

# CHEMICAL HYGIENE PLAN FOR LABORATORIES



**DREW UNIVERSITY  
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## TERMS AND DEFINITIONS

### **Action Level**

A concentration designated in 29 CFR 1910, Subpart Z for a specific substance. This value is calculated as an 8-hour, time-weighted average and initiates certain required activities (e.g., exposure monitoring and medical surveillance).

### **Acute Toxicity**

The toxic effect of a substance that has a rapid onset, sharp or severe effects, and pronounced symptoms; this effect is not chronic.

### **American Conference of Governmental Industrial Hygienists (ACGIH)**

An independent professional organization that prepares an annual list of recommended exposure guidelines for hazardous chemicals in the occupation setting. See “threshold limit value”.

### **Chemical Emergency**

An incident involving chemicals becomes an emergency whenever there is injury of personnel, an unplanned release to the environment, an explosion, or an unplanned or uncontrolled fire.

### **Chemical Hygiene Plan**

A written program developed and implemented by the employer that sets forth procedures, equipment, personal protective equipment, and work practices to (1) protect individuals from the health hazards caused by hazardous chemicals used in a particular workplace, and (2) meet the requirements of paragraph (e) of 29 CFR 1910.1450.

### **Chronic Toxicity**

The toxic effect of a substance that develops gradually, lasts for a long time, and may have a delayed onset after exposure; this effect is not acute.

### **Combustible Liquid**

Any liquid having a flash point at or above 100°F (37.8°C) but below 200°F (93.3°C), except for mixtures having components with flash points of 200°F (93.3°C) or higher, the total volume of which makes up 99% or more of the total of the mixture.

### **Compressed Gas**

1. A gas or mixture of gases in a container that has an absolute pressure exceeding 40 psi at 70°F (21.1°C).
2. A gas or mixture of gases in a container that has an absolute pressure exceeding 104 psi at 130°F (54.4°C) regardless of the pressure at 70°F (21.1°C).
3. A liquid having a vapor pressure that exceeds 40 psi at 100°F (37.8°C), as determined by ASTM D-323-72.

### **Designated Area**

An area that may be used for work with “select carcinogens,” reproductive toxins, or substances that have a high degree of acute toxicity. A designated area may be an entire laboratory, an area of a laboratory, or a device (e.g., a laboratory hood).

### **Designated Carcinogen**

A carcinogen that meets the criteria for OSHA “select carcinogen” or falls into Category 1 or 2 of the ACGIH’s list of carcinogens.

### **Explosive**

A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

### **Flammable Chemical**

A chemical that falls into one of the following categories:

1. *Aerosol, Flammable* – an aerosol that, when tested by the method described in 18 CFR 1500.45, yields a flammable projection that exceeds 18 inches at the full valve opening or a flashback (a flame extending back to the valve) at any degree of the valve opening.
2. *Gas, Flammable* – (a) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13% or less by volume. (b) A gas that, at ambient temperatures and pressure, forms a range of flammable mixtures with air that is more than 12% of volume regardless of the lower limit.
3. *Liquid, Flammable* – Any liquid having a flash point below 100°F (37.8°C), except for mixtures having components with flash points of 100°F (37.8°C) or higher, the total of which makes up 99% or more of the total volume of the mixture.
4. *Solid, Flammable* – A solid, other than a blasting agent or explosive (as defined by 29CFR 1910.109[a]), that may cause fire through friction, absorption change, or retained heat from manufacturing or processing, or that can be ignited readily and when ignited burns vigorously and persistently thereby creating a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than 0.1 inches per second along its major axis.

### **Hazardous Chemical**

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 if individuals are exposed. The term “health hazard” includes chemicals that are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents that act on the hematopoietic systems, or agents that damage the lungs, skin, eyes, or mucous membranes.

### **High Acute Toxicity**

Substances with the following effects (from 29 CFR 1910.1200):

1. Median LD50 of 50 mg/kg orally in albino rats, total dosage 200-300g.
2. Median LD50 of 200 mg/kg by continuous contact for 24 hours with the bare skin of albino rabbits weighing between 2 and 3 kg.
3. Median LC50 in air of 200 ppm (or mg/L) continuous inhalation for 1 hour.

### **Laboratory**

A facility where the “laboratory scale use of hazardous chemicals” occurs, or a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

### **Laboratory Scale**

Work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. “Laboratory scale” excludes those workplaces whose function is to produce commercial quantities of materials.

### **Laboratory Use of Hazardous Chemicals**

The handling or use of such chemicals where all of the following conditions are met:

1. Chemical manipulations are carried out on a laboratory scales.
2. Multiple procedures or chemicals are used.
3. The procedures involved are neither part of a production process, nor in any way simulate one.
4. “Protective laboratory practices and equipment” are available and are commonly used to minimize the potential for exposure to hazardous chemicals.

### **LC50**

“Lethal concentration, 50% is the statistical calculation of the airborne level of a substance that, if inhaled, is fatal to 50% of the test organisms. This concentration is usually expressed in units of mass over volume (e.g., mg/m<sup>3</sup>) or in parts per million (ppm). Species and exposure conditions must be specified.

### **LD50**

“Lethal dose, 50%” is that statistical calculation of the amount of a substance that is fatal to 50% of the test organisms. This value is usually expressed in units of mass per body weight of the tested species (e.g., mg/kg). Exposure route, species, and duration of exposure conditions must be specified.

### **Organic Peroxide**

An organic compound that contains the bivalent –O-O- structure. Such a compound may be considered as a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms have been replaced by an organic radical.

### **Oxidizer**

A chemical, other than a blasting agent or explosive (as defined in 29 CFR 1910.109[a]), that initiates or promotes combustion in other materials, thereby causing fire of itself or through the release of oxygen or other gases.

### **Particularly Hazardous Substances**

For the purpose of this supplement, these include OSHA “select carcinogens,” reproductive toxins, and substances with a high degree of acute toxicity.

### **Permissible Exposure Level (PEL)**

The OSHA exposure limits for hazardous chemicals in the workplace. These limits are contained in 29 CFR 1910, Subpart Z.

### **Physical Hazard**

A chemical for which there is scientifically valid evidence that it is combustible liquid, a compressed gas, an explosive, a flammable, organic peroxide, an oxidizer, a pyrophoric, an unstable (reactive), or a water reactive.

### **Protective Laboratory Practices and Equipment**

Laboratory procedures, practices, and equipment accepted by laboratory health and safety experts as effective, or those that employees/students can show to be effective in minimizing the potential for exposure to hazardous chemicals.

### **Reproductive Toxins**

Chemicals that affect reproductive capabilities, including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

### **Select Carcinogen**

Any substance that is:

1. Regulated by OSHA as a carcinogen.
2. Listed under the category “known to be carcinogens” in the National Toxicology Program’s (NTP’s) *Annual Report on Carcinogens*.
3. Listed under Group 1 (carcinogenic to humans) by the *International Agency for Research on Cancer (IARC) Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man*.
4. Listed in either Group 2A or 2B by IARC or under the category “reasonably anticipated to be carcinogens” by NTP. Such a substance causes statistically significant tumor incidence in experimental animals based on any of the following criteria:
  - a. After oral dosages of less than 50 mg/kg of body weight per day.
  - b. After inhalation of 6-7 hours per day, 5 days per week, for a significant part of a lifetime of levels less than 10 mg/m<sup>3</sup>.
  - c. After repeated skin application of less than 300 mg/kg of body weight per week.

### **Threshold Limit Value (TLV)**

Airborne concentrations of substances to which it is believed that nearly all laboratory workers may be repeatedly exposed, day after day, without adverse health effects.

### **Unstable (Reactive)**

A chemical that, in its pure state or as produced and transported, will vigorously polymerize, decompose, condense, or become self-reactive under conditions of shock, pressure, or temperature.

### **Water Reactive**

A chemical that reacts with water to release a gas that is flammable or a health hazard.



## COMPLIANCE INSPECTION PLAN REVIEW PAGE

In accordance with the Occupational Safety and Health Administration (OSHA) Regulation “Occupational Exposure to Hazardous Chemicals” codified as 29 CFR1910.1450 (e)(4) a review and evaluation of this Chemical Hygiene Plan (CHP) is conducted at least annually to ensure the effectiveness of the plan. As a result of this review and evaluation, the college will amend the CHP within one month of the review to include more effective procedures and controls if the plan proves to be ineffective in: (1) protecting students, faculty, and staff from health hazards associated with hazardous chemicals in the laboratory, and (2) keeping exposures below the regulatory limits specified in 29 CFR 1910, Subpart Z.

<b>Review Date</b>	<b>Plan Update Required (yes/no)</b>	<b>Brief Description of Required Revisions (if necessary)</b>	<b>Signature Certifying to Statement Below</b>	<b>Date of Amendment (if necessary)</b>
__/__/2008	Yes	Update of all SOP's, responsibilities, & control measures		
__/__/2009				
August, 2010	Yes	<b>Updating of emergency contact information, emergency contingency plan and Drew specific items *i.e. medical waste etc.)</b>		August, 2011
August, 2011	<b>Yes</b>	Addition of finalized Particularly Hazardous Substance protocol, use of lab coats by students engaged in or near work involving hazardous materials, addition of a biological safety section, updating Primary Emergency contact, update of forms, formatting		August, 2011

Certification Statement:

“I have completed a review and evaluation of the CHP for Drew University and will/will not amend the Plan as a result.”

## CHEMICAL HYGIENE PLAN LOCATIONS

Per OSHA Regulation 29 CFR 1910.1450 (e)(2), this Chemical Hygiene Plan (CHP), shall be readily available to employees/students, faculty, and staff of the Drew University as well as to the regulatory agencies Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designated representative upon request.

Additional documentation and references made available at the campus include:

- The current edition of the Drew University “Emergency Management Plan”;
- A copy of the “Occupational Exposure to Hazardous Chemical” standard. (Also referred to as the OSHA Laboratory Standard.);
- The chemical inventories for the laboratories at the Drew University;
- Copies of Material Safety Data Sheets (MSDS’s) for chemicals used in laboratories at the Drew University; and
- Additional reference materials relating to laboratory safety and the use of hazardous materials.

In order to ensure that the plan is readily available, copies of the plan will be maintained in the following locations.

1. Biology Operations Manager, Stockroom #144, Hall of Sciences
2. Chemical Operations Manager Office, Room #S219, Hall of Sciences
3. Public Safety (Pepin Building)
4. College Website, [www.drew.edu](http://www.drew.edu) (Environmental Health & Safety webpage)

In case of an emergency when the Chemical Hygiene Officer is not immediately available, contact Campus Security (X4444 for emergencies or X3379 for non-emergencies) to gain access to the documentation and references in.

In all other cases, viewing of the documentation and references must be arranged through:

Mr. Mark Ostapczuk, CIH, CSP Chemical Hygiene Officer  Email: mostapczuk@drew.edu Office: Pepin, Room 213 Telephone: 973-408-3079	Mr. Robert Lucid Director of Public Safety Telephone: x3378
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As revisions to the CHP are made, each copy stored at the above locations will be updated.

## 1.0 INTRODUCTION

Drew University (Drew) has developed this Chemical Hygiene Plan (CHP) to meet the following objectives:

- Educate and protect students, faculty and staff from health concerns associated with the use of hazardous laboratory chemicals.
- Assure that chemical exposures are not in excess of the permissible exposure limit adopted by OSHA.
- Protect college visitors and property against potentially dangerous accidents associated with the handling, storage and disposal of hazardous chemicals.

The CHP follows the general format and content of the Model Chemical Hygiene Plan provided by the Laboratory Safety Institute and modified as appropriate to reflect the current practices at Drew.

This CHP also satisfies the requirements of the U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1910.1450, *Occupational Exposures to Hazardous Chemicals in Laboratories* and commonly referred to as the “Laboratory Standard”. Although some of the policies and practices described in this CHP may not be part of the OSHA Laboratory Standard, they have been deemed by Drew as appropriate for maintaining a safe environment for students, faculty and staff.

### Background

Before 1990, OSHA’s approach to controlling occupational exposure to hazardous chemicals was to develop lists of permissible exposure limits (PELs), substance-specific standards, and the health hazard communication standard (29 CFR 1910.1200 and 29 CFR 1910.1200 Appendices A, B, C, D, and E). These regulations address industrial applications where workers typically received prolonged exposure to large quantities of a few chemicals. The OSHA Laboratory Standard (enacted in 1991) applies to all employees engaged in the use of hazardous chemicals in laboratory workplaces where short-term exposure to varying amounts of such chemicals may be encountered. This standard emphasizes worker training and safe work practices.

### Applicability

The OSHA Laboratory Standard only applies to laboratory workplaces where chemicals are used in a non-routine, non-production manner by workers with at least some education and training in science. Examples of where this standard applies at Drew are biology, chemistry, and physics laboratories. *Not covered* by this standard include photo labs that do not change chemical processes, electronics labs, machine shops, craft shops, and pilot plant operations that are or simulate a production operation in which chemicals will not change.

Laboratory use of hazardous chemicals is defined as the handling or use of hazardous chemicals in which all of the following criteria are met:

1. Procedures using chemicals are carried out on a laboratory scale (e.g., using containers for reactions, transfers, and other handling of chemicals that are easily manipulated by one person).
2. Multiple chemical procedures or chemicals are used.
3. The operations involved are neither part of a production process nor simulate one.
4. Protective laboratory practices and equipment are available and are commonly used to minimize the potential for employee exposure to hazardous chemicals.

When the operations in a particular laboratory meet all of the above criteria, that laboratory must comply with the requirements of this Chemical Hygiene Plan. Operations in laboratories involved in the use of hazardous chemicals that do not meet the criteria previously outlined shall comply with Drew's Hazard Communication Program, including all other applicable OSHA regulations.

Drew's laboratories also generate chemical wastes that may pose environmental, as well as human hazards. These wastes are considered hazardous and are regulated by Federal EPA, state, and local laws and regulations. The most important of these laws and regulations that apply to Drew's laboratories are:

- The Federal Resource Conservation and Recovery Act (RCRA - Title 40 of the Code of Federal Regulations (40CFR) Parts 260-272).
- The NJ State Environmental Conservation Law (Title 42 Chapter 82 Subchapter III in the NJ Code).
- NJ Rules and Regulations relating to the use of the public sewers that apply to certain wastes (saline and sugar solutions only) that can be poured down sink drains and into the public sewer system.

Drew has developed a separate Campus Wide Waste Management Plan (WMP) to ensure compliance with these rules and regulations. The WMP is also available from the Chemical Hygiene Officer.

## 2.0 GENERAL PRINCIPLES

The following principles and elements have been adapted for Drew from the American Chemical Society Model Chemical Hygiene Plan.

1. The CHP provides specific laboratory practices and Standard Operating Procedures (SOP's) to minimize the exposure of faculty, students and staff to hazardous substances. Following the practices and SOP's specified in the CHP will minimize health and safety risks.
2. It is prudent to minimize all chemical exposures because most laboratory chemicals present hazards of one type or another. Control measures to be implemented include engineering controls, the use of personal protective equipment, and hygiene practices. Employees and students will follow general precautions for handling all laboratory chemicals. Specific guidelines for some chemicals that are known to be extremely hazardous, such as those found in the appropriate Material Safety Data Sheets (MSDS), will also be followed.
3. The decision to use a chemical which meets the criteria of a "Particularly Hazardous Substance" (PHS) within a laboratory will be based on the best available knowledge of each chemical's particular hazard and the availability of proper handling facilities and equipment. The circumstances of which may require prior approval from the Laboratory Safety Committee, CHO or administration of Drew before it can be implemented. Substitutions, either of chemicals, demonstrations, or experiments, will be made where appropriate to reduce hazards without sacrificing instructional objectives.
4. The permissible exposure limit (PEL) and threshold limit value (TLV) of a typical chemical used in the laboratory are available on the MSDS for that chemical. Employee and student exposure to hazardous chemicals should not exceed these limits, and by following the procedures and guidelines within this CHP, exposure will be kept below these limits identified by the American Conference of Governmental Industrial Hygienists (ACGIH).
5. The best way to prevent exposure to airborne substances is to prevent their escape into the laboratory by using hoods, ventilation devices, and other protective equipment. These devices must be kept in good working order to provide employees with a safe working area with specific measures taken to ensure proper and adequate performance of such equipment. If hoods are not functioning properly or produce the required face velocity of air flow, then work shall not be conducted in the hood until the hood is repaired.
6. The institution should not accept a chemical from a supplier unless it is accompanied by the corresponding MSDS. All MSDS should be accessible to employees at all times, and employees should be trained to read and use the information provided on the MSDS.

7. Provisions have been established for employees/students to receive appropriate safety information and required training, as well as consultants and medical examinations, if necessary.
8. Designation of the personnel responsible for implementing the chemical hygiene plan, including assignment of a chemical hygiene officer. The establishment of a chemical safety committee is recommended, but not mandatory.
9. Provisions have been established for additional protection for employees/students who work with “particularly hazardous substances.” These include select carcinogens, reproductive toxins, and substances that have a high degree of acute toxicity.

### **3.0 FACULTY, STAFF AND STUDENT RESPONSIBILITIES**

Everyone who teaches, studies or works in Drew laboratories is responsible for being aware, understanding and following the CHP. The most visible person responsible for the CHP is the Chemical Hygiene Officer (CHO). A description of this position and others who share in conveying to the CHO the authority to take the steps necessary to ensure that the CHP is protective are discussed below.

#### **3.1 Provost or Vice President**

Drew's Provost or Vice President of Finance and Operations has the ultimate responsibility for chemical hygiene at Drew and provides, along with other officers and administrators, support for efforts to improve chemical safety and health. The Provost or Vice President supervises and authorizes the CHO to take steps necessary to carry out the objectives of the CHP including the following:

1. Approving the Chemical Hygiene Plan (CHP) for laboratories at DREW.
2. Monitoring the implementation of the CHP at all applicable levels of administration with DREW.
3. Reviewing and adopting any proposed changes to the CHP.
4. Obtaining any required licensing, permits, or approval from local, state, and federal agencies to purchase, store, use, synthesize, administer, and/or dispose of any hazardous material, prescribed medication, or controlled substance.

#### **3.2 Chemical Hygiene Officer**

The School of Sciences at Drew appoints a CHO for the Department of Biology, Physics, and Chemistry. The CHO coordinates all health and safety activities and has the authority to shut down or suspend activities that do not conform to the CHP's practices. Located within Appendix A is the memorandum of designation for the CHO for the institution. Duties include but are not limited to:

1. Determining which part of Drew operations is governed by the OSHA Laboratory Standard, and ensuring that such operations comply with the Chemical Hygiene Plan.
2. Working with the appropriate personnel to evaluate, implement, and update the CHP on a routine basis. Oversee the EH&S activities within the School of Sciences.
3. Providing technical expertise and administrative support to the faculty and staff and direct inquiries to appropriate resources.

4. Ensuring that protocols are in place for handling extremely hazardous substances (EHS's) and that specific standard operating procedures are developed and maintained with instructions for all personnel in the safe use, cleanup and disposal of these substances.
5. Conducting, or designating the conducting of, semiannual inspections of labs and storage areas and provide a written report and recommendations for follow-up activities, as needed. (Inspection Form provided in Appendix B).
6. Coordinating the operation, acquisition, and maintenance of fume hoods, emergency safety showers, and eyewashes, where chemicals are handled.
7. Investigating all reports of lab incidents, chemical spills, and near- misses to prevent repeat occurrences.
8. Acting as a liaison between laboratory operations and the Provost or Vice President's office. Bring unresolved and potentially serious health and safety problems to the Provost or Vice President's attention.
9. Maintaining appropriate training records and making them available to employees and administrative personnel.
10. Completing or designating the task of completing, of an annual computerized inventory of all chemicals in storage rooms. and assisting in the identification of expired and unusable chemicals stored for disposal.
11. Maintaining a collection of references on laboratory safety and hazardous materials including current MSDS for all chemicals.
12. Monitor procurement, use, and disposal of laboratory chemicals;
13. Developing an appropriate implementation program for chemical hygiene, including procedures for complying with each element of the CHP, such as training, information exchange, and record keeping.
14. Provide training to all identified lab employees and other personnel who may come into contact with hazardous chemicals.
15. Coordinating waste pickups with those responsible for waste disposal on campus.
16. Familiarizing oneself with the Campus Wide Waste Management Plan maintained under separate cover.

### **3.3 Faculty and Staff**

Faculty and staff, have the responsibility of implementing applicable Environmental Health & Safety requirements in the laboratory during the



instruction of students at Drew, and must participate in the implementation of this CHP and overall safe lab practice by:

1. Informing and training students and workers on chemical and operational procedure safety as it applies to activities in their areas.
2. Providing students with a copy of the Drew Laboratory Safety Rules and request completion and return of the signed Signature Page at the start of each semester. (See Appendix I)
3. Understanding planned experimental activities and the hazardous chemicals involved, including special personal protective equipment that may be required for those activities.
4. Implementing and enforcing rules and standards concerning health and safety for laboratory, classroom and support facilities.
5. Ensuring student and lab worker compliance with the CHP.
6. Being aware of hazardous properties of chemicals stored and used in the area, and if possible evaluating and limiting an experiment's potential for environmental emissions;
7. Before each lesson, teaching students about hazardous substances used in the lab experiment and ensuring that each student is aware of potential dangers (i.e. identifying safety concerns and developing safety procedures for each experiment).
8. Ensuring that proper protective equipment is available and is in working order, and that individuals in the laboratory have been trained in the proper use of such equipment.
9. Ensuring that all containers of hazardous waste are properly labeled and stored according to the Waste Management Plan.
10. Ensuring that all reagent labels are not defaced or removed.
11. Notifying the CHO and making an incident report immediately if a spill or injury occurs. (Incident Report available in Appendix D)
12. Requesting assistance, if needed, from the CHO.

### **3.4 Student and Lab Workers**

Students and lab workers participate in the implementation of this CHP and overall safe lab practices by:

1. Indicating by signature that they have been notified of the location(s) of the

CHP and understand all safety instructions and are willing to abide by them.

2. Following all health and safety standards, SOP's and rules established in the CHP as communicated by staff and faculty.
3. Reporting all hazardous conditions to the supervising faculty or staff.
4. Wearing and use prescribed personal protective equipment.
5. Reporting any illness or job-related injuries to the supervising faculty or staff. (See Appendix D)
6. Requesting information and training if not sure about proper operational procedures.
7. Monitoring the workplace to identify EH&S concerns.

## **4.0 STANDARD OPERATING PROCEDURES**

Staff and students must follow the CHP to minimize their risk since most laboratory chemicals present some form of potential hazard to human health, the environment and campus safety. Generally, textbooks, laboratory manuals, and other instructional materials designate the safety precautions needed for a particular laboratory activity. However, total reliance on such publications to provide complete and accurate information is not advisable. Employees should consult additional references, including MSDS, before undertaking an unfamiliar activity.

### **4.1 Safety Equipment and Procedures**

Drew shall provide appropriate laboratory safety equipment, such as eyewash stations, emergency showers, fire blankets, fire extinguishers, first aid kits, fume hoods, gloves, respirators, chemical resistant aprons, and face shields. Drew shall provide employees with their own eye protection (e.g., chemical splash goggles or safety glasses). Due to health, safety, and storage concerns, students shall be required to purchase and maintain their own eye protection and laboratory coats. Eye protection should meet the American National Standards Institute (ANSI) Z87.1 requirements. Lab coats shall meet the requirements set forth by Drew.

Safety procedures shall be developed to satisfy parts of this Chemical Hygiene Plan, and their content must be consistent with this document. In particular, the following section, entitled “Standard Work Practices,” will be the primary documentation for how laboratories shall implement the CHP.

### **4.2 Laboratory**

General laboratory SOP’s include the following:

1. Never place food or beverage in storage areas, refrigerators, glassware, or utensils that are also used for lab operations.
2. Do not eat, drink, smoke, chew gum, manipulate contact lenses or apply cosmetics in labs where chemicals or other hazardous materials are present.
3. Minimize exposure to all chemicals regardless of their familiarity.
4. Assume that unknown materials are toxic, and that a mixture is more toxic than its most toxic component.
5. Wash areas of exposed skin well before leaving the lab. Always wash your hands after removing gloves.
6. Confine long hair and loose clothing. Wear shoes in the lab but do not wear sandals, perforated shoes or canvas sneakers. Wear appropriate eye protection at all times.

7. While performing lab work with any hazardous material an appropriate lab coat should be worn. The wearing of short-sleeved T-shirts, short skirts, or shorts is not recommended. Jewelry should not be worn that interferes with gloves, and other protective clothing or that could come into contact with electrical sources or react with chemicals. If short sleeves are worn, a lab coat with long sleeves MUST be worn to cover the exposed arms. Conduct yourself in a responsible manner at all times in the laboratory. This means that horseplay, throwing items, and pranks are prohibited.
8. No one should work alone in the lab or chemical storage area unless others are in the vicinity and are aware that someone is in the laboratory.
9. "Wafting" to test chemical odors should only be done with extreme caution and when only specifically directed to do so in the written experimental procedure. Also, chemicals should never be tasted.
10. Never use your mouth to draw fluid through a pipette. Always use a bulb or other device for suction.
11. Consult a physician if you might be pregnant, or have any medical condition that could render you particularly susceptible to chemical exposure.
12. Do not force glass tubing into rubber stoppers. Lubricate the glass and hold the tubing and stopper with cloth towels as the tubing is inserted into the stopper.
13. Proper Bunsen burner procedures shall be followed. Never leave a flame unattended.
14. Should a fire drill or any other evacuation occur during a lab activity, turn off all Bunsen burners and non-essential electrical equipment. Leave the room as directed.
15. Hot glass looks like cold glass and remains hot for a long time. Determine if an object is hot by bringing your hand close to the object but do not touch the object.
16. In the event of glassware breakage, protection for the hands should be worn when picking up the broken pieces. Small pieces should be swept up with a brush and pan. Broken glass contaminated with hazardous chemicals must be treated as hazardous waste.
17. Minimize the quantities of flammable liquids available in a laboratory to that needed in one day.
18. Ensure that sources of ignition are not close or nearby when working with flammable materials.

19. Use a tip-resistant shield for protection in case an explosion or implosion occurs.
20. Students must read lab directions ahead of time and follow all verbal and written instructions.
21. Students shall perform only authorized experiments.
22. Students shall report all accidents, including spills, or injuries to the instructor at once, no matter how trivial it may seem. The student must go to the nurse for the treatment of cuts, burns, accidental ingestion of chemicals, or inhalation of fumes.
23. Students shall work in a laboratory or chemical storage area only under the direct supervision of a science teacher or laboratory supervisor.
24. Students should dispose of hazardous waste and empty containers in accordance with the Campus Waste Management Plan.
25. Students should ask for assistance from faculty or staff whenever one is unsure regarding the safe handling or disposal of chemicals and waste.

#### **4.3 Housekeeping Practices**

General housekeeping practices to be followed in the laboratories and stock rooms including the following:

1. Keep all work areas clean, dry and uncluttered. Bench tops should be wiped down at the end of every laboratory session.
2. Access to emergency equipment, utility controls, showers, eyewash stations, and lab exits should never be blocked.
3. Sinks are to be used only for disposal of water and those solutions designated by the instructor. All other wastes must be deposited in the appropriate, segregated and labeled receptacles and follow the disposal procedures outlined in the Campus Waste Management Plan.
4. Minimize the release of toxic vapors into the lab by using fume hoods.
5. Clean up all chemical spills as soon as they occur. Chemicals and cleanup materials should be disposed of correctly.
6. Store chemicals and equipment properly. Chemicals should not be stored in aisles, on the floor, in stairwells, on desks, or laboratory tables.
7. Before leaving the laboratory, turn off services (gas, electricity, water) to the extent permitted by existing equipment.

8. Keep all cabinets and drawers closed when not in use to avoid catching and bumping hazards.
9. Bring only your lab instructions, calculators, and writing instruments to the laboratory area.
10. Leave backpacks and other books in the appropriate storage areas in the laboratory.

#### **4.4 Chemical Procurement and Purchasing**

General chemical procurement and purchasing procedures consist of the following:

1. Drew has established a centralized biology, chemistry and physics stockroom where chemicals are procured, received, inventoried, and distributed to individual labs.
2. All laboratory chemical purchases will be made through a central office to facilitate coordination of inventory and purchase approval. The CHO may disallow the purchase of a chemical in consultation with the Drew safety committee.
3. Donated chemicals should not be accepted unless prior permission is received from the CHO.
4. Efforts must be made to purchase chemicals in smallest appropriate containers. The lesser unit cost for bulk purchases are outweighed by the cost of additional storage and disposal of old, unused materials.
5. Check chemical purchases against inventory to reduce duplicate purchases and stock build-up.
6. Before an extremely hazardous chemical is ordered, such as carcinogens, reproductive hazards, and acutely toxic substances, consideration must be given to the adequacy of facilities and equipment to safely handle its type and quantity. Consideration must also be given to whether a less hazardous material may be substituted. Refer to Section 10.0 "Particularly Hazardous Substances" to determine if prior approval is needed to order any chemical or material
7. All purchase orders must include a request that MSDS be sent to the CHO and a copy to each department. It will be up to each department to determine how best to distribute MSDS so employees have access to them during working hours. How distribution is done shall be communicated to the CHO.

## 4.5 Chemical Inventory

An inventory of hazardous and potential hazardous laboratory reagents has been completed for all laboratories on-campus. It focused on the chemical stock rooms where bulk chemicals are stored. It also included each individual laboratory where some bulk chemicals are stored as well as those chemicals used during the academic year. The inventory is to be updated annually and expanded to include the following information:

- Chemical name and Chemical Abstract Service (CAS) registry number;
- Chemical supplier;
- Department, Building, and Room number (if appropriate);
- Hazardous constituents with chemical (or chemical itself);
- Does the chemical have a Reportable Quantity (yes/no) and amount;
- Is the chemical an Extremely Hazardous Substance (yes / no);
- Hazard warning code (e.g. acute health hazard (highly toxic, irritant, corrosive, sensitizer), delayed health hazard (carcinogens), fire hazard (flammable, combustible, air-reactive, oxidizer, pressure hazard (explosive, compressed gas), reactive (unstable reactive, organic peroxide, water reactive));
- Date received;
- Expiration date (if applicable);
- Quantity on hand;
- Physical condition and integrity of the container when inventoried (optional).

Chemicals whose storage limits have expired or containers or labels are in poor condition or missing must be marked for disposal and placed in the inventory until their ultimate disposal.

## 4.6 Chemical Receiving

General chemical receiving procedures include the following:

1. All incoming shipments must be inspected by the Receiving Dept. or trained designee and should be refused if the MSDS is missing, proper labels are not attached, or containers are not intact and not in good condition.
2. If leaking containers are found, the containers must immediately be placed in an appropriate secondary container.
3. Chemicals should arrive with expiration dates assigned. If there is no date,

under no circumstances should the expiration date be later than one year after the date of acquisition.

4. All areas where shipments of chemicals are received will have appropriate personal protective equipment (PPE) and spill-control materials available. Each chemical receiving area should have an appropriate fire extinguisher. There should be a safety shower and eyewash station within the area.
5. Labels on incoming containers shall not be removed or defaced. While there is no regulatory requirement for labeling secondary containers, prudent laboratory techniques make this a desirable practice.

#### **4.7 Chemical Storage and Distribution**

The primary storage concerns with all chemical materials are to minimize the amounts stored, to avoid contact between incompatible chemicals, and to ensure that hazardous storage conditions (e.g., light and heat) are not present. Specific storage procedures, however, will depend on the type of storage equipment available and the chemicals in use. Some standard storage practices are described below.

1. All chemicals should be in tightly closed, sturdy, and appropriate containers. Periodically check the container, label integrity, and the shelf life of chemicals in storage. If deficient, these containers shall be correctly labeled before removing from storage areas.
2. If the chemical has been transferred to a secondary container, the new container should be appropriately labeled, including all of the hazard information. (See Appendix E for Secondary Labeling Template)
3. Do not store incompatible materials in the same cabinet. Corrosives, flammables, oxidizers, and poisons are mutually exclusive categories. When a substance has multiple hazards, preference shall be given to the most acute or reactive property. Chemicals should be stored based on the reactive nature and compatibility group of the chemical. (Refer to Chemical Compatibility Chart Appendix F)
4. Large containers and containers with reactive chemicals, such as acids and bases, should be on low shelves.
5. The classification system used for the storage of chemicals should be displayed in the principal storage area.
6. Do not overload storage cabinets according to the manufacturers recommended storage limits.



7. Flammable chemicals shall be stored in approved storage containers and in approved flammable chemical storage cabinets.
8. Combustible packaging material (i.e. cardboard) should not be stored inside flammable chemical storage cabinets.
9. All storage areas should be securely locked when not in use. Storage and preparation areas should be accessible only to those persons authorized to use the chemicals.
10. Glass bottles containing highly flammable liquids shall not exceed 1 gallon. For larger volumes, metal or approved plastic may not exceed 5 gallons, and safety cans shall not exceed 5 gallons.
11. Refrigerators used to store flammable chemicals shall be labeled and shall be of explosion proof or of lab safe design. Household refrigerators are not to be used.
12. Do not store food with hazardous materials in the same refrigerator. Label refrigerators used for chemical storage.
13. Hand-carried chemicals should be placed in an outside container or acid-carrying bucket to protect against breakage.
14. Wheeled carts used to transport chemicals should be stable and move smoothly over uneven surfaces without tipping or stopping suddenly, and should have lipped surfaces that would restrict the containers if the containers break. If lipped surface is not provided on the cart, chemicals should be placed in an outside container or acid carrying bucket to protect against breakage.
15. Purchase and store only the amount of materials needed for the near future (e.g., a semester).
16. Ventilate storage areas and individual storage cabinets as needed to limit exposure of individuals in the building.
17. Install and maintain smoke detectors in chemical stockrooms and storage areas.
18. Install and maintain automatic locks and self-closures on the outside perimeter of the doors leading into chemical storage rooms.

#### **4.8 Gas Cylinders**

Compressed gases present a unique danger since individuals are exposed to both mechanical and chemical hazards. Hazards can arise from reactivity and toxicity of a gas, and asphyxiation can be caused by high concentrations of even

“harmless” gases such as nitrogen. The large amount of potential energy resulting from compression of the gas makes a gas cylinder a potential rocket or fragmentation bomb. Therefore, the following procedures must be followed when handling compressed gases.

1. The contents of a gas cylinder should be clearly identified with decals, stencils, or appropriate tags. A cylinder lacking proper identification should not be accepted from a vendor.
2. The hazardous properties of each gas should be determined before the gas is put to use. The flammability, toxicity, chemical activity, and corrosive effects of the gas should be considered, and the user should take adequate safety precautions at all times.
3. Gas cylinders should not be dragged, rolled, or slid. A suitable handcart should be used for transporting cylinders. The handcart should be equipped with a belt or chain for securing the cylinder.
4. Under no circumstances should any individual ride in a passenger elevator with a gas cylinder. The cylinder should be secured in the elevator and sent to the desired floor without any passengers. As a precaution, a sign should accompany the gas cylinder indicating that passengers should not enter the elevator.
5. Gas cylinders should only be moved from one location to another with the protective cap securely in place.
6. Both full and empty cylinders should only be stored where they may be securely restrained by straps, chains, or a suitable stand.
7. The protective valve cap should be kept on a cylinder at all time, except when the cylinder is connected to dispensing equipment.
8. Cylinders should be protected from abuses such as exposure to damp ground, direct sunlight, extreme temperature changes, precipitation, direct flames, electrical currents, corrosives, and physical damage.
9. Gas cylinders should only be used with the appropriate dispensing equipment. Do not force connections or use homemade adapters. Standards for design, installation, and maintenance of dispensing equipment are determined by the American National Standards Institute (ANSI).
10. The size of the individual gas cylinders and the total number of cylinder present in a laboratory should be limited to the amount needed for immediate use (e.g., a semester).

11. A cylinder should be considered empty when there is still a slight positive pressure.
12. An empty cylinder should be returned to the supplier as soon as possible after having been emptied or when it is no longer needed.
13. Cylinders should not be exposed to temperatures above 50 °C.
14. Store flammable gases separately from oxidizer gases.

#### **4.9 Waste Disposal**

Drew shall ensure that the disposal of laboratory chemicals is in compliance with the procedures outlined in the Campus Wide Waste Management Plan available from the CHO. To protect the environment, safety, and health of individuals at Drew and in the surrounding community, hazardous waste must be disposed of properly. Therefore, all laboratory personnel who generate or handle hazardous, radioactive, regulated medical or mixed waste should be adequately trained. The following disposal requirements must be enforced.

1. Do not pour hazardous or radioactive chemicals down a sanitary sewer. Retention system drains may be used only when specifically approved for such chemicals.
2. Place wastes in properly designated containers for disposal. All hazardous waste must be removed from laboratories regularly by a licensed hazardous waste disposal service.
3. Before leaving the laboratory, ensure that chemicals and wastes generated are properly labeled, prepared for disposal, and/or assigned to someone who understands how to manage such materials.

#### **4.10 Chemical Spills**

Call Campus Public Safety (**Emergency X4444; Non-Emergency X3379**) if the following occurs:

- An accident or spill involving hazardous materials results in a serious injury.
  - Hazardous material is released into the sewer system.
  - The severity of an incident is unclear.
1. If the chemical involved in the spill is judged to present an immediate hazard, evacuation is to be absolute, and the area should be isolated until a HAZMAT team arrives. These instances would occur if:

- If hazardous vapors are present, the area should be isolated. Only persons trained in the use of respirators may enter the area. This will frequently mean waiting for the arrival of a HAZMAT team.
  - Hazardous material cannot be neutralized or contained safely by the personnel on hand.
  - A fire is involved with any chemical spill or accident.
  - Individuals are unfamiliar with the hazards of the spilled material.
2. If a volatile, flammable material is spilled, immediately extinguish flames, turn off all electrical apparatus, and evacuate the area. Consult the MSDS for appropriate cleanup procedures. If the quantity exceeds the employee's ability or training to handle the spill, seal the area until appropriately trained personnel arrive.
  3. If there is no immediate danger (flammability, toxicity, reactivity, corrosivity) to personnel, containment should be accomplished by use of spill pillows, towels, rolls, or other devices that will keep the spill from spreading.
  4. If there is no immediate danger, cleanup procedures listed on the MSDS should be followed. Appropriate personal protective equipment shall be used and waste disposal procedures followed.
  5. A spill kit is accessible for each laboratory, being available in the central stockroom. The kit should include at least:
    - Spill control pillows
    - Inert absorbents such as vermiculite, clay, sand, or kitty litter
    - Neutralizing agents for acid spills such as sodium carbonate and sodium hydrogen carbonate
    - Neutralizing agents for alkali spills such as sodium hydrogen sulfate and citric acid
    - Quantities of cleanup materials sufficient for the largest anticipated spill.
    - Large plastic scoops and other equipment such as brooms, pails, bags, and dustpans.
    - Appropriate personal protective equipment
  6. If the spill material was a hazardous chemical, all of the materials involved in the cleanup will usually be considered to be hazardous waste and must be disposed of as such.
  7. Individuals exposed to hazardous chemicals should respond immediately.

- In the case of eye exposure, flush eyes promptly with water for 15 minutes and seek medical evaluation.
  - In the case of skin contact, flush the affected area promptly with water and remove any contaminated clothing. See medical evaluation as necessary.
  - In the case of inhalation, isolate the individual from the fumes and seek medical evaluation.
8. A copy of all appropriate MSDSs should accompany anyone sent for medical evaluation because of injury and potential exposure to hazardous materials. In the event of any spill (in any quantity), an Incident Report (Appendix D) should be completed and returned to the CHO.

#### **4.11 Emissions to the Environment**

Chemical users at Drew shall review all new and ongoing laboratory operations to determine if the potential exists for the emission of hazardous materials into the environment. If emissions into the environment are possible, the individual must:

1. Consult with the Chemical Hygiene Officer to determine the appropriate controls needed to limit the amount of environmental emission.
2. Contact the Vice President of Finance and Operations to obtain any required licensing, permits, or approval from local, state, and federal agencies.

## 5.0 CONTROL MEASURES

### 5.1 Reduce Exposure to Hazardous Chemicals

The purpose of this section is to provide the framework for selecting control measures to minimize the risk of chemical hazards. Given the enormous variety of hazardous materials and potential operations, Drew has adopted the following guidelines.

Chemical hazards are reduced through various control measures that work in unison to minimize exposure. These measures include the following (in order of preference):

1. *Chemical Substitution* – Such as using a less hazardous compound.
2. *Engineering Controls* - Such as fume hoods, designated areas, security devices, and facility design.
3. *Administrative Controls* - Such as written safety procedures, training, limited access, and medical surveillance.
4. *Personal Protective Equipment* - Such as respirators, gloves, face shields, and chemical resistant clothing.
5. *Work Practices* - Such as personal hygiene and laboratory technique.

#### Selection of Controls

After preparing a chemical hazard analysis, a combination of controls may be used based on:

1. The inherent toxic and physical properties of the materials and their intended use.
2. The possibility of unplanned outcomes, spills and accidents.
3. Possible exposure routes (inhalation, skin contact, eye contact, or ingestion).
4. Skills, training, and prior experience of the chemical user.

Selection of the final control measures must be made in consultation with the Chemical Hygiene Officer, Coordinator of Safety Programs, and the Student and Employee Safety Teams (if applicable). Consultation is especially needed for new operations and any operations involving particularly hazardous substances.

### 5.2 Personal Protective Equipment

The following Personal Protective Equipment (PPE) should be considered as control measures for use within the laboratories to control safety hazards.

1. It is the responsibility of Drew to provide appropriate safety and emergency equipment for employees and students that is compatible with the required degree of protection for the substances being handled.
2. Where necessary, procedures should be prepared on the use of eye, skin, body protection, respirators, and/or other protective gear.
3. Individuals must wear eye protection when visiting or working in areas where hazardous chemicals are handled. All eye protection devices should conform to ANSI Standard Z87.1-1989. Eyeglasses, even with side shields, are not acceptable protection against chemical splashes.
4. Safety glasses with side shield should be used as the standard protective eyewear.
5. Contact lenses are permitted in the laboratory by students if they are wearing appropriate eye protection on top of the contact lenses and at the discretion of the instructor.
6. Full-face shields protect the face and throat. They must be worn for protection when there is a greater risk of injury from flying particles and harmful chemical splashes. A full-face shield should also be worn when an operation involves a pressurized system that may explode or an evacuated system that may implode. For full protection, safety glasses must be worn with the face shield.
7. Standing shields should be used when there is a potential for explosions, implosions, or splashes, or when corrosive liquids are used. Goggles should be worn whenever using a standing shield.
8. A standing shield should be used for group protection from chemical splash and impact. The standing safety shield should be used with safety goggles and, if appropriate, with a face shield.
9. When working with or near hazardous chemicals or materials, lab occupants must wear an appropriate laboratory coat. Lab coats or aprons, when worn in the laboratory, should offer protection from splashes and spills, and should be easy to remove in case of an accident, and should be fire resistant.
10. When gloves are required, it should be remembered that no one kind of glove is suitable for all situations. The MSDS should be consulted for information regarding the proper type of gloves to be used.
11. Gloves must be worn during transfer of chemicals from one container to another or during the transfer of chemical waste. Gloves are available in all prep rooms and in each individual lab. Gloves should be inspected before

use to ensure that there are no holes, blisters, and cracking or other ways for the chemical to pass through the glove onto the hand and should be replaced periodically or when damaged or punctured.

12. If necessary, individuals shall be trained in the proper use of respirators and shall wear them whenever exposure by inhalation is likely to exceed OSHA or ACGIH limits.
13. Carefully inspect all protective equipment before using. Do not use defective protective equipment. The choice of protective clothing depends on the degree of protection required and shall be set by the CHO.

### **5.3 Hazard Identification and Labels**

The following SOP's will be followed for hazard identification and labels.

1. Laboratory chemicals should be properly labeled to identify any hazards associated with them.
2. Chemicals stored in original bottles, must have the manufacturer's original label identifying potential hazards, and the date of purchase, the date opened, and the initials of the person who opened the container.
3. Chemicals transferred to a secondary container, must be appropriately labeled with the chemical name, formula, concentration (if in solution), solvent (if in solution), hazard warnings, and name or initials of the person responsible for the transfer. (Appendix E)
4. Unlabeled bottles of unknown contents should not be opened, and such materials should be disposed of as discussed in the Hazardous Waste Management Plan.

### **5.4 Signs and Posters**

The following SOP's will be followed for signs and posters.

1. All lab employees must be alerted to hazards in an area they enter. The employer shall post a sign at the location where notices are normally posted to inform employees that they have the right to information regarding toxic substances found in the workplace.
2. Signs shall be used to indicate the location of exits, evacuation routes, safety showers, eyewash stations, fire extinguishers, fire blankets, first aid kits, fume hoods, and other safety equipment.



3. Telephone numbers of emergency personnel such as: Drew Public Safety, and Facilities Department must be posted next to the phone in each lab, storeroom/stockroom, and storage area.
4. Flammable storage cabinets and refrigerators must be labeled according to local fire regulations. Emergency telephone numbers shall be posted in all laboratory areas.

### **5.5 Material Safety Data Sheets (MSDS)**

The following SOP's will be followed for the use and retention of MSDS.

1. Each MSDS received should be maintained and made readily available by the Department ordering the materials to laboratory employees and to students.
2. The MSDS for each chemical usually gives guidelines to exposure limits. Typical limits are expressed as threshold limit values (TLVs), permissible exposure limits (PELs), or action levels. Such limits along with any other information about the hazardous characteristics of the chemical, should be used to set laboratory guidelines. These laboratory guidelines may be used in determining the safety precautions, control measures, and personal protective equipment that apply when working with the toxic chemical.

### **5.6 Records Retention**

The following records are to be maintained by the individual areas ordering chemicals:

- An annual inventory of all chemicals and chemical usage
- Employee training
- Incident reports
- Air monitoring data, exposure assessments, MSDS

### **5.7 Exposure Monitoring**

The following SOP's will be followed for exposure monitoring.

1. If there is reason to believe that exposure levels for a regulated substances have exceeded the action level or permissible exposure limit, the CHO should ensure that the employee or student exposure to that substances is measured.
2. Factors which may raise the possibility of overexposure and therefore warrant an initial measurement of employee or student exposure include:

- The manner in which the chemical procedures or operations involving the particular substances are conducted.
  - The existence of historical monitoring data that shows elevated exposures to the particular substances for similar operations.
  - The use of a procedure that involves significant quantities or is performed over an extended period of time.
  - There is reason to believe that an exposure limit may be exceeded.
  - Signs or symptoms of exposure (e.g., skin or eye irritation, shortness of breath, nausea, or headache), which are experienced by employees or students. (Some of these symptoms are very general and can be due to many other causes including emotional stress or hysteria.)
3. If the substance in question does not have an exposure monitoring or a medical surveillance requirement, exposure monitoring and medical surveillance shall be continued until exposure levels are determined to be below the action level or 50% of the PEL. In the absence of PELs, the American Conference of Governmental Industrial Hygienists (ACGIH) TLVs should be referenced.
  4. If a substance has an exposure-monitoring requirement and if there is reason to believe that exposure levels for that substance routinely exceed the action level or in the absence of the action level, the PEL, the employer shall measure the employee or student exposure to the substance.
  5. If the initial monitoring (described in above) discloses employee exposure over the action level or in the absence of an action level, the PEL, Drew shall immediately comply with the exposure monitoring provisions of the relevant standard for that substance.
  6. Drew shall, within 15 working days after the receipt of any monitoring results notify the employee or student of these results in writing either individually or by posting the results in an appropriate location that is accessible to employees.
  7. The following substances are regulated by OSHA standards and require personal exposure monitoring to determine if personnel exposures have been exceeded in the working environment of the laboratories:
    - lead,
    - benzene,
    - 1,2-dibromo-3-chloropropane,
    - acrylonitrile,
    - ethylene oxide,

- formaldehyde,
- asbestos,
- vinyl chloride, and
- inorganic arsenic.

## **6.0 SAFETY/EMERGENCY FACILITIES AND EQUIPMENT**

### **6.1 Reporting Lab Incidents and Unsafe Conditions**

The following SOP's will be followed for reporting lab incidents and unsafe conditions.

1. Report all lab incidents, no matter how minor, to your supervisor, Public Safety and HR, Incident report forms are available from the Public Safety/HR. Unusual or unexplainable chemical reactions should be discussed with others in the department, to caution others as to the risk of the procedure. Personal reactions to chemicals that are not identified on the MSDS should be reported to the EPA, with the advice of legal counsel, under the TSCA Section 8 regulations.
2. Report any unsafe conditions by contacting the faculty/staff of the area who in return should file a written report with the CHO so that the condition may be corrected. Unsafe conditions that must be reported include:
  - Nonfunctioning hoods in the science area
  - Unsafe storage conditions
  - Blocked emergency exits
  - Improperly charged fire extinguishers
  - Eyewash stations or safety showers that do not work
  - Absence of personal protective equipment

A template for reporting a safety concern is available in Appendix G.

### **6.2 Proper Equipment Use**

The following SOP's will be followed for proper safety equipment use.

1. Use equipment only for its intended purpose.
2. Inspect equipment or lab apparatus for damage before use. Never use damaged equipment such as cracked glassware or equipment with frayed electrical wiring.
3. Consult user manual prior to using equipment for the first time.
4. Airflow through fume hood should be calibrated annually.

### 6.3 Emergency Equipment

The following SOP's will be followed for the availability and use of emergency equipment

1. Emergency equipment items that should be available include: eyewash station, fire extinguisher of the appropriate type, safety shower, telephone for emergencies, fire blanket, and identification signs.
2. Each laboratory should have a standard first aid kit accessible, via storage in the central stockroom.
3. Safety equipment will be tagged following an inspection, showing the date, inspector, and results.
4. Laboratories in which hazardous substances are being used should have spill control kits accessible, yet tailored to deal with the potential risk associated with the materials being used. If there is no immediate danger to employees or students, containment should be accomplished by spill pillows, towels, rolls, inert absorbents, neutralizing agents, or other devices.
5. The path to emergency equipment should remain clear at all times.

### 6.4 Fume Hoods

Specific measure shall be taken to ensure proper installation and adequate performance of fume hoods and other safety equipment, including alarm systems. Drew has adopted guidelines from:

- “Prudent Practices in the Laboratory: Handling and Disposal of Chemicals,” published in 1995 by the National Research Council. (Available from National Academy Press, 2101 Constitution Avenue, N.W., Washington, D.C. 20418)
- “CRC Handbook of Laboratory Safety, 5<sup>th</sup> Edition,” published in 2000 by A. Keith Furr. (Available from CRC Press, 2000 N.W. Corporate Boulevard, Boca Raton, Florida 33431.)

Consult with the Chemical Hygiene Officer before making changes to existing systems and/or to obtain the criteria for unique experimental setups.

The Chemical Hygiene Officer shall conduct regular performance checks on all fume hoods and safety equipment used for hazardous materials. Before working with hazardous material, however, the user should always verify that the fume hood and/or equipment is operating properly. Users noting a deficiency in a fume hood or with safety equipment should immediately notify the Chemical Hygiene Officer. A fume hood or piece of equipment that is not operating as intended

shall not be used for hazardous procedures. To ensure safety, fume hoods used for hazardous materials (e.g., toxic, radioactive, and /or flammable substances) all new fume hoods must have continuous monitoring devices to alert users to their less-than-adequate performance.

1. The American National Standards Institute (ANSI) and the American Industrial Hygiene Associate (AIHA) standard Z9.5-2003 on “Laboratory Ventilation” recommends that a laboratory fume hood be vented at a range of 60-150 feet per minute at the normal operating height. This minimum flow should be checked annually.
2. Hoods are to used for the following:
  - When the chemical is a known or suspected carcinogen, reproductive hazard, sensitizer, or toxic chemical.
  - When handling large quantities of chemicals (more than 500 milliliters of liquid or more than 30 grams of a solid)
  - When handling flammable and reactive substances
  - When mixing acid dilutions
  - When handling a substance that is fine and may create a dust
3. Check fume hoods before use to ensure adequate functioning. File a safety concern requesting hood maintenance if there is a problem and contact the CHO or appropriate faculty/staff immediately. Report all improperly functioning fume hoods to the CHO by way of completing a safety concern form (Appendix G).
4. Hoods should be closed when not in use. If chemicals remain in the hood after use, they should be placed in the rear of the hood and the fan left on.
5. Keep equipment and bottles in use, at least 6 inches from the front of the hood.
6. Connect electrical equipment to outlets outside the hood when possible.
7. Wash the work platform often to maintain a clean, dry surface.
8. Do not use the hoods for a storage area. Once the lab has finished running, remove all bottles to their correct storage areas.

## **6.5 Ventilation**

General laboratory ventilation should not be relied on for protection from exposure to hazardous chemicals. A rate of 4 - 12 room air exchanges per hour should be the accepted standard when local exhaust systems, such as hoods, are

used as the primary method of control. Exhaust from the fume hoods should be vented directly to the outside.

## **6.6 Flammable Storage**

The following SOP's will be followed for the storage of flammable materials.

1. Chemicals with a flash point below 93.3 ° C (200 ° F) or any chemical with a MSDS label indicating "Flammable" is considered a "fire hazard chemical".
2. Fire hazard chemicals in excess of 500 mL should be stored in safety cans or in storage cabinets designed for flammable materials.
3. When transferring significant quantities of flammable liquids from one container to another, it is particularly important that they be properly grounded to prevent accidental ignition of flammable vapors and liquids from static electricity or other sources of ignition.

## **6.7 Electrical**

The following SOP's will be followed for electrical outlets and circuits.

1. All electrical outlets should have a grounding connection accommodating a three-prong plug.
2. All laboratories should have circuit breakers readily accessible. Employees should know how to cut-off electricity to the laboratory in case of emergency.
3. Ground-fault circuit interrupters are required by code to protect users from electrical shock, particularly if an electrical device is hand held during a laboratory operation.

## 7.0 TRAINING

The primary goals of the environmental, safety, and health (ES&H) policies of Drew are to protect individuals from harm, prevent property damage, and limit environmental impact. The OSHA Laboratory Standard stipulates that individuals must be provided with specific information about the chemical hazards in their work area and trained on how to handle such chemicals. Thus, chemical users shall receive the required training that will enable them to take every reasonable precaution in the performance of their work. The training must be conducted and documented in accordance with this Chemical Hygiene Plan and OSHA requirements.

Training can be accomplished through formal courses, informal instruction, and/or on-the-job training. All training, however, must be documented. The frequency for refresher training is not stipulated in the OSHA regulation. Therefore, Drew encourages evaluation of the need for such training on a case-by-case basis.

### 7.1 Required Information

Individuals working in laboratories at Drew shall be provided with the following information:

1. Employees shall be informed of the location of hazardous chemicals in the work area at the time of initial assignment, and before each new assignment, that involves chemicals to which an individual may be exposed.
2. Employees shall be informed of the content of the "Laboratory Standard," 29 CFR Part 1910. Employees shall also be informed of the location and availability of the CHP.
3. Employees shall be informed of the permissible exposure limits (PEL's) or Threshold Limit Values (TLV's) for OSHA regulated substances on site or recommended exposure limits for other hazardous chemicals on site where there is no applicable OSHA standard.
4. Employees shall be informed of the location and availability of known standard reference material on the hazards, safe handling, storage and disposal of hazardous chemicals where there is no applicable OSHA standard.
5. Employees shall be informed of the location of MSDS.
6. Employees shall be informed of the location of personal protective equipment and of emergency equipment as outlined in the CHP.
7. Employees shall be informed of the signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.



## 7.2 Employee Training

Employees will be provided with information and training to ensure that they are apprised of the hazards of chemicals present in their work area, the proper procedures to minimize risk of exposure; and the proper response to accidents.

These orientation and training sessions will cover the following:

- Contents of the Laboratory Standard and its appendices and how Drew has responded to meet its responsibilities, location and availability of the CHP, MSDS, and resources on lab employee health and safety.
- How to read an MSDS and understand the content
- Physical and health hazards of chemical classes
- Signs and symptoms of exposure
- Use of fume hoods and PPE
- Special operating procedures to be used for extremely hazardous chemicals
- How to conduct a laboratory inspection
- Protocol for dealing with permissible exposure limits and other recommended limits
- How to file incident reports and safety concerns by using the appropriate forms.
- Methods and observations used to determine the presence or release of a hazardous chemical, such as periodic monitoring devices, continuous monitoring devices, and the visual appearance or odor of hazardous chemicals being used.
- Control measures to protect individuals from chemical hazards. These include appropriate engineering and administrative controls, personal protective equipment, work practices, and emergency procedures.
- Physical and health hazards in the work area, including flammable and reactive materials, irritants and corrosives, acute poisons, chronic organic toxins, allergens, and genetic toxins.
- Proper labeling, storage, and waste disposal practices.
- Applicable details of this Chemical Hygiene Plan.

Employees should be trained on the potential chemical hazards in the employees' work areas and on appropriate sections of the CHP. This training should be provided to all employees who actually work in the laboratory as well as to other employees whose assignments may require that they enter a laboratory where exposure to hazardous chemicals might occur.

The training an employee receives should be determined by the nature of the work assignment in the laboratory.

### **7.3 Student Training**

Students should receive the following training at a minimum.

1. Instruction in laboratory safety shall be provided to all students involved in laboratory activities.
2. The extent of student training should be based on the CHP, and the level of chemical handling and potential exposure to hazardous chemicals.
3. Safety training should include the importance and the content of the label and of MSDS.
4. At the beginning of the school year and prior to laboratory activities, class time shall be devoted to safe laboratory practices and to the student safety agreement available in Appendix I.

## 8.0 HAZARD EVALUATION

Drew prohibits employees/students from accepting used equipment, chemicals, or biological specimens donated by other universities, institutions, or private companies without prior authorization from the administration. While transfer of such items may have been a routine practice at one time, the expense, space limitations, special storage requirements, liability, and/or regulatory restrictions no longer justify this practice. Exemptions to this policy shall require the written approval of the Chemical Hygiene Officer, Chairperson of the department receiving the donations, and the Associate Dean of the School of Sciences.

Drew prohibits the use, possession, synthesis, or administration of prescribed medications and controlled substances in the laboratory. Exemptions to this policy will be granted only if:

1. A detailed protocol is submitted to the Provost or Vice-President of Finance and Operations setting forth the nature of the proposed experiments, the qualifications of the employees/students who will engage in the experiments, the proposed quantity of each prescribed medication and/or controlled substance involved, and the measures necessary to provide for security and proper record keeping.
2. The Provost or Vice-President of Finance and Operations, in consultation with Drew General Counsel and Chemical Hygiene Officer approves the detailed protocol.
3. Appropriate licensure, permits, and/or approval are secured under the New Jersey Legend and Controlled Substance Research Act.
4. Appropriate licensure, permits, and/or approval are secured from the Federal Food and Drug Administration (FFDA).
5. Appropriate licensure, permits, and/or approval are secured from the Drug Enforcement Administration (DEA).

Additional hazard evaluations will be made for the following.

1. Prior approval should be obtained from the Dept. Chair CHO whenever a new laboratory experiment or test is to be carried out. This prior approval should also be sought for experiments that have not been performed recently or for which the potential for harm is present. The potential for harm may be affected by a change in the amounts of materials being used, the conditions under which the experiment is to be conducted, or the substitution, deletion, or addition of a chemical. The decision to use a chemical which meets the criteria of a “particularly hazardous substance” within a laboratory will be based on the best available knowledge of each chemical’s particular hazard and the availability of proper handling facilities and equipment. The circumstances of which will require prior approval from the Laboratory Safety

Committee , CHO or administration of Drew before it can be implemented. Substitutions, either of chemicals, demonstrations, or experiments, will be made where appropriate to reduce hazards without sacrificing instructional objectives. See Section 10. "Particularly Hazardous Substances"

1. Prior approval before doing any procedure should be obtained where one or more of the following conditions exist:
  - Potential for a rapid rise in temperature.
  - Potential for a rapid increase in pressure.
  - Use of a flammable solvent.
  - Potential for a chemical explosion.
  - Potential for spontaneous combustion.
  - Potential for the emission of toxic gasses that could produce concentrations in the air that exceed toxic limits.
  - Change in a procedure, even if the change is quite small.
  - Involves the use of a Particularly Hazardous Substances.
2. Approval will be initiated by use of the Prior Approval Form for Use of Particularly Hazardous Substance, available in Appendix H.
3. Chemicals should not be distributed to other persons or to other areas of the school without the prior approval of the CHO. Chemicals should not be transferred to another location without the simultaneous transfer of a copy of the appropriate MSDS, nor should they be transferred without the person receiving the chemicals having had an appropriate training in their use, storage, and disposal.
4. Students shall only work in a laboratory or chemical storage area under the direct supervision of a faculty/staff member.

## 9.0 MEDICAL CONSULTATION AND EXAMINATION

All injuries or chemical exposures in the laboratory should be reported immediately to Campus Security and the CHO. Medical attention following an injury or exposure to chemicals in the laboratory should be sought. Consultation, examination, and treatment by licensed physicians and nurse practitioners are available to all employees/students of Drew. In the event of a known acute exposure, referral should be prompt to ensure that appropriate decontamination and medical care are provided in a timely manner.

1. Drew staff working with hazardous chemicals shall receive medical care consistent with established worker's compensation procedures under the direction of the college nurse whenever:
  - An employee develops signs and symptoms of exposure associated with chemicals he/she is using, or may be in contact with OSHA regulated substances measured above "actual" permissible exposure limits.
  - An employee is present at a chemical spill, leak, explosion, or other situation that exposes him/her to a hazardous chemical.
  - An event such as a cut, puncture, spill, leak, or explosion results in exposure to a hazardous material.
2. The college will provide the examining physician with:
  - The generic and trade names of all hazardous chemicals and chemical compounds to which the employee may have been exposed.
  - MSDS and any other relevant data.
  - Conditions under which the exposure occurred.
  - Signs or symptoms of exposure experienced by the employee during, soon after, and within 72 hours after the incident.
  - The results of the investigation of the incident, including witness interviews.
  - Any monitoring or test results.
3. The college nurse, on behalf of the college and the employee, shall obtain a written opinion from the examining physician. The written opinion should include:
  - Recommendation for medical follow-up.
  - The results of all medical examinations.
  - Any medical condition the employee has that places him/her at risk as a result of future exposure to hazardous chemicals.
  - A statement confirming the employee was advised of the risks.

- The opinion must not reveal specific findings of diagnoses unrelated to occupational exposure if such limitation is within the control of the Drew.
4. Medical attention includes:
- Medical history and examination.
  - Specific treatment as necessary.
  - Laboratory tests if required.
  - Follow-up examinations, treatments, and laboratory tests as needed.

## 10.0 PARTICULARLY HAZARDOUS SUBSTANCES

Special consideration shall be given to protecting employees/students from particularly hazardous chemicals. For the purposes of this Chemical Hygiene Plan, these include designated carcinogens, reproductive hazards, allergens, extremely flammable substances, highly reactive, and acutely toxic materials.

When particularly hazardous substances are used in laboratories at Drew, the specific control measures below shall be implemented for additional protection. The Chemical Hygiene Officer shall be consulted for identification of particularly hazardous substances and for guidance on selecting controls. The form in Appendix H (Prior Approval Form for Use of Particularly Hazardous Substance) should be completed and reviewed by the Lab Safety Committee and or the CHO.

1. Establish “designated areas” (see definitions). The chemical user and/or Chemical Hygiene Officer shall ensure that the appropriate warning signs are posted in these areas.
2. Use containment devices (e.g., fume hoods or glove boxes) when:
  - a. Volatilizing substances.
  - b. Manipulating substances that may generate aerosols.
  - c. Using laboratory procedures that may result in an uncontrolled releases of the substance.
3. Use high-efficiency particulate air (HEPA) filters, carbon beds, or scrubber systems with containment devices to protect effluent and vacuum lines, pumps, and the environment whenever feasible.
4. Establish procedures for the safe removal of contaminated waste. The form in appendix should be completed and sent to the Lab Safety Committee or CHO for review. Disposal of any particularly hazardous substance should be done in accordance with the Campus Wide Waste Management Plan and all applicable regulations.
5. Ensure that chemical residues do not remain on the body, clothing, or equipment. Employees/students shall follow Standard Operating Procedures upon completing work with particularly hazardous substances or in the event of accidental contact with such chemicals.
6. Inform employees/students of the hazards in designated areas. Be sure that those individuals who work in designated areas are authorized to do so, and that they are trained on how to handle the hazards in such areas. All training provided shall be documented.

## 10.1 General

General procedures for particularly hazardous substances include:

1. Employees should read and understand these practices before commencing a procedure using particularly hazardous substances (PHS).
2. PHS includes highly toxic chemicals, reproductive toxins, and select carcinogens. In addition, Drew includes highly flammable chemicals, highly reactive chemicals, and highly corrosive chemicals as PHS.
3. The use of these substances requires prior approval of the Chemistry Safety Committee reference form.
4. PHS shall be used in designated areas and in fume hoods.
5. The use of PHS shall require removal of contaminated waste and the decontamination of contaminated areas.

## 10.2 Highly Toxic Chemicals

The precautions below shall be taken when working with chemicals of high-chronic toxicity. Examples of these types of substances include dimethylmercury and nickel carbonyl, benzo[a]pyrene, N-nitrosodiethylamine, and other human carcinogens or substances with high carcinogenic potency in animals. Other examples of highly toxic chemicals (acute or chronic) that were commonly used in the past are benzene, chloroform, formaldehyde, bromine, carbon disulfide, carbon tetrachloride, cyanide salts, and hydrofluoric acid.

1. When a PEL or TLV value is less than 50 ppm or 100 mg/m<sup>3</sup> conduct all transfers and work with these substances in a “controlled area” (e.g., a restricted access hood, glove box, or part of a laboratory designated for working with such substances). Ensure that all persons with access to controlled areas are aware of the substances being used and the precautions required. area. If none is available, no work should be performed using the chemical.
2. Protect vacuum pumps from being contaminated by scrubbers of HEPA filters; vent them into the hood (disposed of oil as waste).
3. Decontaminate the controlled area before normal work is resumed.
4. Remove any protective apparel and thoroughly wash hands, forearms, face, and neck before leaving a controlled area. Place the apparel in an appropriately labeled container.



5. Use a wet mop or a vacuum cleaner with a HEPA filter if the toxic substance is a dry powder; do not dry sweep.
6. Initiate a regular medical surveillance program if large quantities of toxic substances are used.
7. Ensure that the controlled area is conspicuously marked with warning and restricted access signs, and that all containers with these substances are appropriately identified and have warning labels.
8. Ensure that contingency plans, equipment, and materials are available to minimize exposures to people and property if an accident occurs.
9. Store chemicals in unbreakable, chemically resistant, secondary containers. Label the containers appropriately and store them in a ventilated, limited-access
10. If a PEL, TLV, or comparable value is not available, the animal or human median inhalation lethal concentration information, LC 50, should be used as a guideline. If that value is less than 200 ppm or 2000 mg/m<sup>3</sup> when administered continuously for one hour or less, then the chemical should be used in an operating fume hood, glove box, vacuum line, or other device equipped with appropriate traps. If none are available, no work should be performed using that chemical.

### **10.3 Highly Flammable Chemicals**

General procedures for highly flammable chemicals include:

1. Drew defines Class 1A liquids as highly flammable chemicals. Class 1A liquids have a flashpoint of less than 73 ° C and a boiling point of less than 100 ° C.
2. Examples of highly flammable chemicals are diethyl ether, acetone, pentane, petroleum ether, and acetaldehyde.

### **10.4 Highly Reactive Chemicals**

General procedures for highly reactive chemicals include:

1. Reactivity information may be given in a manufacturers' MSDS and on labels. The most complete and reliable reference on chemical reactivity is the current edition of *Bretherick's Handbook of Reactive Chemical Hazards*. A Chemical Compatibility Chart has been provided as Appendix F.
2. A reactive chemical is one that:

- Is described as such on the label, in the MSDS, or by Bretherick.
  - Is ranked by the NFPA as 3 or 4 for reactivity.
  - Is identified by the Department of Transportation (DOT) as an oxidizer, an organic peroxide, or an explosive (Class A, B, or C).
  - Fits the Environmental Protection Agency definition of reactive in 40 CFR 261.23.e, or is known or found to be reactive with other substances.
3. Reactive chemicals should be handled with all proper safety precautions, including segregation in storage (refer to Chemical Compatibility Chart, Appendix F), and prohibition of mixing even small quantities with other chemicals without prior approval and appropriate personal protection and precautions.
  4. Examples of commonly encountered highly reactive chemicals are ammonium dichromate, nitric acid, perchloric acid, hydrogen peroxide, and potassium chlorate, azides, organic nitrates, and acetylides.

### **10.5 Highly Corrosive Chemicals and Contact Hazard Chemicals**

General procedures for highly corrosive chemicals (such as 18M H<sub>2</sub>SO<sub>4</sub>, 15M HN<sub>3</sub>, and 50% H<sub>2</sub>O<sub>2</sub>) and contact hazards include:

1. Corrosivity, allergen, and sensitizer information is provided in manufacturers' MSDS and on labels.
2. A corrosive chemical is one that:
  - Fits the OSHA definition of corrosive in 29 CFR 1910.1200.
  - Fits the EPA definition of corrosive in 40 CFR 262.22 (has a pH greater than 12 or a pH less than 2.5).
  - Is known to be reactive to living tissue, causing visible destruction, or irreversible alterations of the tissue at the site of contact.
3. A contact - hazard chemical is an allergen or sensitizer that:
  - Is so identified or described in the MSDS or on the label.
  - Is so identified or described in medical or industrial hygiene literature.
  - Is known to be an allergen or sensitizer.
4. Corrosive and contact hazard chemicals will be handled with all proper safety precautions, including wearing safety glasses with side shields, using appropriate gloves tested for the absence of pinholes and known to be resistant to permeation or penetration by the chemical, and wearing a laboratory apron or laboratory coat.

5. Examples of highly corrosive chemicals are hydrochloric, sulfuric, nitric, phosphoric, and perchloric acids (all acids in greater than 1 Molar concentration), and potassium hydroxide (either solid or in aqueous solution greater than 1 Molar concentration).

## 10.6 Reproductive Toxins

General procedures for reproductive toxins include:

1. A reproductive toxin refers to chemicals which affect reproductive capabilities including chromosomal damage (mutations) and which effect fetuses (teratogenesis).
2. A reproductive toxin is a compound that is described as such in the applicable MSDS or label.
3. Only where necessary, reproductive toxins may be used in the school's laboratories, but must have written authorization from the Chemical Safety Committee. SOP's must be modified for lab procedures to identify a written warning of such reproductive toxin usage.
4. If such chemicals are used:
  - They should be handled only in a hood and when satisfactory performance of the hood has been confirmed.
  - Skin contact should be avoided by using gloves and wearing protective apparel.
  - Persons using such substances should always wash hands and arms immediately after working with these materials.
  - Unbreakable containers of these substances should be stored in a well ventilated area and will be labeled properly.
5. Examples of reproductive toxins are organomercurial compounds, ethidium bromide, carbon disulfide, xylene, toluene, benzene, mercury, lead compounds, ethyl ethers, and vinyl chloride.

## 10.7 Allergens and Embryotoxins

The precautions below shall be taken when working with allergens and embryotoxins.

1. Review each use of these materials with the research supervisor; review continuing uses annually or whenever a procedural change is made.
2. Properly label these substances; store them in an unbreakable secondary container in an adequately ventilated area.
3. Notify supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.
4. Examples of and the requirements for these substances area as follows:
  - a. Allergens – Wear suitable gloves to prevent hand contact with allergens or substances of unknown allergenic activity (e.g., diazomethane, isocyanates, and bichromates).
  - b. Embryotoxins – If you are a woman of childbearing age, only handle these substances (e.g., organomercurials, lead compounds, and fomamide) in a hood that functions properly. Use appropriate protective apparel (especially gloves) to prevent skin contact.

# 11. BIOLOGICAL HAZARDS BIOLOGICAL SAFETY

## 11.1 Scope

This section is applicable to all laboratory, research, service and support activities that may involve exposure to biohazardous agents. Materials/information in the section were obtained from the CDC/NIH Guidelines for Biosafety in Microbiological and Biomedical Laboratories and or the Princeton University Biological Safety Manual

Activities which are those specifically addressed are those involving:

- ▶ various bacterial, fungal, and parasitic agents
- ▶ Live viruses
- ▶ experimentally infected research animals
- ▶ Human blood and tissues

## 11.2 Regulatory Requirements

Guidelines developed by the [National Institutes of Health \(NIH\)](#) and the [Centers for Disease Control and Prevention \(CDC\)](#) form the basis for the biosafety practices included in this manual. These guidelines must be followed to ensure the continuation of grant funds from federal agencies.

The CDC-NIH, [Biosafety in Microbiological and Biomedical Laboratories \(BMBL\)](#) address the appropriate measures and facilities for **work with all microbial agents**, including bacterial, viral, fungal, parasitic, and rickettsial agents.

For **work with human blood and some other body fluids and tissue**, the requirements of the [Occupational Exposure to Bloodborne Pathogens](#) standard from the Occupational Safety and Health Administration (OSHA) apply. Special training, medical surveillance, procedures, and equipment that must be in place to ensure compliance with these requirements.

The obtaining, possession, use, or transfer of any **select biological agent or toxin** is strictly regulated by federal code and regulations. It requires federal permits and inspection as well as significant measures of lab security, personnel training, and accurate record keeping regarding the status of possessed materials.

**Handling and disposal of bio hazardous waste** is regulated and monitored by the NJ Department of Environmental Protection under the Regulated Medical Waste rules found in the NJ Administrative Code at 7:26-3A. The procedures for biological waste handling are outlined in Section F below and in the Drew Campus Wide Waste Management Plan comply with the requirements of these rules.

## 11.3. Responsibilities

### Principle Faculty Member

- ▶ Accepts direct responsibility for the health and safety of those working with biological materials in his/her laboratory
- ▶ Ensures proper lab orientation, training, and instruction for laboratory personnel in safe practices and protocols, including, instruction in good microbiological techniques and practices needed to work safely with the biological agents and materials involved
- ▶ Ensures that laboratory personnel receive any necessary medical surveillance
- ▶ Ensures compliance by laboratory personnel with the relevant regulations, guidelines, and policies
- ▶ Ensures biosafety cabinets are certified as needed and personal protective equipment is provided and used

### Researcher or User:

- ▶ Participates in appropriate training and instruction
- ▶ Becomes familiar with all biological agents being used in the lab and the potential risks associated with exposure
- ▶ Follows all laboratory practices and protocols and complies with all applicable guidelines and policies
- ▶ Completes any necessary medical surveillance
- ▶ Reports all accidents, spills, or contamination incidents to supervisor/instructor

**Environmental Health and Safety (EHS)** Consults with researchers on issues of biosafety and the safe use of biological materials in the laboratory

Develops protocols and procedures to address issues of biosafety  
Provides training in safe use and practices for those involved in work with potentially biohazardous materials and activities  
Advises researchers on proper waste disposal methods based on federal and state regulations and established practice

## 11.4 WORKING SAFELY WITH BIOLOGICAL MATERIALS

### 11.4a. Exposure Control

The term "containment" is used in describing safe methods for managing infectious agents in the laboratory environment where they are being handled or maintained. The purpose of containment is to reduce or eliminate exposure of laboratory workers, other people, and the outside

environment to potentially hazardous agents. The three elements of containment include laboratory practice and technique, safety equipment, and facility design.

#### **11.4b Laboratory Practice and Technique**

The most important element of containment is strict adherence to standard microbiological practices and techniques. Persons working with infectious agents or infected materials must be aware of potential hazards, and must be trained and proficient in the practices and techniques required for handling such material safely. The Principle Faculty Member PFM or laboratory supervisor is responsible for providing or arranging for appropriate training of personnel.

Each PFM should identify specific hazards that will or may be encountered, and consider practices and procedures needed to minimize or eliminate risks. Personnel should be advised of special hazards and are expected to follow the required practices and procedures.

#### **11.4c Safety Equipment (Primary Barriers)**

Safety equipment includes biological safety cabinets, enclosed containers, and other engineering controls designed to eliminate or minimize exposures to hazardous biological materials. The biological safety cabinet (BSC) is the principal device used to provide containment of infectious splashes or aerosols generated by many microbiological procedures. See Attachment #1 for more information on BSCs.

Safety equipment may also include items for personal protection such as personal protective clothing, respirators, face shields, safety glasses or goggles. In some situations, personal protective clothing may form the primary barrier between personnel and the infectious materials.

#### **11.4d Facility Design (Secondary Barriers)**

The design of a facility is important in providing a barrier to protect those working inside and outside the laboratory and to protect people or animals in the community from infectious agents which may be accidentally released from the laboratory. Facilities must be commensurate with the laboratory's function and the recommended biosafety level for the agent being manipulated.

The secondary barrier(s) needed will depend on the risk of transmission of specific agents and exposure risks involve direct contact with the agents, or inadvertent contact through contaminated work environments. Secondary barriers in these laboratories includes separation of the laboratory work area from public access, availability of a decontamination facility (e.g., autoclave) and handwashing facilities.

### **11.5. Summary Laboratory Biosafety Levels**

CDC-NIH has established **four levels of biosafety**, based on the degree of hazard associated with an organism, to describe the combination of laboratory practices and techniques, safety equipment, and facilities needed to protect against exposure. These four biosafety levels (BSL) require successively more restrictive practices and facilities as work moves from the least

restrictive BSL1 to work with the highest hazard level of BSL4. Exposure to biohazardous agents is intended to be prevented or limited by establishing and following the appropriate biosafety level practices and conditions. Research at Drew facilities is currently limited to BSL1 and BSL2.

**BSL1** applies to the basic level of containment and essentially represents good microbiological practice with no special primary or secondary barriers required. This applies to work with defined and characterized strains of viable microorganisms not known to consistently cause disease in healthy adult humans. This includes such organisms as the bacteria *Bacillus subtilis*, *Vibrio harveyi*, or host/vector strains of *E coli* and yeast *Saccharomyces cerevisiae*.

**BSL2** applies to work with a broad spectrum of moderate-risk agents that are generally present in the environment at large and are associated with human disease of varying severity.

All of the viral agents used in campus research, such as adenovirus, cytomegalovirus, and other herpes viruses fall within the BSL2 level of work. Other microorganisms assigned to this containment level include salmonella spp., toxoplasma spp., hepatitis B, and HIV. With the use of good microbiological techniques, much of this work can be done on open bench tops as long as there is limited potential for splashes and aerosol creation. **In addition to BSL1 conditions**, this level of work also requires that:

- Laboratory personnel have specific training in handling any pathogenic agents used
- Access to the laboratory is limited when BSL2 work is being done
- Gloves and other suitable personal protective equipment are worn
- Extreme precautions are taken with contaminated sharps
- Biosafety cabinets are used when there is potential for splash or aerosol creation

**BSL3** and **BSL4** apply to work with exotic agents of increasingly greater potential for causing serious human illness or death. No work at the BSL3 or 4 is currently being done and facilities that would meet the requirements of these biosafety levels are not available at Drew.

## **11.6 Laboratory Procedures and Equipment**

### **11.6a Guidelines for Good Laboratory Practices at BSL1 and BSL 2**

#### ***Biosafety Level (BSL) 1***

Biosafety Level 1 is suitable for work involving well-characterized agents not known to consistently cause disease in immunocompetent adult humans, and present minimal potential hazard to laboratory personnel and the environment. BSL-1 laboratories are not necessarily separated from the general traffic patterns in the building. Work is typically conducted on open bench tops using standard microbiological practices. Special containment equipment or facility design is not required, but may be used as determined by appropriate risk assessment. Laboratory



personnel must have specific training in the procedures conducted in the laboratory and must be supervised by a scientist with training in microbiology or a related science.

The following standard practices, safety equipment, and facility requirements apply to BSL-1.

**A. Standard Microbiological Practices**

1. The laboratory supervisor must enforce the institutional policies that control access to the laboratory.
2. Persons must wash their hands after working with potentially hazardous materials and before leaving the laboratory.
3. Eating, drinking, smoking, handling contact lenses, applying cosmetics, and storing food for human consumption must not be permitted in laboratory areas. Food must be stored outside the laboratory area in cabinets or refrigerators designated and used for this purpose.
4. Mouth pipetting is prohibited; mechanical pipetting devices must be used.
5. Policies for the safe handling of sharps, such as needles, scalpels, pipettes, and broken glassware must be developed and implemented. Whenever practical, laboratory supervisors should adopt improved engineering and work practice controls that reduce risk of sharps injuries. Precautions, including those listed below, must always be taken with sharp items. These include:
  - a. Careful management of needles and other sharps are of primary importance. Needles must not be bent, sheared, broken, recapped, removed from disposable syringes, or otherwise manipulated by hand before disposal.
  - b. Used disposable needles and syringes must be carefully placed in conveniently located puncture-resistant containers used for sharps disposal.
  - c. Non-disposable sharps must be placed in a hard walled container for transport to a processing area for decontamination, preferably by autoclaving.
  - d. Broken glassware must not be handled directly. Instead, it must be removed using a brush and dustpan, tongs, or forceps. Plastic ware should be substituted for glassware whenever possible.
6. Perform all procedures to minimize the creation of splashes and/or aerosols.
7. Decontaminate work surfaces after completion of work and after any spill or splash of potentially infectious material with appropriate disinfectant.
8. Decontaminate all cultures, stocks, and other potentially infectious materials before disposal using an effective method. Depending on where the decontamination will be performed, the following methods should be used prior to transport.

- a. Materials to be decontaminated outside of the immediate laboratory must be placed in a durable, leak proof container and secured for transport.
  - b. Materials to be removed from the facility for decontamination must be packed in accordance with applicable local, state, and federal regulations.
9. A sign incorporating the universal biohazard symbol must be posted at the entrance to the laboratory when infectious agents are present. The sign may include the name of the agent(s) in use, and the name and phone number of the laboratory supervisor or other responsible personnel. Agent information should be posted in accordance with the institutional policy.
10. An effective integrated pest management program is required.
11. The laboratory supervisor must ensure that laboratory personnel receive appropriate training regarding their duties, the necessary precautions to prevent exposures, and exposure evaluation procedures. Personnel must receive annual updates or additional training when procedural or policy changes occur. Personal health status may impact an individual's susceptibility to infection, ability to receive immunizations or prophylactic interventions. Therefore, all laboratory personnel and particularly women of childbearing age should be provided with information regarding immune competence and conditions that may predispose them to infection. Individuals having these conditions should be encouraged to self-identify to the institution's healthcare provider for appropriate counseling and guidance.

***B. Special Practices*** None required.

***C. Safety Equipment (Primary Barriers and Personal Protective Equipment)***

1. Special containment devices or equipment, such as BSCs, are not generally required.
2. Protective laboratory coats, gowns, or uniforms are recommended to prevent contamination of personal clothing.
3. Wear protective eyewear when conducting procedures that have the potential to create splashes of microorganisms or other hazardous materials. Persons who wear contact lenses in laboratories should also wear eye protection.
4. Gloves must be worn to protect hands from exposure to hazardous materials. Glove selection should be based on an appropriate risk assessment. Alternatives to latex gloves should be available. Wash hands prior to leaving the laboratory. In addition, BSL-1 workers should:
  - a. Change gloves when contaminated, glove integrity is compromised, or when otherwise necessary.
  - b. Remove gloves and wash hands when work with hazardous materials has been completed and before leaving the laboratory.
  - c. Do not wash or reuse disposable gloves. Dispose of used gloves with other contaminated laboratory waste. Hand washing protocols must be rigorously followed.

#### ***D. Laboratory Facilities (Secondary Barriers)***

1. Laboratories should have doors for access control.
2. Laboratories must have a sink for hand washing.
3. The laboratory should be designed so that it can be easily cleaned. Carpets and rugs in laboratories are not appropriate.
4. Laboratory furniture must be capable of supporting anticipated loads and uses. Spaces between benches, cabinets, and equipment should be accessible for cleaning.
  - a. Bench tops must be impervious to water and resistant to heat, organic solvents, acids, alkalis, and other chemicals.
  - b. Chairs used in laboratory work must be covered with a non-porous material that can be easily cleaned and decontaminated with appropriate disinfectant.
5. Laboratories windows that open to the exterior should be fitted with screens.

#### ***Biosafety Level (BSL) 2***

**Biosafety Level 2** builds upon BSL-1. BSL-2 is suitable for work involving agents that pose moderate hazards to personnel and the environment. It differs from BSL-1 in that 1) laboratory personnel have specific training in handling pathogenic agents and are supervised by scientists competent in handling infectious agents and associated procedures; 2) access to the laboratory is restricted when work is being conducted; and 3) all procedures in which infectious aerosols or splashes may be created are conducted in BSCs or other physical containment equipment.

The following standard and special practices, safety equipment, and facility requirements apply to BSL-2:

##### ***A. Standard Microbiological Practices***

1. The laboratory supervisor must enforce the institutional policies that control access to the laboratory.
2. Persons must wash their hands after working with potentially hazardous materials and before leaving the laboratory.
3. Eating, drinking, smoking, handling contact lenses, applying cosmetics, and storing food for human consumption must not be permitted in laboratory areas. Food must be stored outside the laboratory area in cabinets or refrigerators designated and used for this purpose.
4. Mouth pipetting is prohibited; mechanical pipetting devices must be used.
5. Policies for the safe handling of sharps, such as needles, scalpels, pipettes, and broken glassware must be developed and implemented. Whenever practical, laboratory supervisors should adopt improved engineering and work practice controls that reduce risk of sharps injuries. Precautions, including those listed below, must always be taken with sharp items. These include:

- a. Careful management of needles and other sharps are of primary importance. Needles must not be bent, sheared, broken, recapped, removed from disposable syringes, or otherwise manipulated by hand before disposal.
  - b. Used disposable needles and syringes must be carefully placed in conveniently located puncture-resistant containers used for sharps disposal.
  - c. Non-disposable sharps must be placed in a hard walled container for transport to a processing area for decontamination, preferably by autoclaving.
  - d. Broken glassware must not be handled directly. Instead, it must be removed using a brush and dustpan, tongs, or forceps. Plasticware should be substituted for glassware whenever possible.
6. Perform all procedures to minimize the creation of splashes and/or aerosols.
7. Decontaminate work surfaces after completion of work and after any spill or splash of potentially infectious material with appropriate disinfectant.
8. Decontaminate all cultures, stocks, and other potentially infectious materials before disposal using an effective method. Depending on where the decontamination will be performed, the following methods should be used prior to transport:
- a. Materials to be decontaminated outside of the immediate laboratory must be placed in a durable, leak proof container and secured for transport.
  - b. Materials to be removed from the facility for decontamination must be packed in accordance with applicable local, state, and federal regulations.
9. A sign incorporating the universal biohazard symbol must be posted at the entrance to the laboratory when infectious agents are present. Posted information must include: the laboratory's biosafety level, the supervisor's name (or other responsible personnel), telephone number, and required procedures for entering and exiting the laboratory. Agent information should be posted in accordance with the institutional policy.
10. An effective integrated pest management program is required.
11. The laboratory supervisor must ensure that laboratory personnel receive appropriate training regarding their duties, the necessary precautions to prevent exposures, and exposure evaluation procedures. Personnel must receive annual updates or additional training when procedural or policy changes occur. Personal health status may impact an individual's susceptibility to infection, ability to receive immunizations or prophylactic interventions. Therefore, all laboratory personnel and particularly women of child-bearing age should be provided with information regarding immune competence and conditions that may predispose them to infection. Individuals having these conditions should be encouraged to self-identify to the institution's healthcare provider for appropriate counseling and guidance.

## ***B. Special Practices***

1. All persons entering the laboratory must be advised of the potential hazards and meet specific entry/exit requirements.
2. Laboratory personnel must be provided medical surveillance and offered appropriate immunizations for agents handled or potentially present in the laboratory.
3. When appropriate, a baseline serum sample should be stored.
4. A laboratory-specific biosafety manual must be prepared and adopted as policy. The biosafety manual must be available and accessible.
5. The laboratory supervisor must ensure that laboratory personnel demonstrate proficiency in standard and special microbiological practices before working with BSL-2 agents.
6. Potentially infectious materials must be placed in a durable, leak proof container during collection, handling, processing, storage, or transport within a facility.
7. Laboratory equipment should be routinely decontaminated, as well as, after spills, splashes, or other potential contamination.
  - a. Spills involving infectious materials must be contained, decontaminated, and cleaned up by staff properly trained and equipped to work with infectious material.
  - b. Equipment must be decontaminated before repair, maintenance, or removal from the laboratory.
8. Incidents that may result in exposure to infectious materials must be immediately evaluated and treated according to procedures described in the laboratory biosafety safety manual. All such incidents must be reported to the laboratory supervisor. Medical evaluation, surveillance, and treatment should be provided and appropriate records maintained.
9. Animals and plants not associated with the work being performed must not be permitted in the laboratory.
10. All procedures involving the manipulation of infectious materials that may generate an aerosol should be conducted within a BSC or other physical containment devices.

## 11.7 Decontamination

**Decontamination** is a process or treatment that renders an instrument or environmental surface safe to handle. A decontamination procedure can be as simple as clean-up with detergent and water or as thorough as sterilization. Sterilization, disinfection, and antisepsis are all forms of decontamination.

**Sterilization** is the use of physical or chemical processes to destroy all microbial life, including highly resistant forms, such as bacterial spores.

**Disinfection** is the elimination of essentially all pathogenic non-spore forming microorganisms but not necessarily all microbial forms from work surfaces and equipment. Effectiveness is influenced by a number of factors, including: types and numbers organisms; amount of organic matter; the object being disinfected; the disinfectant being used; exposure time, temperature and concentration.

**Antisepsis** is the application of a liquid antimicrobial to skin or other living tissue to inhibit or destroy microorganisms. Examples include hand washing with germicidal solutions or swabbing skin before an injection.

#### When to Decontaminate

All material and equipment contaminated with or containing potentially infectious agents should be decontaminated:

- Upon completion of procedures involving the use of biologically-active materials
- In the event of spills of such materials
- At least daily
- Before being washed, stored, or discarded

#### Autoclave Use

Autoclaving (saturated steam under pressure of approximately 15 psi to achieve a chamber temperature of at least 250oF for a designated time) is the preferred and most convenient method to rapidly destroy all forms of microbial life. However, to do this, the autoclave process must reach proper temperature and time and also prevent the entrapment of air in the bag or container of treated material.

- Material to be sterilized must come into contact with live steam.
- Bags or containers should be left open during autoclaving or water (~200ml) should be added to sealed bags to generate steam.
- Heat indicator tape should be used with each autoclave load to indicate that sterilization has been completed.
- Autoclave sterility monitoring should be conducted on a regular basis using biological indicators (such as *B. stearothermophilus* spore strips) placed among treated materials and at locations throughout the autoclave. The spores, which are more resistant to heat than most microbials, provide validation of general microbial destruction when they are effectively inactivated (250 deg. F for 13 minutes) by autoclave operation.

#### Chemical Disinfectant Use

The most practical use of chemical disinfectants is for surface decontamination and, when used in sufficient concentration, as a decontaminant for liquid wastes prior to final disposal down the drain.

Decontaminate equipment and work surfaces at completion of work, at the end of the day, and following spills of viable materials. If a spill occurs, cover the spill with paper towels and soak the towels with a 1 to 10 dilution of chlorine bleach or other suitable disinfectant. Allow the material to soak for approximately 20 minutes before discarding materials in biohazard bag. Bench tops are impervious to water and resistant to solvents, acids, alkalis, and chemicals used for surface decontamination. Laboratory surfaces and spaces between fixtures are designed to be easily cleaned; no carpets or rugs.

Work on open bench tops is permitted; use of special containment equipment such as a biological safety cabinet (BSC) is not generally required for agents assigned to BL1.

- **Work in the open laboratory is permitted, except that a properly maintained biological safety cabinet is required whenever:**

Procedures with a potential for creating infectious aerosols or splashes are conducted. These may include **centrifuging, grinding, blending, vigorous shaking or mixing, sonic disruption, opening containers of infectious materials** whose internal pressures may be different from ambient pressures, **inoculating animals intranasally**, and **harvesting infected tissues from animals or embryonate eggs**.

**High concentrations or large volumes of infectious agents are used.** Such materials may be centrifuged in open laboratory if sealed rotor heads or centrifuge safety cups are used, and if these rotors or safety cups are opened only in a biological safety cabinet.

**Be aware that air sampling studies have shown that most of the common manipulations of bacterial and viral cultures in research laboratories release aerosols of viable organisms. This must be considered when evaluating need for use of the biological safety cabinet or other physical containment device.**

#### General Guidelines

##### Liquid Decontamination

- **Add liquid chlorine bleach to provide a final 1:10 dilution**
- **Let stand at least 20 minutes**
- **Discard down the drain**

##### Surface Decontamination

- **Wipe with 1:10 dilution of chlorine bleach, or**
- **Wipe with iodophor disinfectant (per label concentration), or**
- **Wipe with 70% alcohol**

(See Attachment 1 for information on BSC)

## 11.8 Exposure to Infectious Agents

In the event of an exposure to an infectious agent or material, the following guidelines should be used:

Intact skin

- Remove contaminated clothing
- Vigorously wash contaminated skin for 1 minute with soap and water

Eye

- Immediately flush eyes for at least 15 minutes with water, preferably using eyewash; if no eyewash is available, pour water on the eye(s) for 15 minutes, rinsing from the nose outward to avoid contamination of the unaffected eye.
- Hold eyelids away from your eyeball and rotate your eyes so that all surfaces may be washed thoroughly.
- Seek medical attention at the Health Center

**Ingestion or Inhalation**

- Seek medical attention at the Health Center
- Do not induce vomiting unless advised to do so by a health care provider

## 11.9 Biological Material Spills

### Spills and Preparing for Them

In the event of a spill of biological material, the individual(s) who caused the spill is responsible for the clean-up.

- Minimize the consequences of any spill of biological material by performing all work on plastic-backed liner to absorb spills
- Have a simple spill kit on hand including:
  - Chlorine bleach or some other concentrated disinfectant
  - A package or roll of paper towels
  - Autoclavable bags
  - Rubber gloves
  - Forceps for pick-up of broken glass

Spills Inside a Biological Safety Cabinet

1. **LEAVE THE CABINET TURNED ON**  
While wearing gloves, spray or wipe cabinet walls, work surfaces, and equipment with disinfectant equivalent to 1:10 bleach solution. If necessary, flood the work surface, as well as drain pans and catch basins below the work surface, with disinfectant for a contact time of at least 20 minutes
2. Soak up disinfectant and spill with paper towels. Drain catch basin into a container. Lift front exhaust grill and tray and wipe all surfaces. Ensure that no paper towels or solid debris are blown into the area beneath the grill.
3. Autoclave all clean-up materials before disposal in the biohazard waste container. Wash hands and any exposed surfaces thoroughly after the clean-up procedure.



Small Spill of Material Outside of a Biological Safety Cabinet (Spill that can be covered by a few paper towels)

1. Wearing gloves and a lab coat, cover the spill with paper towels and gently apply disinfectant, proceeding from the outer edge of the spill to its center. Leave in place for 20 minutes.
2. Pick up the towels and discard into a biohazard container. Pick up any pieces of broken glass with forceps and place in sharps container.
3. Re-wipe the spill area with disinfectant and thoroughly wash hands after glove removal.

Large Spill of BL2 Material (>500ml) Outside of a Biological Safety Cabinet

1. Hold your breath and leave the room immediately.
2. Warn others to stay out of the spill area to prevent spread of contamination; post a sign stating: "**DO NOT ENTER, BIOHAZARD SPILL**", contact (name and phone #) for information".
3. Remove any contaminated clothing and put into a biohazard bag for later autoclaving.
4. Wash hands and exposed skin and inform your PI or supervisor about the spill
5. Put on protective clothing (lab coat, gloves and, if indicated, surgical mask, eye protection, shoe covers) and assemble clean-up materials.
6. Wait 30 minutes before re-entering the contaminated area to allow dissipation of aerosols.
7. Cover the spill with paper towels and gently apply disinfectant, proceeding from the outer edge of the spill to its center. Leave in place for 20 minutes
8. Collect all treated material and discard in a biohazard container. Pick up any broken glass with forceps and place them into a sharps container.
9. Re-wipe the spill area with disinfectant and wash hands thoroughly at completion of clean-up.

## 11.10. Biohazards Associated with Animal Handling

### Zoonotic Diseases

A zoonotic disease, or zoonosis, is an infectious disease which can be transmitted between humans and animals. Of the hundreds of zoonotic diseases known, a handful are of concern in the research animal facility. Modern animal production techniques and animal facility operating procedures are designed to minimize the threat of zoonotic diseases, both to personnel and valuable animal colonies. When human infection does occur, it often results from the failure to follow long established, well accepted procedures. Serious cases of human disease in recent years have resulted from infection with well-recognized zoonoses, "new" or previously unrecognized diseases, and "old" diseases which had not caused problems for years.

**Toxoplasmosis** is a disease acquired from cats that if acquired by a pregnant woman during pregnancy can cause birth defects and other disorders in an unborn fetus. It is recommended that pregnant women not work with cats in a laboratory.

### Injuries

As discussed above, there are a number of ways in which you can be injured by animals. Bites, scratches, kicks and other injuries are avoided by knowing the species you work with, using proper equipment, and using tranquilizers and anesthetics where appropriate.

Working with animals often involves heavy lifting. Back injuries are amongst the most common causes of lost work-time by animal workers, both in laboratory animal facilities and in farm buildings. Proper lifting technique will help avoid back injuries.

### **Allergies**

Allergies may be an annoyance or may keep you from working with some species of animals. Consult Health Services if you think animal allergies are a problem. If you wear work clothing to class or home, you may expose others to animal allergens.

## **BASIC PRINCIPLES OF WORKING SAFELY WITH ANIMALS**

- Healthy animals are less likely to transmit diseases. A comprehensive animal care program includes selection of the source of animals, quarantine of newly arrived animals where appropriate, preventative health programs and treatment of sick or injured animals. Where possible, animals are obtained from disease-free colonies or herds.
- Animal housing areas are separate from "people areas". Animal facilities are physically separate spaces with their own air-handling systems. Where animal facilities and people areas adjoin, air pressure in the animal areas is negative to adjoining areas so that air and odors are kept from people areas. Animal facilities are locked to limit access to authorized personnel only. People whose work is not animal related should not be exposed to animal odors, allergens or diseases.
- Pest control programs are in place to prevent the introduction of disease to animal colonies by insects, rodents, wild birds and other pests.

### **What You Must Do to Protect Yourself**

- Do not handle animals unless you have been trained in the proper methods of handling and restraining the animal.
- Report all injuries (bites, scratches, even cuts on equipment), however small, to your instructor/supervisor.
- Get a tetanus vaccination at least every 10 years.

### **Animal Work with Chemical of High-Chronic Toxicity**

The following precautions shall be taken when animal work involves chemicals of high-chronic toxicity;

1. Administer the substance by injection or gavage instead of in the diet, when possible. If the substance is administered by diet, use a caging system under negative pressure or under laminar airflow directed toward HEPA filters.

2. Develop procedures that minimize the formation and dispersal of contaminated aerosols, including those from food, urine, and feces. Use HEPA filtered vacuum equipment for cleaning; moisten contaminated bedding before removal from the cage; mix diets in closed containers in a hood.
3. Wear plastic or rubber gloves and fully buttoned laboratory coats or jumpsuits when working in the animal room. Other apparel and equipment (e.g., shoe and head coverings or respirators) may be used because of incomplete suppression of aerosols.
4. Special facilities with restricted access are preferred for large-scale studies.

## **11.11 Biological /Regulated Medical Waste Disposal**

**Handling and disposal of bio hazardous waste** is regulated and monitored by the NJ Department of Environmental Protection under the Regulated Medical Waste rules found in the NJ Administrative Code at 7:26-3A.

All infectious biological waste and other wise regulated medical waste should be decontaminated prior to disposal. All regulated medical waste must be placed in labeled red plastic bags with the universal biohazard symbol. NJ DEP labeling requirements include identification of the source in each container (see attachment #2 for a summary of the NJDEP Regulated Medical Waste Regulations.) All medical waste containers must be kept closed/secured when not actively adding waste. When ready for shipment all regulated medical waste in appropriate containers should be placed and secured in the medical waste storage room on the loading dock in the Hall of Sciences.

### **Animal Bedding Waste**

All animal bedding is bagged by animal care personnel and staged for movement to the pick-up location. Any waste from animals exposed to BSL 2 organism or pharmaceutical agents are regulated as medical waste. Bags should be filled only to a depth and weight that will allow for effective tying of the bag by animal facility staff and for ease of handling by one person (bag weight should not exceed 40 pounds). This will help to prevent repetitive motion injury to staff and help to prevent bags from being ripped open while being handled.

### **Animal Carcasses**

When possible keep animal carcasses in freezers or cold rooms schedule for appropriate disposition – Any animals exposed to BSL 2 organism or pharmaceutical agents are regulated as medical waste. All other animals are prepared for transfer to Raptor Trust.

c.

## 12.0 MAINTENANCE AND INSPECTION PROGRAM

Drew has a maintenance and inspection program to ensure that ventilation systems and emergency safety equipment are functioning properly and that lab working conditions meet legal and acceptable standards. The maintenance and inspection program will target facilities known to be using extremely hazardous chemicals including known potential carcinogens, highly acutely toxic, reproductive toxins, allergens, and others.

### 12.1 Maintenance Program

The general ventilation system in labs must be well maintained and the quantity and quality of airflow monitored every three months by Facilities Management to ensure that:

1. General ventilation provides fresh air eight (8) to fourteen (14) air changes per hour to all labs. All exhaust air from labs is vented to the outside and not circulated throughout the building. Special attention will be paid to labs in which fume hoods are routinely operating to ensure a proper balance of airflow.
2. All chemical storage areas receive six air changes an hour, and exhausted air is not re-circulated through the facility. Centralized heating, ventilation, and cooling systems that impact labs will be maintained by:
  - Filters changed or cleaned
  - Water frequently checked for proper flow and biological growth
  - Drip pans cleaned regularly
3. The fume hood maintenance program comprises:
  - Fans checked for bearing over heating, belt drives for proper tension, fan wheels for proper freedom from accumulations and rotation.
  - Ductwork check for intact joints and no dents or holes in the system
  - Visual inspection of the hood will be done to check for signs of corrosion or other indications of needed repairs
  - Cleaning the surface of the hood, the sash glass, and the light unit will be cleaned.
4. Emergency eyewash and deluge showers:
  - Any needed maintenance and repair will be determined during biannual facility inspections/tests.
5. Fire extinguishers:

- All fire extinguishers will be inspected and maintained by Security on a regular basis, twice a year, to ensure proper charging in case of fire. Problems should be reported to the CHO immediately.

## 12.2 Inspections

The inspection protocols will consist of the following:

1. The CHO will conduct semiannual inspections of all labs for unsafe conditions and practices, and test key safety equipment to ensure proper functioning (Appendix B). Before the inspections, the CHO will receive a copy of the chemical inventory and a description of basic operations conducted in a lab from the instructor.
2. The CHO will write inspection reports identifying problems needing immediate attention and those of a lesser priority. Inspection results will be discussed with the department chair and lab workers, indicating the follow-up needed to correct any problems.
3. The CHO will evaluate fume hood performance using smoke tubes to determine if the hood is exhausting and will monitor the rate of flow at the face as well as the uniformity of air delivered to the hood by making a series of face velocity measurements at various points. Each measurement should not vary more than 25%.
4. Facilities Management should be notified of any problem with emergency equipment. The following should be checked:
  - Emergency exits
  - Fire extinguishers
  - Availability of spill-control emergency equipment
  - Availability of MSDS
  - Proper and working protective equipment is in the facility
  - General housekeeping conditions and systems used to communicate hazards
  - Storage areas for proper segregation of chemical classes, storage facilities, and container integrity
  - Waste disposal practices

As routine policy, the second inspection of the year will focus on labs in which improvements should have been made, either by lab employees or by management. Any serious or potentially serious lab safety and/or health problems will be identified and a schedule of steps and a time frame for completing them will be prepared by the CHO.



**12.0 EMERGENCY SERVICES CONTACT INFORMATION**

<b>Name</b>	<b>Phone Number Off-site</b>
Campus Security (Robert Lucid, Director of Public Safety) Non-Emergency Emergency	  X 3379 X 4444
CHEMTREC Transportation Spill Response	800-429-9300
Madison Fire Department Non-Emergency Emergency	 973-593-3020 911
Madison Police Department Non-Emergency Emergency	 973-593-3000 911
Borough of Madison Water Department	973-593-3045
PSE&G (Electric)	800-436-7734
PSE&G (Gas)	800-436-7734
National Weather Service	800-754-4633
Poison Control Center	800-936-2034
New Jersey Emergency Management Agency Non-Emergency Hazardous Chemical and Oil Spills	 800-262-3400 800-262-3300

<b>DREW PERSONNEL AND AUTHORITY</b>	
<b>Name</b>	<b>Phone Number Off-site</b>
Director of Public Safety (Emergency Coordinator) Mr. Robert Lucid	X 3378
Chemical Hygiene Officer Mark Ostapczuk	973- 408-3079
Drew Safety and Environmental Management Systems Team Mark Ostapczuk Peter Wocial Mary-Ann Pearsall Cheryl Colbeck Christina Notas Laureen Chapman Gabriele Hiltl-Cohen	973-408-3079 973-408-3493 973-408-3367 973-408-3259 973-408-3660 973-408-3828 973-408-3758
School of Sciences Dean - Jonathan Levin Chair, Biology – Tammy Windfelder Chair, Chemistry - Mary-Ann Pearsall Chair, Physics -	973-408-3495 973-408-3057 973-408-3108 973-408-3081
School of Art Chair, Art – Raymond Saa Stein	973-408-3199
Facilities Director Mike Kopas	X 3580
Provost: Ms. Pamela Gunter-Smith	X 3037
General Counsel Ms. Marie Suozzo 10 Park Place Morristown, NJ 07960	973-538-8008



**APPENDIX A**

**DESIGNATION OF CHEMICAL HYGIENE OFFICER**

# College Name

## Memorandum

**TO: Mark Ostapczuk, Director Environmental Health and Safety**

From: Name, Dean

Date: June 2010

Subject: Designation of Chemical Hygiene Officer

In accordance with the requirements set forth in 29 CFR 910.1450, you are hereby designated as the Chemical Hygiene Officer for the Drew University. As such you are responsible for the implementation of the Chemical Hygiene Plan and its annual review.

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**APPENDIX B**

**SEMI-ANNUAL INSPECTION OF LABORATORIES AND CHEMICAL STORAGE  
AREAS**

# Drew University Chemical Hygiene Inspection Checklist, 5/2011

Date of Inspection: \_\_\_\_\_ Conducted by: \_\_\_\_\_

Location (room number & building): \_\_\_\_\_  
\_\_\_\_\_

## 1.0 GENERAL WORK PRACTICES

- Yes  No  NA 1.1 Eating, drinking, smoking, etc. prohibited. . Food, drink not stored in lab, refrigerators, freezers, etc.
- Yes  No  NA 1.2 Radioactive, carcinogenic, biohazard, volatile or other particularly hazardous substances handled in laboratory hoods
- Yes  No  NA 1.3 Open flames, sparks kept away from flammables
- Yes  No  NA 1.4 Contact phone nos. for lab supervisor, security and safety officer current

## 2.0 HOUSEKEEPING

- Yes  No  NA 2.1 General appearance of lab is neat and orderly
- Yes  No  NA 2.2 Aisles and exits free from obstruction
- Yes  No  NA 2.3 Work surfaces protected from obstruction
- Yes  No  NA 2.4 Spills Absent
- Yes  No  NA 2.5 Electrical cords and wires in good condition
- Yes  No  NA 2.6 Tools and equipment in good repair
- Yes  No  NA 2.7 Defective glassware absent

## 3.0 HAZARD COMMUNICATION

- Yes  No  NA 3.1 Primary and secondary chemical containers labeled appropriately
- Yes  No  NA 3.2 Signs on storage areas (e.g. , refrigerators) and lab room doors
- Yes  No  NA 3.3 MSDS complete and available
- Yes  No  NA 3.4 Chemical Hygiene Plan available
- Yes  No  NA 3.5 The front door to all labs should have signs indicating the type of hazards present in the lab. Write down all information

## 4.0 PERSONAL PROTECTIVE EQUIPMENT

- Yes  No  NA 4.1 Eye protection available and used (safety glasses with side shields)
- Yes  No  NA 4.2 Gloves available, used, and matched to hazards
- Yes  No  NA 4.3 Respirators absent (unless by permission of the EH&S Office)
- Yes  No  NA 4.4 Are lab workers wearing appropriate laboratory attire, (i.e. no open toes shoes, inappropriate clothing, etc)

## 5.0 CHEMICAL STORAGE

- Yes  No  NA 5.1 Incompatible chemicals segregated
- Yes  No  NA 5.3 Hazardous chemicals not stored above 6' on open shelves
- Yes  No  NA 5.4 Bulk quantities of flammable liquids stored in approved safety cans, cabinets
- Yes  No  NA 5.5 Safety carriers available for bottles
- Yes  No  NA 5.6 Expired or out-of-use chemicals absent
- Yes  No  NA 5.7 Excessive quantities of chemicals not stored on benches
- Yes  No  NA 5.8 Lab limits for flammables not exceeded (Limit=\_\_\_\_\_)

## 6.0 COMPRESSED GAS CYLINDERS AND VACUUM PUMPS

- Yes  No  NA 6.1 Chained, secured
- Yes  No  NA 6.2 Inspected for condition, pressure retention
- Yes  No  NA 6.3 Gas lines, piping, manifolds, etc. labeled with identity of contents. Gas ports labeled.
- Yes  No  NA 6.4 Protective caps in place except when cylinders are in use
- Yes  No  NA 6.5 Vacuum pumps appropriately ventilated. Rotovaporators wrapped in electrical tape when possible
- Yes  No  NA 6.6 Vacuum pumps enclosed with fan belt guard
- Yes  No  NA 6.7 Flammable gas lines equipped with flashback arrestors (i.e. AA)

## 7.0 WASTE DISPOSAL

- Yes  No  NA 7.1 Hazardous wastes not disposed in general sewer system (sink) or in general trash
- Yes  No  NA 7.2 Waste containers closed except when adding or removing waste
- Yes  No  NA 7.3 Containers for hazardous wastes in good condition
- Yes  No  NA 7.4 Containers of hazardous waste labeled with the words hazardous waste and other descriptive words
- Yes  No  NA 7.5 Is there spill containment available?
- Yes  No  NA 7.6 Satellite accumulation areas posted and orderly? Waste moved to central storage area when container is full?
- Yes  No  NA 7.7 Broken glassware in designated containers and not in general trash
- Yes  No  NA 7.8 Discarded sharps in designated containers and containers closed

## 8.0 LABORATORY HOODS AND VENTILATION

- Yes  No  NA 8.1 Hoods in sound working condition
- Yes  No  NA 8.2 Hoods marked with operating heights, average face velocity. Date of last check:
- Yes  No  NA 8.3 Hoods not cluttered with chemicals, equipment

## 9.0 SAFETY EQUIPMENT/EMERGENCY RESPONSE

- Yes  No  NA 9.1 Spill containment clean-up material available and stocked?
- Yes  No  NA 9.2 Eye wash/safety showers in sound working condition, not blocked
- 9.3 Fire extinguishers:
- Yes  No  NA 9.3.a Type and appropriate location, not blocked, good working order.
- Yes  No  NA 9.3.b Date of last inspection: \_\_\_\_\_
- Yes  No  NA 9.3.c All laboratories have at least one extinguisher.
- Yes  No  NA 9.4 First aid kit available and stocked?
- Yes  No  NA 9.5 Fire blanket available as appropriate
- Yes  No  NA 9.6 Locations marked for all above items

**APPENDIX C**

**CHEMICAL INVENTORY TEMPLATE**



**APPENDIX D**

**INCIDENT REPORT Contact Public Safety or HR**





**APPENDIX E**

**SECONDARY CONTAINER LABEL TEMPLATE**  
(to be used with Universal Laser Printer Labels, 80108)

**APPENDIX F**

**CHEMICAL COMPATIBILITY CHART**

**APPENDIX G**

**SAFETY CONCERN FORM**

**SAFETY CONCERN**

Return completed form to Mark Ostapczuk, Chemical Hygiene Officer, Mail Stop Pepin 210

**Name** *(optional)* \_\_\_\_\_

**Contact e-mail** *(optional)* \_\_\_\_\_

**Department of concern** \_\_\_\_\_

**Laboratory of concern** \_\_\_\_\_

**Description of safety concern**

\_\_\_\_\_

\_\_\_\_\_

**Suggested Corrective Action**

\_\_\_\_\_

\_\_\_\_\_

.....

**SAFETY CONCERN**

Return completed form to Mark Ostapczuk, Chemical Hygiene Officer, Mail Stop Pepin 210

**Name** *(optional)* \_\_\_\_\_

**Contact e-mail** *(optional)* \_\_\_\_\_

**Department of concern** \_\_\_\_\_

**Laboratory of concern** \_\_\_\_\_

**Description of safety concern**

\_\_\_\_\_

\_\_\_\_\_

**Suggested Corrective Action**

\_\_\_\_\_

\_\_\_\_\_

**APPENDIX H**

**Prior Approval Form for Use of Particularly Hazardous Substance**



AppendixH  
Drew University  
Prior Approval Form for Use of Particularly Hazardous Substance.  
3/2011

1. Material to be used: \_\_\_\_\_

2. Hazard Summary/HMIS Rating: Health: Flammability: Reactivity:  
Other special hazards?

1. Title of Project \_\_\_\_\_

**2. Project Owner Information**

Project Owner \_\_\_\_\_

Department \_\_\_\_\_

Building \_\_\_\_\_ Room Number \_\_\_\_\_

Telephone \_\_\_\_\_ Fax \_\_\_\_\_

e-mail \_\_\_\_\_

**3. Laboratory Information where project will be conducted:**

Building \_\_\_\_\_ Room Number \_\_\_\_\_

Telephone \_\_\_\_\_

**Laboratory contact person if other than owner**

Name \_\_\_\_\_ Title \_\_\_\_\_

Telephone \_\_\_\_\_ email \_\_\_\_\_

**4. List of individuals working on this particular project (including students)**

<u>Name</u>	<u>Title</u>	<u>Chemical Hygiene Training Date</u>

**5. Brief non-technical abstract of planned work (Use other sheets if more space is needed):**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**6. Indicate applicable category of this project:**

New proposal



- Addition or modification to existing proposal (Indicate additional project approval #)
- Teaching / Training

7. List below the particularly hazardous chemicals that will be used in connection with this project.

Chemical Name	Chemical Abstract Number (CAS)	Hazard Class (Carcinogen, Reactive, mutagen, etc)

8. What is your previous work experience with the chemicals specified in Section 7?  
(Use additional sheets if necessary):

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9. Are Material Safety Data Sheets (MSDS) available to all employees working on this project?

- yes     no    If "no" please acquire all necessary MSDS

**CONTAINMENT AND SAFETY EQUIPMENT**

10. Will a chemical fume hood be used:  yes  no  
 Indicate flow-rate and date the chemical fume hood was last tested: \_\_\_\_\_  
 (Chemical fume hoods require annual testing and certification)

11. Indicate Personal Protective Equipment (PPE) to be used:

Gloves (indicate type \_\_\_\_\_)    Eye Protection (Indicate type \_\_\_\_\_)

Protective clothing (indicate type \_\_\_\_\_)    Respiratory Protection \* \_\_\_\_\_

Other (specify) \_\_\_\_\_

\* Note: If a respirator is used, the wearer must be examined by a health care professional to determine if the user is medically fit to wear a respirator. The CHO will choose the appropriate respirator and provide fit testing for the user.

**CHEMICAL WASTE DISPOSAL AND HAZARD COMMUNICATION**

12. Perform a waste determination on all waste streams resulting from this project in accordance with the Hazardous Waste Management Plan. Waste Streams identified:

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13. Is current emergency contact information posted in the laboratory where this project is to be performed?

yes     no

14. Indicate the type of fire extinguishers required

ABC  
 D  
 Not applicable

Is that type available in the lab     yes     no

Date fire extinguishers were last inspected \_\_\_\_\_

15. Please indicate any additional information or components pertinent to the CHO's review of this protocol:

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16. I have read and am familiar with the Chemical Hygiene Plan, Material Safety Data Sheets, safety practice, containment equipment, and laboratory facilities recommended for the chemicals used in this project. I agree that all faculty, staff and students working on this project will follow these recommendations as a condition of the Safety Comm8ittee approval of this project.

\_\_\_\_\_ **Date**

\_\_\_\_\_ **Project Owner**

**TO BE COMPLETED BY THE CHO ONLY**

**Date Received** \_\_\_\_\_

**Date Reviewed:** \_\_\_\_\_

**Approved**    \_\_\_\_ Yes    \_\_\_\_ No

**If no, explain:** \_\_\_\_\_

**If yes, assign approval #:** \_\_\_\_\_

**Date Returned to Project Owner:** \_\_\_\_\_

**CHO Name** \_\_\_\_\_ **Signature**  
*(print)*

## **Appendix I**

### **Drew Laboratory Safety Rules**

**Appendix I - DREW UNIVERSITY 7/26/10**  
**LABORATORY AND STOCKROOM SAFETY PROCEDURES AND RULES**

1. Everyone must wear protective glasses with side shields at all times in the laboratory. An appropriate type can be purchased from the stockroom. Contact lenses may be worn in lab, with appropriate protective equipment at the discretion of the instructor. Do not eat, drink, smoke, chew gum, or apply cosmetics in the laboratory.
2. Long hair must be tied back. Open shoes, sandals or bare feet are not permitted in the laboratory. Students should wear appropriate clothing for working with chemicals. This includes coverage of torso, shoulders and upper leg areas. Ask your instructor if you are unclear about what appropriate lab attire is.
3. Always wear protective equipment, depending on the hazards involved this may include but not limited to safety glasses with side shields, goggles face shield, gloves and apron. Refer to your instructor, lab safety manual or the chemical's material safety data sheet for specific information on the hazards of the chemicals used. Never taste a chemical. Never use a mouth pipette. Avoid unnecessary exposure to chemicals by whatever route.
4. Working with chemicals: Know what you are working with – assume all reagents are hazardous until told otherwise. Your instructor will describe any special precautions that need to be taken. You should work in the hood for all chemical reactions unless directed otherwise. Information on the hazardous properties of all chemicals in use are available on MSDS (Material Safety Data Sheets) located in the stockroom or online through various sources from the chemical manufacturer's and distributor's (<http://www.mallbaker.com/>, <http://www.fishersci.com>, <http://www.sigmaldrich.com/safety-center.html>) Never take reagents directly from the reagent bottle unless directed to do so. Always close chemical containers after pouring out the required quantity for a procedure. Do not allow chemicals to evaporate into the general room ventilation.
5. Never dispose of chemicals down drain unless the lab procedure specifically permits it. ALL volatile solvents and other hazardous chemicals must be disposed of in the waste containers provided. Before disposal in the waste jar check that the label includes the chemical you are adding, if it does not add it to the label using chemical names not formulae. Keep the lids of waste jars tightly closed at all times.
6. In case of skin contact with a chemical, wash immediately with a stream of water for 15 minutes. In case of eye contact with a chemical, wash immediately with a stream of water from the eye wash for 15 minutes.
7. For acid spills: Neutralize with solid sodium bicarbonate. The acid is neutralized when no more bubbles of gas (CO<sub>2</sub>) are evolved upon addition of the sodium bicarbonate. The spill may then be cleaned up and washed down the drain with plenty of water. For basic spills: neutralize with vinegar solution.
8. Report any injuries (however minor), spills and broken glass immediately. Clean or rinsed glassware may be disposed of in the regular broken glass receptacles. Dirty or contaminated broken glassware must be disposed of in the container designated for dirty broken glass.
9. Treat balances with respect. Clean up ANY spillage immediately. Benches and instruments must be cleaned and stools placed under benches before leaving the laboratory.
10. Perform only authorized experiments. None of the instrumentation may be turned on or off without the permission of the instructor.
11. Students are not allowed in the lab or stockroom without an instructor or stockroom technician. No chemicals or equipment are to be removed from the laboratory area.
12. Rules for safe practices in the laboratory must be followed. If you do not understand the above rules and protocols, please ask your instructor for clarification. Repeated failure to follow the above rules may result in a student being barred from the lab.

**I HAVE READ THE ABOVE PROCEDURES AND RULES. I UNDERSTAND THEM AND AGREE TO ABIDE BY THEM AT ALL TIMES.**

\_\_\_\_\_  
SIGNED

\_\_\_\_\_  
DATED

\_\_\_\_\_  
PRINT YOUR NAME

\_\_\_\_\_  
LAB COURSE



Appendix J  
Biosafety Cabinets

# Biological Safety Cabinets (BSCs)

## Types of BSCs

BSCs are classified as Class I, Class II or Class III cabinets. When properly maintained and operated, they effectively contain and capture microbial contaminants and infectious agents using HEPA (High Efficiency Particulate Air) filters. (See Figure 1.) Biosafety cabinets should not be confused with clean benches which only protect the material being worked with and are not suitable for work with infectious or toxic material. (Although clean benches, like BSCs, have HEPA-filtered air, with clean benches the air flows over the experimental material toward the user rather than being drawn away.) BSCs should also not be confused with conventional fume hoods that do not filter microorganisms.

**Class I BSCs** provide personnel and environmental protection, but not product protection. (See Figure 2).

**Class II BSCs** are the most commonly used BSC on campus. These cabinets provide personnel, environmental and product protection. (See Figure 3). Only those which are hard ducted to the outside and provide a face velocity of 80 to 125 feet per minute should be used when working with volatile chemicals. Additionally, cabinets are not designed to prevent ignition of volatile flammable chemicals.

## Working in a BSC

1. Turn the cabinet on for at least 10 - 15 minutes prior to use, if the cabinet is not left running.
2. Disinfect work surface with 70% alcohol or other suitable disinfectant.
3. Consider the materials necessary for the planned work in the cabinet.
4. Place items into the cabinet so that they can be worked with efficiently without unnecessary disruption of the air flow, working with materials from the clean to the dirty side.
5. Wear appropriate personal protective equipment. At a minimum, this will include a buttoned laboratory coat and gloves.
6. Adjust the working height of the stool so that the worker's face is above the front opening.
7. Delay manipulation of materials for approximately one minute after placing the hands/arms inside the cabinet.
8. Minimize the frequency of moving hands in and out of the cabinet.
9. Do not disturb the airflow by covering any of the grillwork with materials.
10. Work at a moderate pace to prevent the air flow disruption that occurs with rapid movements.
11. Wipe the bottom and side of the hood surfaces with disinfectant when work is completed.

**NOTE:** Be very careful when using small pieces of materials such as kimwipes in the hood. These can be blown into the hood and disrupt the motor operations.

## Certification of the BSC

Certification is a series of performance tests on the BSC to confirm that it will provide the user and experimental material the protection for which it is designed. The air flows, filters, and cabinet integrity are checked to ensure that the cabinet meets minimum performance standards. Certification is arranged through the department and provided by an outside vendor.

BSCs intended for user protection must be certified:

- After they are received and installed (before use with infectious materials)
- After filter changes
- Annually

Biological safety cabinets intended only for protection of the experimental material are certified at the discretion of the Principal Investigator