release of Chemicals

The procedures described below are to be used for small chemical spills where materials for clean-up are available in the lab and if employees have received training in their use.

- Locate spill cleanup materials. Laboratories should be equipped with spill cleanup kits. If your laboratory area does not have such emergency items, the supervisor can contact Safety Officer for assistance in obtaining the appropriate material.
- Wear the appropriate personal protective equipment (e.g., gloves, goggles) when cleaning up spills.
- Acid Spills
 - Apply neutralizer (or sodium bicarbonate) to perimeter of spill.
 - Mix thoroughly until fizzing and evolution of gas ceases. Note: It may be necessary to add water to the mixture to complete the reaction. Neutralizer has a tendency to absorb acid before fully neutralizing it.
 - Check mixture with pH indicator paper to assure that the acid has been neutralized.
 - Transfer the mixture to a plastic bag, tie shut, fill out a waste label, and place in the fume hood. Notify supervisor or call Safety Officer for disposal.
- Caustic Spills
 - Apply neutralizer to perimeter of spill.
 - Mix thoroughly until fizzing and evolution of gas ceases.
 - Check mixture with pH indicator paper to assure that the material has been completely neutralized.
 - Transfer the mixture to a plastic bag, tie shut, fill out a waste label, and place in the fume hood. Notify supervisor or call facilities or Safety Officer for disposal.
- Solvent Spills
 - Apply activated charcoal to the perimeter of the spill.
 - Mix thoroughly until material is dry and no evidence of liquid solvent remains.

- Transfer absorbed solvent to a plastic bag (if compatible), tie shut, fill out and attach a waste label, and place in the fume hood. Notify supervisor or call Safety Officer for disposal.
- Mercury Spills
 - Using a mercury vacuum available through safety, vacuum all areas where mercury was spilled with particular attention to corners, cracks, depressions and creases in flooring or table tops.
 - Call Safety Officer for mercury vacuum delivery or pick-up.
 - To clean up small spills with a mercury spill kit, dampen the mercury sponge with water, then wipe the contaminated area.
 - Do this procedure slowly to allow for complete absorption of all free mercury. A silvery surface will form on the sponge.
 - Place the contaminated sponge in its plastic bag, tie shut, fill out and attach a waste label, and place in the fume hood. Notify supervisor or call Safety Officer for disposal.

(d) Release of Pathogens or Infectious Material

Appropriate personal protective measures must be taken for cleanup of potentially infectious materials. Laboratories using biological or infectious agents should be operated at the appropriate biosafety level as assigned by the UMBI Institutional Biosafety Committee.

Procedures for containing and cleaning up spills of infectious agents are available in the Emergency Response Guide. Contact the UMBI Compliance Officer at (410) 385-6329 for further assistance.

Most biological materials used in UMBI laboratories pose a low to moderate risk to employee health, and releases can be contained with an appropriate disinfectant and the waste materials autoclaved. Laboratories using biological materials at biosafety level 2 (BSL-2) or higher must follow strict protocols and should develop SOPs to ensure safe handling and disposal.

(e) Release of Radioactive Materials

Several laboratories at UMBI use radioisotopes. Should any of these materials be accidentally released into the laboratory, all personnel in the area should be notified and the lab should be evacuated.

If the release is small and confined to a restricted area, cover the spill immediately with absorbent paper towels, and contact the Safety Officer. Only authorized users or the Safety Officer may respond to the spill. If the authorized user is present, they can still contact the Safety Officer and may also clean up the spill. Clean the area with the decontamination detergent provided to each lab, and dispose of all cleaning materials in the Radioactive Materials Solid Waste Bin. Monitor the area with a Geiger counter or swab sampling, as appropriate, and repeat this process until there is no sign of residual radioactivity. Always wear gloves, lab coat, safety glasses and a dosimeter badge. Check body for radiation after cleanup. If the release is major and is not controllable or could spread quickly to a large area (such as, the spill of a large volume of radioactive liquid waste, contact the principal investigator or laboratory supervisor and Safety Officer immediately, place paper towels over the area, evacuate the lab, and seal off until the spill has been cleaned up.

(f) Fire Safety and Response.

UMBI Units have Fire Evacuation and Response Plans for staff to follow in the event of a fire emergency. Consult the Unit's Emergency Response Guide.

It is UMBI policy that a fire emergency exists whenever:

- A fire evacuation alarm sounds in the building;
- An uncontrolled fire or imminent fire hazard is observed;
- There is the presence of smoke, or the odor of burning;
- 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.

(g) Small Laboratory Fires.

Small fires which are contained in beakers or flasks can be extinguished by covering the fire with a larger beaker if the laboratory personnel are confident to do so.

- Do NOT attempt to fight a fire that cannot be extinguished immediately by covering with a larger beaker.
- Do not call 911 if the fire is small and has been controlled quickly.

(h) Personnel Clothing on Fire

The rescuer should instruct the victim to **Stop – Drop – Roll, and call 9-911 immediately**. Victims should also place their hands over their face and NOT RUN to find a fire blanket. If a fire blanket is available, it may be used by a rescuer to smother the flames.

- Do NOT use fire extinguishers to extinguish a person that is on fire.
- Do NOT attempt to remove clothing from burned areas.
- Do NOT put water on large burns.
- Keep burned areas clean and dry.

J. EXPOSURE MONITORING

OSHA has established "Permissible Exposure Limits" (PEL) for staff exposed to certain regulated substances. Exposure levels must be determined and monitored under certain circumstances. The Safety Officer must enforce a medical surveillance program for laboratory users when lab assignments have been identified that would involve the handling of toxicologically significant quantities of a substance. This program and any subsequent monitoring results shall be included in the employee's personnel records.

Exposures to any substance regulated by an OSHA standard shall be measured when there is reason to believe that exposure levels routinely exceed the action or permissible level. Laboratory researchers must notify the PI and Safety Officer if there is concern or suspicion for significant exposure. While employee exposure is greatly reduced when using the material within a chemical fume hood or biosafety cabinet, as appropriate, not all laboratory activities can be conducted within containment equipment. The procedures below may be triggered when exposure cannot be restricted to containment equipment.

Issues relating to exposure monitoring involve Permissible Exposure Limits, dermal absorption, initial vs. routine monitoring, and training. These are reviewed briefly below.

(a) *Permissible Exposure Limits (PELs)*. PELs are specified in U.S. OSHA Regulation 29 CFR 1910, Subpart Z Toxic and Hazardous Chemicals. In addition, PELs are usually indicated on the MSDS. These limits are defined as:

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

(b) *Initial Vs. Routine Monitoring*. Exposure should be monitored in the following circumstances:

- 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
- Periodically, where the initial monitoring discloses exposure over the action level (or in absence of an action level, the PEL).
- Results of personal monitoring shall be made available to the affected employee and PI within five days of receipt by the Safety Officer.

(c) *Training*. Should exposure monitoring be required for laboratory users, the Safety Officer will develop a monitoring plan specific to this situation and conduct training for the PI and lab staff. The training should include information regarding the identification of situations where 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 Officer may perform or coordinate area and/or personal exposure monitoring at the request of any PI or lab employee. The requesting individual will be provided written notification of monitoring results, within 15 working days after receipt of monitoring results by the Officer.

(d) *Exposure Over Action Level*. Where initial monitoring discloses exposure over the action level (or in the absence of an action level, the PEL), the affected individual must be provided with personal protective equipment, unless engineering controls are available as a feasible means of controlling exposure. Monitoring will be terminated when appropriate in accordance with the relevant standard.

K. MEDICAL PROGRAM.

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

- An employee who develops signs or symptoms associated with exposure to a hazardous substance in the laboratory;
- An event takes place in the work area to create a likelihood of hazardous exposure; or,
- 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 Section J, above).

(a) Events of Potential Risk for Hazardous Exposure. Examples of events or circumstances that may result in hazardous exposure include:

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

(b) Procedures for Handling Job-Related Injuries at UMBI. UMBI 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.

- Accidents which occur in the laboratory must be immediately treated.
- Injuries requiring first aid may be treated using the first aid kit, if available.
- In the event of a life-threatening injury or illness, call “911” immediately and notify the Security Guard.
- In the event of a non-life-threatening injury, personnel should be referred to the nearest health center or hospital. They should not seek medical assistance alone and should have someone else take them and drive. They can always contact the Safety Officer for assistance.

L. INCIDENT REPORTS

UMBI personnel should report all on-site injuries and illnesses to their supervisor or PI and the Safety Officer immediately following the incident.

(a) Verbal Notification Immediately Following Event/Exposure. The following information should be provided at the time that an employee or student is referred for medical consultation and/or examination:

- Identity of the chemical(s);
- Description of the conditions under which the exposure occurred, including any quantitative exposure data, if available; and
- A description of the signs and symptoms of exposure that the individual experienced, if any.
- If the injured laboratory employee is transported by ambulance and is unable to provide this information at the time of treatment, a coworker should accompany the employee to the hospital.

(b) Incident Reports. When an employee has been exposed to a chemical or injured in the lab, he/she must complete a First Report of Injury report <http://www.umbi.umd.edu/human-resources/images/first-report.pdf> and fax it to UMBI’s Human Resources Office (410) 385-6345.

(c) Medical Report, When Required. In the event of an injury requiring medical assistance, the employee must obtain a medical report from the treating physician or hospital. This report is submitted to UMBI's Human Resources. The physician's report(s) should indicate ONLY the specific findings of diagnoses related to occupational exposure and should include the following information:

- Any recommendation for further medical follow-up;
- The results of the medical examination and any associated test(s);
- Any medical condition, which may be revealed in the course of the examination which may place the employee or student at increased risk as a result of exposure to a hazardous workplace; and
- A statement that the physician has informed the individual of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.
- All medical reports should be provided to UMBI's central personnel records.

(d) Duties of the Safety Officer. As indicated above, all incidents of hazardous exposure (including disposition) should be reported to, and documented by the Safety Officer. 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, the Safety Officer will initiate a formal exposure assessment. 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 or student. An exposure assessment may include the following items:

- Interviews with the affected individual and complainant (if different)
- Monitoring or sampling the air in the area for suspect chemicals
- Determination of whether the current control measures were adequate during the time of the incident
- The names of chemicals that may be involved and other chemicals used by the individual and others in the immediate area and other chemicals stored in the immediate area
- Symptoms exhibited or claimed by the affected person
- Comparison of symptoms with those referenced in the Material Safety Data Sheet for each involved chemicals
- Observation of control measures and personal protective equipment in use during the event; and
- Notation of any on-site exposure monitoring performed previous to or during the event.

M. WASTE DISPOSAL

All laboratory personnel must be informed on the proper procedures for the management and disposal of wastes generated within a laboratory environment. Failure to follow these procedures is a violation of state and federal regulations. Regulated wastes may include:

- Trash (towels, wrappers from chemicals, etc.)
- Glass (empty containers, broken beakers)
- Sharps (razors, contaminated tips)
- Syringes
- Special Medical Waste (materials contaminated with infected materials, animals)
- Radiological Waste (containing radioisotopes)
- Hazardous Waste (all spent chemicals, or chemical solutions)

- o Cartridges and Filters
- o Special Waste Streams (mercury, batteries, used oil)

(a) *Trash*. The trash cans should be used only for wastes that do not fit the other classifications listed above. No food or beverage is permitted in the lab, and many other lab wastes are restricted from trash disposal. Therefore, the volume of trash generated in the lab is anticipated to be small.

(b) *Paper* – All spent paper and cardboard from packaging, etc., can be placed in the paper recycling bins provided throughout the lab.

(c) *Shipping Containers* – Cardboard containers can be recycled in the paper bin. Styrofoam containers may be recycled by being returned to the company.

(d) *Glass* – Large cardboard boxes labeled GLASS may be available for disposal of uncontaminated glass, such as broken glass, empty bottles, and other waste glass. Glass waste from laboratories is not recycled since it may contain trace amounts of chemicals. There are two methods of disposal for glass waste: pipettes and bottles/beakers. Glass pipettes should be discarded into sharps containers, even if the pipette does not contain any biological contaminant. All other glass waste can be discarded into cardboard stand-alone glass waste containers. Discarded bottle labels must be defaced. Discarded bottles must not contain liquids. If the glass waste is potentially contaminated with a radionuclide, discard the glass into the radioactive waste container for solids.

(e) *Pipettes and Pipette Tips* – Proper disposal of pipettes and pipette tips vary depending on whether the pipette and tip are made of plastic or glass, and whether they are contaminated. Contaminated pipette tips should be discarded into a sharps container. Pipettes that were in contact with microorganisms can be autoclaved and then discarded as trash. Uncontaminated plastic pipettes can be discarded into normal trash. Uncontaminated glass pipettes can be discarded into the glass waste box.

(e) *Sharps* – These include spent razors, needles, capillary tubes, microscope slides and pipette tips. Never place sharps waste into the regular trash. Razors, needles and contaminated pipettes should be discarded into sharps containers. These containers should be available in each lab. It is best to discard sharps immediately after use. Contact the Safety Officer for advice about sharps disposal containers and autoclave bags. Do not to bend, break or recap disposal needles. Never reach into a sharps disposal container. When a sharps container is $\frac{3}{4}$ full, contact the Safety Officer for disposal.

(f) *Syringes* – Glass syringes are expensive and can be reused. If they have been used with microorganisms, they must be autoclaved before reuse.

(g) *Special Medical Waste(Infected Waste)* – This category includes sharps, gels, or other materials that contain or have been in contact with cultures of microorganisms, pathogens, human blood, tissue, internal body fluids and animal blood, tissue or internal body fluids exposed to human materials, and dead animals. These materials should be handled and stored as infectious waste, placed in autoclave bags, autoclaved for at least one hour, and discarded into laboratory trash. Animal carcasses should be stored in autoclave or red bags in a refrigerator or freezer. Notify the Safety Officer for disposal instructions.

(h) Radioactive Waste - This waste is restricted and must be managed by the Safety Officer. All radioactive waste must be placed only in special containers designated for liquid or solid radioactive materials. This waste is generated only by personnel authorized to work with radionuclides who have received training on the use of radioisotopes. Contact the Safety Officer for further assistance.

(i) Chemical Hazardous Wastes – All chemical waste is classified as a ‘hazardous waste’ and is strictly regulated. UMBI Units provide waste management containers for the placement of these wastes. Never pour any chemical waste down the drain, or store in chemical fume hoods. Move all wastes to the waste storage areas. Ensure that each chemical waste container is marked with the chemical contents, date and initials of the lab user. Always use appropriate PPE (gloves, safety glasses, lab coat) when working with chemicals and wastes. Move filled chemical waste containers to the waste storage areas provided for each lab.

(j) Other Regulated Wastes – Some commonly used materials that contain hazardous chemicals should not be discarded into general trash. Certain batteries, fluorescent bulbs, used oil and equipment containing mercury and are referred to as “universal wastes.” These are regulated less strictly than hazardous wastes UNLESS they are cracked, broken, released, or otherwise not intact. Once broken or cracked, they must be managed as a Hazardous (Chemical) waste (see above). If intact, they must be collected and sent offsite for recycling. Examples of regulated ‘universal’ waste include: fluorescent bulbs, ni-cad batteries, lead-acid batteries, equipment containing mercury, and certain pesticides. Laboratories that have other types of batteries (such as computer APCs) should contact the Safety Officer for disposal instructions. Used oil is regulated and shall not be discarded in the municipal waste stream. Used oil from any source must be collected, labeled, and stored as a hazardous waste, prior to off-site removal. Do not mix other wastes with used oil.

Each waste storage area contains a plastic bin for universal wastes and used oil. Fluorescent bulbs are collected by the safety or facilities staff. For equipment containing mercury, ensure that the mercury is contained and the equipment labeled to contain mercury. Should any mercury be released, immediately try to containerize it. Do not handle mercury by hand. Place the mercury in a sealed jar with a small amount of water over the mercury. For large mercury spills contact the Safety Officer.

(k) Cartridges and Filters. Laboratory equipment may have printers that use replaceable cartridges or vacuum line filters that can be collected for recycling or special disposal. Check with the manufacturer of the equipment or contact the Safety Officer for guidance on which companies offer this service, and how to prepare them for offsite removal and recycling.

N. VACATING A LAB

When a Principal Investigator leaves a laboratory at UMBI, they must follow certain procedures to ensure that their lab area is cleaned up and does not contain hazardous materials. Investigators shall ensure that all chemicals are removed, all wastes sent for disposal and work areas decontaminated. There is a UMBI VII-12.00 UMBI POLICY AND PROCEDURE FOR CLEARANCE UPON SEPARATION

<http://www.umbi.umd.edu/policies-procedures/images/vii-12.00.pdf> and a Separation Clearance Form available at the UMBI website:

<http://www.umbi.umd.edu/policies-procedures/images/vii-12.00separationclearanceform.pdf>

Refer to Appendix G for a copy of the form.

O. ADDITIONAL CHEMICAL INFORMATION

The Safety Officer has access to Material Safety Data Sheets for materials used at UMBI.

Additional information may be obtained by the chemical manufacturers. Refer to the following link for a list of chemical manufacturers:

<http://www.des.umd.edu/os/rtk/msds/lab.html>

More information on paint, oils, lubricants, pesticides, and interpretation of MSDSs, go to:

<http://www.des.umd.edu/os/rtk/msds/index.html>

and

http://www.sigmaaldrich.com/Technical_Library/Technical_Library_Home.html

V. PRIOR APPROVALS

The Principal Investigator or lab personnel may be required to obtain authorization or prior approval from the Safety Officer or other Program Manager before adding new materials or procedures that are regulated, into the lab setting. These activities may include the purchase of laboratory research animals, pathogens, vectors, and certain chemicals or other regulated materials. Prior approval may also be needed to revise chemical fume hood settings or modification of biosafety cabinets for specific purposes. The PI must complete the Prior Approval form (see Appendix D) and submit this to the Safety Officer or other designated officer (see list below). In addition, lab personnel must obtain prior approval from their PI if they implement changes or new materials to the laboratory procedures.

- (a) *Equipment Modification*. Any modification to a chemical fume hood, biosafety cabinet, centrifuge or other laboratory local exhaust system must be reviewed and approved by the Research Compliance Officer and the Unit Safety Officer in order to minimize worker exposure to hazardous materials.
- (b) *Hazardous Materials*. Use of any of the materials listed below that may present a hazardous condition due to inadequate ventilation must be reviewed and approved by the Safety Officer prior to initiation of the operation.
 - Explosives
 - Hazardous chemicals
 - Radioactive materials
 - Extremely toxic gases
- (c) *Extremely Toxic Gases*. The use of extremely toxic gases listed below must be reviewed and approved by the Safety Officer prior to implementation.
 - 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

- (d) *Animal Research*. Any research involving animals must be reviewed and approved by the Institutional Animal Care and Use Committee. Additional information is available at UMBI Animal Research website
<http://www.umbi.umd.edu/research-development/compliance/vertebrate-animal-iacuc.php>
- (e) *Controlled Substances*. Any purchase, possession or use of select agents and toxins is prohibited unless the UMBI Research Compliance Officer submits an application on behalf of the Institution, including a FBI background check and fingerprinting, and receives certification for the institution and the laboratory. More information is available at the Research Compliance & Safety National Regulations and Guidelines website
<http://www.umbi.umd.edu/research-development/compliance/national-regulations-guidelines.php>
- (f) *Radioactive Materials*. Any possession or use of radioactive materials or radiation-producing devices must be reviewed and approved by the Unit's Radiation Safety Officer.
- (g) *Use of Respirators*. Any use of respirators must be reviewed by the Safety Officer to determine whether the user has been properly fit-tested for the respirator, and whether the respirator is the right type for the chemical or hazard.
- (h) *Changes to Lab Protocol*. All lab personnel must obtain the approval of their PI for the following activities:
- Laboratory operations that will be left unattended.
 - Modification of any established laboratory procedure.
 - Modification to laboratory chemical inventory.
 - Continuation of any laboratory procedure if unexpected results occur.
 - Use of toxic or hazardous chemicals in areas without proper engineering controls (e.g., fume hood or biosafety cabinet).

APPENDIX B – Standard Operating Procedures (SOPs)

LABORATORY _____ PI _____

BUILDING _____ ROOM _____ DATE _____

1. Process:	
2. Hazardous Chemical\Class of Hazardous Chemical:	
3. Personal Protective Equipment:	
4. Engineering \ Ventilation Controls:	
5. Special Handling Procedures Storage Requirements	
6. Spill Containment\ Accident Procedures:	
7. Waste Disposal	
8. Special Precautions\ Animal Use:	
9. Required Approvals:	
10. Decontamination:	
11. Designated Areas:	

Example of a SOP

Title: Procedure to evaluate effect of certain chemicals on protein

Laboratory: Cell Biology Effectors Response

Location: CARB II, Room xx

Prepared by: Dr.

Date written/revise: xx/xx/xxxx

#1 PROCESS:	Evaluation of the effects of certain chemicals on protein
#2 HAZARDOUS CHEMICALS AND/OR CLASS OF HAZARDOUS CHEMICALS:	EthylNitrosourea, N-nitroso-N-ethylurea
#3 PERSONAL PROTECTIVE EQUIPMENT:	Nitrile gloves, lab coat, safety glasses, goggles or face shield
#4 ENGINEERING CONTROLS:	Weigh chemicals in glove box. Add chemical to plants according to instructions.
#5 SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS:	Chemical vials are to be kept inside plastic container to reduce potential for spills. Only open chemical vials/plastic containers inside glove box. Store chemical reagents and prepared solutions in refrigerator.
#6 SPILL CONTAINMENT AND ACCIDENT PROCEDURES:	Contain spill with spill pads from spill control kit. Wear PPE as necessary to prevent exposure to chemicals. Transfer waste materials to leak-tight plastic bags or open-top container for waste disposal. Use additional pads or paper towels to clean up excess liquid. Dispose as hazardous waste.
#7 WASTE DISPOSAL:	All wastes are to be placed in leak proof containers for pickup by environmental staff. The PI will coordinate all pickups.
#8 SPECIAL PRECAUTIONS FOR ANIMAL USE:	No animals are involved with this procedure.
#9 REQUIRED APPROVALS:	Lab personnel must be trained in proper use of the glove box and biological safety cabinet before using these pieces of equipment. Notify the PI of any chemical spills. Any deviation from this SOP must be approved by the PI.
	All work surfaces will be disinfected (xxxx) at the conclusion of the process and at the end of the day.
	The biosafety cabinet in Room (xxxx) is the only location where this chemical will be used.

APPENDIX C – Prior Approval Form for Activities, Equipment Modifications or Use of Regulated Materials

LABORATORY _____ PI _____

BUILDING _____ ROOM _____ DATE _____

Describe circumstances under which a particular laboratory operation, procedure or activity requires prior approval from the laboratory supervisor (or designee) before implementation. If no circumstances are identified, the laboratory supervisor shall write “none” in the first provided space. Additional pages may be added as needed.

1. Circumstance: _____

Prior approval to be obtained from: _____

2. Circumstance: _____

Prior approval to be obtained from: _____

3. Circumstance: _____

Prior approval to be obtained from: _____

APPENDIX D - Laboratory Compliance Checklists

Version I

Chemical Safety Laboratory Checklist			
Location:			Safety Rep.
PI:			Audit Date:
Unit:			Audited By:
GENERAL			
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	1. Emergency phone numbers are posted at the laboratory entrance.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	2. Warning signs are posted at the laboratory entrance.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	3. Right-To-Know law bulletin is posted within the unit.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	4. All personnel know how to obtain MSDSs.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	5. All personnel have received Lab Specific Training.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	6. All personnel have received Lab Safety Training.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	7. Lab coats are available.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	8. Lab coats are worn.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	9. Chemical protective gloves are available.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	10. Reusable gloves are in good condition.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	11. Safety glasses/goggles are available.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	12. Safety glasses/goggles are worn.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	13. An eyewash fountain is present (deck, drench, combo, faucet, plumbed, potable).
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	14. Eyewash/shower is not obstructed.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	15. Eyewash test log is available.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	16. Eyewash design, location and quantity is adequate.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	17. An emergency shower is present (in room, in hallway, in neighboring lab).
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	18. Food and beverage are not stored or used in lab.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	19. Aisles are uncluttered and without a tripping hazard.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	20. Chemical spill kits are available.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	21. Sharps container available.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	22. Chemical fume hoods have current inspection sticker.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	23. All exits are free and unobstructed.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	24. Fire extinguishers are available and not obstructed.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	25. Fire extinguishers have current tag and are sealed.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	26. Current inventory of chemicals is available.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	27. Chemical Hygiene Plan is available.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	28. Laboratory SOPs are available.
CHEMICAL STORAGE & HANDLING			
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	1. Gas cylinders are properly secured.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	2. No leaking containers are present.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	3. All chemical containers are properly labeled.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	4. Chemicals are stored according to compatibility.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	5. Peroxide forming reagents are dated when opened.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	6. Peroxide forming reagents are discarded or tested after expiration date.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	7. Flammable and corrosive storage areas labeled.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	8. Flammables are kept away from sources of heat, ignition, flames, etc.

<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	9.	Corrosive materials are stored low to the ground.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	10.	Carcinogen storage area(s) is labeled.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	11	Chemicals in the open are kept to a minimum.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	12.	Flammable/Combustible liquids do not exceed NFPA storage limits.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	13.	Flammable/Combustible liquid total volume is not greater than 10 gallons.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	14.	Flammable gases are not present.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	15.	Poisonous gases are not present.
CHEMICAL WASTE				
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	1.	Hazardous waste containers are all labeled with content names and kept closed.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	2.	Hazardous waste tags are complete.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	3.	Hazardous wastes are not stored beyond 90 days.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	4.	All waste sharps are placed in red bags for disposal as biological wastes.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	5.	Waste oil from equipment is stored in a closed container and removed as hazardous waste.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	6.	Spent batteries are placed in gray bin by waste storage area.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	7.	Wastes are not mixed together. unless they are the same type.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	8.	Empty bottles and other glass are placed in cardboard glass container.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	9.	Wastes to be autoclaved are kept separate from trash, and autoclaved as generated.
<input type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> NA	10.	Equipment containing mercury is containerized and placed in storage cabinets

Version II

Location:	Safety Rep.
PI:	Audit Date:
Unit:	Audited By:

Topic	Yes	No	N/A	Comments
-------	-----	----	-----	----------

General

- Eating and Drinking Prohibited _____
- Proper Storage of Materials _____
- Chemicals labeled _____
- Controls and Equipment _____
- Unobstructed (i.e. breaker boxes) _____

Means of Egress/ Fire Safety

- Exits unobstructed _____
- Exit lights illuminated _____
- Exits clearly marked and visible _____
- Evacuation Plan/Drill _____
- Occupants familiar with evacuation plan _____
- Fire Extinguishers accessible _____
- Overtemp protection on unattended heating equipment _____

Emergency Equipment

- Periodic inspection of eyewashes/showers _____
- Fire extinguishers, present and unobstructed _____
- Fire alarm pull stations unobstructed (if present) _____
- 18" clearance maintained from sprinkler heads _____

Electrical Safety

- Plugs free from deformities _____
- GFCI's installed where necessary _____
- Flexible cords undamaged _____
- Extension cords not used in lieu of permanent wiring _____

Chemical Safety/Use

- Chemical Hygiene Plan reviewed _____
- Material Safety Data Sheets available _____
- Proper labeling of substances including; substance name (written out) and primary hazards _____
- Proper storage of substances _____
- No more than 10 gallons of flammable liquids stored outside of flammable liquid storage cabinets _____
- No combustible materials stored near heat sources _____
- Refrigerators/freezers approved for flammable liquid storage _____
- Obsolete/old substances discarded _____
- _____

- Fume hoods monitored for adequate performance

Topic **Yes** **No** **N/A** **Comments**

Biosafety

- Use of recombinant organisms, human blood, tissue, primary cell lines or microorganisms pathogenic to humans or animals
- Biosafety risk assessment conducted to determine level of safety precautions (i.e. BSL-1, BSL-2, BSL-3)
- If BSL-2 or BSL-3 lab, post as such
- Biosafety cabinets certified within past year
- Autoclaves tested/inspected
- Sharps containers present for collection and disposal of sharps
- Sharps handled with caution, used only when necessary
- Needles are never recapped, bent or broken by hand
- Mouth pipetting prohibited
- Procedures for handling biological waste (autoclave, incineration, etc.)
- Hand washing occurring after working with cultures and removing gloves/before leaving lab
- Appropriate disinfectants available
- Work surfaces disinfected daily and after spills
- Insect and rodent control program

Radiation Safety

- Any use of radioisotopes
- Any use of radiation producing equipment

Personal Protection Use (PPE)

- Hazard assessment conducted to determine appropriate PPE (safety glasses, gloves, lab coat are common items used in labs)

Hazardous Waste Management

- Safety Officer notified when hazardous wastes generated and in need of disposal?
- Waste volume at or below 220 lbs (100kg) (1 kg of acutely hw) waste
- Waste placed in proper containers
- All waste containers closed
- All waste containers labeled with;
 - o Contents (name & %)
 - o Words "Hazardous Waste"
 - o Date when filling started
- Waste segregated by type
- Secondary containment used

- No wastes disposed of in drain
- Chemical spill kit available

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Compressed Gas Cylinder Use

- Gas cylinders properly secured
- Caps in place when moving cylinders and during storage
- Cylinders marked for their contents

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

APPENDIX E – UMBI Health & Safety Training Plan

Also available at the Research Compliance & Safety website

<http://www.umbi.umd.edu/images/healthandsafetytrainingplan.pdf>

Last Name: _____ First Name: _____

Position/Title: _____ Advisor/Supervisor's Name: _____

Unit: _____ Building/Room Number: _____ Phone Number: _____

Email Address: _____

Date of Employment/Appointment/Assignment: _____

Sometimes the work environment may contain hazards. It is of utmost importance that all personnel be aware of potential hazards and use all appropriate precautions. In the interest of safety, all UMBI personnel must read the policies and procedures appropriate to their work area in accordance with IV - 2.30 (A) UMBI Policy on Health and Safety Training (http://www.umbi.umd.edu/policies-procedures/images/iv-2_30_a.pdf). All personnel should be familiar with the Emergency Response Guide for their Unit (CARB/CBR/COMB/MBC). All laboratory workers should be familiar with Right to Know/Hazcom (<http://www.umbi.umd.edu/images/youhavearighttoknow.pdf>). Depending on a laboratory worker's tasks, additional training may be required. Additional training courses may include, but are not limited to, Bloodborne Pathogens, Shipping Biologics or Chemicals, Radiation Safety, Human Subject Research, Laboratory Animal Research, and Research Requiring Respiratory Protection.

All personnel shall confirm with their advisor/supervisor which training courses they must take. Laboratory personnel must take required training courses and read appropriate policies and procedures as soon as possible after employment/appointment/assignment. Additional training topics not listed below may be added by your supervisor as they deem necessary.

This form must be printed, signed and returned to your advisor/supervisor within two months of commencement of employment/appointment/assignment. Your advisor/supervisor will forward the form to the unit administrator.

- 1) I have read the UMBI Policies and Procedures appropriate to my work area (Required by all personnel)
Date Required: _____ Date Completed: _____ Training Location: _____
- 2) I have read or attended training on fire and building emergency procedures (Required by all personnel)
Date Required: _____ Date Completed: _____ Training Location: _____
- 3) I have read or attended training on right to know/hazard communication. Required Y N
Date Required: _____ Date Completed: _____ Training Location: _____
- 4) I took the online CITI Animal Research training (<https://www.citiprogram.org/>) Required Y N
Date Required: _____ Date Completed: _____ Training Location: _____
- 5) I have attended Laboratory Hazardous Waste training. Required Y N
Date Required: _____ Date Completed: _____ Training Location: _____
- 6) I have attended Bloodborne Pathogens training. Required Y N
Date Required: _____ Date Completed: _____ Training Location: _____
- 7) I took the online CITI Human Subjects training (<https://www.citiprogram.org/>). Required Y N
Date Required: _____ Date Completed: _____ Training Location: _____
- 8) I have attended IATA/DOT Shipping training. Required Y N
Date Required: _____ Date Completed: _____ Training Location: _____
- 9) I have attended Radiation Safety training. Required Y N
Date Required: _____ Date Completed: _____ Training Location: _____
- 10) Other training I have attended. _____ Required Y N
Date Required: _____ Date Completed: _____ Training Location: _____

Personnel Signature: _____ Date: _____

Advisor/Supervisor Signature: _____ Date: _____

APPENDIX G – OSHA List of Carcinogens

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 revisions of all applicable substance-specific standards if individual exposure routinely exceeds the OSHA mandated permissible exposure limit (or Action Level, if specified).

APPENDIX H – UMBI Employee's First Report of Injury Form

<http://www.umbi.umd.edu/human-resources/images/first-report.pdf>

(To be completed by employee at time of accident AND faxed immediately to UMBI HR at (410) 385-6345)

WC Policy No. 921094 IWIF CASE #: _____

Employee Name: _____ Male _____ Female
Last First Middle

Date of Birth: _____ Marital Status: _____ Biweekly Salary: \$ _____

SSN: _____ # of dependents: _____ Full Time or Part Time?: ___ FT ___ PT

Home Address:

Street

Phone

City

State

Zip Code

Present Job Title: _____ Employment Start Date: _____

UMBI Unit: _____ Supervisor: _____

Work

Address _____

City

State

Zip Code

Accident Date: _____ Time: _____ AM ___ PM Time Shift Began: _____ AM ___ PM

Accident

Location _____

Bldg.

Address

Area (hallway, etc.)

When was Accident reported to Supervisor? _____

Describe fully how accident occurred (your activities at that time) (continue on other side, if necessary):

Describe bodily injury sustained (be specific about part(s) of body affected) (continue on other side, if necessary):

Was medical treatment sought? ___ Yes ___ No If so, where: _____

Name Address

City

State

Zip Code

Phone

Safety equipment (list items in use): _____

Name(s) of witness(es): _____

Name

Phone

Recommendation on how to prevent this accident from recurring:

Signature of employee: _____ Date: _____

rev 04/08

APPENDIX I – Laboratory Safety References & Resources

(a) University of Maryland

All employees at CARB can access additional information from the Safety Officer, the Research Compliance Officer and the University of Maryland's Department of Environmental Safety. Go to the following websites.

- CARB – Environment, Health and Safety Officer – Information on intranet
<https://carb.umbi.umd.edu/user/login> Click on “ Environmental Health & Safety”
- UMBI – Compliance Officer – Information on UMBI website
http://www.umbi.umd.edu/index.php?view=article&catid=63-umbi-core-facilities&id=629-ord-research-compliance&Itemid=47&option=com_content
- Department of Environmental Safety – College Park. UMD
Website has wide range of fact sheets, resources, other links
<http://www.umd.edu/des/ls/index.html>

(b) Laboratory Safety Guide

The University of Maryland Department of Environmental Safety prepared and distributed a guide for laboratory users to assist lab personnel in their daily operations. The Guide provides resources and regulatory information on the following topics:

- Environmental Affairs
- Industrial Hygiene
- Safety
- Fire Safety & Means of Egress
- Biosafety
- Other General Resources

The Guide can be found at: <http://www.umd.edu/des/ls/index.html>

(c) Fire Safety

- National Fire Protection Association (NFPA)
fire codes and standards
<http://www.nfpa.org>
- State Fire Codes Available From
<http://www.Lexus.org>
McKeldin Library
Maryland Law Library

(d) Electric Standards

- *National Electric Code*
http://www.mindconnection.com/_links/lnkcode.htm

(e) Environmental Programs

- US Environmental Protection Agency
<http://www.epa.gov>
- Maryland Department of the Environment
<http://www.mde.state.md.us/>
- Maryland Department of Natural Resources
<http://www.dnr.state.md.us/>

- State of Maryland Regulations/ Environment
COMAR 26
http://www.dsd.state.md.us/comar/title_search/searchTitle26.htm

- (f) Occupational & Safety Programs
 - Occupational Safety & Health Administration (federal)
OSHA regulations, interpretations, PELs, etc.
http://www.osha-slc.gov/OshStd_toc/OSHA_Std_toc.html
 - Maryland Occupational Safety & Health
Maryland occupational safety regulations & programs
<http://www.dlir.state.md.us/labor/mosh.html>
 - NIOSH
Hazardous materials information, studies, databases, etc.
<http://www.cdc.gov/niosh/homepage.html>
 - National Safety Council
Source for safety programs & information
<http://www.nsc.org/>

- (g) Biosafety Resources
 - American Biological Safety Association
www.absa.org
 - American Society for Microbiology
<http://www.asm.org/>
 - CDC-NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL) 5th Edition 2007
<http://www.cdc.gov/OD/ohs/biosfty/bmb15/bmb15toc.htm>
 - CDC/NIH Primary Containment for Biohazards: Selection, Installation & Use of Biological Safety Cabinets 3rd Edition 2007
http://www.cdc.gov/od/ohs/biosfty/primary_containment_for_biohazards.pdf
 - CDC HBV, HCV & HIV Postexposure Guidelines
<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5011a1.htm>
 - CDC HIV Postexposure Prophylaxis - Updated
<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5409a1.htm>
 - Biosafety Cabinet Certifications
Select from list of NSF Accredited Biohazard Cabinet Field Certifiers
<http://www.nsf.org/Certified/Biohazard-Certifier/>
 - OSHA Bloodborne Pathogens Standard (29 CFR 1910.1030)
http://www.osha-slc.gov/OshStd_data/1910_1030.html
 - Other Federal Programs (NIH/CDC) Biosafety in Microbiological and Biomedical Laboratories
<http://www.cdc.gov/od/ohs/biosfty/bmb14/bmb14toc.htm>
 - Material Safety Data Sheets for Infectious Agents
<http://www.hc-sc.gc.ca/pphb-dgspsp/msds-ftss/index.html>
 - NIH Guidelines for Experiments Involving Recombinant DNA
<http://www4.od.nih.gov/oba/rac/guidelines/guidelines.html>
 - Primary Containment for Biohazards: Selection, Installation and Use of Biological Safety Cabinets
<http://www.cdc.gov/od/ohs/biosfty/bsc/bsc.htm>
 - Select Agents (Requirements for Facilities)
<http://www.cdc.gov/od/ohs/lrsat/42cfr72.htm>

(h) Emergency Response/Reporting

- National Response Center
Federal reporting of hazardous materials releases
<http://www.nrc.uscg.mil/index.htm>

(i) Other Miscellaneous

- American Chemical Society
Professional organization for chemists, also has EH&S component
<http://www.acs.org>
- American National Standards Institute
Consensus standards often adopted by regulation
<http://www.ansi.org>
 - Bureau of Labor Statistics
Occupational illness/injury statistics and other information
<http://stats.bls.gov>
 - American Society of Heating, Ventilating and Air Conditioning Engineers
Ventilation standards & information
<http://www.ashrae.org/>
 - NOAA Chemical Reactivity Worksheet
Computer program that predicts reactions when substances are mixed
<http://response.restoration.noaa.gov/chemaids/react.html>