

**M<sup>c</sup>DANIEL COLLEGE**

**CHEMICAL HYGIENE PLAN**

**(revised 3/11)**

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## FOREWORD

There is a widely held belief that accidents are difficult to prevent because they occur randomly and have many different causes. Although accidents may have random parts, the injuries resulting from accidents are predictable, well known, and widely understood. Moreover, while accidents have multiple causes, injuries have a single cause: an exposure to excess energy.

Safety depends on the identification and control of energy (hazards) in the laboratory and work area. We can prevent and control the injuries resulting from accidents.

The purpose of the Chemical Hygiene Plan (CHP) is to remind all personnel of the policies and procedures for controlling energy in the laboratory and their work area.

Federal laws (29 CFR 1910) require that you know the information in the Chemical Hygiene Plan. Please read through carefully and address your questions to your direct supervisor and/or professor in charge of the laboratory.

This document and the procedures contained herein are intended to comply with regulations set forth in the Federal Register, in particular 29 CFR 1910.1450 and associated appendices A and B. Readers should refer to those documents for further details and definitions. As of 3/2011, those documents may be found at [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10106](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106)

If you are unable to read the written form, it can either be read to you or you can have an audio cassette to which you can listen.

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## OBJECTIVES

- 1. To set forth work practices, procedures, personal protective equipment and other equipment that will protect employees from hazards in the laboratories and work place.**
- 2. To keep exposures below government standards.**
- 3. To be readily accessible to employees**
- 4. To be reviewed at least annually and updated if necessary.**

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## I. GENERAL POLICIES AND PROCEDURES

### A. INTRODUCTION

**A definition for Safety: SAFETY MEANS THE PREVENTION OF INJURIES. Injuries in the work place are caused by the release of uncontrolled mechanical, thermal, electrical, nuclear, and/or chemical energy.**

**Acute injuries: Some injuries can take place quickly. Examples of sudden or acute injuries are: a cut by broken glass, the ingestion of a poison, a skin**

lesion from a corrosive chemical, a burn from a flame or hot object, or infection with AIDS virus.

**Chronic injuries:** Some injuries develop slowly over a long period of time. Examples of long term or chronic injuries are: Cancer from exposure to benzene, birth defects from exposure to a teratogenic agent, lung and heart disease from exposure to tobacco smoke or other harmful vapors.

## **B. SUMMARY OF LABORATORY SAFETY PROCEDURES**

It is helpful to recognize that although there are numerous rules and regulations for laboratory work, the rules all can be grouped into a small set of common strategies. **SHIELDING, SUBSTITUTION, AND REDUCTION.**

In addition, there is a simple and systematic approach to the application of these strategies. Each strategy is first discussed, then followed by methods to apply them.

### **1. Strategies to Control Energy in the Laboratory.**

#### **a. Shield People from Energy**

Standards and regulations based on this strategy include:

- 1. Protective clothing such as laboratory coats, aprons, gloves, safety glasses, and face shields.**
- 2. Restricting laboratory access to trained personnel or requiring that non-trained personnel only work under direct supervision.**
- 3. Restricting the type of work done in the laboratory by a person working alone.**
- 4. Developing standards for new or non-routine procedures.**
- 5. Employee training and education.**
- 6. Phones or room-connected sound systems.**

#### **b. Shield Energy from People**

Standards include:

- 1. Zoning regulations, building codes, and fire codes.**
- 2. Ventilation systems and respirators.**

3. Hoods and protective safety shields.
4. Warning labels, signs, and Material Safety Data Sheets.
5. Safety storage cabinets, and regulations.
  
6. Safety showers and eye wash stations.
7. Fire extinguishers, and alarm systems.

**c. Substitution**

Examples of substituting less dangerous materials or procedures for another are:

1. Substituting a less hazardous chemical for a more hazardous one, where possible and practical in a procedure, demonstration, or experiment.
2. Substituting non-breakable glassware or plastic containers for breakable glass containers.

**d. Reduction**

Reduction is the strategy of reducing the amount of a material available in a laboratory or building. Examples of reduction are:

1. Ordering and storing the minimum amount of a chemical appropriate for use during an agreed upon time period. (semester, one year, two years, etc.)
2. Preventing the accumulation of wastes.
3. Limiting the storage of flammable chemicals.
4. Preventing the accumulation of dangerous vapors by providing adequate ventilation.
5. Using micro or semi-micro scale equipment and amounts of reagents.

**2. Accidents**

**a. In case of an accident or injury:**

**1. Inform the responsible supervisor or faculty member IMMEDIATELY of any laboratory, or on-the-job accident or injury to anyone. (student, faculty, staff or visitor.)**

**2. First Aid kits are located in each laboratory or research area.**

**3. If the injury requires medical attention other than immediate first-aid, a registered nurse is available in Winslow Center. Call extension 2700.**

**4. If the injury is severe, the supervisor may call Campus Safety at extension 2202; or an ambulance at 9-911.**

**5. An INCIDENT REPORT must be completed for each accident or injury, and submitted to the appropriate Department Head and the Chemical Hygiene Officer as soon as possible after an accident or injury. Incident Report Forms are available in each department or from the Chemical Hygiene Officer.**

**6. INCIDENT/ACCIDENT FORM**

**PURPOSE: To ensure accurate records of untoward effects that happen at McDaniel College for both student and staff safety.**

**ACTIONS: All accidents will be documented by the employee or the supervisor. Preventative and/or corrective steps will be instituted as the situation demands, and will be recorded. A brief summary will be submitted on the General Incident/Accident Form also.**

**The total Incident/Accident Report must be completed and reviewed by McDaniel College's Chemical Hygiene Officer or his/her designee within 24 hours of occurrence.**

**All necessary departments (e.g. Chemistry, Biology, Nursing, Administration, Medical Director) must sign before the document is complete.**

**A log of such reports will be maintained in the Chemical Hygiene Office/Environmental Safety Office and a copy placed on the involved employee's/student's chart. A report will be furnished to the injured persons' referring physician.**

## **C. GENERAL RULES FOR SAFETY**

### **1. ACCIDENT AND INJURY PREVENTION**

#### **a. Introduction**

The outcome of a laboratory accident depends on three determinants:

- 1. The person or persons involved.**
- 2. The environment (or place) where the injury/damage occurred.**
- 3. The agent or type of energy(ies) involved.**

The three determinants are also known as the host (person), environment (place), and agent (thing or energy) involved.

The amount of injury or property damage depends on the condition of the host, environment, and agent *before, during* , and *after* the accident occurs. Therefore, laboratory safety strategies (i.e. policies and procedures) belong to one of nine categories: those policies and procedures affecting the PERSON, ENVIRONMENT, and AGENT BEFORE, DURING and AFTER a laboratory operation.

#### **b. BEFORE ANY OPERATION - POLICIES**

##### **1. Personnel**

**a. Never work alone in a laboratory without the express permission of the responsible faculty member, department head, or the Chemical Hygiene Officer.**

**b. Never work alone in a chemical storage area unless authorized by the responsible department head.**

**c. Wear appropriate clothing:**

**Cut-offs, shorts, tank-tops, sandals, and barefeet are prohibited in laboratories and work areas.**

**Safety goggles, sturdy closed toe shoes, and laboratory coat (or protective apron) are mandatory in laboratories or work areas where chemicals are used as**

directed by the supervisor. Disposable gloves are available, when required.

**Protect body and street clothing. Protective laboratory clothing must be worn by staff and students performing tests or handling samples and by anyone handling test reagents or animals.**

**Plastic aprons, masks, face shields and goggles are available to wear if there is a risk of fluid being splashed into the face area.**

**d. Shoulder length hair, neckties, etc. must be secured to avoid mishap around equipment.**

**e. Be aware of locations and proper usage of:**

**EMERGENCY SAFETY EXITS, FIRE EXTINGUISHERS and FIRST AID KITS. If any of the Fire Extinguishers are missing or have been discharged, notify the appropriate faculty member and/or the Campus Safety (extension 2202) immediately.**

**f. Obey regulations that protect against fire and explosion hazards.**

**g. Know and follow safety regulations stated in the safety manual for the particular department in which you are working.**

## **2. Environment**

### **a. TELEPHONES and EMERGENCY PHONE NUMBERS**

**Red telephones are located:**

- near the eyewash/safety showers in all large laboratories and student research labs in Eaton Hall and in all faculty offices.**

**In case of emergency call:**

**CAMPUS SAFETY- extension 2202**

**FIRE/POLICE/AMBULANCE: 9-911**

**Student Health Service - Registered Nurse - extension  
2700**

- b. SAFETY EXITS are marked by Exit lights.**
- c. FIRST AID KITS are located in each laboratory.**
- d. Additional First Aid supplies are available from Student Health Services the Winslow Center.**
- e. Eating, drinking and the application of cosmetics in laboratories and work areas is strictly forbidden.**
- f. Food and/or beverages are NOT to be stored nor consumed in any laboratory technical area. Trash from food must not be disposed of in laboratory trash cans.**
- g. Laboratory refrigerators and ovens are NOT to be used for food containers.**
- h. Laboratory glassware and/or containers are NOT to be used for food or beverages.**
- i. Since Biology and Chemistry Laboratory Building is designated as a NO SMOKING building, smoking is forbidden in any laboratory or work area in Biology and Chemistry Laboratory Building.**
- j. Ice from refrigerators or ice chests are not to be used for food consumption or beverage cooling.**

### **3. Agent**

- a. Consider ALL chemicals as potentially dangerous.**
- b. Be alert to the hazards of chemicals that are used in your work area and laboratory.**
- c. Study the manufacturers' directions for instructions in case of emergency contact or spillage.**
- d. Copies of Material Safety Data Sheets (MSDS) are available through your department or the Chemical Hygiene Officer.**

**e. A labeling system which identifies laboratory substances (reagents, specimen, etc.) must be observed. Always read the label before opening a chemical substance. Pay Attention to warnings and First Aid instructions.**

**f. Accurately label all containers:**

**Chemical Name - avoid abbreviations**

**Concentration**

**Date**

**Your Name (if other than the supervisor of the laboratory area)**

**c. DURING ANY OPERATION - POLICIES**

**1. Personnel**

**a. Each person must have the proper training, credentials, and supervision to perform the procedure or test attempted. Check with your supervisor to be certain.**

**b. Hands and face must be protected to avoid contact between skin and chemicals. Safety glasses are mandatory, and gloves will be provided if required.**

**c. Avoid touching hands to face, lips, mouth, etc. Be diligent in washing hands. Do not contaminate the work area.**

**d. Copies of Material Safety Data Sheets are available for inspection through your department or the Chemical Hygiene Officer.**

**e. Employees who wear contact lenses must exercise caution in a laboratory. The wearing of contact lenses in the laboratory is discouraged. Some chemicals may interact with lenses, complicating a situation beyond the extent of the chemical alone. Bacterium may become trapped between the eye and the lens.**

**f. Hand Washing shall be performed between each procedure. Hands shall be vigorously lathered and**

**rubbed together for approximately fifteen seconds under a moderate stream of water. Hands shall be thoroughly rinsed, then dried with a paper towel, and using the same towel, the faucet shall be turned off.**

**g. Following work, it is the responsibility of the worker to properly clean the work area of hazardous materials and properly dispose of same. Failure to do so may result in loss of laboratory privileges.**

**h. Supervisors are responsible for determining that those under them follow all safety procedures.**

## **2. Environment**

### **a. Equipment Safety**

**1. Be familiar with instructions and safety features of laboratory and work area equipment.**

**2. Some instruments and equipment are under service maintenance contracts. Check with the responsible faculty or department heads to determine which equipment is covered by these contracts before attempting repairs or modification.**

**3. Be aware of possible electrical shock dangers with electrical instruments. All electrical instruments must be properly installed and used.**

**4. Be aware of the moving parts on certain instruments and equipment. Keep hair, fingers and clothing from becoming entangled.**

**5. Centrifuges must be properly balanced before being used to prevent tube breakage. A centrifuge must NOT be opened until it has come to a full stop. NO attempt to brake, or stop a centrifuge by hand is permitted.**

**6. If breakage occurs within a centrifuge, turn off the machine immediately. Wait for the centrifuge to come to a full STOP. Use forceps to remove large pieces. Use paper towels to remove the remaining material. Decontaminate any affected area. Use appropriate clean-up**

**materials. Dispose of gloves, towels and breakage as appropriate (i.e. non-hazardous, hazardous, or bio-hazardous).**

**7. Exercise extreme caution when operating an autoclave. An autoclave must only be operated by a trained and qualified operator. Follow all safety instructions.**

**b. Be sure to place dangerous chemicals or solutions in properly marked waste containers when no longer needed.**

**c. Pipetting by mouth is PROHIBITED.**

**d. Avoid hand to mouth contact. Do not lick labels, chew pencils or turn pages by licking fingers!**

**e. Utilize disposable latex gloves where appropriate.**

**f. To prevent aerosolization:**

**1. Pour liquid specimens gently and with caution.**

**2. Gloves and masks must be worn when making suspensions.**

**3. Never forcefully eject or discard any materials which have been in contact with chemicals.**

### **3. Agent**

**a. Consider ALL chemicals as potentially dangerous.**

**b. Be alert to the hazards of chemicals that are used in your work area and laboratory.**

**c. Because no test method can offer complete assurance that BIO- HAZARD, including infectious agents, are absent, SAMPLES AND REAGENTS SHOULD BE HANDLED AS THOUGH CAPABLE OF TRANSMITTING A SERIOUS INJURY.**

**d. OSHA BLOODBORNE PATHOGENS REGULATIONS. SEE [APPENDIX 'A'](#). p. 28.**

## **d. AFTER ANY OPERATION - POLICIES**

### **1. Personnel**

**a. Report any breakage or damage to the responsible supervisor immediately. Send a copy of incident report to the Chemical Hygiene Officer. All breakage and material must be removed from equipment before operation may be continued.**

**b. Clean the work area. Clean all work surfaces daily, especially at the end of the work period.**

**c. All broken glass or shards shall be placed into special containers, clearly identified to alert maintenance and housekeeping staff. The waste containers shall consist of rigid-walled, impervious materials capable of resisting punctures and tears from the broken glass.**

**d. Hand washing is essential after handling bio-hazard, and especially when leaving the laboratory or work area for breaks, lunch, at the end of scheduled laboratory period, and at the end of the day.**

### **2. Environment**

**a. Spills must be cleaned up immediately. Broken or chipped items must be disposed of at once in an appropriate, controlled method.**

**b. Spills occurring on hard, non-porous surfaces (counter tops, floors, etc.) must be wiped up immediately with absorbent materials then cleaned and decontaminated. All materials used for clean up and decontamination must be placed in proper hazardous or bio- hazardous waste container for disposal.**

### **3. Agent**

**a. Equipment which is exposed to blood and/or blood products must be cleaned on a regular basis to avoid contamination. Use a solution of 10% Sodium Hypochlorite (bleach).**

**b. Accidental spills of hazardous chemicals must be cleaned up and the area decontaminated immediately by qualified personnel. Spill kits are located in each lab with materials to clean up spills involving acids, bases and volatile liquids. For assistance and advice, contact the Chemical Hygiene Officer.**

**c. Return all reagents and supplies to proper storage facility.**

**d. Leaving unlabeled containers of chemicals or glassware contaminated with chemicals in the laboratory is strictly forbidden.**

#### **e. SPILLAGE AND BREAKAGE-POLICIES**

##### **1. Spillage - Chemicals and/or Biologicals**

**a. The following are general procedures to be followed in the event of chemical or biological spills in a laboratory.**

**1. If personnel are injured or contaminated by the incident, they must be taken or directed to a safety shower or eyewash station located in the laboratory. Appropriate decontamination actions and any first aid or medical assistance should be initiated. Heavily contaminated clothing should be removed.**

**2. If a flammable chemical is involved, turn off all electrical equipment, and sources of flames, and ventilate the room.**

**3. Chemicals must be cleaned according to manufacturers' directions as indicated on the appropriate Material Safety Data Sheet.**

**4. Avoid skin contact during clean up. Dispose of gloves, towels, and clean up materials as hazardous, bio-hazardous, or non-hazardous waste as appropriate.**

**5. Saline and hydrogen peroxide solutions will remove blood stains.**

**6. Dilute (10%) sodium hypochlorite (bleach) can be used to disinfect biologically contaminated areas.**

## **2. Breakage - Glassware**

**a. Use available items such as brushes and dust pans to clean up broken glassware. Never use bare hands to clean up broken glass. Place broken glass only in cardboard receptacles labeled Broken Glass, which are provided in each laboratory. Never put broken glass in trash cans used for general paper waste.**

**b. For large amounts of breakage or assistance call maintenance/physical plant, ext. 2710.**

## **f. DISPOSAL OF HAZARDOUS WASTES**

**1. Hazardous chemical wastes will be professionally disposed of on an annual or biannual basis, depending on the volume collected during the year.**

**2. Each department must contact the Chemical Hygiene Officer whenever there are hazardous materials to be removed. The Chemical Hygiene Officer will determine how best to dispose of the materials. If possible, the material will be safely disposed of in-house, under the supervision of the Chemical Hygiene Officer. If the material cannot be safely disposed of in-house, it will be collected and stored in Eaton G5 until the annual or biannual disposal by a qualified hazardous waste contractor.**

**3. Biological wastes will be collected, packaged, and disposed of on a regular basis by a qualified contractor under the direction of the director of Student Health Services.**

**4. Bacteria cultures and other non-human biological waste generated in the microbiology lab will be autoclaved and placed in black trash bags to be discarded with normal trash.**

## **g. MAJOR ACCIDENTS OR EVENTS REQUIRING EVACUATION OF BUILDING (EATON HALL)**

**1. See [Appendix B](#) for evacuation of Eaton Hall**

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## **II. VENTILATION AND SAFETY EQUIPMENT**

### **A. VENTILATION**

- 1. Room ventilation is measured once every semester.**
- 2. The calculated room ventilation must be not less than eight air changes per hour. This is a minimum standard, and does not protect against toxins having a low air concentration limit, or a high vapor pressure.**

### **B. FUME HOODS**

- 1. Fume hood air flow is measured once every semester.**
- 2. Fume hoods must provide an air flow of 70 to 90 linear feet/min.**
- 3. Proper use of fume hoods**
  - a. A fume hood is a backup device for equipment that collects vapors and fumes. It is never to be used to 'dispose' of chemicals by evaporation unless the vapors are trapped and recovered for proper waste disposal.**
  - b. Equipment in a fume hood must be placed on the counter top of the hood at least six inches from the front edge.**
  - c. Fume hood windows must be closed (lowered) at all times except when necessary to adjust or move the items inside the fume hood.**
  - d. The fume hood ventilation fan must be operating whenever a chemical is inside the hood.**
  - e. Personnel must be trained in procedures to be taken in the event of a power failure, or fume hood failure.**
  - f. Ducts, vents and fans must be inspected at frequent intervals. Fume hood maintenance must be scheduled with Physical Plant at the end of each spring semester.**
  - g. Fume hoods must never be used for the storage of chemicals, apparatus or other materials.**
  - h. If a fume hood alarm sounds, cease work in that hood immediately and transfer any hazardous materials to a properly functioning hood. Immediately notify your supervisor and the Chemical Hygiene Officer of the hood failure.**

### **C. FLAMMABLE STORAGE**

- 1. Flammable materials in excess of 500 ml must be stored in flammable storage cabinets.**
- 2. Storage of flammable materials must not exceed the cabinet limits.**
- 3. Combustible materials, including paper, and cardboard, must NOT be stored near flammable storage cabinets.**

### **D. CORROSIVE STORAGE**

- 1. Corrosive materials in excess of 500 ml must be stored in vented, corrosive safety cabinets.**
- 2. Storage of corrosive materials must not exceed the cabinet limits.**
- 3. Store only compatible corrosive materials inside each safety cabinet.**

### **E. EYEWASH FOUNTAINS AND SAFETY SHOWERS**

- 1. Laboratories must be equipped with tepid water eyewash fountains and safety showers.**
- 2. Faculty, staff, and students must know the location of the eyewash fountains and safety showers.**
- 3. Access to eyewash fountains and safety showers must NEVER be blocked by temporary storage of objects, or in any other way.**
- 4. Eyewash fountains are to be checked once each month to verify that the fountains are operational, and the water is clean.**
- 5. Safety showers are to be checked once each month to verify that the showers are operational, and the water is clean. Safety shower checks are performed by the Biology and Chemistry Department lab personnel.**
- 6. Record logs are to be kept of the eyewash fountains and safety showers checks.**

### **F. VAPOR DETECTION**

- 1. Whenever there is reason to suspect that a toxic chemical inhalation limit might be exceeded, or a suspicious odor is noticed, notify the Chemical Hygiene Officer.**
- 2. NEVER use odor as a means of determining that inhalation exposure limits are being exceeded.**
- 3. Personnel may wear appropriate respirators for protection against the suspect vapor until measurements show the suspect is absent OR the laboratory or room must be vacated until tests verify the safety of the air.**

## **G. HIGH FIELD NMR ISSUES**

**Two safety issues are particularly relevant to the use of high field NMRs, strong magnetic fields and cryogen handling.**

### **1. High strength magnetic fields**

**Standards for Exposure - The ACGIH (American Conference of Governmental Industrial Hygienists) has set guidelines for continuous exposure to static electromagnetic fields as follows:**

**Note: 1 Gauss (G) = 0.1 milliTesla (mT)**

**5 G Highest allowed field for persons with implanted cardiac pacemakers.**

**600 G Allowed time weighted average routine exposure to the whole body.**

**6000 G Allowed time weighted average routine exposure to the extremities.**

**2 T Ceiling limit (no exposure is allowed above this limit).**

**Note: Time of exposure is normally only a concern for extremely high flux exposure to the whole body.**

**Magnetic Field Measurements - NMR (Nuclear Magnetic Resonance) magnets commonly produce core fields from 0.2 T to 20 T. These fields decrease in intensity as the distance from the core increases. A flux (field strength) map of the area surrounding the magnet must be developed and posted for use by staff.**

**Posting of Magnetic Field Hazards - Rooms containing magnets shall be marked with magnetic field hazard signs (available from chemistry**

stockroom manager). The 5 G threshold line shall be clearly identified with floor tape, rope, or equivalent markings. The location of the 5 G line will vary with the operating frequency and resulting magnetic flux. As an example, one vendor indicates the following values for their product line:

**Operating frequency of 200 MHz - 5 G threshold line @ 1.3 meters**

**Operating frequency of 500 MHz - 5 G threshold line @ 3.5 meters**

**Operating frequency of 800 MHz - 5 G threshold line @ 6.0 meters**

**Access Restrictions - Persons with cardiac pacemakers shall be restricted to areas outside the 5 G threshold line. Security (locked doors) must be maintained to prevent unauthorized access to the magnet area.**

**Hazards and Bioeffects - Ferrous objects may present a kinetic energy hazard if brought into areas closer than 3 meters from the magnet (where the fields exceed 10 G). There are no known adverse bioeffects for flux densities within the ACGIH limits.**

**Kinetic Energy Hazards - Due to the large flux associated with NMR magnets, ferrous objects can be accelerated toward the magnet with sufficient energy to seriously injure staff and/or damage the magnet. As a precaution, even small metal objects such as tools, razor blades, and paper clips must be kept at least 3 meters from the magnet. Large ferrous objects (equipment racks, tool dollies) must never be moved around in the room while the magnet is energized.**

## **2. Cryogen Issues**

**Types and Expansion Ratios - The cryogenic (liquefied) gases used in NMR magnets are Liquid Nitrogen (-320 deg. F) and Liquid Helium (-452 deg. F). If these liquids are raised to room temperature, the resulting gases expand to hundreds of times their liquid volumes, displacing the air in the room (LN =694/1, LH = 700/1).**

**Quench - Quench is the unexpected loss of superconductivity in a NMR magnet that results in rapid heating through increased resistance to the high current. This can violently damage the magnet and cause rapid venting of large volumes of gas into the room, quickly resulting in an oxygen deficient atmosphere. To avoid a quench situation, check cryogen level sensors at least weekly and always refill or de-energize the magnet if low cryogen levels are indicated on the sensors.**

**Personal Protective Equipment (PPE) - When handling cryogenics, the use of insulated gloves (to protect against thermal burns), face shields or other splash eye/face protection, closed toed shoes, and labcoat are required.**

**Dewars - The containers used for transporting cryogenics must be made of metal. Glass dewars can easily implode, causing seriously injury. All dewars must have appropriate vents. Unvented containers can rupture as the liquids warm and expand. All transfers of cryogenics must be continuously attended to prevent spills or frozen valves.**

**Room Ventilation - Generally speaking, 5 complete room changes per hour is considered adequate for managing small spills or releases. In the event of a major release, the staff must immediately leave the room and the room doors must be left open. If the risk of a catastrophic release exists, auxiliary ventilation (fans) may be needed to restore a safe oxygen level atmosphere.**

**Bioeffects of Cryogen Exposure - Direct contact with the skin or eye tissues can cause severe damage through frostbite (tissue damage from freezing). If the frostbite is severe, the damaged tissues may need to be amputated. Inhalation of concentrated cryogen gases may cause loss of consciousness and death through asphyxiation (oxygen deprivation).**

**For additional information on working with cryogenics see**

- [Safe Handling of Cryogenic Liquids](#)

## **G. LASER HAZARDS**

**Laser is an acronym for "light amplification by stimulated emission of radiation." Radiation in this case occurs in the portions of the electromagnetic field with insufficient energy to induce ionization or breaking up on the atom (i.e., it is non-ionizing). Non-ionizing radiation occurs in the radio frequency, microwave, infrared visible and ultraviolet ranges.**

**Lasers operate in two modes: pulsed (e.g. Q-switched lasers) and continuous wave (CW). Generally, pulsed lasers are more hazardous than CW lasers. Lasers using CO<sub>2</sub> and certain other materials emit beams that are not visible to the eye, hence they are particularly hazardous.**

**Biological damage caused by lasers includes thermal burns, photochemical burns and retinal injury. Electrical safety and fire are also important concerns.**

**In the use of a laser, safety procedures must be established and followed so that protection is provided for students, teachers, workers, visitors, bystanders and passersby.**

**Hazards may include:**

**Vaporized target material from high-energy laser cutting, drilling and welding operations.**

**Gases from lasers**

**Gases from cryogenic coolants**

**Ultraviolet or infrared radiation**

**Electrical hazards--cables between the power supply and laser head must be properly selected and placed and the capacitor system safeguarded.**

**All electrical equipment must be well-maintained to prevent shocks and burns. Energy sources for lasers are essentially high-voltage equipment. Capacitors must be de-energized before cleaning or any repairing. All voltage on capacitors must be removed before leaving equipment. Interlocks must be provided to prevent access to components of high-voltage currents. Fire buttons must be remote from the charge and hold buttons to prevent accidental discharge of a laser. All ultraviolet and infrared radiation must be shielded.**

**Hazard controls in the operation of lasers are:**

- 1.Do not look into the primary beam or at reflections of the beam.**
- 2.Avoid aiming the laser with the eye to prevent looking along the axis because of the hazard of reflection.**
- 3.If possible, work with lasers must be done in areas of high general illumination to keep pupils constricted.**
- 4.Proper safety glasses must be worn to filter out specific injurious frequencies of the unit.**
- 5.Terminate the laser beam with material that is non-reflective and fire resistant.**
- 6.Provide adequate clear space around the laser path.**

**7. Provide protection from electrical shock from the potentially dangerous electrical sources of high and low voltage.**

**8. High-voltage rectifiers may generate X-rays and require protection.**

**There are many special precautions that must be taken from the particular lasers as high-powered pulsing lasers and low-powered gas and semiconducted systems. Carbon dioxide and nitrogen lasers are fire hazards.**

**Any room where a laser is located must be adequately marked on the entering door and in the room so that everyone (students, faculty, staff, and/or visitors) is aware of its presence.**

**Security of the equipment against inadvertent intrusion must always be considered when operating a laser.**

**At least two people must be present at all times when lasers are in operation or if a person must work alone, contact Campus Safety before and after. Under no circumstances must a room containing an active laser be left unattended or unlocked.**

**Ventilation of the room must be considered to remove any accumulation of hazardous gases or fumes that are generated in the operation of the laser.**

**All personnel in the laser area should be informed about the potential eye hazard of accidental exposure to the beam. It is the responsibility of the project supervisor to give each person concerned a copy of these rules and ensure that all safety precautions are observed.**

**More detailed information is given in the American National Standard for the safe use of lasers (ANSI Z136.1-1973) and OSHA 29 CFR 1910.32 for eye protection; 21 CFR 1040 (U.S. Food and Drug Administration's control of commercial devices); and OSHA's 29 CFR 1926.54 construction uses. These standards cover facilities, program requirements and safety measures. It is strongly recommended these standards be reviewed as supplementary information to be followed.**

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### **III. PERSONNEL TRAINING AND INFORMATION**

#### **A. CURRENT EMPLOYEES (Including Designated Student Employees)**

- 1. Must read and understand the provisions of the Chemical Hygiene Plan (CHP) and individual Laboratory Safety Manuals for departments in which they work.**
- 2. Must review the Chemical Hygiene Plan and individual Laboratory Safety Manuals for departments in which they work at least yearly and sign a log indicating they have read and understand its provisions.**
- 3. Be aware of the location of Material Safety Data Sheets (MSDS) for chemicals in use and review those of any highly toxic materials with which they work.**
- 4. Using sources such as the Chemical Hygiene Plan and Material Safety Data Sheets, will review the signs and symptoms associated with over exposure to chemical or bio-hazards used in their research or laboratory.**
- 5. Will review the measures to be taken for protection from chemical or bio-hazards, before, during, and after exposure.**

#### **B. NEW EMPLOYEES**

- 1. Read the standard operating policies and procedures for the departments or divisions in which they work. Supervisors shall provide additional information and training as necessary.**
- 2. Must review the Chemical Hygiene Plan and individual Laboratory Safety Manuals for departments in which they work and sign a log indicating they have read and understand its provisions.**
- 3. Learn the operating instructions, and safety policies for specific equipment and chemicals to be used in their research or laboratories.**
- 4. Be aware of the location of Material Safety Data Sheets (MSDS) for chemicals in use and review those of any highly toxic materials with which they work.**
- 5. Using sources such as the Chemical Hygiene Plan and Material Safety Data Sheets, will review the signs and symptoms associated with over exposure to chemical or bio-hazards used in their research or laboratory.**
- 6. Will review the measures to be taken for protection from chemical or bio-hazards, before, during, and after exposure.**

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#### **IV. PRIOR APPROVAL**

**Personnel must obtain prior approval to proceed with a laboratory task from the responsible faculty or staff member whenever:**

- A. A new procedure or test is to be carried out.**
- B. It is likely that toxic limit concentrations could be exceeded, exposures to pathogenic organisms may be excessive, or that other harm is likely to occur.**
- C. There is a change in a procedure or test, even if it is very similar to prior practices. A 'change' in procedure means:
  - 1. A ten percent increase or decrease in the amount of one or more reagents.**
  - 2. A substitution or deletion of any of the chemicals in a procedure is to be conducted.**
  - 3. Any change in other conditions under which the procedure is to be conducted.****
- D. There is a failure of any of the equipment used in the process especially of safeguards such as ventilation systems, fume hoods, electrical apparatus and warning devices.**
- E. Personnel become ill, suspect that they or others have been exposed to a hazard, or there is any suspicion about a failure of safeguards.**

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#### **V. PROVISIONS FOR MEDICAL CONSULTATION AND EXAMINATION**

**There may be times to suspect that personnel have been exposed to a chemical or biological hazard to a degree and in a manner that might have caused an injury to the person(s).**

**If the circumstances suggest a reasonable suspicion of exposure, that person is entitled to a medical consultation and, if so determined in the consultation, also to a medical examination at no cost, without loss of work time attributed to that person.**

- A. Criteria for Reasonable Suspicion of Exposure
  - 1. It is the policy of McDaniel College to promptly investigate all incidents in which there is even a remote possibility of employee over- exposure to a chemical, biological, radiation or lazer hazard.****

**2. Events or circumstances that might reasonably constitute over-exposure include:**

- a. A chemical or biological leak, spill or rapid release in an uncontrolled manner.**
- b. Skin, mouth, or eye contact with a chemical or biological hazard.**
- c. Personnel exhibit symptoms such as a rash, headache, nausea, coughing, tearing, irritation or redness of the eyes, irritation of nose or throat, dizziness, loss of motor dexterity or judgement, etc. and
  - 1.) some or all of the symptoms disappear when the person is taken away from the exposure environment and breathes fresh air, and**
  - 2.) the symptoms reappear soon after the employee returns to the suspect environment with the same chemical or biological hazards.****
- d. Two or more persons in the same suspect environment have similar complaints.**

#### **B. Exposures**

- 1. All complaints and their disposition, no matter what the ultimate disposition may be, are to be documented by the supervisor and the Chemical Hygiene Officer.**
- 2. If no further assessment of an event is deemed necessary, the reason for that decision should be included in the documentation.**
- 3. If the decision is to investigate, a formal exposure assessment will be initiated by the Chemical Hygiene Officer.**

#### **C. Exposure Assessment**

- 1. In emergencies, exposure assessments are only initiated after the subject personnel have been treated.**
- 2. The exposure assessment is to determine if there was an exposure that might have caused an injury and, if so, to identify the chemical or biological hazard involved.**

**3. The exposure assessment is conducted to determine facts, not to make recommendations. It is NOT conducted to assign blame for failure to follow standard or regulated practices.**

**4. Other investigators may use the assessment results to derive recommendations for several purposes.**

**5. These actions constitute an exposure assessment:**

**a. Interview the complainant and/or injured person(s).**

**b. List the essential information about the circumstances of the complaint:**

**1.) the status of the complainant and/or injured person(s).**

**2.) the laboratory, and the suspected chemical or biological agent, radiation or laser before, during, and after the exposure took place, specifically cite:**

**a.) The chemical or biological hazard under suspicion**

**b.) Other chemical or biological hazards exposures.**

**c.) All chemical or biological hazards being used in the immediate area.**

**d.) Symptoms claimed and exhibited by the complainant and/or injured person.**

**e.) How these symptoms compare to symptoms stated in the Material Safety Data Sheets for each of the identified chemical or biological hazards.**

**f.) Were control measures, such as gloves, or fume hoods, shields, etc. used appropriately?**

**g.) Were any sampling or monitoring devices in place? If so, are the measurements obtained from these devices consistent with other information?**

**6. Monitor or sample the air in the area for suspect chemical or biological hazards or radiation.**

**7. Determine whether the present control measures and safety procedures are adequate to prevent a recurrence.**

## **D. NOTIFICATION**

**1. Within fifteen days of receipt of the results of any monitoring, notify the college Personnel Office of the results.**

## **E. MEDICAL CONSULTATION AND EXAMINATION**

**1. Purpose: The *medical consultation* determines whether a *medical examination* is warranted. The details of medical consultations and examinations are determined by the physician.**

**2. When the results of an exposure assessment demonstrates or suggests that a person was over-exposed to a chemical or biological hazard, the person should obtain medical consultation from, or under the direct supervision of, a licensed physician.**

**3. When warranted, the subject person must receive a medical examination from, or under the direct supervision of, a licensed physician who is experienced in the diagnosis and treatment of patients who have experienced over-exposure to chemical or biological agents.**

**4. These provisions apply to the employer:**

**a. The employer must provide personnel with an opportunity to receive medical consultation and examination when:**

**1.) The person develops signs and symptoms associated with a chemical or biological agent to which the person was exposed in the laboratory, or workplace.**

**2.) Monitoring, routine or otherwise, suggests that there could have been an over-exposure to a chemical or biological agent.**

**3.) There is a spill, leak, of uncontrolled release of a chemical or biological agent.**

**b. The employer must provide the physician with:**

**1.) The identity of the chemical or biological agent to which the person was exposed.**

**2.) The exposure conditions.**

**3.) The signs and symptoms of exposure, if any, the person is experiencing.**

**c. The physician must supply the employer as soon as possible with a written report. The physician may make an emergency oral report if the nature of the exposure could threaten other persons. The written report must include:**

- 1.) Recommendations for follow up, if determined to be pertinent.**
- 2.) A record of the results of the consultation, and of the examination, if applicable; and the results of any tests that were conducted.**
- 3.) Conclusions concerning any other medical condition noted that could put the person at increased risk.**
- 4.) A statement that the person has been informed both of the results of the consultation or examination, and of any medical condition that may require further examination and treatment.**
- 5.) These written statements and records must NOT reveal any specific findings that are not related to an occupational exposure.**

#### **5. Notification**

**The Personnel Office shall be notified of the results of any medical consultation or examination with regard to any medical condition that exists or might exist as a result of over-exposure to a chemical and/or biological hazard agent.**

#### **6. Documentation**

**All memos, notes, and reports related to a complaint of actual or possible exposure to hazardous chemicals or biological agents are to be maintained as part of the records maintained at the Personnel Office.**

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## **VI. CHEMICAL HYGIENE OFFICER (CHO)**

### **Duties of the Chemical Hygiene Officer**

**A. Review and update the Chemical Hygiene Plan (CHP) yearly. The CHO will review the CHP in May of each year, and make any updates by August of that same year.**

**B. Inform employees of the existence and location of the Chemical Hygiene Plan.**

**C. Keep records of employees exposed to hazardous materials.**

**D. Provide employees and students with:**

**1. Training and information regarding chemical, biological and physical hazards.**

**2. Identification of other hazards.**

**3. Access medical consultation and examination.**

**4. Special safety equipment when required.**

**E. Keep all Material Safety Data Sheets that are received, and make them available to employees.**

**F. When hazardous chemicals are generated, train personnel in their safe handling.**

**G. If chemicals are produced for off-site use, comply with appropriate Environmental Protection Agency, (EPA) and Department of Transportation, (DOT) regulations.**

**H. Arrange for the concentration measurement of an agent, if there is reason to suspect that exposure limits have been exceeded for any chemical, biological or radioactive agent with a substance-specific standard. If the concentration exceeds the established standard:**

**1. Notify applicable personnel of the results of the measurements and**

**2. Comply with OSHA regulations for that chemical as stated in 29 CFR 1910.1000 through 1910.1199.**

**I. Follow the Respiratory Protection Standard, 29 CFR 1910.134, if respirators are necessary to keep exposures below the applicable standards.**

**J. Records and Record Keeping**

**1. Federal law requires that records of monitoring, exposures, medical consultations and examinations be maintained for a least 30 years and that they be accessible to employees and their representatives.**

2. It is desirable to develop a system that retains documents related to the distribution of Material Safety Data Sheets, employee training, and significant employee suggestions for the lifetime of the institution.

3. Specific records may be required in the event of lost work time resulting from an exposure or injury on the job. Use OSHA Form 200 to record lost workdays that occur.

4. It is desirable to keep records developed internally that document exposure complaints and suspected exposure regardless of the outcome. These records may include:

a.) employee comments and complaints together with the results of the follow-up investigation.

b.) Near-miss reports

c.) Repair and maintenance records.

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**VII. ADDITIONAL PROTECTION FOR WORK WITH SELECT CARCINOGENS, REPRODUCTIVE TOXINS, UNKNOWN MATERIALS AND SUBSTANCES WITH A HIGH DEGREE OF TOXICITY**

**A. Select carcinogens, Reproductive Toxins, and Substances with a High Degree of Toxicity are known as "*Acute Biohazards*".**

**B. "*Select Carcinogen*" means a substance which meets one of the following criteria:**

**1. It is regulated by OSHA as a carcinogen.**

**2. It is listed in the latest edition of the Annual Report on Carcinogens published by the National Toxicology Program, or is listed by the latest edition of the International Agency for Research on Cancer Monographs.**

**3. Causes tumors when exposed to experimental animals after specified oral, dermal or inhalation exposure.**

**C. "*Reproductive Toxin*" means a substance which affects the reproductive capabilities, including chromosomal damage (mutations) and affects on fetuses (teratogenesis).**

**D. "Substances with a High Degree of Toxicity" are so classified by the appropriate Material Safety Data Sheet.**

**E. "Designated Area" means a fume hood, glove box, portion of a laboratory, or an entire laboratory designated as the only areas where work with "Acute Biohazards" in excess of limits specified by the Chemical Hygiene Officer shall be permitted.**

- 1. "Designated Areas" shall be posted and their boundaries clearly marked.**
- 2. Only those persons trained to work with "Acute Biohazards" will work with those substances in a designated area. All such persons will:**
  - a. Use the smallest amount of the acute biohazard substance consistent with the requirements of the work to be done.**
  - b. Use high efficiency particulate air filters and high efficiency scrubber systems to protect vacuum lines and pumps.**
  - c. Store the Acute Biohazard substances or remove them from storage.**
  - d. Decontaminate a designated area.**
  - e. Prepare wastes from work with chemicals for waste disposal in accordance with the Resource Conservation and Recovery Act and as designated by the college Chemical Hygiene Officer.**
- 3. Store Acute Biohazard substances in locked and enclosed spaces with slight negative pressure compared to the rest of the building.**
- 4. Wear appropriate protective clothing when working in the "designated area".**
- 5. When working in the "designated area" do NOT wear jewelry since decontamination of jewelry may be extremely difficult.**

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## **VII. RESPONSIBILITY**

**The Chief Executive Officer, the President of the College, has the ultimate responsibility for safety and will appoint a Chemical Hygiene Officer (CHO).**

The Chemical Hygiene Officer must be qualified by training and experience to provide technical guidance in the development of the Chemical Hygiene Plan (CHP).

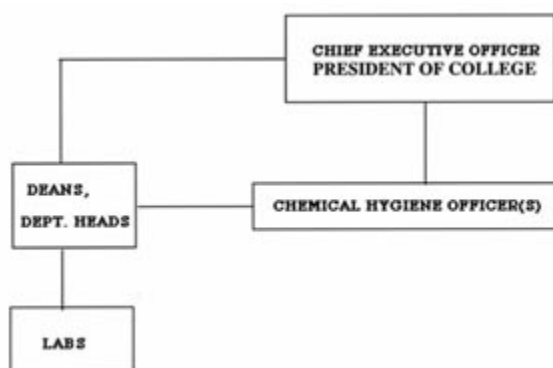
The Chemical Hygiene Officer acts as a representative of the Chief Executive Officer for Safety.

The Chemical Hygiene Officer may appoint qualified laboratory personnel to supervise sections of The Chemical Hygiene Plan.

A chart of the organizational responsibility is shown below.

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**McDANIEL COLLEGE  
CHEMICAL HYGIENE PLAN  
ORGANIZATION CHART**



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**APPENDIX A**

**RE: OSHA Bloodborne Pathogens regulations**

This section and the procedures contained herein are intended to comply with regulations set forth in the Federal Register, in particular 29 CFR 1910.1030 and associated appendices A and B. Readers should refer to those documents for further details and definitions. As of 3/2011, those documents may be found at [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=standards&p\\_id=10051](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=10051)

**Date: February 21,1996**

**In order to comply with OSHA and MOSH regulations, the College has established the following policy based on federal and state guidelines:**

**All employees will follow guidelines requiring universal precautions when dealing with potentially infectious materials. Briefly, potentially infectious material is defined as "blood, semen, vaginal secretions, cerebral spinal fluid, synovial fluid, pleural fluid, pericardial fluid, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids; any unfixed tissue or organ from a human (living or dead); and HIV containing or HBV containing cultured medium or other solution; and blood, or other tissues from experimental animals infected with HIV or HBV." Universal precautions require that "all human blood and certain body fluids are treated as if known to be infectious for HIV, HBV, and other bloodborne pathogens." (excerpt from Federal Register Volume 56, Number 235,299CFR Part 1910.10300 Subpart Z, 1-3) Text available on file in Personnel Services.**

**Except for those employees with and occupationally required exposure to potentially infectious materials, employees are directed to contact Housekeeping at extension 2710 during business hours, or Campus safety at extension 2202 after hours, in the event of discovery of potentially infectious material. Additionally, employees are directed not to handle any red plastic bags or boxes marked by a biohazard label (shown below). these containers are contaminated with potentially infectious material.**

**Employees who have occupationally required contact with potentially infectious materials will be defined as high risk and will be notified and specially trained. Questions on this topic may be directed to the Personnel Services Office at extension 2229.**

**TGS/ny**



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## Appendix B - **EATON and LEWIS HALL EVACUATION PLAN**

### Safety; Emergency Action Plan for Eaton and Lewis Hall

Situations could arise that would require that all or parts of Eaton or Lewis Hall be evacuated. Examples are major fires, power outages, major chemical spills or severe weather. All possible attempts shall be made to circulate information as to the type of emergency and the proper evacuation routes. Should you hear the alarm sound, leave the building immediately because someone is warning you of a severe hazard. Except in the case of severe weather (see below), leave by the closest stairwell, exit via the closest set of doors, and move away from the building. Elevators must not be and cannot be depended on for use during any evacuation procedure. Do not reenter the building until either the alarm has stopped or you are told by campus safety that it is safe to reenter the building.

In any evacuation, steps should be taken to secure to insure all doors are closed and locked. This is advised from a security aspect as well as for the need to contain the spread of any hazard. If time permits, all occupants should carry any personal items (e.g. purses, coats, paperwork, computer disks) that might be required if the building were to be closed overnight. Once the building has been evacuated, you will not be allowed to return to your office or workstation until the "all clear" has been sounded.

**Severe Weather:** In the event of severe weather, all areas above ground are to be evacuated via the south stairwell to the basement. In the event of severe weather, the north stairwell must not be used since it contains a large area of exposed glass. These windows may be blown in during severe wind conditions. Remain below ground until the "all clear" has been sounded.

**Major Fire or explosion:** This type of emergency requires rapid evacuation. If the fire alarms are sounding, leave immediately! Use the nearest stairwell not blocked by smoke or flames. Do not use the elevators. Close all doors; especially fire doors. If you are a person discovering a fire, sound the alarm by activating a pull station as you leave the building. The fire alarm boxes are located near the stairwells. When it is safe to call campus safety, do so to provide more information. Stay on the line until the dispatcher hangs up. If you are trapped in a smoky corridor, remember that smoke rises, leaving the cleanest air near

**the floor. Crawl on hands and knees on the floor to the nearest exit. Get outside as rapidly as possible.**

**Major chemical spills and gas leaks: This type of emergency is similar to fire with the exception the fumes are usually invisible and heavier than air. They may accumulate in low areas. If you are below ground, leave the building as soon as possible. Many fumes are flammable or even explosive. Put out all potential sources of ignition immediately. Do not turn light or any other electrical equipment on or off. Avoid any action that may create sparks.**

**Power failures or loss of ventilation: This type of emergency also requires evacuation of the building, although in this case leaving can be more orderly. Experience has shown that the air within the building may become unhealthy once the ventilation system stops working.**

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