**Eastern Mennonite University**

**Chemical Hygiene and Safety Plan**

## **Table of Contents**

##### Page

1. Introduction 4

###### University Safety Policy Statement 4

###### General Principle 5

###### Responsibilities   5

###### General Principles for working with laboratory chemicals 7

* 1. Laboratory Design 7
  2. Revisions 7

1. Hazard Determination and Assessment  8

###### Critical Hazards Identification 8

###### Environmental Monitoring and Surveillance 8

1. Chemical Procurement, Distribution, Storage, and Disposal 9

###### Procurement of Chemicals 9

###### Initial Storage and Distribution 10

###### Chemical Storage 10

* 1. Disposal of Waste Chemicals 11

1. Medical Surveillance & Emergency Attention  11

###### Examination Determination 11

###### Medical Exam Criteria and Frequency 12

###### Bioassay Frequency and Criteria 13

###### Emergency Medical Attention 13

1. Facilities Maintenance and Inspection                                                                 13

###### Ventilation/Containment Systems 13

###### Fire Safety Equipment  14

###### Safety Showers/Eye Washes 14

###### Special Alarms, Detection Devices, and Emergency Equipment 15

1. Personal Protective Equipment 15

###### Respiratory Protection 15

###### Protective Clothing 15

###### Hearing Protection 16

###### Eye Protection 16

* 1. Foot Protection 16

1. Signs and Labels 17

###### Postings and Signs 17

###### Labels and Labeling 17

1. Training 17

###### Chemical Safety Training 17

###### Specialty Training 18

###### Emergency Response 19

1. Records and Program Assessment 20

###### Records Retention 20

###### Internal Program Evaluations 20

###### External Program Evaluations 20

###### Assessment Review and Evaluation 21

Appendix A General Laboratory Safety Rules and Practices 22

Appendix B Emergency Response Guidelines 28

            Appendix B (C) (2) Supervisors’ Workmen’s Compensation Responsibilities 32

                        And Employee on the Job Injury Report 33

            Appendix B (C) (3) Non-employee Accident/Injury Report Form 35

Appendix C Process Hazards Identification Checklist 36

Appendix D OSHA Regulated Substances                                                                    41

Appendix E Chemical Compatibility Guide 43

Appendix F Hazardous Waste Handling, Disposal 47

Appendix G Glove Compatibility Guide 51

Appendix H Laboratory Inspection Checklist 54

Appendix I Material Safety Data Sheets 56

Appendix J DEA Controlled Substances 57

Appendix K Reproductive Hazards, Mutagens, Teratogens 57

Appendix L Biological Hazards – Pathogens 60

**Eastern Mennonite University**

**Chemical Hygiene and Safety Plan**

1. **Introduction**

The Chemical Hygiene and Safety Plan provides written requirements for working with hazardous chemicals in laboratories.  This plan:

* Identifies responsibility for performing specified safety functions in the Science Center at EMU.
* Specifies training, and hazard assessment procedures, and lab facilities/equipment needs prior to starting work.
* Details steps to obtain, work with, and dispose of chemicals used in laboratories.
* Specifies the kind of protective equipment that must be worn while working with hazardous chemicals.
* Specifies when air monitoring and medical surveillance is required.
* Identifies actions to take in the event of an accident/emergency.
* Recommends criteria to be used to determine the frequency for maintenance and inspections of facilities and equipment.

1. **EMU Safety Policy Statement**

It is the policy of Eastern Mennonite University to prevent injuries to its employees, students, and visitors, to protect its property from damage, and to provide for the safety of the public connected with University operations and facilities. In that regards this Chemical Hygiene and Safety Plan applies to all laboratory employees and students using hazardous chemicals at Eastern Mennonite University (EMU).  The plan has been developed in accordance with Occupational Safety and Health Administration (OSHA), Final Rule 29 CFR Part 1910.1450, entitled “Occupational Exposures to Hazardous Chemicals in Laboratories.

Copies of this written Chemical Hygiene and Safety Plan are kept on file with the Chemistry and Biology Secretary in the EMU Science Center.  A copy of the OSHA standard (29CFR 1910.1450) is available in the Chemical Hygiene Office, Science Center room 32 (SC32). In addition to this written policy, information detailing the Chemical Hygiene and Safety Plan, is verbally communicated to laboratory employees through an annual lecture attended by the chemistry and biology laboratory employees. A similar lecture is given to incoming general chemistry students by the professors or Chemical Hygiene Officer(CHO) and to continuing chemistry students by the lab professor/instructor.

1. **General Principle**

Foundational to the implementation of the Chemical Hygiene and Safety Plan are the following general practices:

1. Minimize all exposures to chemicals.  This requires an awareness of the physical and chemical properties of the chemicals, how their exposure affects the body, and the control measures that shall be used to prevent/minimize an exposure.  Skin contact should always be avoided as a cardinal rule.
2. Avoid underestimating the health risk of chemical exposures.  One must assure that any mixture will be more toxic than its most toxic component.  And that all substances of unknown toxicity are as toxic as chemicals with similar structures.
3. Provide adequate protective controls.  If it is necessary to be exposed to a chemical the level of protection provided by engineering controls and personal protective equipment must be understood and permissible exposure limits not exceeded.
4. Institute a Chemical Hygiene Plan [called for in appendix A, CFR1910.1450].
5. Observe the Permissible Exposure Limits (PELs) outlined by OSHA in 1910.1000 subpart Z and the current edition of the Threshold Limit Values of the ACGIH (American Conference of Governmental Industrial Hygienists).
6. **Responsibilities**
7. *Laboratory Workers/Work Study Students* are responsible for planning and conducting each operation in accordance with this plan.
8. *Professor/Laboratory Instructor* is responsible for:
   1. Determining the required levels of protective apparel and equipment for their students.
   2. Ensuring that laboratory workers and students know and follow chemical hygiene and safety practices; that appropriate protective equipment is available and in working order, and that the required training for the type of work being conducted has been provided.
   3. Providing regular housekeeping inspections.
   4. Demonstrating an understanding of the current legal requirements associated with regulated substances used in their laboratory.
   5. Ensuring that facilities and training are adequate for the chemicals being used.
   6. Identifying maintenance or supply problems with safety showers, eyewashes, emergency first aid equipment, fire blankets, and fume hoods.
9. *Department Head* is responsible for facilitating the implementation of chemical hygiene and safety practices within the department.
10. *Chemical Hygiene Officer*, CHO, a person appointed by the Undergraduate Academic Dean, is responsible for assisting Department Heads and Professors or

Laboratory Instructors in the implementation of their responsibilities.  Duties of the CHO include:

* 1. Performing and overseeing hazard assessments and recommending engineering/process controls.
  2. Recommending protective equipment for laboratory workers.
  3. Monitoring of laboratory workers as required or requested.
  4. Explaining process control and handling requirements for regulated substances – Appendix D, OSHA Regulated Substances
  5. Providing guidance for disposal of hazardous wastes generated in the laboratory – Appendix F, Hazardous Waste.
  6. Assessing the Chemical Hygiene and Safety Plan and recommending improvements to the chemistry and biology staff.
  7. Periodically inspecting laboratory facilities to ensure compliance with the provisions of the Chemical Hygiene and Safety Plan.
  8. Arranging for environmental surveillance as appropriate and informing affected personnel of the results.
  9. Remaining abreast of the regulatory and legal requirements associated with the use of hazardous chemicals.
  10. Acting as liaison to the Chemical Safety Committee and the Campus Safety Committee.

1. *Chemical Safety Committee* (CSC) consists of the Chemical Hygiene Officer, one faculty representative from chemistry or biology and the Academic Dean. The CSC is responsible for monitoring the Chemical Hygiene and Safety Plan and Program. The Committee will:
   1. Establish goals and acceptable performance levels for chemical hygiene activities.
   2. Perform an annual assessment of the Chemical Hygiene and Safety Plan to ensure established goals and performance levels are being met.
   3. Determine and advise when and where changes in policies and resources are needed to ensure compliance with the Chemical Hygiene and Safety Plan.
   4. Meet at least annually
   5. Select a chair from committee members to serve no more than two consecutive year terms.
   6. Report to the Campus Safety Committee.
2. *Physical Plant Director*   Specific duties include:
   * 1. Working with laboratory department heads to design laboratory modifications and new constructions in accordance with established design criteria and relevant regulations.
     2. Serves as the site Safety Coordinator and, in conjunction with the CHO, ensures campus wide consistency in regulatory compliance.    Conducting annual performance tests for safety showers and eye wash fountains.
     3. Establishing a routine work order for inspecting the laboratory ventilation system.
     4. Responding to Chemical Hygiene Officer, Laboratory Professors or Laboratory Instructor requests for maintenance of failed systems.
3. The undergraduate Academic Dean and the Vice President of Business and Finance in consultation with the CHO are responsible for ensuring adequate support for the individuals who are responsible for conducting safe operations within the laboratories.
4. The Undergraduate Dean has ultimate responsibility for holding EMU personnel accountable for complying with the guidelines outlined in this plan. EMU holds individuals (faculty, staff and students) who  work with hazardous chemicals and physical agents responsible for conducting safe operations within the workplace.
5. **General Principles for Working with Laboratory Chemicals**

Appendix A, *General Laboratory Safety Rules and Practices,* lists the general safety practices which personnel are expected to follow regardless of the nature of the experimentation, research, or work being performed.

1. **Laboratory Design**

The safe design of laboratory systems is essential for the prevention of accidents and minimization of hazardous chemical exposures in the laboratory.  Design requirements for laboratories and furniture will be developed jointly by the Chemistry and Biology Departments and the Physical Plant.  The Chemical Safety Committee will review these requirements and any subsequent modifications to the design criteria document.

As a minimum, design criteria will meet local code requirements and ANSI standards specific to the type of laboratory, furniture or equipment used.  Deviations from established design criteria require the concurrence of the Chemistry and Biology Department Chairs, the Chemical Hygiene Officer and the Campus Safety Committee.  Any modifications to installed and operating systems/equipment must meet established design criteria.

1. **Revisions**

Revisions to the Chemical Hygiene Plan can be made as necessary by the Chemical Hygiene Officer, but will be approved annually by the Chemical Safety Committee

1. **Hazard Determination and Assessment**
2. **Critical Hazards Identification**
3. *Initial Hazards Assessment*

Prior to the initial start up of a procedure or a substantial change in an existing procedure, the Laboratory Professor or Laboratory Instructor must evaluate the potential hazards associated with the work and the protective measures needed to control each hazard.  The following methods are acceptable means to do this:

1. Use the hazards identification checklist contained in Appendix C, *Process Hazards Identification Checklist*
2. Perform your own review, if it equals or exceeds the process in Appendix C, document the criteria used and record the findings.
3. The Chemical Hygiene Officer must be notified of any of the following:
   * + 1. Work involving any chemical listed in Appendix D, OSHA Regulated Substances.
       2. Decision to use respiratory protection.
       3. Installation of alarms/sensors for the purpose of alerting the user that a hazardous condition exists.
       4. Project Process Changes  
            
          Each process change must be evaluated in a manner similar to the initial evaluation.  A simple memo or a specific note in a laboratory notebook will be sufficient to document each change and associated evaluation.
4. **Environmental Monitoring and Surveillance**
5. *Initial Sampling Determination*
   1. Air sampling will be performed for any process where a known or suspected carcinogen, allergen, or reproductive hazard, is used and where a fume hood or filtered glove box is not used to contain the contaminant.
   2. Air sampling will be performed where respiratory protection is required.
   3. Air sampling will be performed upon the request of the Laboratory Professor, Laboratory Instructor, laboratory worker, or student.
   4. Air sampling will be performed as required by OSHA 1910. subpart Z.
6. *Routine Sampling*
   1. Routine sampling will be performed when the results of initial sampling indicate such a need.
   2. NIOSH/OSHA/ACGIH protocols, where they exist, will be used when performing air sampling.
   3. Routine sampling will continue until:
      1. The experiment is terminated.  
          OR
      2. Two consecutive sampling periods taken at least 7 days apart, show an air concentrations less than 10% of the OSHA PEL or, where one does not exist, the ACGIH TLV or NIOSH REL.
7. *Non-routine sampling*
   1. Non-routine sampling may be performed for:
      1. A single step operation where verification of process controls is desired and multiple/consecutive air sampling is impractical.
      2. Laboratory Professor, Laboratory Instructor, or laboratory worker when requested or when laboratory accidents occur involving release of air contaminants.
8. Results of the environmental surveillance will be sent to the involved subjects  within five working days after receiving the results and a copy of the results forwarded to the EMU Student Health Services and the CHO.

1. **Chemical Procurement, Distribution, Storage and Disposal**
2. **Procurement of Chemicals**

The following guidelines are to be followed when procuring chemicals for laboratory experiments or research projects:

1. Laboratory Professors/Instructors order chemicals as needed.
2. To the extent practicable, the amount is to be limited to the experiment(s) that will be performed over a one year period.
3. Acquisitioners are to ensure that current Material Safety Data Sheets for the chemicals being ordered are available.
4. The procurer of new chemicals listed in Appendix D, *OSHA Regulated Substance* or substances controlled by the Drug Enforcement Agency must notify the Chemical Hygiene Officer prior to ordering.  See Appendix J for a discussion of Controlled Substances.
5. Procurer of pathogenic biological specimens or organisms must notify the Chemical Hygiene Officer prior to placing the order. See Appendix L, Biological Hazards – Pathogens.
6. Inform department secretary of all chemical acquisitions to ensure inventory is updated.  Forwarding the invoice to the secretary will generally meet this requirement.
7. **Initial Storage and Distribution**
8. When hazardous chemicals arrive in the Campus Center Post Office, they are to be placed into the holding area by the transporter/carrier.
9. Post Office personnel are to call the receiver and notify them or the CHO if he is on site of the arrival of a hazardous chemical. Nonhazardous chemicals may be delivered by the mail personnel.
10. The requisitioner whose name is on the transport document is ultimately responsible for moving hazardous chemicals from the post office to the Science Center Chemical Storeroom.
11. **Chemical Storage**  
      
    Storage in laboratories will be performed as follows:
12. Incompatible chemicals are to be separated.  Appendix E, Chemical Compatibility Guide, contains guidance on chemical compatibility.
13. Incompatible chemicals are to be separated from each other. For ease of location organics are separated from inorganics and oxidizers are separated from both.
14. Flammable chemicals are stored in the vault, back side of room 35, or in flammable cabinets in the laboratories.
15. Acids are stored in wooden acid cabinet in the foyer of the chemical store room and in laboratories.
16. Cabinets or under hood storage areas must be ventilated if they are used to store flammable or carcinogenic liquids.
17. Refrigerators used for storage of flammable liquids must be explosion proof.
18. Total quantities of flammable and combustible liquids allowed in a laboratory must not exceed 60 liters.
19. Cylinders of compressed gases must be securely chained to a wall.  The use of clamps and straps is NOT permitted.
20. Cylinders are to be capped when not in use. Ensure that the suppliers provides caps for the gas cylinders when they are delivered.
21. All cylinders and chemical containers are to be stored away from heat sources and direct sunlight.
22. A list of the chemicals in the Chemistry Store Room (Room 35) may be found on the table outside of Room 35 along with the associated Material Safety Data Sheets.  A current list is also accessible on the g drive, biology, departmental, chemical inventory.
23. Mark containers of peroxide formers with the date received and the date the container when it is opened. Dispose of unopened containers after one year and opened container after 6 months.
24. **Disposal of Waste Chemicals**

Disposal of hazardous chemicals must be in compliance with local (landfill), State (VA DEQ), and Federal (EPA) regulations.

1. The cost for disposing of waste chemicals is commonly greater than the cost for buying new chemicals. Restrict buying to what is needed.
2. All chemicals including waste chemicals must be labeled.
3. Hazardous waste chemicals are to be labeled with a “Hazardous Waste Label.”
4. See Appendix F Hazardous Waste Handling, Disposal.
5. Inform department secretary when a container is emptied for its removal from the inventory.

1. **Medical Surveillance and Attention**
   1. **Examination Determination**

Medical examinations are required for the following:

1. Personnel working in areas where Air Purifying respirators are required.
2. Work involving listed substances in Appendix D where an exposure above the TLV or PEL may occur.
3. Personnel who exhibit signs or symptoms attributed to an exposure to a hazardous chemical.
   1. Medical exams may be requested by Health Services, the Chemical Hygiene Officer, Laboratory Professor, Laboratory Instructor, or students.
   2. Medical exams will be provided, upon request to personnel exposed to hazardous chemicals as a result of a spill, leak, or explosion.
   3. Contact Health Services (4317) to arrange for medical surveillance examinations.
4. **Medical Examination Criteria and Frequency**
5. Examination criteria
   1. The choice of baseline and follow-up procedure will be determined by a licensed physician.
   2. Where there are recommended examinations, such as for OSHA Regulated Substances, those criteria will be submitted to the physician with the examination request. See chemical Appendix D.
6. Examination Frequency
7. For examinations used in certifying respirator users, the examination frequency will be annual for those over 45 years, and every three years for all others.
8. For examinations where there is a potential overexposure to hazardous substances, the examination frequency will be determined by the licensed physician.
9. For examinations resulting from exposures to OSHA Regulated Substances, the examination frequency will be the period set within the OSHA standard.
10. Information to be transferred to the examining physician
11. The identity of the hazardous chemical(s) to which the employee or student has been or may be exposed.
12. A description of the conditions under which the exposure occurred, including surveillance data.
13. A description of the signs and symptoms of exposure that the employee is experiencing.
14. A copy of the MSDS when chemicals are involved.
15. Information supplied by the physician to EMU’s Health Services
16. Recommendations for further medical follow-up.
17. The result of the medical examination and any associated tests.
18. A report of any medical condition which may place the employee or student at increased risk as a result of exposure to a hazardous chemical.
19. A statement that the employee or student has been informed by the physician of the results of the consultation/examination and any medical condition that may require further examination or treatment.
20. A copy of the employee or student’s record will be filed in the EMU Health Services office.
21. The employer’s copy of the physician’s results must only contain information related to occupational exposures of the employee.
22. **Bioassay Frequency and Criteria**
23. The examining physician will determine the type and frequency of bioassays to be performed.
24. OSHA, NIOSH, or ACGIH guidance will be used in determining action levels and follow-up examinations.
25. The Chemical Hygiene Officer in collaboration with EMU Health Services and the examining physician will document, noting references, which criteria to use, and why.
26. **Medical Attention (For Employee/Student Injuries see Appendix B (C) (2))**

In the event an employee or student sustains an injury, it is the responsibility of the person in charge to pursue medical care.  The gravity of the situation will dictate the type of care that should be pursued:

1. For life threatening injuries, call 9-911 and EMU Health Services (ext. 4317).
2. For less serious injuries requiring non-emergency medical attention, first call EMU Health Services.  If they are not available, call RMH Center for Corporate Health, 564-5622.  Send a service request form with subject (Appendix B (C) (4)).
3. For minor cuts or bruises the employee or student should go to Health Services or the RMH Center for Corporate Health.

1. **Facilities Maintenance and Inspection**
2. **Ventilation/Containment Systems**
   1. Fume Hoods
      1. Only material and equipment directly related to the experiment in progress is to be kept in the fume hood.
      2. Each fume hood is marked with a working sash height mark. Work requiring fume hood protection shall not be conducted with the sash opened beyond that mark.
      3. Hoods with sashes opened to the working height must have a ventilation flow rate > 100 linear feet per minute.
      4. Fume hoods should be checked by the user each day prior to use.
      5. Fume hoods will be inspected and tested monthly by the Chemical Hygiene Officer during the months when the hoods are in use.
      6. Work/experiments in a hood will be discontinued whenever maintenance or repair of the system is being performed.
      7. Fume hoods will be inspected and tested after repairs are made to the supply/exhaust system.
   2. Other Local Exhaust/Containment Systems
      1. Glove Boxes will be tested for leaks prior to use on the day of use.
3. **Fire Safety Equipment**
   1. Fire Extinguishers
4. Each lab will be equipped with a fire extinguisher capable of extinguishing the type of fire that may be generated by the materials used in the lab.
5. All fire extinguishers will be inspected annually by an outside vendor under contract with the Physical Plant.
6. The Chemical Hygiene Officer is responsible for ensuring that fire extinguisher(s) are present and receive a monthly inspection. Section IX, Part B).
7. Report missing, discharged, or malfunctioning extinguishers to the Physical Plant immediately after discovery.  
   1. Fire Blankets

The Chemical Hygiene Officer is responsible for ensuring that fire blankets are present in each of the chemistry labs and stored as intended during the monthly laboratory inspection (see Section IX, Part B).

Other fire protection equipment such as exhaust fire dampers are to be maintained and inspected by the Physical Plant.

1. **Safety Showers/Eyewashes**
2. The operability of eyewashes should be determined by the Chemical Hygiene Officer during the monthly laboratory inspection (see Section IX, Part B).
3. Safety showers will be tested annually by the Physical Plant.
4. **Special Alarms, Detection Devices, and Emergency Equipment**
5. Installation of alarms or detection devices designed to alert personnel to the presence of a hazard condition must be approved by the CHO.
6. Alarms and detection devices will be tested prior to initial use and annually thereafter if used continuously by the Laboratory Professor or Laboratory Instructor.
7. The Chemical Hygiene Officer is responsible for inspecting first aid supplies during the monthly inspection (see Section IX, Part B.) Use of the First Aid Kit is for very minor injuries such as scratches and for covering skin abrasions for protection while traveling to the EMU Health Services Department. Blood spills need to be cleaned up with a 10 % solution of Clorox in water by persons who have had blood borne pathogen training. All injuries other than a minor scratch must be seen by EMU Health Services.

1. **Personal Protective Equipment**

Requirements for personal protective equipment are outlined in 29 CFR 1910.134.

1. **Respiratory Protection**
2. The use of respiratory protection requires training from and approval of the Chemical Hygiene Officer.
3. Details for respiratory protection program can be obtained by calling the Chemical Hygiene Officer.
4. **Protective Clothing**
5. Protective clothing such as gloves, lab coats, aprons, or suits should be selected to resist the substance being used.
6. The Laboratory Professor or Laboratory Instructor is responsible for determining the protective clothing needed for laboratory personnel/students.
7. Appendix G, Glove Compatibility Guide and the MSDS is to be used as a reference when choosing a glove or coveralls.
8. Gloves are to be inspected and tested prior to use.
9. **Hearing Protection**
10. Hearing protection shall be administered whenever employee noise exposures equal or exceed an 8-hour time weighted average sound level (TWA) of 85 decibels.
11. Consult the Chemical Hygiene Officer if you suspect a problem so that accurate noise measurements can be made, correct hearing protection can be provided, noise reduction engineering controls can be considered and if relevant a noise protection program developed.
12. **Eye Protection**
13. **Virginia OSHA regulations put the responsibility for ensuring that laboratory workers wear eye protection on the person who is responsible for the laboratory/work spaces.**
14. Eye protection is mandatory for all entries into and work within a lab, where hazardous chemicals are used.
15. The level of eye protection required will be determined by the Laboratory Professor or Laboratory Instructor.
16. Eye protection needs to meet ANSI Z87.1 requirements.
17. As a minimum wearers of contact lenses are required to wear the same eye and face protection as non-wearers. There may be occasions when it is not advisable to wear contact lenses for example working with solvents or dust. This will be the call of the person responsible for the laboratory. Contact lens wearers shall be informed that:
    1. It is difficult to remove contacts following a splash affecting the eye.
    2. Contact lenses interfere with emergency flushing.
    3. Contact lenses trap solid materials between the eyes and the lens.
    4. The person responsible for the laboratory must know who wears contacts to ensure wearers are handled during emergencies.
18. **Foot Protection**
19. Shoes that completely cover the foot are standard foot requirements for chemistry laboratories.
20. Fabric shoes are not to be worn, they absorb liquid quickly and hold  it in contact with the skin.
21. The following shoe types are not to be worn in the laboratories when working with hazardous chemicals: sandals, clogs, high heels, clogs, shoes THAT EXPOSE THE FOOT IN ANY WAY.
22. **Signs and Labels**
23. **Postings and Signs**
    1. Laboratories that use OSHA regulated substances (Appendix D) will be posted “OSHA Regulated Substance.”
    2. Laboratories that use hazardous chemicals have a posting on the laboratory side of the exit doors that contains the phone numbers to call if an emergency occurs.
    3. Signs for emergency response equipment such as safety showers, eye wash, First Aid Kits, and fire extinguishers will be clearly visible and unobstructed.
    4. NFPA diamond signs are posted on the lover 1/3 of the entrance doors where hazardous chemicals are used.  The classification shows the nature of the hazard in the room.  Posters explaining the NFPA classification scheme are posted in the labs and the chemical store room.  The Chemical Hygiene Officer is responsible for their up keep.
    5. Noise notification signs need to be posted where the nose level equals or exceeds 85 dB for 8 hours, time weighted average.
24. **Labels and Labeling**
25. It is the responsibility of the laboratory professor/instructor to ensure that all stock chemicals are labeled correctly, i.e. chemical name, hazardous class, target organ and manufacturer.
26. Chemical containers that will be used within one day and by the same person  are exempt from this requirement.
27. Hazardous waste containers are to be marked with a Hazardous Waste label, see Appendix F.
28. **Training**
29. **Chemical Safety Training**
    1. Employees and students will be provided safety training prior to their initial assignment to the laboratory work area or class room.
    2. The laboratory Professor or Laboratory Instructor is responsible for training their employees/students.  The Chemical Hygiene Officer will provide the training when requested.
    3. The training will include:
30. The contents of OSHA standard (29CFR1910 1450) and its appendices.
31. Location and availability of the EMU Chemical Hygiene Plan.
32. Location of permissible exposure limits for OSHA regulated substances and ACGIH TLV’s where OSHA standards do not exist.
33. Common signs, symptoms, and health hazards associated with exposures to hazardous chemicals in the laboratory.
34. The location of reference material on the hazards, safe handling, storage, and disposal of hazardous chemicals found in the laboratory.
35. Methods and observations that may be used to detect the presence or release of a hazardous chemical.
36. Protective measures an employee or student can take to prevent or reduce exposure to a hazardous chemical.
37. Emergency response procedures.
    1. The Chemical Hygiene Officer will maintain the training documents of the EMU employees, who received training and the dates training was provided.  The person who is responsible for the laboratory will maintain a record of the student training.  See IX Records and Program Assessment and retention guidelines.
38. **Specialty Training**
    1. Laboratory Professors or Laboratory Instructors will ensure training is provided to laboratory personnel for procedures/experiments involving the following chemicals:
39. Personnel exposed to concentrations in excess of values listed for the substances in Appendix D, OSHA Regulated Substances need additional training outlined in the OSHA regulations.
40. Explosives/Highly Reactive Experiments. Principal Investigators/Laboratory Instructors need additional training to work with highly reactive/explosive chemicals.  Contact the CHO for further information.
41. Human blood/secretions. Laboratory Professors/ Laboratory Instructors/students who have potential contacts with human blood are required to have Blood Borne Pathogen training. The Chemical Hygiene Officer will arrange for such training.  OSHA CFR 1910.1030 is the regulation that governs this activity.
42. Recombinant DNA. Biosafety levels must be established according to the Center for Disease Control – National Institute for Health (CDC – NIH) guidelines, which address training, handling and disposal.
43. Pathogenic Microorganism. Laboratory Professors/Instructors should review the publication Biosafety in Microbiological and Biomedical Laboratories before beginning work with pathogenic microorganisms and follows guidelines outlined in Appendix L.  This publication is available from the CHO (x4626).
44. Handlers of hazardous waste are exempt from Hazardous Materials Training if they are a Conditionally Exempt Small Quantity Generator. See Appendix F Disposal of Waste Chemicals.  Presently EMU is exempt. See Appendix F for more information.
45. DEA Controlled Substances (narcotics). Persons using Controlled Regulated Substances i.e, narcotics defined by the Drug Enforcement Administration (DEA), need to be familiar with the requirements of the DEA Controlled Substances Act.A license to use most of the substances is required. A copy of the act is available in the Chemical Hygiene Office..
46. The Chemical Hygiene Officer will assist with the training and maintenance of the training documentation.
47. **Emergency Response**

Accidents involving hazardous chemical spills, personnel injuries, fires or explosions shall be reported immediately to the Chemical Hygiene Officer, ext 4626, or the Chemistry Department Chair, ext 4403 or Physical Plant ext 4390. If it is a major event, call 9-911.  Reporting of accidents should be clear and concise, and shall include:

         the nature of the accident

         location

         name of caller

         phone where caller can be reached

All accidents (injuries, fires, spills, explosions) must be reported to the respective Department Chairs and the Chemical Hygiene Officer. Personnel at the immediate scene of the accident should take actions that will mitigate the extent of the accident without jeopardizing their health and safety.  When in doubt, warn others in the area, vacate the area, travel to a safe location and make a phone call to the Chemical Hygiene Officer,  ext 4626, Chemistry Chair, ext 4403 or the Physical Plant ext 4390. General guidance for handling specific types of emergencies are contained in Appendix B, Emergency Response Guidance.

1. **Records and Program Assessment**

1. **Records Retention**
   1. Training records for the staff will be maintained by the Chemical Hygiene Officer for four (4) years.
   2. Professor/Laboratory Instructors shall document training provided for their students and retain them with the student records.
   3. Training records of staff or students involved in accidental exposures of hazardous chemicals are to be forwarded to EMU Health Services and retained with their medical records.
   4. The Chemistry Department Chair will maintain  training records when students are involved in the use of special substance Appendix D.
   5. Accident reports will be prepared by the Laboratory Professor/Instructor and forwarded to the Chemical Hygiene Officer who will send them to the EMU Health Services.
   6. Environmental and Medical Surveillance records will be maintained by the EMU Health Services.
2. **Internal Program Evaluations**

Each Laboratory Professor and Laboratory Instructor will ensure his/her laboratory is inspected at least quarterly using the checklist in Appendix H or an equivalent document.

The Chemical Hygiene Officer, the Academic Dean and the Chemistry Chair will be responsible for performing an annual safety assessment of all laboratories in the Science Building.

All accidents that involve explosions, spills, fires, personal injuries or near misses will be reported to the Chemical Hygiene Officer.  The Chemical Hygiene Officer will assist the Department Chair or Laboratory Instructor in evaluating the cause and initiate corrective actions.

1. **External Program Evaluations**

Biennially, an evaluation of the EMU Chemical Hygiene Program will be performed by an individual or company independent of EMU.

1. **Assessment Review and Evaluation**

The Chemical Hygiene Officer will prepare an annual report for the Chemical Safety Committee which will contain the following:

1. summary of accidents, types and causes.
2. summary of program deficiencies and recommended corrective actions
3. progress in meeting goals established by Chemical Safety Committee.

The Chemical Safety Committee will review the report and send an executive summary with recommendations to the Office of the Dean and the Campus Safety Committee.

Appendix A.   General Laboratory Safety Rules and Practices

**A.  General Principles**

1. Know the safety rules and procedures that apply to the work that is being done.  Determine the potential hazards (e.g., physical, chemical biological) and appropriate safety precautions before beginning any new operation.
2. Know the location of, and how to use, the emergency equipment in your area, as well as how to obtain additional help in an emergency, and be familiar with emergency procedures.
3. Know the types of available protective equipment and how to select and use it.
4. Keep work areas clean and uncluttered.
5. Be alert to unsafe conditions and actions and call attention to them so that corrections can be made as soon as possible.  Someone else’s accident can be as dangerous to you as any you might cause.
6. Avoid consuming food or beverages or smoking in areas where chemicals are being used or stored.
7. Avoid releasing hazards to the environment by following accepted waste disposal procedures, see Appendix F Hazardous Waste Handling and Disposal.
8. Chemical reactions may require traps or scrubbing devices to prevent the escape of toxic substances to the environment.
9. Be certain all chemicals are correctly and clearly labeled.  Post warning signs when unusual hazards, such as radiation, flammable materials, biological hazard, or other special problems exist.
10. Remain out of the area of a fire or personal injury unless it is your responsibility to help with the emergency.  Curious bystanders interfere with rescue and emergency personnel and endanger themselves.
11. Avoid distracting or startling any other worker or student.  Practical jokes or horseplay cannot be tolerated at any time.
12. Use equipment only for its designation purpose.
13. Position and clamp reaction apparatus thoughtfully in order to enable manipulation without the need to move the apparatus during the reaction process.
14. Combine reagents in appropriate order, and avoid adding solids to hot liquids.
15. Think, act, and encourage safety until it becomes a habit.
16. Use fume hood when working with hazardous chemicals. Keep reagent containers back 6 inches from the bench top edge. The hood sash is not to be raised beyond the designated mark.
17. Do not use the fumehood for a storage area.

**B.  Health and Hygiene**

* 1. Wear appropriate eye protection at all times. Laboratory Professor/Instructor must be aware which student are wearing contact lenses and remind them of potential problems associated with removal of contacts after a splash to the face.
  2. Use protective apparel, including face shields, gloves, and other special clothing as appropriate when in the laboratory.
  3. Confine long hair and loose clothing when entering a laboratory.
  4. Use a pipette bulb or an aspirator to provide suction or to start a siphon, DO NOT pipette chemicals by mouth.
  5. Use appropriate safety equipment to avoid exposure to gases, vapors, and aerosols.
  6. Wear shoes that cover the foot. Minimize bare skin areas.
  7. Wash your hands well before leaving the laboratory area.  Avoid the use of solvents for washing the skin.  They remove the natural protective oils from the skin and can cause irritation and inflammation.  In some cases, washing with a solvent might facilitate absorption of a toxic chemical eg. methanol.
  8. Exercise appropriate precaution when working with reproductive and embryo toxins. See Appendix K. Teratogens, Mutagens.
  9. Exercise special precaution to avoid skin contact when working with allergens such as diazomethane,  isocyanides, nickel, dichromates.

**C.  Food Handling**

Contamination of food, drink, and smoking materials is a potential route for exposure to toxic substances.  Food should be stored, handled, and consumed in an area free of hazardous substances.

1. Consumption of food or beverages is not permitted in areas where laboratory operations are carried out.
2. Glassware or utensils that have been used for laboratory operations are not to be used to prepare or consume food or beverages.  Laboratory spaces, refrigerators, ice chests, cold rooms, and such are not to be used for food storage; separate equipment should be dedicated to that use and prominently labeled.

**D.  Housekeeping**

1. Work areas should be kept clean and free from obstructions.  To the extent practicable cleanup should be done at the end of each day.
2. Wastes should be deposited in appropriate receptacles.
3. Spilled chemicals should be cleaned up immediately and disposed of properly.  Disposal procedures should be established and all laboratory personnel should be informed of them.
4. Unlabeled containers and chemical wastes should be removed from the laboratories.  Avoid accumulating chemicals that are not likely to be used in the laboratory.
5. Floors should be cleaned regularly; accumulated dust, chromatography adsorbents, and other assorted chemicals and materials pose respiratory hazards.
6. Stairways and hallways should not be used as storage areas.
7. Access to exits, emergency equipment, controls, and such should never be blocked.
8. Equipment and chemicals should be stored properly; clutter should be minimized.
9. Clean glass ware and reagents from laboratory bench tops at the end of class period, experiment.
10. Maintain materials free area if front of electrical panels 30 inches wide and 36 inches deep.

**E. Equipment Maintenance**

1. Develop an inspection and maintenance schedule for laboratory safety equipment, such as safety showers and fumehoods.
2. Faulty or non-functional equipment must be tagged such that an individual is warned not to use the equipment.

**F.  Guarding for Safety**

1. All mechanical equipment should be adequately furnished with guards that prevent access to electrical connections or moving parts (such as belts and pulleys of a vacuum pump).
2. Inspect equipment before using it to ensure that the guards are in place and functioning.
3. Provide emergency shutoff devices for equipment such as ovens, water baths, and evaporators that will be operating unattended.

**G.  Shielding for Safety**

* 1. Safety shielding should be used for an operation that has the potential for an explosion, particularly:
  2. when a reaction is attempted for the first time (small quantities of reactants should be used to minimize hazards).
  3. when a familiar reaction is carried out on a larger than usual scale (e.g., 5-10 times more material).
  4. when operations are carried out under non-ambient conditions.
  5. Shields must be placed so that all personnel in the area are protected from hazard.

**H.  Glassware**

1. Careful handling and storage procedures should be used to avoid damaging glassware.
2. Adequate hand protection should be used when inserting glass tubing into rubber stoppers or corks or when placing rubber tubing on glass as hose connections.
3. The use of plastic or metal connectors should be used to connect glass joints rather than rubber tubing.
4. Glass-blowing operation should not be attempted unless proper annealing facilities are available.
5. Vacuum-jacketed glass apparatus should be handled with extreme care to prevent implosions.
6. Equipment such as Dewar flasks should be wrapped with tape or shielded.
7. Only glassware designed for vacuum work should be used where vacuum environments are required.
8. Hand protection should be used when picking up broken glass (Small pieces should be swept up with a brush into a dustpan).  Use a “Broken Glass” container for disposal.
9. To minimize cut potentials KEEP broken glass out of the daily trash.
10. Provide instructions to first time users of glass equipment designed for specialized tasks, where there are unusual risks.  (For example, separator funnels containing volatile solvents can develop considerable pressure during use).

**I.  Flammability Hazards**

1. Do not use an open flame to heat a flammable liquid or to carry out a distillation under reduced pressure.
2. Use of open flames must be approved by the Laboratory Instructor.
3. Before lighting a flame, remove flammable substances from the immediate area.  Check all containers of flammable material in the area to ensure that they are tightly closed.
4. Notify other occupants of the laboratory in advance of lighting a flame.
5. Record date received on labels of peroxide formers. Check for peroxides before using peroxide formers when container opened exceeds 6 months.  
     
   Dispose of unopened peroxide formers after one year.
6. Use only non-sparking electrical equipment in areas where flammable vapors are present.

**J.  Cold Traps and Cryogenic Hazards.**

1. Gloves and a face shield are needed when preparing or using cryogenic liquid baths.
2. Liquid nitrogen should not be used to cool a flammable mixture in the presence of air because oxygen can condense from the air and create an explosion hazard.
3. Dry gloves designed for handling cryogenic materials should be used when handling dry ice. Add it slowly to the liquid portion of the cooling bath to avoid foaming over.
4. Avoid lowering your head into areas where dry ice (carbon dioxide) or liquid nitrogen have accumulated.

**K.  Systems under Pressure**

* 1. Reactions should never be carried out in a closed system, or heat applied to an apparatus that is a closed system, unless it is designed and tested to withstand the maximum pressure that could result.
  2. Pressurized apparatus should have an appropriate relief device.  If the reaction cannot be opened directly to the air, an inert gas purge and bubbler system should be used to avoid pressure buildup.

**L.  Waste Disposal Procedures**

**Also see Appendix F Hazardous Waste Handling and Disposal**

1. Design experiments so that a minimum quantity of waste is generated.
2. Label waste containers with Hazardous Waste label showing chemical name(s), concentration(s), accumulation date and initials of generator.
3. Limit consolidation to compatible chemicals of like hazard classes
4. Record mixture components showing chemical name, quantity and concentration.
5. Use original containers or containers of like materials for collecting hazardous waste.

**M.  Warning Signs and Labels**

* 1. Laboratory areas that have special or unusual hazards must be posted with warning signs.
  2. All signs and symbols must be left in place and not altered unless a change to laboratory operations occurs.
  3. All chemical containers not in immediate use (day of experiment) must be labeled showing chemical name, concentration, date, hazard characteristic and owner.
  4. Laboratory doors must be marked with an NFPA diamond label showing the characteristic of the most hazardous chemical in the area.

**N.  Unattended Operations**

* + 1. Plan for unscheduled interruptions in utility services such as electricity, water, and inert gas.  Operations should be designed to fail safe.
    2. Wherever possible, arrange for routine periodic inspections of the operation.
    3. In all cases, the laboratory lights should be left on and an appropriate sign should be placed on the door to alert the Security Officer what to do in the event of a failure along with the telephone number of the responsible laboratory professor/instructor.
    4. The name and phone number of the laboratory worker and their Laboratory Professor/Instructor shall be posted in the hallway directly outside of the laboratory showing permission has been granted to work unattended or to set up unattended experiments.  Instructions are given to show the notification order of the persons who are to be notified in the event of an accident or emergency.

**O.  Working Alone – (not within earshot)**

1. Working alone is to be avoided and only done with the approval of the Laboratory Professor/Instructor.
2. If work must be conducted alone in the laboratory, the worker must arrange to have someone check on his/her status periodically (e.g. 30 minutes).

**P.  Accident Reporting**

1. All accidents involving fire, personal injury, explosion or spill must be reported to the Chemical Hygiene Officer.
2. Emergency telephone numbers to be called in the event of fire, accident, flood or hazardous chemical spill will be posted on the laboratory side of the exit doors.

**Appendix B.  Emergency Response Guidance**

**A.  Hazardous Chemical Spills**

**1.  General Response Actions**

* 1. Stop the source of the spill, if it can be done safely.
  2. Attend to any person(s) who may have been contaminated.
  3. Notify Laboratory Professor/Instructor and persons in the immediate area of the spill.
  4. Evacuate all nonessential personnel from the spill area.
  5. If the spilled material is flammable, turn off ignition and heat sources. Use remotely located shut offs to avoid spark sources.
  6. Avoid breathing vapors of the spilled material.
  7. Employ external ventilation such as fume hoods and portable fans.  Keep portable fans upwind of the spill source.
  8. Secure supplies to effect cleanup.
  9. During cleanup, wear appropriate protective apparel.
  10. Notify the Chemical Hygiene Officer if a regulated substance (Appendix D) is involved.
  11. At least quarterly inspect the emergency response kits, equipment to ensure that it has the appropriate response materials.
  12. Emergency spill kits are designed to deal with the chemicals used in the laboratory where they are located. Laboratory Professor/Instructor are responsible for ensuring that the appropriate materials are available at the beginning of each class period.

**2.  Cleaning and Handling Instructions for Spilled Liquids**

* 1. Confine or contain the spill to a small area.  Do not let it spread.
  2. For small quantities of inorganic acids or bases, use a neutralizing agent or an absorbent mixture (e.g., soda ash or diatomaceous earth).  For small quantities of other materials, absorb the spill with a non-reactive material (such as vermiculite, dry sand, or towels).
  3. For larger amounts of inorganic acids and bases, contact the Chemical Hygiene Officer. Neither acids or bases are to be discharged into the storm drain or sanitary sewer. Neutralization prior to release will be considered by the CHO or emergency response personnel, for some chemicals.
  4. Mops used in a clean up must be resistant to the chemicals.  Determine if the water qualifies for drain release.  (Water with a pH < 5.5 or >9.5 may not be released to the drain.)
  5. Carefully pick up and clean any cartons or bottles that have been splashed or immersed during the spill.
  6. If a vacuum cleaner is used it must be approved for the material involved, remembering that the exhaust of a vacuum cleaner can create aerosols or dust and, thus, should be vented to a hood or through a filter.
  7. If the spilled material is extremely volatile, remotely disconnect the electrical power to the zone. Do not excercise electrical switches in the room where the spill occurred. Let the solvent evaporate and be exhausted by the fume hoods. The exhaust fans in our laboratories have explosion proof motors.
  8. Dispose of residues according to hazardous waste disposal procedures outlined in Appendix F Disposal of Waste Chemicals.

**3.  Cleaning and Handling Instructions for Spilled Solids**

* 1. For substances which are of low toxicity and solid (i.e. not carcinogens, allergens, reproductive hazards or poisons) push them into a dustpan and place them in a solid-waste container for disposal. Attach a completed Hazardous Waste label.
  2. Additional precautions such as the use of a vacuum cleaner equipped with a HEPA filter will be necessary when cleaning up spills of more highly toxic solids.  Call the Chemical Hygiene Officer to get assistance and to report the incident.

**4.  Instructions for Leaking Compressed Gas Cylinders**

1. Occasionally, a cylinder or one of its component parts develops a leak.  Most such leaks occur at the top of the cylinder in area such as the valve threads, safety device, valve stem, or valve outlet.
2. If a leak is suspected don appropriate protective gear and check for its location with soapy water or other suitable solutions.
3. If the leak cannot be remedied by tightening a valve gland or packing nut, notify the supplier and take steps to move the cylinder outside.
4. Laboratory workers should never attempt to repair a leak at the valve threads or safety device; rather, they should consult with the supplier for instructions.
5. The following general procedures can be used for leaks of a minimum size where the indicated actions can be taken without serious exposure to personnel:
6. If it is necessary to move a leaking cylinder through populated areas of the building, place a plastic bag, rubber shroud, or similar device over the top and tape it (duct tape preferred) to the cylinder to confine the leaking gas.
7. Move leaking cylinder to an isolated area (away from combustible material if the gas is flammable or an oxidizing agent) and post signs that describe the hazard. Evacuate the area consistent with the degree of hazard.
8. Corrosive gases may increase the size of the leak as they are released.  Move the cylinder to an isolated, well-ventilated area and use suitable means to direct the gas into an appropriate chemical neutralizer.  Post signs that describe the hazards and state warnings.
9. Toxic gases - Follow the same procedure as for corrosive gases.  Move the cylinder to an isolated, well-ventilated area and use suitable means to direct the gas into an appropriate chemical neutralizer or absorbent.  Post signs that describe the hazards and state the warnings.

**B.  Fires and Explosions**

1. **General Response Actions**
2. Alert other personnel in the laboratory.
3. Determine if the size of the fire should be attacked with an extinguisher. **If the** **answer is no**, vacate area and activate the nearest fire alarm. Fire alarm boxes are located at the main entrances to the building. **Note the firebox alarms in the** **Science Center do not send messages to the local fire department. Call  9-911,** **to notify the Fire Department** **give your name, location, and nature of the emergency.**
4. If an extinguisher is to be used it should only be used by members of the Science Center staff - persons who have had fire extinguisher training.
5. All of the extinguisher in the Science Center are Class ABC and can be used on most of the fires in the area. Inform the Physical Plant anytime a fire extinguisher is used to ensure prompt replacement.

**C.  Personal Injury**

1. **General response Actions** 
   1. Warn others and render assistance to persons involved.
   2. If further exposure is life threatening, then remove injured persons from the affected area.
   3. If chemicals are involved, wash person under safety shower for 15 minutes and/or eye wash for a minimum of 15 minutes.
   4. Contact Health Services (ext. 4317) for guidance.  If they are not available, take necessary action based on gravity of the injury.  **If the injury is life threatening and the subject has sustained an exposure injury, call 9-911**.  If the subject  is in need of medical assistance and is able to walk, transport him/her to Rockingham Memorial Hospital Center for Corporate Health (Spotswood Valley Shopping Center).  Complete Service Request Form and send it with subject.  For all other conditions, transport subject to RMH.   Call the Health Center before leaving and discuss the patient’s status with clinic coordinator, 564-5622.  All injuries are to be reported to Health Services using EMU Injury Report Form (page 23).  For minor cuts or burns consult with  professor.
   5. Notify the Chemical Hygiene Officer (4626) of all injuries (page 22).
2. **Employee Injury- Workers’ Compensation**
   1. Supervisor’s Responsibilities Appendix  B (C) (2)
   2. Employee on the Job Injury Report From Appendix B (C) (2)
3. **Non-employee Accident/Injury** 
   1. Available in First Aid Box room 30.
4. **Employee and Student Service Request Form  Appendix B (C) (4)**
   1. Available in First Aid Box room 30.
   2. Complete and send with employee/student destined for the RMH Center for Corporate Health.  Call the RMH Center for Corporate Health before leaving to ensure they will accept the injured employee/student.  Their capabilities are those of an out-patient clinic.  Major injuries need to go to the RMH Emergency Room.

EMU Chemical Hygiene and Safety Plan

**Appendix B (C) (2)**

**Eastern Mennonite University**

**Supervisor’s Workers’ Compensation Responsibilities**

Eastern Mennonite University has adopted the following policies to define your responsibility as the SUPERVISOR of an employee (including work study students) who has been injured or is ill due to his/her work duties:

1. Provide a safe and healthful working environment for those you supervise and encourage safe work practices.  The Chemical Hygiene Officer will be happy to assist you; if you have questions, please call x 4626.
2. If an employee you supervise is injured on the job and/or has a job-related illness:
   1. Send the employee for medical treatment.  If it is a minor injury send the employee to the EMU Health Services.  If the EMU Health Services is not available contact RMH Center for Corporate Health (564-5622) during normal working hours.  If an employee you supervise is BADLY injured outside of normal working hours and needs EMERGENCY medical treatment, send or take him/her to Rockingham Memorial Hospital’s emergency room.
   2. After the employee has received medical treatment, give him/her an Accident Report form for Workers’ Compensation (Appendix B I) to complete, and assist him/her if necessary.
   3. Inform the Human Resources Office of the accident immediately after the incident. The Human Resources Office must contact the insurance company as soon as possible after the injury.  When the employee returns the accident report to you, check to make sure each question has been answered COMPLETELY and forward the form to the Human Resources Office.
   4. If the employee misses work because of the injury or illness, report the date he/she returns to work to the Human Resources Office.  The employee must obtain a WORK EXCUSE from the attending physician for all the days lost in connection with the injury.  If an employee takes unauthorized leave from work it will be listed as sick or annual leave.
   5. Forward medical bills received by the employee for the medical treatment to the Human Resources Office.  The employee should not pay for the medical treatment.
   6. It is imperative that SUPERVISORS inform employees of their rights and responsibilities in connection with EMU Workers’ Compensation procedures before and at the time of the injury.
   7. University employees who are injured on the job must complete the “Accident Report for Workers’ Compensation Claim.”  An example is attached as B (C)(2).  Students who are injured on our premises need to report the incident to the professor responsible for the area where the accident occurred.  The accident is also to be reported using the prescribed “Non-Employee Injury Report Form.”  An example is attached as Appendix B(C)(3).
   8. Attempt to remedy the situation which caused the accident.
3. For further information or questions regarding EMU’s Workers’ Compensation Program call the Human Resources Office at ext. 4108.

**EMU Chemical Hygiene and Safety Plan**

**Appendix B (C) (2)**

**Eastern Mennonite University**

**EMPLOYEE INJURY REPORT**

(First Report of Accident)

**Instructions:**

1. *Complete the form promptly (in ball-point pen) for incidents involving injury or potential injury*.

2. *Return completed form to the Human Resources Office*

Date Reported: ­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

This report was prepared by: ­­­­­­­­­­­­­­­­­­­­

(Print Name and Title)

**EMPLOYEE INFORMATION**

Name: ­­Date of Birth:

Address: Phone #:

Male Female Full-Time Part-Time Social Security#: - -

Married Single # of Dependents

Length of time at current job: years months

Nature of duties:

**NATURE AND CAUSE OF ACCIDENT**

Date of Injury: Time of Injury: a.m. p.m.

Date of incapacity: Time incapacity began: a.m. p.m.

Describe fully how injury or illness occurred (*e.g. slip/fall, lifting, chemical*):

Cause of accident (specify if machine, tool, or object causing injury or illness):

Part of body injured (*e.g. forehead, neck, right arm, left leg*):

Nature of injury (*e.g., fracture, sprain, laceration*):

Equipment, material or substance involved:

Were safeguards provided? \_\_\_\_\_ yes \_\_\_\_\_ no Were safeguards used? \_\_\_\_\_ yes \_\_\_\_\_ no

Description of safeguards:

If motor vehicle accident, driver’s license #: State where issued:

Contributing factors:

If other parties involved: (*name, address, phone*):

Witness information: (*name, address, phone*):

Was the accident on employer’s premises? \_\_\_\_\_ yes \_\_\_\_\_ no

Did employee lose any time from work? \_\_\_\_\_ yes \_\_\_\_\_ no

Is the employee back at work? \_\_\_\_\_ yes \_\_\_\_\_ no If yes, date returned:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Was employee paid for date of injury? \_\_\_\_\_ yes \_\_\_\_\_ no

**TREATMENT**

**First aid** What type of first aid was administered? 1st day of treatment:

Who administered first aid?

\_\_\_\_**Hospital/Clinic** (*name, address, phone #*):

Treatment: Length of stay: 1st day of treatment:

**Physician** (*name, address, phone* #):

Treatment: Specialty: 1st day of treatment:

**HUMAN RESOURCES OFFICE USE ONLY**

Date reported to workers’ compensation insurance \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Reported as “Incident Only” yes no

**EMPLOYEE JOB INFORMATION**

Occupation when injured:

Date of hire: Hours worked per day: \_\_\_\_\_\_\_\_\_ Days worked per week: \_\_\_\_\_\_\_\_\_

Wages per hour: $\_\_\_\_\_\_\_\_\_\_ Earnings per week: $\_\_\_\_\_\_\_\_\_\_

Supervisor’s name (*first, MI, last*), Phone #/Ext.:

Scheduled work hours:

**ACCOUNT INFORMATION**

Human Resource: Yvonne Fajardo, HR Assistant

Employer’s Name and Address: Eastern Mennonite University

1200 Park Road

Harrisonburg, VA 22801 Phone: 540-432-4049

Federal tax ID#: 54-0575812

Nature of Business: Education

**EMU Chemical Hygiene and Safety Plan**

**Appendix B (C) (3)**

**NON-EMPLOYEE ACCIDENT/INJURY REPORT FORM**

**Instructions:**

1. *Assist the injured party in receiving medical attention as needed.*

2. *Complete the form promptly (in ball-point pen) for incidents involving injury or potential injury to students and visitors*.

3. ***Return completed form as follows:***

*- Science Center injuries return to the Chemical Hygiene Officer*

*- Other injuries return to the Human Resources Office*

Person reporting injury: Date Reported:

Date of injury: Time: a.m. p.m.

Name

Address

*Street City State Zip*

Telephone Number *(Day)* *(Night)*

\_\_\_Student \_\_\_Visitor \_\_\_\_Leasee

Accident Location

Instructor *(if applicable)*

Course *(if applicable)*

Injury Suffered

Cause of Injury

Description of immediate first aid administered or action taken:

Administered by

Was further treatment or follow-up treatment suggested? \_\_\_\_ yes \_\_\_\_no

If so, what? \_\_\_\_EMU Health Center \_\_\_\_ RMH \_\_\_\_ Rescue Squad \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Other

Witnesses

*Name Phone #*

*Name Phone #*

Suggestions for future avoidance

Reported to Campbell Insurance

*Date Time Initials*

**Appendix C. Process Hazards Identification Checklist**

The following questions, guidelines are to be used in designing experiments that will minimize potential hazards associates with the type of chemicals addressed below.

**A.  Determination of Chemical Hazard**

1. Determine, based on MSDS information, if the chemicals used or the reaction byproducts can be classified as one of the following:
2. carcinogen
3. allergen
4. reproductive hazard (mutagen, teratogen)
5. acutely toxic
6. peroxide formers

If the answer is yes, notify the CHO.

1. Are any of the process chemicals or reaction byproducts an OSHA regulated substance. See Appendix D. If Yes, contact the Chemical Hygiene Officer (ext. 4626).
2. Will perchloric acid be used in the process? If yes contact the Chemical Hygiene Officer.
3. Has the use of  less toxic materials been considered and is the quantity reduced to the smallest amount necessary for the experiment?
4. Is the ventilation/containment system adequate to control the materials being used and generated?  There should be a minimum of 100 linear feet per minute.

**B.  Hazards Assessment of Chemical Process**

1. Has the literature for the intended process been researched to identify the accidents that have occurred and their causes/prevention?
2. Will an exothermic reaction occur if any of the following failure modes occur?
3. quench failure or loss of external cooling
4. change in purity of material or catalysts
5. excess or deficiency of one reactant
6. loss of agitation
7. local hot spot due to inadequate mixing
8. excessive point or surface temperature leading to  “runaway” reactions
9. delayed onset of batch reaction while continuing reactant addition
10. leakage of coolant into reactants
11. backflow of a reactant due to depressurizing system
12. excessive heat
13. high-pressure reaction acceleration
14. For experiments being scaled up or down have the following have been evaluated for impact on reaction rates?
15. change in surface area, heat and cooling capacity
16. degree of agitation and mixing
17. changes in reactant proportions
18. rates of addition
19. Are the reactants being used endothermic compounds with low energy activation values?
20. Are amine metal oxysalts used in a process that is subject to friction, heating or impact?
21. Are pyrophoric materials used in a process that will result in oxidation or hydrolysis?
22. Are water reactive compounds used in a process that could result in contact with water?
23. Has the oxygen balance of the compounds been evaluated to determine explosive potential?
24. Are peroxidizable compounds used or produced which are concentrated due to heating or evaporation?
25. Has the creation of toxic off gas byproducts due to contact between reaction byproducts and reactants or process surfaces been evaluated?
26. Will flammable liquids be used such that the ignition temperature for the vapors produced can be exceeded?
27. Are the reactants or reacting byproducts highly corrosive?
28. Is spontaneous polymerization possible for the reaction process?
29. Is the wrapping material on the dewar flask compatible with the process chemical?

**C.  Hazards Assessment Physical Process**

* 1. Are precautions implemented to prevent implosions or explosions of flasks.
  2. Are pressure relief valves/devices available for sealed system under cryogenic cooling?
  3. Are safety relief devices provided for pressurized processes?
  4. Are the safety relief devices capable of operating at the pressure of concern?
  5. Are the process flow lines, containers and clamps capable of withstanding process pressures?
  6. Are pressure relief devices located so that personnel will not be exposed if these devices are activated?
  7. For laboratory projects involving a continuous flow of water (such as condensers) is protection provided to prevent flooding from tube failures, pump failures, blockage in flow lines, connection disruptions and pressure spikes?
  8. Are proper regulators and valve fittings used for compressed gases, especially CO2 and corrosive gases?
  9. Is the glass and plastic equipment used for pressurized or vacuum processes adequate?
  10. Are pumps adequately protected, from the process reactants and byproducts with traps?
  11. Are guards provided for belt driven mechanical pumps?

**D.  Hazards Assessment Fire and Electrical Process**

1. Are ground fault circuit interrupters provided in areas where there is a danger of splashing water into the receptacle?
2. Is equipment layout such that flammable materials are segregated from ignition sources?
3. Where electrical equipment is used with flammable liquids are measures in place to prevent heating above the ignition temperature of the liquid?
4. Is bonding and grounding protection provided for containers, especially large metal drums, of flammable liquids?
5. Are variable autotransformers (heaters, stirrers) located so as to prevent contact between the windings and flammable vapors?
6. Are heating mantles properly grounded?
7. Is heating equipment provided with automatic temperature controls and with high temperature limit switches?
8. Are non-sparking tools and motors used for work involving flammable chemicals?
9. Is electrical equipment positioned to guard against liquids being spilled onto the equipment?
10. Are drying ovens constructed so that temperature controls and heating elements are separated from their interior atmosphere?
11. Are highly flammable solvents such as ethers stored in explosion proof refrigerators.
12. For work involving the generation of flammable vapors are all the laboratory switches explosion proof?
13. For stirring and mixing devices can these devices be remotely shut off?  (e.g. electrical shut off for laboratory)
14. Do all hot plates have their heating elements completely enclosed?
15. Is the received and opened date recorded on containers of flammable chemicals capable of forming peroxides.
16. Are the chemical and physical properties of the reagents and reaction products known and understood?
17. Are the medical emergency measures for the respective chemicals covered in the MSDS and readily available?
18. Is/are the reaction(s) understood and predictable under normal circumstances as well as the factors that can cause upset conditions?

**E.  Hazardous Waste Planning**

1. Have provisions for hazardous waste disposal been addressed?
2. Are provisions provided in the experiments to prevent the release of hazardous materials into the drain system?
3. For solvent distillations, are trapping devices adequate to prevent entertainment of solvent vapors into stream that is released to the drain?
4. Have steps been taken to minimize the amount of waste generated by the process?
5. Are methods included in the process to render the reactants and by-products non-hazardous?
6. Are bimetallic thermometers used in place of mercury thermometers to prevent generating mercury contaminated waste?
7. See Appendix F Hazardous Waste, Handling and Disposal.

**F.  Administrative Preparation Assessment**

1. Is a detailed and updated written protocol available to all personnel performing part or all of an assigned experiment or research project.?
2. For experiments that will run continuously,  areprovisions made for periodically checking the experimental set-up to ensure operational safety?
3. Is there a written protocol provide with instructions for handling upsets and credible emergencies?
4. Is there a schedule for providing routine maintenance and checks made of interlocks relied on to shut down equipment?
5. Has training in protocol been provided to all personnel performing the laboratory experiments or research projects?
6. Are suitable materials available for neutralizing and containing materials that could be spilled during the process?
7. What process hazards are introduced by reaction products and/or by products?
8. Are special detectors and alarm devices needed to warn of the generation of hazardous materials?
9. If special detectors and alarm devices are needed, are protocols and equipment available for periodic calibration and testing of these devices?
10. If special detectors and alarm devices are used, has the Chemical Hygiene Officer and Campus Security been notified of what they indicate and how to respond?
11. For operations involving liquid nitrogen as a coolant, have precautions been instituted to eliminate the condensation of liquid oxygen before charging a trap?

**Appendix D.  OSHA Regulated Substances**

***Notify CHO if plan to use any of the listed chemicals.***

Substance CAS No.                     29CFR Action Level

Acrylonitrile (T)(C)(M) 107-13-1 1910-1045 1 ppm-8hrTWA

Asbestos 1332-21-4 1910.1001 0.1f/cc 8hr. TWA

4-Nitrobiphenyl (C) 92-93-3 1910.1003 >0.1% of mixture

by weight/vol.

alpha-Naphthylamine (C) 134-32-7 1910.1004 >1.0% of mixture

by weight/vol.

Methyl Chloromethyl 107-30-2 1910.1006 >0.1% of mixture

Ether (C)                                                                                                        by weight/vol.

3,3Õ-Dichlorobenzidine (C) 91-94-1 1910.1007 >1.0% of mixture

by weight/vol.

Bis-Chlormethyl  (C) 542-88-1   1910.1008 >0.1% of mixture

Ether by weight/vol.

beta-Napthylamine (C) 91-59-8 1910.1009 >0.1% of mixture

by weight/vol.

Benzidine (C) 92-87-5 1910-1010 >0.1% of mixture

                                                                                                                        by weight/vol.

4-Aminodiphenyl (C) 92-67-1 1910.1011 >0.1% of mixture

by weight/vol.

Ethylene Oxide  (C) 75-21-8 1910-1047 0.5 ppm-8hrTWA

Ethyleneimine  (C) 151-56-4 1910.1012 >1.0% of mixture

by weight/vol.

Formaldehyde  (C) 50-00-0 1910.1048 0.5 ppm-8hrTWA

beta-Propiolactone  (C) 57-57-8 1910.1014 >0.1% of mixture

by weight/vol.

2-Acetylamino- 53-96-3 1910.1014 >0.1% of mixture

flouene   (C)  by weight/vol.

4-Dimethylamin- 60-11-7 1910.1015 >1.0% of mixture

oazobezene  (C)  by weight/vol.

N-nitosodimethlamine (C) 62-75-9 1910.1016 >1.0% of mixture

by weight/vol.

Vinyl Chloride 75-01-4 1910.1017 0.5 ppm-8hrTWA

Inorganic Arsenic 7440-38-2 1910.1018 5 ug/M3-8hrTWA

Lead 7439-92-1 1910.1025 30 ug/M3-8hrTWA

1,2-dibromo-3- 96-12-8 1910-1044 1 ppb-8hrTWA

chloropropane (DBCP)

Benzene 71-43-2 1910.102B 5.0 ppm  15 min max

1.0 ppm   8 m PEL

Cadmium 7440-43-9 1910.1027 5 ng/m3 8 kc PEL

(C)    Cacinogen – its use in the laboratory require a regulated area  1910.1003 (c)

(T)     Toxic

(M)  Mutagen

**Appendix E.  Chemical Compatibility Guide**

**Chemical                                                                     Incompatible With**

Acetic acid                                                            Chromic acid, nitric acid, hydroxyl

                                                                                  compounds, ethylene glycol,

                                                                                 perchloric acid, peroxides,

                                                                                 permanganates

Acetylene                                                                Chlorine, bromine, copper,

                                                                                    fluorine, silver, mercury

Acetone                                                                    Concentrated nitric and sulfuric

                                                                                    acid mixtures

Alkali and alkaline earth metals                              Water, carbon tetrachloride or

(such as powdered aluminum or                                other chlorinated hydrocarbons,

magnesium calcium, lithium,                                     carbon dioxide, halogens

sodium, potassium)

Ammonia (anhydrous)                                              Mercury (in manometers, for

                                                                                   example), chlorine, calcium

                                                                                   hypochlorite, iodine, bromine,

                                                                                   hydrofluoric acid (anhydrous)

Ammonium nitrate                                                    Acids, powdered metals,

                                                                                    flammable liquids, chlorates,

                                                                                    nitrites, sulfur, finely divided

                                                                                    organic combustible materials

Aniline                                                                       Nitric acid, hydrogen peroxide

Arsenical materials                                                Any reducing agent

Azides                                                                        Acids

Bromine                                                                     See chlorine

Calcium oxide                                                            Water

Carbon (activated)                                                     Calcium hypochlorite, all oxidizing agents

Carbon tetrachloride                                                  Sodium

Chlorates                                                                   Ammonium salts, acids, powdered

                                                                                  metals, sulfur, finely divided

                                                                                  organic or combustible materials

Chromic acid and chromium                            Acetic acid, naphthalene, camphor

trioxide                                                                        glycerol, alcohol, flammable

                                                                                    liquids in general

Chlorine                                                                      Ammonia, acetylene, butadiene,

butane, methane, propane (or

                                                                                    other petroleum gases), hydrogen,

                                                                                    sodium carbide, benzene, finely

                                                                                    divided metals, turpentine

Chlorine dioxide                                                         Ammonia, methane, phosphine,

                                                                                    hydrogen sulfide

Copper                                                                        Acetylene, hydrogen peroxide

Cumene hydroperoxide                                              Acids

Flammable liquids                                                     Ammonium nitrate, chromic acid,

                                                                                  hydrogen peroxide, nitric acid,

                                                                                  sodium peroxide, halogens

Fluorine                                                                       All other chemicals

Hydrocarbons (such as butane,                                   Fluorine, chlorine, bromine,

propane, benzene)                                                       chromic acid, sodium peroxide

Hydrocyanic acid                                                        Nitric acid, alkali

Hydrofluoric acid (anhydrous)                                   Ammonia (aqueous or anhydrous)

Hydrogen peroxide                                                      Copper, chromium, iron, most

                                                                                    metals or their salts, alcoholos,

                                                                                    acetone, organic materials, aniline,

                                                                                    nitromethane, combustible

                                                                                    materials

Hydrogen sulfide                                                   Fuming nitric acid, oxidizing gases

Hypochlorites                                                              Acids, activated carbon

Iodine                                                                          Acetylene, ammonia (aqueous or

                                                                                    anhydrous), hydrogen

Mercury                                                                    Acetylene, fulminic acid, ammonia

Nitrates                                                                    Sulfuric acid

Nitric acid (concentrated)                                         Acetic acid, aniline, chromic acid,

                                                                                    hydrocyanic acid, hydrogen

                                                                                    sulfide, flammable liquids,

                                                                                    flammable gases, copper, brass,

                                                                                    any heavy metals

Nitrites                                                                        Acids

Nitroparaffins                                                              Inorganic bases, amines

Oxalic acid                                                                  Silver, mercury

Oxygen                                                                        Oils, grease, hydrogen; flammable

                                                                                    liquids, solids or gases

Perchloric acid                                                            Acetic anhydride, bismuth and its

                                                                                   alloys, alcohol, paper, wood,

                                                                                   grease, oils

Peroxides, organic                                                     Acids (organic or mineral), avoid

                                                                                    friction, store cold

Phosphorus (white)                                                   Air, oxygen, alkali’s, reducing agents

Potassium                                                                  Carbon tetrachloride, carbon

                                                                                    dioxide, water

Potassium chlorate                                                   Sulfuric and other acids

Potassium perchlorate (see also                               Sulfuric and other acids

chlorates)

Potassium permanganate                                          Glycerol, ethylene glycol,

                                                                                benzaldehyde, sulfuric acid

Selenides                                                                    Reducing agents

Silver                                                                          Acetylene, oxalic acid, tartaric

                                                                                    acid, ammonium compounds,

                                                                                    fulminic acid

Sodium                                                                      Carbon tetrachloride, carbon

                                                                                    dioxide, water

Sodium nitrite                                                            Ammonium nitrate and other

                                                                                    ammonium salts

Sodium peroxide                                                    Ethyl or methyl alcohol, glacial

                                                                                   acetic acid, acetic anhydride,

                                                                                    benzaldehyde, carbon disulfide,

                                                                                    glycerin, ethylene glycol, ethyl

                                                                                    acetate, methyl acetate, furfural

Sulfides                                                                     Acids

Sulfuric acid                                                            Potassium chlorate, potassium

perchlorate, potassium permanganate (similar compounds of light metals, such as sodium, lithium)

Tellurides                                                                   Reducing agents

**APPENDIX F. HAZARDOUS WASTE CHEMICALS AND BIOLOGICAL MATERIALS Handling and Disposal**

Disposal of hazardous chemicals must be in compliance with local (landfill regulations), state (VA DEQ) and federal (EPA) regulations.  Under the Virginia Hazardous Waste Regulation, EMU’s chemistry and biology laboratories are classified as Conditionally Exempt Small Quantity Generators (CESQG) of hazardous waste.  To meet this classification the amount of hazardous waste generated per month must be less than 100 kg (220 lbs) or the acute hazardous waste generated in a month must be less than 1 kg (2.2 lbs).  Also, the total amount of hazardous waste generated in one year may not exceed 1000 kgs (2200 lbs).

Should the threshold amounts designated above be exceeded, the VADEQ must be contacted for a generator reclassification.   The CHO should make the DEQ contact.

A. Hazardous Waste Chemicals.

Minimize waste generation at the source by limiting the quantities of materials purchased and used.

* 1. Design experiments in ways that will reduce the amount of waste that will result.
  2. All waste chemical containers must be labeled with a hazardous waste label showing the chemical name, accumulation date, concentration and initials of the generator.
  3. Ensure identity of chemical at all times. Identifying unknown chemicals is costly ($600 per chemical) and must be done before a disposal company will remove them from our premises.
  4. Hazardous waste may not be poured down the drain or put into the daily refuse.
  5. Inorganic acids and bases may be neutralized and released to the drain. The pH range where drain release is permitted is between 5.5 and 9.5.
  6. Allow 1 ½ to 2 inches of head room when filling liquid waste containers.
  7. Avoid mixing chlorinated solvents with non-chlorinated solvents.
  8. Silver containing photographic solutions may not be released to the drain.
  9. Avoid mixing carcinogens, mutagens, teratogens with organic waste.
  10. Avoid mixing aqueous reagents with organic solvents.
  11. Do not accumulate more than 1000 Kgs of hazardous waste or 1 Kg of acutely hazardous waste on site. Larger quantities disqualify EMU for Conditional Exempt Small Quantity Generator (CESQG) status.
  12. Special training for waste handlers is not required for CESQG status.
  13. Consolidation of waste chemicals must be restricted to materials of like hazard class.
  14. Use the original, or comparable containers, as a collection vessel for waste chemicals.
  15. Use EPA approved waste packaging, transporting and disposal facilities for off site disposal.

B. Infectious Waste And Contaminated Material Containers

 1.  Infectious Waste

* + 1. Infectious waste is defined as a waste capable of producing disease.
    2. This definition requires the following factors to be considered for induction of disease:
       - 1. presence of a pathogen of sufficient virulence
         2. dose
         3. portal of entry
         4. resistance of the host
    3. For waste to be considered infectious, it needs to contain oncogenic viruses or pathogenic microorganisms with sufficient virulence and quantity so that exposure to the waste by a susceptible host could result in an infectious disease.
    4. Transport of infectious waste must adhere to Virginia Infectious Waste Management regulations.
    5. According to Virginia Infectious Waste Management regulations, the following wastes are designated as infectious:

Cultures and stock of microorganisms and biologicals.  Discarded cultures, stocks, specimens, vaccines and associated items likely to have been contaminated by them are infectious wastes if they are **likely to contain organisms which are likely to be pathogenic to healthy humans.** Discarded etiologic agents are infectious waste.  Wastes from the production of biological by products and antibiotics are likely to have been contaminated by pathogenic organisms.

Blood and blood products.  Wastes consisting of human blood, human blood products (including serum, plasma, etc.)  and items contaminated by free-flowing human blood are infectious waste.

Pathological wastes.  All pathological wastes and all wastes that are human tissues, organs body parts, or body fluids are infectious wastes.

Sharps.  This includes used hypodermic needles, syringes, scalpel blades, Pasteur pipettes, broken glass and similar devices likely to be contaminated with organisms that are pathogenic to healthy humans always consider sharps used in a patient’s care to be infectious wastes.

Animal carcasses, body parts, bedding, and related wastes.  When animals are intentionally infected with organisms likely to be pathogenic to healthy humans for the purposes of research, in vivo testing, production of biological materials or any other reason; the animal carcasses, body parts, bedding material and all other wastes likely to have been contaminated are infectious wastes when they are discarded, disposed of, or placed in accumulated storage.  As is any residue or contaminated soil, water, or other debris resulting from the cleanup of a spill of any infectious waste.    
  
For guidance on the disposal of animal carcasses that are not intentionally infected with pathogens, and have been certified to be pathogen free, contact the DEQ representative for disposal at the local landfill.

* + 1. Containers for Contaminated Material

1. Containers for Contaminated Biological Material (CMC)  may be procured from the EMU Health Center or EMU Science Center (S-31).  They should be assembled according to instructions on the box side panel and placed in the laboratory area as needed.
2. As a result of increasingly stringent Federal and State regulations, it has become necessary to track the origin of infectious waste.  The following information, found on the top panel of the CMC box, must be completed:

                DATE                          CONTACT

               PHONE                       DEPARTMENT

               BLDG/ROOM             WASTE TYPE

Sharps containers are placed in laboratory areas for needle collection.  These plastic boxes must be deposited in a CMC box before transporting.

* + 1. DISPOSALDisposal of the CMCs will be arranged with the EMU Health Services. Health Center.

**Appendix G.  Glove Compatibility Guide**

Resistance to Chemicals of Common Glove Material

 (E = Excellent. G = Good, F = Fair, P = Poor)

**Natural**

**Chemical                                   Rubber    Neoprene Nitrile Vinyl**

---------------------------------------------------------------------------------------------------------------

Acetaldehyde  G G E G

Acetic acid                                  E                   E            E                   E

Acetone                                      G                   G           G                   F

Acrylonitrile                                 P                     G                   -                    F

Ammonium hydroxide (conc.)          G                    E             E                   E

Aniline                                           F                     G                     E                   F

Benzaldehyde                               F                      F                      E                  G

Benzene                                            P                    F                      G                  F

Benzyl Chloride (a)                           F                    P                     G                  P

Bromine                                            G               G                    -                    G

Butane                                               P                      E                     -                    P

Butyraldehyde                                   P                     G                     -                    G

Calcium hypochlorite                       P                      G                     G                  G

Carbon disulfide                               P                      P                     G                  F

Carbon tetrachloride                          P                    F                    G                  F

Chlorine                                            G                  G                   -                    G

Chloroacetone                                  F                      E                   -                    P

Chloroform (a)                                P              F                   G                  P

Chromic acid                                     P                     F                   F                   E

Cyclohexane                                     F                     E                   -                    P

Dibenzyl ether                                   F                      G                    -                    P

Dibutyl phthalate                               F                      G                    -                    P

Diethanolamine                                  F                    E                   -                    E

Diethyl ether                                      F                    G                  E                   P

Dimethyl Sulfoxide  (b)                    -                       -                    -                    -

Ethyl acetate                                       F                   G                  G                  F

Ethylene dichloride  (a)                     P                   F                   G                  P

Ethylene glycol                                   G                     G                  E                   E

Ethylene trichloride  (a)                      P                     P                    -                    P

Fluorine                                          G               G         -                G

Formaldehyde                             G                    E                   E                   E

Formic acid                                       G                    E                  E                   E

Glycerol                                            G                    G                  E                   E

(E = Excellent. G = Good, F = Fair, P = Poor)

**Natural**

**Chemical                                   Rubber    Neoprene Nitrile Vinyl**

----------------------------------------------------------------------------------------------------------------

Hexane                                               P                 E                   -                    P

Hydrobromic acid (40%)                   G                     E                   -                    E

Hydrochloric acid (conc.)                  G                   G                 G                  E

Hydrofluoric acid (30%)                    G                    G                 G                  E

Hydrogen peroxide                           G                     G                 G                  E

Iodine                                                G                G                   -                    G

Methylamine                                    G                  G                  E                   E

Methyl cellosolve                              F                    E                   -                    P

Methyl chloride  (a)                           P                   E                   -                    P

Methylene chloride  (a)                     F                   F                   G                  F

Methyl ethyl ketone                          F                     G                  G                  P

Monoethanolamine                           F                     E                   -                    E

Morpholine                                       F                    E                   -                    E

Naphthalene  (a)                               G                   G                   E                   G

Nitric acid (conc.)                              P                 P                   P                   G

Perchloric acid                                   F                    G                  F                   E

Phenol                                                 G                    E                   -                    E

Phosphoric acid                                G                 E                    -                    E

Potassium hydroxide (sat.)               G                    G                   G                  E

Propylene dichloride                          P                    F                   -                    P

Sodium hydroxide                             G                   G                  G                  E

Sodium hypochlorite                         G                P                   F                   G

Sulfuric acid (conc.)                          G                     G                  F                   G

Toluene  (a)                                       P                   F                   G                  F

Trichloroethylene  (a)                        P                   F                   G                  F

Tricresyl phosphate                           P                 F                   -                    F

Triethanolamine                                 F                    E                   E                   E

Trinitrotoluene                                  P                 E                    -                    P

(a) Aromatic and halogenated hydrocarbons will attack all types of natural and synthetic glove material. Should the glove swell when it comes into contact with a solvent, change to another kind of glove.

 (b) No data on the resistance to dimethyl sulfoxide to natural rubber, neoprene, nitrile rubber, or vinyl materials are available; the manufacturer of the substance recommends the use of butyl rubber gloves.

 The Compatibility  Guide  was taken from Prudent Practices for Handling Chemicals  in Laboratories, National Research Council, National academy Press Washington, D.C., P. 159-160 (1981)

**B.  Physical Performance Chart**

*Glove             Abrasion       Cut                Puncture        Heat*

*Material          Resistance    Resistance    Resistance      Resistance      Flexibility      Dry Grip*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Natural Rubber | 1 | E | E | E | F | E |
| Neoprene | F | E | E | E | G | G |
| Buna-N | G | E | G | F | F | G |
| Butyl | G | G | G | P | G | F |
| Polyvinyl Chloride | G | E | E | F | F | E |
| Polyvinyl Alcohol | G | E | E | F | F | E |
| Polyethene | E | F | E | P | G | G |
| Nitril-Buradiene Rubber | E | E | E | F | G | G |

Key:  E-Excellent, G-Good, F-Fair, P-Poor, NR-Not Recommended

**Appendix H.  Laboratory Inspection Checklist**

To:                                                                   for Laboratory No.                   Bldg.

             (person conducting experiment)

*Areas of Inspection                                                                             Comments and Recommendations*

1.   Bench tops                                                     \_\_\_\_

2.   Areas under sinks                                                 \_\_\_\_

3.   Cabinets, drawers, shelves (chemicals storage) \_\_\_\_

4.   Hoods                                                          \_\_\_\_

5.   Aisles                                                                     \_\_\_\_

6.   Window ledges                                            \_\_\_\_

7.   Walls, floors                                          \_\_\_\_\_

8.   Chairs, stools, upholstery, casters               \_\_\_\_\_

9.   Safety glasses, face shields, protective clothing \_\_\_\_\_

10.  Fire Extinguishers                                            \_\_\_\_\_

11.  Compressed gas cylinders                         \_\_\_\_\_\_

12.  Broken glassware:  destroy? repair?               \_\_\_\_\_\_\_

13.  No Smoking sign                                           \_\_\_\_\_

14.  Tubing: condition? proper use?       \_\_\_\_\_

15.  Guards on moving equipment                     \_\_\_\_                                                                                 \_

16.  Interlocks                                                         \_\_\_\_                                                                                \_\_

17.  Condition of laboratory equipment            \_\_\_\_                                                                                  \_

18.  Refrigerators                                         \_\_\_\_\_\_

19.  Electric cords, other wiring                       \_\_\_\_\_

20.  Eye wash fountains                                                                                                                    \_\_\_\_\_

21.  Storage of peroxide-forming chemicals     \_\_\_\_\_

22.  Labels on containers                                                                                                                 \_\_\_\_\_

23.  Evaluation of amount of chemicals in laboratory                                                                                   \_

24.  Evaluation of amount of supplies and equipment     \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

25.  Laboratory desks, bookshelves                                                                                                  \_\_\_\_\_

26.  Office Housekeeping                                                                                                                     \_\_\_\_\_

27.  Other                                                                                                                                                       \_\_\_\_\_

Actions taken and other recommendations:

1.   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2.   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3.   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4.    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5.    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6.    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7.    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8.    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9.    \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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21.

22.

23.

24.

25.

26.

Inspection made by:                                                                  Date

**APPENDIX I - MATERIAL SAFETY DATA SHEETS**

1. Material Safety Data Sheets (MSDS) are the backbone of the EMU Chemical Safety Program.  OSHA requires chemical manufacturers and importers to produce one MSDS for each hazardous chemical they manufacture or import.  MSDSs are maintained at EMU, and provide detailed health and property information.  For instance, MSDSs outline the signs and symptoms associated with exposures to hazardous chemicals.  They also give permissible exposure limits (PEL) for OSHA regulated substances and American Conference of Governmental Industrial Hygiene (ACGIH) exposure limits expressed as threshold limit valves or (TLVs). EMU has a file of MSDSs on the table by the Chemistry Storage area, Room 35. Laboratory supervisors, employees, and students can get a copy of any MSDS by calling (x 4626), the Chemical Hygiene Officer or searching the Internet using the words “MSDS and the chemical name.
2. MSDS Requirements

* 1. The MSDS must include the following information:

1. The identity of the substance designated on the container label
2. Single substance:  chemical and common names
3. Mixtures tested as a whole:  chemical and common names of all ingredients which are health hazards, in concentrations of 1% or greater.
4. Mixtures untested as a whole:  chemical and common names of all ingredients which are health hazards and which are in concentrations of 1% or greater; carcinogens in concentration of 0.1% or greater.

1. Physical and chemical characteristics of the hazardous chemicals.
2. Physical hazards (potential for fire, explosion, etc.
3. Acute and chronic health effects and related health information.
4. Primary routes of entry into the body.
5. Information on exposure limits – OHSA, PELS, ACGIH, Threshold Limit Values (TLV)
6. Carcinogens specified by: OSHA, the International Agency for Research on Cancer, or the National Toxicology Program.
7. Safe handling practices, generally acceptable control measures (engineering controls), and personal protective equipment).
8. Emergency and first aid procedures.
9. Date of MSDS preparation, or most recent change.
10. Name, address, and phone number of the party responsible for preparing and distributing the MSDS.

The MSDS is a quick reference to the potential hazards of a particular chemical and should be a reference of choice.

**APPENDIX J - DEA CONTROLLED SUBSTANCES**

1. **Controlled substances are regulated under the Controlled Substances ACT of the Comprehensive Drug Abuse Prevention and Control Act of 1970.**

1. **Controlled substances are listed in schedules I-V. Schedules and the Drug Enforcement Agency (DEA) regulations are available in the Chemical Hygiene Office.**
2. **A license is required to use controlled substances.**
3. **Periodic inventories are required.**
4. **Disposal of regulated substances is regulated and is best managed by using a buy back arrangement with companies such as Pharmalink Inc. , a national pharmaceutical returns and disposal company.**

**APPENDIX K - REPRODUCTIVE HAZARDS, MUTAGENS, TERATOGENS**

1. Reproductive Toxins/Mutagens

Mutagens are chemical and physical agents that induce mutations in DNA and in living cells.  They affect the genetic system in such a way as to cause cancer or hereditary changes in chromosomes.  Individuals exposed to chemicals with mutagenic properties may develop genetic damage to the extent that future offspring will be affected.

* 1. Two forms of somatic (body/organ) cell interference may be noted:

Leukemias:  white blood cells are produced far more rapidly than they can be removed from the blood, interfering with normal body functions.

Cancers:  cells that do not normally divide during adult life begin to proliferate to the extent that such division displaces or invades normal tissues.

  Examples of mutagens:

Arsenic

          Ethidium Bromide

   Ionizing Radiation (gamma, x-rays)

  Alkylating agents (i.e., dimethyl sulfate)

* 1. Storage and Handling

Before working with suspected or known mutagenic compounds, obtain health hazard information for each compound, the MSDS is a recognized source.  In addition, compile spill cleanup emergency procedures for your laboratory.  For more information, call the CHO (x4626).

1. Embryotoxins

Females of child bearing age should handle embryotoxins such as organomercurials, lead compounds or formamide, only in a hood with gloves.  Store these substances in adequately ventilated areas in properly labeled, unbreakable containers whenever possible.

* 1. Teratogens

Teratogens are chemical and physical agents that interfere with normal embryonic development.  Teratogens differ from mutagens in that there must be a developing fetus.  Damage to the fetus (embryo) is  most likely to occur early in pregnancy, during the first 8-10 weeks.  Teratogens may produce congenital malformations or death of the fetus without inducing damage to the pregnant woman.

* + - 1. Examples of materials thought to be teratogens are:

            Antimony

         Carbon disulfide

           Ethylene thiourea

          Polychlorinated biphenols (PCBs)

          Nitrous oxide

         Lead and mercury compounds

           Ethylene dibromide

            Ionizing radiation

* + - 1. Storage and Handling

Before working with suspected or know teratogenic compounds, obtain health hazard information for each compound.  In addition, compile spill cleanup emergency procedures for your laboratory.  For more information, call the CHO (x4626).

**APPENDIX L – BIOLOGICAL HAZARDS AND PATHOGENS**

1. Introduction

Much of the microbiological work in university laboratories is not concerned with know pathogenic (i.e. disease causing) organisms.

However, certain safety measures are essential because (1) the dividing line between pathogens and non-pathogens is not clear cut; (2) the possibility of adventitious growth of pathogens exists and cross-contamination of cultures may occur.  The teaching of the principles and techniques of handling microorganisms safely is an essential component of training workers using microbiological techniques.  Before beginning work involving pathogen, contact the Chemical Hygiene Officers for additional information.

1. General Precautions
2. Before beginning work, ensure that supplies of an appropriate disinfectant are available.  Carry out all work in a thoughtful and meticulous way.  Treat all microorganisms as if they are pathogenic.  Swab benches and worktops with a suitable disinfectant before leaving the laboratory.
3. Never leave contaminated material unattended unless it is sealed and clearly labeled.  If contaminated material is stored in a refrigerator or cold room, stand it in a tray large enough to contain the contents should the container break.  Seal contaminated materials in a suitable container before sterilization or incineration.
4. To minimize contamination through spillage, stand vessels containing infectious materials in trays and cover the working surface with disposable absorbent material, which can be incinerated after use.
5. Keep work spaces as uncluttered as possible.
6. Do not eat, drink, apply cosmetics or smoke in laboratories, animal houses or any other potentially contaminated place and avoid putting any objects, such as a pen or pencil, into your mouth.  Gummed labels must not be licked:  use self adhesive labels or a glass pencil.  Never pipette anything by mouth, but use an automatic pipette.  If pipettes are to be used with infected material, plug them with non-absorbent cotton wool.  If only small drops of culture are required, use a plugged Pasteur pipette with a rubber teat.
7. Wear appropriate protective clothing and use automatic devices when appropriate.  Seal any abrasions of the skin before entering a contaminated zone, to prevent contamination by infectious materials.  Remove contaminated clothing before leaving the contaminated area and then wash your hands.  Arrangements should be made for the sterilization of contaminated clothing.  Do not wear contaminated clothing in any place where eating, drinking or smoking is permitted.  Wash protective gloves after handling contaminated apparatus or materials, and also before removing them, and then wash hands thoroughly.  Clean under and around fingernails but do not abrade the skin by vigorous scrubbing.  All accidents and spillages must be recorded even when no personal injury was involved.
8. Before use, flame the apparatus or glassware after removing the plug or cap.  A hooded Bunsen burner or a micro-incinerator is the safest way of sterilizing wire loops.  Materials which spit from overcharged loops may not have been sterilized.  Always support culture tubes, bottles, etc. in a rack, preferably one made from plastic coated wire:  do no prop them up or lay them down on the bench.
9. Sterilize all contaminated apparatus and glassware before sending it for cleaning.  Immerse used pipettes, tips downwards, in a jar of suitable disinfectant and compatible detergent. Leave the pipettes long enough to be sterilized.  Replenish the disinfectant regularly.
10. Smears of infected material and cultures on microscope slides may still be infectious after fixation and staining so they should be sterilized in a similar manner.

1. Aerosols

Aerosols are a major route of infection.  Finely disseminated droplets are formed whenever the surface film of a liquid is broken, or when dry material is being crushed, ground, shaken or vibrated.

Once disseminated they cause extensive contamination of the laboratory  and may persist in the air for some time.

Accidental breakage of containers is an obvious source of aerosol formation.  The precautions necessary to minimize aerosols formation include the following:

1. Handle reagents gently at all times.
2. Never blow material from pipettes.
3. Never bubble gases through liquid cultures, unless there is a filtered exhaust for the exit gas.
4. Do no wet the cap or plug when shaking vessels containing liquid cultures.
5. Use disposable loop or loops made of platinum or soft wire.
6. When transferring infectious material into or out of a rubber stoppered bottle, wrap a disinfectant soaked swab around the hypodermic needle and the stopper of a bottle before removing the needle.  Do this with negative pressure in the bottle.  Do not leave the bottle under greater than atmospheric pressure after transferring fluid through the stopper.
7. Expel any air and excess fluid from a syringe into a disinfectant soaked swab.
8. Remove the needle from a syringe after finishing and place in “sharp” disposal box; also scalpel blades.
9. Place all instruments in trays of disinfectant after use.
10. Carry out all procedures likely to cause aerosols such as agitating, blending, grinding, post-mortem dissection and the inoculation of animals in a microbiological safety cabinet.

1. Accidents

When culture vessels are broken, the debris should be immediately covered with a disposable towel or cloth soaked in a suitable disinfectant (5% solution sodium hupocholorite – cholorox). It should be possible to do this without the operator bringing his face into the aerosol cloud.  This should then be left for at least 10 minutes to allow the disinfectant to work. Immunization and regular booster injections should be offered to professors and laboratory technicians as a supplemental safety precaution.  As a minimum those who conduct experiments involving potential contact with blood or body fluid should have a current hepatitis immunization and those who have frequent contact with soil should have a current tetanus immunization.

The debris end of the cloth should then be put into a discard bin or an autoclavable dustpan and hand brush.

Sweeping brooms should not be used.  The area can then be swabbed with disinfectant using disposable cloths or paper towels.  Heavy duty gloves should be worn and care taken to avoid wounding be glass splinters.

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