

Michigan Technological University Safety Manual

Michigan Tech’s mission to “prepare students to create the future” involves the use of a wide variety of hazardous materials and processes that require special training and control measures to protect students, employees, and our environment from harm. The following University safety, health, and environmental policy and the management program outlined in this document form the basis for accomplishing our mission in a safe and environmentally responsible manner.

MTU Safety and Environmental Policy

The Safety Policy of Michigan Technological University is based on the firm conviction that accidents which cause personal injury or damage to the environment can be prevented. No phase of University business or operation is of greater importance than the safety of our students, faculty, staff, and visitors, and protection of the environment.

Michigan Technological University will provide and maintain a safe and healthy environment at all locations and will establish operating practices designed to assure the safety of all.

All students, faculty, and staff are responsible for their individual safety performance and for protection of the environment. Each instructor/supervisor also has the responsibility to create a climate of safety and environmental awareness. Safety and environmental protection must be an integral part of every job. It is the responsibility of all to comply with safety rules and to work in such a manner as to prevent injuries to themselves and others, and to prevent damage to the environment.

The prevention of accidents and the protection of the environment is in the best interest of all. Only through constant mutual effort and cooperation can we achieve these goals.

MTU Safety, Health, and Environmental Policies and Procedures

The safety, health, and environmental policies and procedures documented in this manual apply to all students, contractors, visiting scholars and scientists, and employees - regardless of rank - involved in activities associated with the operation of Michigan Technological University or performed on University owned or leased property.

1.0 Responsibilities

1.1 President

- ▶ Ensure that the University has an effective safety, health, and environmental program.
- ▶ Ensure that the necessary resources are allocated to effectively administer and implement the program.

- ▶ Make appointments to the Presidential Committee on Safety and Environmental Health and attend at least one meeting each year.
- ▶ Include a review of the University safety program in at least one meeting with the Vice Presidents each year.
- ▶ Reinforce a positive safety culture by commenting on obvious safety efforts and hazards during visits to campus work areas.

1.2 Vice Presidents

- ▶ Ensure that the divisions under their administration are effectively implementing the University safety and environmental program.
- ▶ Include a safety review in at least one meeting with division reports annually.
- ▶ Recognize and reward excellence in safety performance by division reports.
- ▶ Attend at least one meeting of the Presidential Committee on Safety and Environmental Health annually.
- ▶ Reinforce a positive safety culture by commenting on obvious safety efforts and hazards during visits to campus work areas.

1.3 College and School Deans

- ▶ Ensure that the departments under their administration are allocating sufficient resources and are effectively implementing the University safety and environmental program through such activities as regular on-site visits and reviews of safety inspection reports.
- ▶ Review the department's safety program with each department chair/director annually.
- ▶ Recognize and reward excellence in safety performance by department chairs and directors.
- ▶ Reinforce a positive safety culture by commenting on obvious safety efforts and hazards during visits to campus work areas.

1.4 Department Directors and Chairs

General Responsibilities:

- ▶ Allocate sufficient budget and personnel resources to implement the University safety and environmental programs and policies.
- ▶ Convey a positive attitude toward the University safety and environmental programs.
- ▶ At least annually, or more frequently as needed, evaluate the effectiveness of department safety efforts by reviewing safety inspection results and injury reports as well as walking through each work area.
- ▶ Recognize and reward excellence in safety performance by department faculty and staff.
- ▶ Direct department activities such that protection of the safety and health of students, visitors, and employees, as well as the environment, is an integral part of each activity.
- ▶ Ensure that students, contractors, visiting scholars and scientists, and employees are informed of their responsibilities within the University safety, health, and environmental protection policies and programs and that they fulfill those responsibilities.
- ▶ Ensure that students, contractors, visiting scholars and scientists, and employees receive appropriate safety and environmental information and training in a timely manner.
- ▶ Maintain up to date and available all necessary written department safety plans, chemical inventories, and material safety data sheets.

Specific Responsibilities:

- ▶ Appoint the department safety liaison and supervise and direct their activities.
- ▶ Department chairs with one or more chemical laboratory must appoint a qualified chemical hygiene officer (see section 10.2.1 of this manual for additional information).
- ▶ Complete and file a research employee exit statement for each research faculty, staff, and graduate student leaving the University (see Safety, Health, and Environmental Policies, section 3.3).
- ▶ Approve all exceptions to the University policy on children in the work place (see

Safety, Health, and Environmental Policies, section 3.2).

- ▶ Establish a list of the safety and environmental training required for each position within the department and ensure that each employee receives the necessary training. Occupational Safety and Health Services, OSHS, should be consulted for assistance in establishing training requirements.
- ▶ Implement a process for reporting and correcting department safety, health, and environmental hazards and for verifying that appropriate corrective actions have been taken, including those identified as a result of an injury.
- ▶ Complete and return the Annual Department Safety Report to OSHS by June 30 each year.

1.5 Faculty, Managers and Supervisors

- ▶ Integrate safety, health, and environmental protection into the daily activities of students, employees, and any other persons they supervise.
- ▶ Provide training and information to students, employees, and all others they supervise as requested by department administration and as required under University programs and policies.
- ▶ Review new equipment and procedures for recognized safety, health, and environmental hazards and take appropriate precautions before they are used or implemented.
- ▶ Investigate all incidents resulting in injury or property damage and report them to their department administrator and Occupational Safety and Health Services, OSHS (see section 5.7). Close calls must also be investigated and reported if they are found to have had the potential for personal injury or property damage. All employee fatalities must be reported immediately to OSHS regardless of cause.
- ▶ Enforce safety rules and review work areas daily.
- ▶ Maintain a written record of the content of each training session and the identification of the trainer and all attendees.

1.6 Department Safety Liaison

The safety liaison performs duties related to department safety, health, and environmental protection under the direction of the department chair/director/manager and acts as an intermediary with Occupational Safety and Health Services. All academic departments

shall have a department Safety Liaison unless exempted by OSHS.

1.7 All Students and Employees

Each student and every employee is responsible for the safety of their own actions, both for themselves and for their coworkers. They are also responsible for attending all training and informational meetings as requested, following proper work procedures, wearing assigned or required personnel protective equipment, and reporting all hazardous conditions and incidents to their supervisor, instructor, or other applicable person. Employees are also expected to participate in the development of safe work procedures and methods of protecting the environment through their involvement with safety committees or other means of providing feedback to the University.

1.8 Occupational Safety and Health Services

Occupational Safety and Health Services, OSHS, provides technical support to assist the University Administration in developing and implementing a safety, health, and environmental program and evaluating its effectiveness. OSHS responsibilities include:

- ▶ Acting as a University liaison with local, state, and federal regulatory agencies.
- ▶ Keeping those responsible for compliance informed of changes in safety, health, and environmental regulations.
- ▶ Providing the technical resources needed by the University to protect the safety and health of students and employees.
- ▶ Maintaining the safety, health, and environmental records necessary to document the University's programs and as required by specific regulations.

2.0 **Emergency Action and Fire Prevention Plan**

This section contains general emergency response procedures to be followed in the absence of department- or facility-specific procedures. The supervisor or person responsible for the area where an emergency occurs is responsible for investigating all emergency incidents and reporting them to Occupational Safety and Health Services.

2.1 Building Evacuations

There are several types of actual and potential emergency situations that might necessitate a building evacuation including fire, explosion, chemical spill, gas leak, terrorist threats, etc. The evacuation alarm is primarily intended for initiating a general evacuation during fire emergencies. During emergencies other than fire, the possibility that occupants could

enter a danger area (e.g., chemical spill in exit path, potential explosion area, exposure to gunman, etc.) while exiting the building should be considered before initiating the evacuation alarm. In those instances where a general evacuation is not safe, the evacuation will have to be conducted room by room in buildings that do not have a public address system.

2.1.1 Physically Disabled Occupants

It is the responsibility of faculty to notify students in each class of the need to identify themselves (in private if desired) if they will need assistance during a building evacuation and to establish an evacuation plan for those identified. Such evacuation plans may include the buddy system and the use of safe refuge areas. Safe refuge areas are places relatively resistant to smoke and heat within a building, for example a sprinkler protected room or hallway, or a stairway landing where an occupant could wait until help arrives to assist in an evacuation. If a safe refuge area is to be used it is essential to assign, at the time of the emergency, a specific individual with the task of notifying emergency responders of the location of the waiting occupant.

Employees are responsible for identifying themselves to their supervisor if they will need assistance during a building evacuation and the supervisor is responsible for establishing a workable evacuation plan for those employees.

2.2 Building Fires

- A. Initiate a building evacuation using the nearest alarm pull station.
- B. Dial 911 to notify Public Safety and request fire department assistance.
- C. If the fire is small and you have been trained in the use of portable fire extinguishers, you may attempt to extinguish the fire.
- D. Use the nearest safe exit route to exit the building. Close all doors on the way out to prevent the spread of smoke and fire.
- E. After exiting, immediately proceed to a safe location at least 100 feet from the building.
- F. Do not re-enter the building until the all-clear is given by Public Safety or the fire department.

2.3 Medical Emergencies

- A. Evaluate the immediate area for potential safety hazards, e.g., fire, toxic or explosive gas vapors, etc., before approaching or that may require moving the injured to a safer location. Otherwise move the injured no more than necessary.
- B. Dial 911 to notify Public Safety and request first aid assistance or an ambulance.
- C. Provide emergency first aid as needed if you have been trained to do so.
- D. If the injury involves exposure to a hazardous chemical, provide the Material Safety Data Sheet to the medical emergency responders. If the MSDS cannot be located in time, call the emergency room to offer the information as soon as possible.

2.4 Chemical Spills

Each employee responsible for an activity involving the use of a hazardous substance must prepare a written procedure to be followed in the event of a spill and communicate the procedure to any students, contractors, visiting scholars and scientists, and employees involved in the activity. The written procedure and associated training must include information on when to request outside assistance.

The following procedures are for chemical spills that can not be handled safely by persons working in the area.

2.4.1 Chemical Spills Indoors

- A. If the spill represents a hazard that is immediately dangerous to life or health, IDLH, evacuate the room and, if necessary or in doubt, evacuate the building.
- B. Dial 911 to notify Public Safety and request assistance. Describe the situation and whether there is a potential for fire or if there are injuries. Public Safety will contact the Occupational Safety and Health Services emergency spill response coordinator for assistance. Be prepared to provide a description of the substance spilled and a material safety data sheet, if possible.
- C. The area of the spill must be secured to prevent students or employees from entering the danger zone.
- D. From a safe location, provide directions to the location and information about the spill to Public Safety or other emergency response personnel as needed.

2.4.2 Chemical Spills Outdoors

- A. Dial 911 to notify Public Safety. If the hazard is primarily to the environment and the

spill is too large to be cleaned up by onsite personnel, request assistance from Occupational Safety and Health Services. If there is a danger to people in the vicinity from fire or toxic vapors, request assistance from Public Safety and the Houghton City fire department.

- B. Follow your Department emergency spill response procedures to contain the spill. Do not attempt a cleanup once you have determined that outside assistance is needed, or if the spill has entered the soil, groundwater, or surface water.
- C. Remain a safe distance away from the spill and warn passers-by to stay clear until help arrives. Be prepared to provide information about the substance spilled, including the material safety data sheet, to emergency responders.

2.5 Building Fire Safety

- ▶ Building occupants shall not obstruct or tamper with any safety features such as exit signs, sprinkler systems, heat and smoke detectors, alarm pulls, horns and strobes, etc.
- ▶ Fire doors may not be propped open except with an approved magnetic interlock device.
- ▶ Sprinkler heads and pipes may not be used to support decorations or other items and stored materials must be at least eighteen inches below a sprinkler head.
- ▶ Flammable and combustible storage shall be in conformance with the applicable sections of this document and the National Fire Protection Association and MIOSHA standards.
- ▶ Stairwells shall be kept free of obstructions and shall not be used for storage, recycle containers, vending machines, etc.
- ▶ Hallways may not be used for storage of combustible materials, items that could inadvertently be moved into the traffic path during an emergency, or items that reduce the width of the hallway.
- ▶ Vending machines may not be located where they will reduce the width of a hallway or other building exit path during refilling operations and may not be located in stairways.
- ▶ Items may not be placed in hallways without approval from Facilities Management and Occupational Safety and Health Services. Cabinets with doors or drawers will not be approved if the open drawer or door reduces the hallway width below the minimum required.

- ▶ A minimum 36 inch clear exit aisle must be maintained from each work station.
- ▶ Special events must be planned so that displays and refreshment tables do not obstruct exits or exit access routes.
- ▶ Classrooms without fixed seating shall be set up to allow access to the exit door(s) from each row of seats and seating may not exceed 49 in rooms with a single exit.
- ▶ Additional occupants may not be accommodated in aisles, exit paths, or other portions of classrooms and other assembly areas provided with fixed seating.
- ▶ Open flames are permitted only in laboratories and other designated hot work areas unless a hot work permit is obtained (see section 5.3 in this manual).
- ▶ Lighted candles are not permitted except in supervised dining areas provided they are securely supported on a noncombustible base and the flame is protected.

2.5.1 Holiday Decorations In Buildings Other Than Residence Halls and Apartments

- ▶ Decorated artificial trees may be set up indoors and displayed starting the Monday after Thanksgiving through the end of the calendar year.
- ▶ The use of cut natural trees is not permitted without approval from Occupational Safety and Health Services.
- ▶ Electric lights and lighted decorations must bear the Underwriters Laboratories seal and must be turned off when the room or space is not occupied.
- ▶ Decorations must be located so that they do not obstruct any exits, hallways, stairs, or fire fighting equipment from view or use. No lights or lighted decorations may be placed on or near an exit sign.
- ▶ Electric lights may not be placed on an all-metallic tree or other metallic structure.
- ▶ Combustible decorations may not be placed in stairwells and should be kept to a minimum in corridors.
- ▶ Lighted candles are not permitted except in supervised dining areas provided they are securely supported on a noncombustible base and the flame is protected.

3.0 **Safety, Health, and Environmental Policies**

3.1 Government Regulations

Policy: Michigan Technological University will comply with all federal, state, and local safety, health, and environmental regulations.

Additional Information: Due to the large number of these regulations, it is not feasible to list or summarize them here. Occupational Safety and Health Services is responsible for communicating the requirements of these regulations to appropriate University departments and employees on behalf of the University Administration and for making them available to students and employees as needed.

3.2 Children at MTU

Policy: It is the policy of Michigan Technological University that children under the age of 12 are not permitted in work areas (e.g., offices, classrooms, shops), except those spaces specifically intended for public use, without the written permission of the department chair or director. Children under the age of 12 who are not enrolled in a Michigan Tech class or program are not permitted in laboratories at any time. Children under the age of 16 must be under the direct supervision of the laboratory supervisor while visiting or participating in MTU sponsored activities in laboratories containing hazardous chemicals or equipment.

Additional Information: It is the intent of this policy that the department chair or director will verify that a student or employee has a workable plan to provide age-appropriate supervision and protection from foreseeable safety and health hazards before allowing a child to be brought into a campus work area. Children must not be allowed to roam the building unsupervised. Permission may not be given for a child under 12 to enter a laboratory or other area with hazardous substances, machinery or tools except as part of an organized event where special provisions have been made to prevent exposure to these hazards.

3.3 Laboratory Employees Leaving the University

Policy: Department Chairs are responsible for ensuring that each employee or graduate student has properly disposed of all scrap, raw materials, product samples, waste, and laboratory samples from their office and work areas prior to leaving the University. Another department member(s) must accept responsibility for any equipment, unused chemicals, or product samples that are not disposed. An exit statement of compliance, including an inventory of all equipment and materials retained and the name of the person to whom they have been transferred, shall be made in writing by the Department Chair, signed by the exiting employee or graduate student, and kept on file for three years.

3.4 Donations of Chemicals and Waste Minimization

Policy: Donations of laboratory chemicals, or substances which would be subject to Michigan Hazardous Waste regulations at the time of disposal, shall not be accepted without approval by the Director of Occupational Safety and Health Services and shall not exceed the quantity necessary for use in an ongoing or funded project.

Additional Information: Minimization of chemical waste is in the best interest of the faculty and staff as well as the University. Excessive laboratory waste production diverts valuable funds away from more productive activities and increases the regulatory compliance burden on the University. Because there is a direct correlation between the total University chemical inventory and our total waste production, waste minimization must begin with chemical inventory minimization. Chemicals should be acquired in the amounts needed for a specific project and not simply to have on hand. Current purchase and delivery services make this practice unnecessary and waste disposal costs make the practice short-sighted. Micro-scale or reduced scale experiments, just-in-time delivery for reagents, good housekeeping, proper labeling, prompt disposal, and ordering only what is needed for the project are all effective methods of laboratory waste minimization.

3.5 Building Construction and Renovation

Policy: All proposed projects involving changes in use, alterations, construction or additions to buildings or spaces owned or operated by Michigan Technological University shall be approved in writing for adequacy of utilities and Life Safety by Facilities Management and Occupational Safety and Health Services prior to requesting a purchase order, funding, or construction bid proposal. A physical space review will also be conducted by Facilities Management and Occupational Safety and Health Services before a new or renovated space may be occupied.

Additional Information: Departments or individuals considering a potential building renovation or alteration should contact Facilities Management. Facilities Management is responsible for the administration of all building renovation and alterations.

3.6 Headsets

Policy: All University employees are prohibited from wearing portable stereo headsets or any other devices that may limit the hearing capabilities of the employee while on the job. This does not include protective devices which are required for hearing safety.

4.0 Safety Committees

There are a number of safety and health regulations and guidelines that require safety committee review and approval of certain activities. These committees are composed of faculty and employees involved in the activity and other experts as required. Examples of these safety committees include:

Institutional Biosafety Committee - Required by the National Institutes of Health for research involving recombinant DNA. Membership is through appointment by existing committee members.

Biological Safety Committee - Required by state of Michigan for research involving animals. Membership is through appointment by existing committee members.

Committee for the Protection of Human Subjects - Required by federal law for research involving human subjects. Membership is through appointment by existing committee members.

Radiation Safety Committee - Required by Nuclear Regulatory Commission for possession or storage of licensed radioisotopes. Membership is through appointment by existing committee members.

Presidential Committee on University Safety and Environmental Health - Reviews safety, health, and environmental issues related to MTU and makes recommendations to the President. Members are appointed by the President.

Department Safety Committees - Large departments with complex and/or numerous safety, health, or environmental issues should have a department safety committee composed of employee/union and management representatives. These committees can perform area inspections, develop safe work practices and procedures as well as other activities that enhance the department safety program. Membership is determined by the department.

5.0 **General Safety**

5.1 Personal Protective Equipment

University students and employees may be required to wear personal protective equipment, PPE, as identified by department safety plans, job hazard analyses, posted signs, written procedures, or regulatory requirements. It is the responsibility of all employees and students to wear the required personal protective equipment. It is the responsibility of the faculty/supervisor to make it available to employees and to ensure that it is worn where required, including students, contractors, vendors, and visitors.

5.1.1 Selection of Personal Protective Equipment

Personal protective equipment requirements must be determined for each job or task assignment and will be determined by the supervisor or faculty member in charge with assistance from OSHS as needed or required. This determination must be documented in writing by the supervisor and a copy kept on file in the OSHS office. Once the

appropriate PPE has been determined, its use is mandatory. It is the responsibility of the faculty/supervisor to ensure that proper training or other required pre-qualification has been implemented before the student or employee begins a task for which PPE is required. The following guidelines are intended to assist the faculty member or supervisor in selecting appropriate personal protective equipment. Additional information on the selection of PPE is available from OSHS.

5.1.2 Eye and Face Protection

Each affected person shall use appropriate eye or face protection if a hazard exists due to any of the following:

- ▶ Flying objects or particles.
- ▶ Moving or dangling objects like slings and chains.
- ▶ Dusts and mists.
- ▶ Molten metal.
- ▶ Liquid chemicals.
- ▶ Acids or caustic liquids.
- ▶ Chemical gases or vapors.
- ▶ Glare.
- ▶ Injurious radiation.
- ▶ Electrical flash.
- ▶ Any combination of the above hazards.

Occupational Safety and Health Services should be contacted for additional information and assistance in the selection of appropriate eye protection.

Following are some of the MIOSHA requirements for eye protection:

Side protection shall be used whenever there is a hazard from flying objects. Spectacles without side shields are allowable for frontal protection only (it should be noted that this situation would be extremely unlikely).

A face or eye protector shall be in compliance with all of the following minimum requirements:

- ▶ It shall protect against the particular hazards for which it is designed.
- ▶ It shall fit snugly and shall not unduly interfere with movements of the wearer.
- ▶ It shall be capable of withstanding sanitizing.

Care shall be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards.

Adequate protection against the highest level of hazard must be provided when multiple hazards are present.

Operations involving heat may also involve optical radiation. Protection from both hazards shall be provided.

Safety glasses or goggles must be worn under face-shields.

Persons whose vision requires the use of prescription lenses shall wear either protective devices fitted with prescription lenses or protective devices designed to be worn over regular prescription eye-wear. Prescription eye-glasses, regardless of lens type or sales claims, do not fulfil the requirements for eye protection unless they comply with American National Standards Institute standard Z87.1-1989.

Wearers of contact lenses shall also be required to wear appropriate eye and face protection devices in a hazardous environment.

Caution should be exercised in the use of metal frame protection devices in electrical hazard areas.

Welding helmets or hand-shields shall be used only over primary eye protection.

5.1.3 Hand Protection

Each affected person shall use appropriate hand protection when their hands are exposed to hazards that may cause any of the following:

- ▶ Skin absorption of harmful substances.
- ▶ Severe cuts or lacerations.
- ▶ Severe abrasions.
- ▶ Punctures.
- ▶ Chemical burns.
- ▶ Thermal burns.
- ▶ Harmful temperature extremes.

Selection of the appropriate hand protection shall be based on an evaluation of the performance characteristics of the hand protection relative to all of the following:

- ▶ The task to be performed.
- ▶ Conditions present.
- ▶ Duration of use.
- ▶ The hazards and potential hazards identified.

Selection of chemical resistant gloves should be based on manufacturer-specific permeation and degradation data when prolonged contact is expected. Assistance in the selection of chemical resistant gloves is available from most vendors and manufacturers.

5.1.4 Head Protection

Each affected person shall be provided with, and shall wear, head protection equipment and accessories in areas where a hazard exists from falling or flying objects, other harmful contacts or exposures, or where there is a risk of injury from electric shock, hair entanglement, chemicals, or temperature extremes.

Head protection equipment that has been physically altered or damaged shall not be worn or reissued to a student or employee. Protective helmets purchased after July 5, 1994, shall be in compliance with American National Standards Institute standard Z89.1-1986. Protective helmets purchased before July 5, 1994, shall be in compliance with American National Standards Institute standard Z89.1-1969.

Protective helmets or safety hats and caps shall be of the following types:

- ▶ Class -A -Limited voltage protection.
- ▶ Class -B -High voltage protection.
- ▶ Class -C -No voltage protection.

A Class C helmet or any metallic head device shall not be furnished or used for head protection, except where it has been determined that the use of other types of protective helmets or safety hats or caps is impractical, such as where chemical reaction will cause the deterioration of other types of head protection.

Bump hats or caps or other limited-protection devices shall not be used as a substitute for protective helmets for the hazards described in this section.

A hat, cap, or net shall be used by a person where there is a danger of hair entanglement in moving machinery or equipment, or where there is exposure to means of ignition. It shall be designed to be reasonably comfortable to the wearer, completely enclose all loose hair, and be adjustable to accommodate all head sizes. Material used for a hair enclosure shall be fast dyed, nonirritating to the skin when subjected to perspiration, and capable of withstanding frequent cleaning. It shall not be reissued from one person to another unless it has been thoroughly sanitized.

5.1.5 Hearing Protection

When a noise exposure of 85 dBA (an environment where normal speech levels can not

be understood) is exceeded for any 8 hour time period, a hearing conservation program shall be established. If there are concerns that this action level of 85 dBA may be exceeded, OSHS should be contacted to make noise measurements and to assist in selecting appropriate noise abatement measures and establishing a hearing conservation program if necessary.

5.1.6 Foot Protection

Each affected person shall wear protective footwear when working in areas where their feet are exposed to electrical hazards or where there is a danger of foot injuries due to falling or rolling objects or a danger of objects piercing the sole of the shoe. Safety shoes and boots which are not worn over shoes and which are worn by more than one person shall be maintained, cleaned, and sanitized inside and out before being reissued.

Where a hazard is created from a process, environment, chemical, or mechanical irritant which would cause an injury or impairment to the feet by absorption or physical contact, other than from impact, footwear, such as boots, overshoes, rubbers, wooden-soled shoes, or their equivalent, shall be used.

All protective footwear purchased after July 5, 1994, shall bear a permanent mark to show the manufacturer's name or trademark and certification of compliance with the provisions of ANSI standard Z41-1991. Protective footwear purchased before July 5, 1994, shall bear a permanent mark to show the manufacturer's name or trademark and certification of compliance with American national standards institute standard Z41.1-1967.

MTU employees who purchase ANSI Z41.1-compliant footwear are eligible for reimbursement of up to \$40.00, not to exceed the purchase price excluding sales tax, once per year. Reimbursement may be obtained by demonstrating possession of the compliant footwear and providing the original sales receipt to Occupational Safety and Health Services.

5.1.7 Respiratory Protection

Selection of respiratory protection is solely the responsibility of Occupational Safety and Health Services. Any person who suspects the presence of a hazardous air contaminant must request assistance and obtain approval from Occupational Safety and Health Services before selecting, or using a respirator or dust mask. More information about respiratory protection can be found in the written University Respiratory Protection Program.

5.2 Working Alone

Students, contractors, visiting scholars and scientists, and employees may not work alone if the work involves exposure to hazards that: are potentially life threatening, could inhibit self-rescue, could cause injuries requiring immediate assistance, or pose a fire or explosion hazard beyond the person's ability to respond effectively. Appropriate methods to address the need to perform such hazardous operations include the buddy system, intercom communication to a nearby area, periodic supervisor inspections, periodic phone contacts, etc., as long as the method implemented is appropriate to the level of hazard and the required response time in the event of an incident. Each department is responsible for establishing a system and criteria for approving requests to work alone.

5.3 Hot Work

Hot work is any temporary activity involving an open flame or that produces heat, sparks, or hot slag. This includes, but is not limited to brazing, cutting, grinding, soldering, thawing pipes, torch applied roofing, and welding. Such activities will require the issuance of a Hot Work Permit before beginning hot work and adherence to the procedures outlined in the University Hot Work Program.

5.4 Exposure to Bloodborne Infectious Diseases

Each department must determine if they have employees whose required job duties result in actual or reasonably likely exposures to human blood or other potentially infectious body fluids. If so, a bloodborne infectious diseases program must be established to protect them from exposure. The program will include a written compliance plan, employee training, the use of universal precautions, personal protective equipment, engineering controls, and offering the hepatitis B vaccination series.

Employees who believe that their required job duties involve exposure to blood or other infectious materials should contact their supervisor to see if they should be part of the department bloodborne infectious diseases program. If the department does not have an existing bloodborne infectious diseases program, the supervisor should contact Occupational Safety and Health Services for information and assistance in determining whether a program is needed.

Students or employees who are concerned about potential exposure to bloodborne infectious diseases due to good Samaritan activities may also contact Occupational Safety and Health Services for information about protective measures that can be taken.

5.5 Asbestos In Buildings

Several older campus buildings were constructed using a variety of products containing asbestos fibers. These products most commonly include structural steel fire insulation, steam pipe fitting insulation, and floor tiles. Although some of the asbestos-containing

materials have been removed, it is not economically feasible nor prudent to attempt to remove it all.

Wherever asbestos-containing insulation is located above a suspended ceiling, only authorized and trained employees may lift or remove the ceiling tiles for any purpose. Maintenance or other procedures that have the potential for releasing asbestos fibers are not allowed except under controlled conditions by trained and authorized employees.

It is the responsibility of each Department to inform employees of the existence and location of asbestos-containing products in their work areas and the health reasons for avoiding contact with or disturbance of asbestos fibers. Department officials should contact Facilities Management for information on the types and locations of asbestos containing materials in their building.

5.6 Safety and Health Training

Each department shall be responsible for providing safety orientation training for each new employee within five days of their start date. Additional training must also be provided as required for specific tasks and, depending on the task, may be required before the employee is permitted to begin work.

5.6.1 Training Responsibilities

- ▶ Individual department chairs, deans of schools, and directors are responsible for ensuring that safety training is provided for all employees as appropriate.
- ▶ Supervisors and faculty members are responsible for providing training to employees and students under their supervision and are responsible for requesting OSHS assistance when needed.
- ▶ Employee supervisors are required to attend all safety training provided for their employees.
- ▶ Occupational Safety and Health Services is responsible for providing the safety portion of the training associated with the use of forklifts, respirators, portable fire extinguishers, shipping and receiving dangerous goods, and asbestos work. Other training may be requested on a case-by-case basis.

5.6.2 Qualifications, Training Content, and Record Keeping

Except where the qualifications of the trainer are specified in a regulation or standard, department chairs may assign training duties to knowledgeable employees as appropriate. Likewise, the content of the training may be determined by the trainer except where

specified in a regulation or standard.

Occupational Safety and Health Services should be consulted to determine whether the training content is specified under a particular regulation and can assist with content and training materials and aids.

All safety training shall be documented in writing and a record retained for a period of no less than two years for annual training and for the duration of employment for one-time training.

5.6.3 Training Topics

Every employee, including student, temporary, and part-time employees, shall be given safety orientation training before beginning any job assignments. The safety orientation should include general information about emergency response procedures, how to report injuries, how to obtain emergency assistance, and how to get additional safety information.

Additional training may be required by specific safety and health standards before an employee is assigned to perform tasks covered under the standard. Examples include heavy equipment operation, electrical work, exposure to bloodborne pathogens, work with radioisotopes, chemical laboratory work, respirator use, hazardous materials shipping and receiving, and many others.

Each department is responsible for contacting Occupational Safety and Health Services to assist them in determining what type of safety training is required and appropriate for its employees.

5.7 Incident and Injury Investigations and Reporting

Supervisors, including faculty, laboratory managers, office managers, etc., are responsible for investigating and reporting incidents involving injury or property loss in their area as well as close calls or “near misses.” The supervisor will complete a Supervisor’s Incident and Injury Investigation Report and submit a copy to Occupational Safety and Health Services. The form also serves as a helpful investigation guide.

Incident investigations typically involve a review of the location as well as interviews of all who were involved in or observed the incident. Emphasis should be placed on identifying the underlying causes of the incident rather than placing blame. The investigation is not considered complete until all actions which will prevent recurrences have been identified. Corrective actions taken as a result of the investigation should be documented.

If the injured employee, including student employees, requires medical attention, a copy of the Workers Compensation Return to Work Form should be filled out by the physician after completing the examination and submitted to Occupational Safety and Health Services. The supervisor may insist that an injured employee be seen by a doctor if in his/her judgement it is prudent to do so. Injuries to students during class activities or on University property should also be reported, however, students may not be forced to accept medical treatment.

All employee fatalities must be reported to OSHA immediately regardless of cause.

6.0 **Storage and Handling of Hazardous Materials**

The use and storage of hazardous materials is regulated by the Michigan Right to Know Law, also called the Hazard Communication Standard. The Right to Know Law affects nearly every employee at MTU because it applies to the use of all chemicals or products that have a documented safety or health hazard. Such substances include toners and cleaners used in office environments, janitorial supplies, lubricants, welding electrodes and gases, metal stock, etc. The MIOSHA Laboratory Standard supercedes the Right to Know Law in chemical laboratories.

6.1 The University Hazard Communication Plan

The University Hazard Communication Plan requires containers to be properly labeled and Material Safety Data Sheets to be maintained in an organized collection and available at all times to employees in each work area. It also requires each employee to be trained in the interpretation of Material Safety Data Sheets, the protective measures to be taken, the symptoms of exposure and other information related to the substances they use. Each person who supervises students or employees exposed to substances regulated by the MIOSHA Hazard Communication Standard must be familiar with the University Hazard Communication Plan and comply with its requirements.

6.2 Flammable Liquids Outside of Laboratories

Storage of flammable liquids in buildings shall be limited to that required for the operation of office equipment, maintenance, and classroom demonstrations in addition to the following restrictions:

- ▶ Containers of Class IA liquids shall not exceed one pint capacity for glass containers, one gallon capacity for metal, or two gallons capacity for safety cans.
- ▶ Containers of Class IB liquids shall not exceed one quart capacity for glass containers, one gallon capacity for metal, or two gallons capacity for safety cans.

- ▶ Containers of Class IC liquids shall not exceed one gallon capacity for glass containers, one gallon capacity for metal, or two gallons capacity for safety cans.
- ▶ Containers of combustible liquids shall not exceed one gallon capacity for glass containers, or five gallons capacity for metal containers and safety cans.
- ▶ Not more than ten gallons (or 25 gallons in safety cans) of Class I and combustible liquids combined shall be stored in a single fire area outside of a UL listed or FM approved storage cabinet or an inside flammable liquids storage area.

Definitions:

Class IA flammable liquid - a liquid having a flash point below 73 F (22.8 C) and having a boiling point below 100 F (37.7 C).

Class IB flammable liquid - a liquid having a flash point below 73 F (22.8 C) and having a boiling point at or above 100 F (37.7 C).

Class IC flammable liquid - a liquid having a flash point at or above 73 F (22.8 C) and below 100 F (37.7 C).

Combustible liquid - a liquid having a flash point at or above 100 F.

6.3 Compressed Gases

Compressed gas cylinders, either empty or full, shall be used, handled, and stored in accordance with the following:

- ▶ Compressed gases cylinders must be stored in a vertical position and may not be stored in hallways, stairwells, receiving areas, locations where they are subject to damage.
- ▶ A chain, bracket, clamp, or other restraining device shall be used at all times to prevent cylinders from falling.
- ▶ Acetylene or liquified gas cylinders shall not be placed on their sides, but shall be stood valve-end up.
- ▶ A cylinder, whether empty or full, shall not be used as a roller or as a support.
- ▶ A cylinder, whether empty or full, in storage or during shipment, shall have the valve closed and cap connected in place, if a cap is provided in the design, or the valve shall be otherwise protected.

- ▶ Cylinders shall be marked with either the chemical or trade name. Marking shall be by stenciling, stamping, or labeling and shall not be tampered with or be readily removable. If the labeling is unclear or defaced, return the cylinder or obtain a new label from the supplier. Unlabeled cylinders shall not be used.
- ▶ Empty cylinders shall be marked “empty” or “MT” at time of depletion.
- ▶ Cylinders of oxidizers such as oxygen shall be stored at least 20 feet from fuel gas cylinders or a highly combustible material such as, but not limited to, oil, grease, flammable gas or a source of ignition, or be separated from the material by a noncombustible wall, not less than 5 feet high, having a fire resistance rating of one hour. All cylinders shall be stored away from heat in excess of 125 degrees Fahrenheit.
- ▶ Where different gases are stored, they shall be grouped by types. Groupings shall separate the flammable gases from the oxidizing gases.
- ▶ Storage shall be set up to ensure "first-in, first-out" usage.
- ▶ A cylinder storage area shall be posted with the names of the individual gases stocked, and a warning posted against tampering by an unauthorized employee. An assigned storage area shall be located where a cylinder will not be knocked over or struck by a passing or falling object.
- ▶ A storage area for cylinders shall be well ventilated. A cylinder shall not be stored in basements or pits except where appropriate ventilation is furnished to keep the area purged of any accumulation of gases.
- ▶ Cylinders shall be transported in an upright position and securely fastened by a restraining device to the truck or handcart. Approved handcarts are to be used when transporting cylinders within a building.
- ▶ When transported, the regulator must be removed and the protective cap replaced.
- ▶ A cylinder shall not be dropped, dragged, rolled on its side, or struck violently.
- ▶ A cylinder shall be lifted only by enclosed platforms when using a crane or hoisting device. Electromagnets, ropes, or slings shall not be used.
- ▶ When transporting cylinders in an elevator, other passengers should not be allowed to occupy the elevator.

- ▶ Use cylinders in an upright position and secure them firmly with chains or clamps.
- ▶ Do not use a cylinder of compressed gas without reducing the pressure through a regulator attached to the cylinder valve.
- ▶ Use regulators and pressure gauges only with gas for which they were designed and intended. Do not use adapters or modify connectors to circumvent this rule.
- ▶ Make sure the threads on a regulator or union correspond with those on the cylinder valve outlet. Do not force mismatched connections.
- ▶ Never use oil or grease on valves or attachments for oxygen cylinders. Avoid handling oxygen cylinders and apparatus with oily hands, gloves, or clothing.
- ▶ Open cylinder valves slowly with valve outlet directed away from personnel. Close the main cylinder valve as soon as it is no longer necessary to have it open.
- ▶ Gases shall not be mixed within a cylinder except by the supplier.
- ▶ A cylinder shall not be placed where it will become a part of the electrical circuit by accidental grounding or where it may be burned by electric Welding arc. A cylinder shall not be placed so that hot slag or flame will reach it or it shall be protected by a fire resistant shield. An electrode shall not be tapped against a cylinder to strike an arc.
- ▶ A frozen or ice-clogged valve shall be thawed either by warm air or use of warm water and dried before using. Boiling water or a flame shall not be used. Force shall not be applied to a valve or cap to loosen a cylinder frozen in place.
- ▶ A cylinder without fixed hand wheels shall have keys, handles, or non-adjustable wrenches on valve stems while in service. A multiple cylinder installation shall require only 1 key or handle for each manifold. A hammer shall not be used to open a cylinder valve or loosen a cap.
- ▶ A leaking cylinder or a cylinder with a valve stuck open or a valve in need of repair shall be taken outdoors - if it is safe to do so - away from sources of ignition, slowly emptied, tagged with a warning sign, and the manufacturer or distributor notified. Complete removal of the stem from the cylinder valve shall be avoided.
- ▶ Nothing shall be placed on top of a cylinder which would damage a safety device or interfere with the quick closing of the valve.

- ▶ Return empty cylinders to the vendor as soon as possible.

7.0 **Environmental Protection**

7.1 Waste Disposal

Numerous types of wastes are generated at MTU and their disposal is regulated under a variety of federal, state, and local laws and regulations. The following is a general description of most waste streams at MTU and how they are regulated and disposed. Occupational Safety and Health Services should be contacted for specific information regarding proper waste disposal procedures.

7.1.1 Office Waste

Michigan solid waste rules regulate the disposal of solid office waste, which includes such things as paper, cardboard, textiles, etc. These items may be placed in waste baskets and the large trash receptacles outside each building. Office equipment and machines, furniture, and liquid wastes may not be disposed in these office waste receptacles.

7.1.2 Sewer Waste

The City of Houghton municipal waste ordinance regulates the disposal of wastewater from kitchens, bathrooms, and work areas. The intent of the ordinance is to avoid the accumulation or release of toxic or flammable vapors within the system and to prevent damage to the treatment plant or contamination of the environment. Solvents, cleaners, and other substances that are not intended for use in the fixtures connected to the sewerage system may not be disposed in any drain without prior approval from Occupational Safety and Health Services.

7.1.3 Old Furniture and Equipment

Michigan solid waste rules for scrap metals apply to the disposal of metal furniture and equipment or components. As long as the scrap does not include other regulated substances like mercury, PCBs, or oil, they can be disposed by contacting the Grounds Department for removal. Also contact the Grounds Department for disposal of wood or plastic furniture and large pieces of wood. Equipment or components containing circuit boards, cathode ray tubes, mercury, PCBs, or other hazardous substances may not be disposed with other materials in this category.

7.1.4 Lighting, Computers, and Monitors

Michigan's Universal Waste rules regulate the disposal of computers, video monitors, televisions, and fluorescent lights. Facilities Management coordinates the disposal of all

fluorescent light tubes at MTU unless they are broken. Broken fluorescent light tubes are disposed of as hazardous waste through OSHS. Contact Central Stores for disposal of all fluorescent light tubes, computers, video monitors, and televisions. Computers without batteries or monitors may also be disposed as scrap metal by contacting the Facilities Grounds Department.

7.1.5 Laboratory Waste

There are a number of waste streams generated in laboratories at MTU including medical waste, hazardous waste, liquid industrial waste, broken glassware, empty containers, chemical spill cleanup debris, and disposable supplies. Prior approval must be obtained from OSHS before any laboratory waste may be drain disposed or placed in waste baskets or outdoor receptacles, except for office-type wastes. The rules and regulations affecting the collection, storage, and disposal of laboratory wastes are too extensive and complex to summarize in this document. Prior to generating chemical wastes, contact OSHS for information and assistance in identifying and classifying laboratory waste streams for disposal and to ensure compliance with applicable regulations.

Once appropriate waste collection procedures have been implemented, a waste chemical may be disposed by submitting a completed collection request form available from OSHS. OSHS will pick up the waste, place it in temporary storage, and then arrange for its disposal.

The generating department is responsible for all charges and fees related to the disposal of its laboratory waste including chemical analysis of unknowns and special handling for chemicals that are, or are suspected to be, explosion hazards. The latter can be very expensive and easily avoided through proper labeling and management of chemicals that become unstable after opening or exposure to certain conditions.

Waste disposal costs vary widely depending on the quantity and type of waste as well as the type of collection container used. It is highly recommended that OSHS be contacted during the project planning stage to discuss waste minimization and disposal options. The MTU policy on laboratory waste minimization can be found in section 3.4.

Broken glass must be collected in a designated broken glass container and empty reagent container labels should be defaced prior to disposal in the regular trash.

7.1.6 Non-Laboratory Chemical Waste

Chemical wastes such as old cleaning products, fuels, solvents, asbestos contaminated materials, and biohazardous wastes such as blood contaminated sharps are regulated in Michigan. A waste determination must be made at the time of generation of each waste type to determine if and how it is regulated. Storage, labeling, handling, and disposal of

these wastes are subject to the requirements discussed above for laboratory wastes. Occupational Safety and Health Services should be contacted for training and information related to the generation and disposal of these types of wastes.

7.2 Spill Prevention and Control

Highly toxic, flammable, or environmentally hazardous liquids should be stored in unbreakable containers when possible and glass containers should be placed in secondary containment devices. When these liquids are dispensed where a spill could reach a sink or floor drain, provisions must be made to prevent such a spill from entering the drain. This can be accomplished by working within a containment device or area, covering the drain opening, etc. All drum quantities of hazardous liquids should be stored in a secondary containment device. An appropriate type and quantity of liquid absorbent material should always be available wherever hazardous liquids are used or stored. Users must be trained in spill cleanup procedures as well as when and how to request outside assistance.

In the absence of a substance- or area-specific emergency spill response procedure, the emergency spill response procedures outlined in section 2.3 of this plan should be followed.

8.0 **Electrical Safety**

8.1 Portable Equipment, Tools, and Appliances

All portable devices must be UL listed for the application they are to be used. In addition, tools that are not double insulated and appliances with metal housings must be grounded. Electrical cords must be free from damage, unauthorized repairs, and deterioration. Portable tools or devices used in wet or damp locations or near a source of water must be protected by a ground fault circuit interrupting outlet or adapter.

8.2 Fixed and Hardwired Equipment

Non-portable equipment wiring and connections must meet the requirements of the National Electrical Code and MIOSHA Part 39. A local disconnect capable of being locked out must be provided. All persons performing maintenance and repairs must be qualified and authorized by the University to do so and follow all the applicable provisions of the University Hazardous Energy Control Program.

8.3 Electrical Welding Equipment

All electrical welding equipment must meet the requirements of the Michigan General Industry Safety Standard Part 12 for welding and cutting.

8.4 Extension Cords

The use of extension cords is restricted to portable equipment intended to be moved from place to place. Items which are capable of being moved, for example a desktop computer, but are part of a fixed work station are not considered portable. Surge protection devices are not considered to be extension cords when used to protect sensitive electronics.

Extension cords may not be used as an alternative to fixed wiring or to extend the existing electrical supply capacity of a work area. Instead, a request should be made to the Facilities Department to install additional outlets.

Never combine extension cords end to end and always verify that an extension cord is rated for the maximum capacity of the load to be applied and for the environment in which it is to be used. Do not run an extension cord under carpeting or where it will be damaged or cause a tripping hazard.

8.5 Electrical Safety-Related Work Practices

Employees who face a risk of electrical shock that is not reduced to a safe level by the installation design must be trained in the safety-related work practices that pertain to their respective job assignments and the requirements of MIOSHA Safety Standard Part 40. Job titles of employees typically requiring such training include but are not limited to: electrical and electronics engineers, electrical and electronics technicians, electricians, equipment operators, welders, painters, and their supervisors. Training and work practice requirements specific to these employees can be found in the University Electrical Safe Work Practices Plan.

Unauthorized persons shall not tamper with electrical fuse boxes, alter existing wiring, or install electrical wiring. Facilities Management authorizes, in writing, those personnel specifically permitted to work on campus electrical circuits. All electrical wiring installation, service, and maintenance will be performed in accordance with the National Electrical Code and MIOSHA General Industry Standard Part 39.

9.0 **Equipment Safety**

Departments purchasing new or used equipment are responsible for ensuring that all required and necessary safety guards and systems are in place and properly functioning before using the equipment. The fact that a piece of equipment is new is no assurance that it meets MIOSHA requirements for operator protection and guarding or is safe to operate.

Employees and students are responsible for replacing any guards that have been removed for maintenance or adjustments before operating the equipment and for reporting any

missing guards to their supervisor so they can be replaced before the equipment is put back into operation.

Students and employees who operate equipment subject to the lockout provisions of the University Hazardous Energy Control Program must receive training in those procedures prior to operating the equipment.

9.1 Grounds Keeping and Heavy Equipment

Grounds keeping and heavy equipment including lawn tractors, end loaders, dump trucks, and road graders must be operated and maintained according to the manufacturer's instructions. Operators must be trained according to the manufacturer's operating instructions as well as any applicable equipment-specific MIOSHA standards before operating the equipment unsupervised. Applicable personal protective equipment such as hand, foot, eye, and hearing protection must be selected by the supervisor with assistance from Occupational Safety and Health Services and worn at all times by the equipment operators.

9.2 Forklifts and Powered Pallet Jacks

Forklifts and powered pallet jacks must be maintained according to the manufacturer's instructions and meet the requirements of the applicable MIOSHA standards. Forklift operators must be trained in the operation of the equipment under the direct supervision of a qualified trainer. The employee must receive safety training within 30 days of the start of operator training. Occupational Safety and Health Services provides forklift safety training by request.

Pallet jack operators must be trained in the safe operation of the equipment before operating unsupervised. Training shall be provided by a qualified supervisor or designated person.

9.3 Cranes

Cranes shall be operated, inspected, and maintained according to the manufacturer's instructions as well as the MIOSHA safety standard applicable to the particular crane. Operators shall be trained in the safe operation of each type of crane they will operate by a qualified supervisor or designated person before operating the crane unsupervised. No crane shall be installed or used without a capacity certification label attached and visible from the floor. User manufactured cranes must be rated and certified by a qualified professional engineer.

9.4 Metal- and Woodworking Machinery

Employees who work in metal or wood shops must be qualified by education and/or apprenticeship in the operation of the equipment and must also be trained according to the applicable requirements of MIOSHA General Industry Safety Standards Parts 26 and 27. Operators should also be familiar with and follow the manufacturer's operating and maintenance instructions.

Adequate space must be provided for aisles, layout, material handling, and machine setup and maintenance.

9.5 Welding and Cutting

Only employees who have been properly trained and authorized by their supervisor may perform welding and cutting operations using electrical or fuel gas operated equipment. In addition, authorized employees must also be trained in the safe operation of the equipment, and the MTU Confined Space Entry and Hot Work programs. Equipment must meet the requirements of MIOSHA General Industry Safety Standards Part 12. In addition the supervisor shall select and provide personal protective equipment according to the requirements of MIOSHA General Industry Safety Standards Part 33 for welding and cutting operations.

The principle hazards to welders are: fire, burns, electric shock, metal vapor poisoning, bruises, and explosions of compressed and/or flammable gases.

The welder's clothing should be non-flammable, have no pockets, cuffs, or folds, and must completely cover all skin areas. A long leather apron with a high bib is desirable for outer clothing. Gloves with long gauntlets prevent metal from burning the welder's wrists. Shoes should have tops high enough to extend up inside the trouser leg. Ears should be covered only when goggles are worn.

Appropriate eye protection must be worn at all times. All faculty, staff, students, and visitors are required to wear eye protection in areas classified as eye-hazardous, including protection from welding flash. Detailed requirements are outlined in the MIOSHA Face and Eye Protection Standard (Part 35) available from OSHS.

Be sure the arc welder is insulated and transformers are grounded. Dry leather gloves and non-conductive flooring are standard.

Metals with coatings of lead, zinc, cadmium and other toxic metals offer fume hazards in welding operations. Other noxious fumes, depending upon the base metal being welded and the welding rods used, can include the oxides of nitrogen and carbon, copper, manganese, selenium, silica, arsenic, titanium, and fluorine. Proper ventilation must be provided.

9.6 Department-Specific Equipment

Departments are responsible for establishing safe operating and emergency response procedures and training for students and employees who operate or work near hazardous equipment. Examples of hazardous equipment include high energy magnets, robots, injection molding machines, power presses, pressure vessels (see Pressurized System Safety Guide), lasers (see Laser Safety Guide), cryogenic gas storage and delivery systems, etc.

9.7 Lockout of Hazardous Energy Sources

Employees authorized by the University to perform maintenance or repairs on machines and equipment in which the unexpected energization or startup could cause injury must be trained in accordance with the provisions of the University written Hazardous Energy Control Program for authorized employees. All other employees who operate or work near such machines or equipment must be trained in accordance with the provisions of the University written Hazardous Energy Control Program for affected employees.

Each department responsible for the operation of machines or equipment which could cause injury due to unexpected energization or startup during maintenance or repairs is responsible for establishing a written lockout procedure for each machine. Either the written lockout procedure or directions to its location must be posted where it will be visible from the point of operation of the equipment.

10.0 **Laboratory Safety**

The door to each laboratory utilizing hazardous equipment, toxic or flammable chemicals, and to hazardous materials storage rooms must be posted with an emergency response sign listing the nature of the hazards and name(s) and phone number(s) (work and home) of the individuals who are responsible for and/or familiar with the hazards and secured against unauthorized entry when the laboratory is unattended.

10.1 Flammable Liquids In Laboratories And Chemical Storage Rooms

The storage and use of flammable liquids in laboratories shall comply with the applicable provisions of the National Fire Protection Association Standard 45, Fire Protection For Laboratories Using Chemicals, 1997.

Refrigerators used for the storage of flammable liquids must be designed for this purpose and labeled as such. Domestic refrigerators may not be used for flammable liquids storage and must bear a label prohibiting flammable storage. Existing domestic refrigerators modified by MTU Facilities Department may continue to be used for

flammable storage as long as they are properly labeled. Explosion-proof refrigerators (also referred to as intrinsically safe) are intended for use in locations where the atmosphere outside the refrigerator is, or is reasonably likely to be, explosive and are typically not required in MTU laboratory environments.

Most laboratory fires are caused by ignition of flammable liquid spills or vapors that have spread from open containers near ignition sources such as hot-plates and burners. Experiments and demonstrations should be planned in advance to ensure that sufficient distance is maintained between ignition sources and exposed flammable liquids (some solvent vapors can spread 10 feet or more along a bench top or floor).

The purpose of a flammable liquid storage cabinet is to delay the ignition of stored flammable liquids during a laboratory fire. It is not intended to contain or remove harmful or foul smelling vapors from poorly capped or contaminated containers. Venting of storage cabinets can reduce the level of fire protection and is discouraged except when the contents are so volatile and foul smelling that it is absolutely necessary. Venting must be accomplished according to the manufacturer's recommendations and in compliance with building fire safety codes and with the approval of Occupational Safety and Health Services and Facilities Management. The vent covers provided with the cabinet must be maintained in place at all times except when removed for the installation of a vent system.

Storage of flammable liquids within a laboratory shall be limited to that required for the operation of the laboratory in addition to the following restrictions for laboratories and chemical storage rooms:

- ▶ Containers of Class IA liquids shall not exceed one pint capacity for glass containers, one gallon capacity for metal or approved plastic, or two gallons capacity for safety cans.
- ▶ Containers of Class IB liquids shall not exceed one quart capacity for glass containers, five gallons capacity for metal or approved plastic and safety cans.
- ▶ Containers of Class IC liquids shall not exceed one gallon capacity for glass containers, five gallons capacity for metal or approved plastic and safety cans.
- ▶ Containers of combustible liquids shall not exceed one gallon capacity for glass containers, five gallons capacity for metal or approved plastic containers and safety cans, and 60 gallons for metal drums.
- ▶ Not more than five gallons of Class I flammable liquids - or 10 gallons for Class I and combustible liquids combined - shall be stored outside of a UL listed or FM approved storage cabinet per 100 gross square feet of floor space.

- ▶ The maximum total amount of flammable liquids stored inside and outside of approved storage cabinets may not exceed ten gallons of Class I flammable liquids - or 20 gallons for Class I and combustible liquids combined - per 100 gross square feet of space.

Definitions:

Approved Plastic - A plastic container approved for shipment of a particular flammable liquid under Chapter I, Title 49 of the Code of Federal Regulations.

Class IA flammable liquid - a liquid having a flash point below 73 F (22.8 C) and having a boiling point below 100 F (37.7 C).

Class IB flammable liquid - a liquid having a flash point below 73 F (22.8 C) and having a boiling point at or above 100 F (37.7 C).

Class IC flammable liquid - a liquid having a flash point at or above 73 F (22.8 C) and below 100 F (37.7 C).

Combustible liquid - a liquid having a flash point at or above 100 F.

10.2 Chemical Laboratories

10.2.1 Chemical Hygiene Plan

Chemical laboratories requiring a chemical hygiene plan and a chemical hygiene officer are those which use multiple chemical procedures or chemicals in a laboratory environment (i.e., where protective laboratory practices and equipment are available and in common use to minimize the potential for employee exposure to hazardous chemicals). Pilot plant operations which simulate production processes are exempt.

Departments with laboratories meeting the MIOSHA definition of a chemical laboratory must appoint a chemical hygiene officer who will assist in the development and implementation of a written department-specific chemical hygiene plan. The chemical hygiene plan will contain procedures for procurement, storage, use, and disposal of laboratory chemicals as well as the use of emergency equipment, personal protective equipment, engineering controls, and administrative controls for student and employee protection against laboratory hazards. The chemical hygiene plan must also contain

laboratory-specific standard operating procedures, SOPs, for each chemical procedure. The written laboratory-specific SOPs must include a list of chemicals in use, the required personal protective equipment to be used for each procedure, and the safe work practices for each procedure. Spill response and waste disposal procedures should also be addressed in the SOP.

The department chemical hygiene officer shall be qualified by training or experience to provide technical guidance in the development and implementation of the provisions of the chemical hygiene plan. This should include a knowledge of the regulatory requirements for laboratory work as well as chemical safety and related industrial hygiene practices; supervisory experience; knowledge of department-specific chemical operations, inventories, hazards, purchasing and disposal practices, and safety equipment; and good written and verbal communication skills.

10.2.2 Chemical Labels and Material Safety Data Sheets

The labels on incoming chemical reagent containers must be maintained and a label containing the same chemical hazard information must be applied if the material is transferred into another container. Laboratory preparations must be labeled with the chemical identity of the contents, the date, and the identity of the owner. Chemical formulas are not acceptable as part of the identity description except for those that would be recognized and understood by faculty and staff outside the department. If the laboratory preparation is transferred to another location the label must also include a primary hazard warning statement. A material safety data sheet or its equivalent may be required if the material is to be shipped off campus.

It is the responsibility of the person who receives an incoming chemical shipment to retain any material safety data sheets that are included and to forward a copy to the Chemical Stores facility for placement in the archives. Each department may decide how and where material safety data sheets will be made available to students and employees as long as they are available whenever students or employees are on site. The Chemical Stores archive does not meet the requirement for availability, and therefore, may not be referenced on the required MIOSHA workplace notification poster, available from OSHS.

10.2.3 Fume Hoods

Fume hoods are a critical component of the total safety and health protection system provided to students and employees working with hazardous materials and serve to protect the rest of the building occupants as well. However, a fume hood is only effective if it is designed, installed, maintained, and used properly. Fume hood users share responsibility for ensuring that the hoods are properly maintained by notifying the laboratory supervisor or department chair whenever a fume hood is not functioning properly. The fume hood user is also responsible for properly utilizing the hood. The

following guidelines should be considered:

- ▶ Always work in a fume hood rather than on an open bench when using substances that have objectionable odors or emit toxic or flammable vapors.
- ▶ Verify proper air flow in the hood before starting work by checking the built-in flow meter or by holding a piece of paper towel near one of the air slots at the rear of the hood (learn to distinguish between the strength of the airflow caused by the blower and the flow caused by the “chimney effect” when the blower is not running). The sound of the blower motor is no assurance of hood operation because the drive belt may have failed.
- ▶ Remove everything from the hood that is not needed for the work to be performed.
- ▶ Avoid situations that could cause cross-drafts in front of the hood like open windows or doors, fans, pedestrian traffic, rapid movement of hands in or out of the hood, or rapid changes in sash position.
- ▶ Always work with the sash in the lowest possible position.
- ▶ Set up work at least six inches behind the plane of the sash.
- ▶ Adjust the hood baffles, if available, for the anticipated density of vapor emissions relative to that of the surrounding air. Emissions lighter than air as a result of heating or low molecular weight should correspond to shifting the baffle opening toward the top of the hood and vapors heavier than air should be captured near the bottom.
- ▶ Use a support stand, if possible, to keep large containers and instruments a few inches above the work surface inside the hood to improve air flow around the setup.
- ▶ Avoid placement of cabinets or other objects in close proximity to the hood that might restrict the operator’s ability to back away during an emergency or that cause turbulence in the airflow into the hood.
- ▶ Work with heated perchloric acid only in a properly functioning perchloric acid hood. Be sure you are familiar with the manufacturer’s operating instructions.
- ▶ California hoods are designed to be operated with all doors fully closed.
- ▶ “Walk-in” hoods are not intended to be entered by the operator while in use. They are designed to permit the use of larger setups than a benchtop hood can accommodate. The same general principles of operation apply as for a benchtop hood.

- ▶ Pay attention to the most recent face velocity measurement posted on the hood. Do not work with highly toxic substances in a hood with a face velocity significantly less than 100 fpm.
- ▶ Use only intrinsically safe electrical instruments and connections in a hood when using heated or highly volatile flammable liquids and eliminate all other sources of ignition.
- ▶ The hood sash is not an explosion shield. If an explosion is the possible outcome of an instrument or operator failure, the experiment should be operated remotely or in a specially designed test cell or facility.

10.2.4 Chemical Purchases

Laboratory chemicals may not be delivered directly to an individual's office. All deliveries must be made to an area staffed during University operating hours by personnel who have been trained in accordance with the MTU Hazard Communication Plan and the Department of Transportation requirements. The delivery area and process must also provide for adequate security to prevent unauthorized access to the chemicals.

The MTU Purchasing Department procurement card policy forbids their use for laboratory chemical purchases.

When laboratory chemicals are purchased on blanket purchase orders, it is the responsibility of the person placing the order to forward a copy of the material safety data sheet to Occupational Safety and Health Services for archiving.

10.3 Radiation Producing Equipment and Materials

10.3.1 Nuclear Regulatory Commission Regulated Materials

Work involving equipment or materials regulated by the Nuclear Regulatory Commission, NRC, is overseen by the MTU Radiation Safety Committee and the Radiation Safety Officer, RSO, in the Occupational Safety and Health Services Department. Requirements and procedures for the purchase, use, storage, and disposal of these materials is described in the MTU Radiation Safety Manual. Only employees specifically named in the MTU radioactive materials license may purchase these materials and each purchase must be approved by the RSO in advance. Faculty and staff wishing to engage in research involving radioactive materials should contact the RSO for information and assistance in obtaining any necessary approvals.

10.3.2 Ionizing Radiation Producing Equipment and Radioactive Materials

The installation and use of equipment which generates ionizing radiation is regulated by the Radiation Section of the Michigan Bureau of Health Systems. Radiative materials used as radiation sources in such equipment are also regulated by the Michigan Department of Environmental Quality if they are not regulated by the NRC. The MTU Radiation Safety Committee and RSO also oversee the use of these devices. Faculty and staff intending to purchase equipment that produces ionizing radiation, for example, x-ray diffraction machines, scanning electron microscopes, gas chromatographs, etc., must first contact the RSO for information about registration, operation, and training.

10.3.3 Lasers

Each department utilizing laser equipment is responsible for ensuring that the equipment is classified and labeled according to the requirements of the Federal Laser Product Performance Standard: Title 21 of the Code of Federal Regulations; Part 1000; [parts: 1040.10 and 1040.11]. Depending on the power output classification of the laser(s) in use, the department may need to designate a laser safety officer, LSO, to oversee the installation, use, and maintenance of equipment as well as the training of personnel. The University written Laser Safety Guide contains important information from the Occupational Safety and Health Administration on laser safety.

10.4 Biological Laboratories

All activities involving the use of recombinant DNA/RNA must receive prior approval of the Institutional Biosafety Committee. Work involving infectious agents generally requiring Biosafety Level 2 or 3 practices must receive prior approval of the Biological Safety Committee. Activities requiring Biosafety Level 4 practices are forbidden at this time.

Activities involving the use of human body fluids, cell lines, and unfixed tissues require training and implementation of a written bloodborne infectious diseases exposure control plan.

Activities involving the use of nonhuman primate body fluids, cell lines, and unfixed tissues require training and documentation.

Activities that generate Medical Waste (sharps and potential or known human pathogens including zoonotic) require training and site registration with the Michigan Department of Health. Decontaminated biohazardous waste may not be placed in the regular trash without removal of all biohazard labels and markings. Overpacking or covering a biohazard label are not acceptable.

Activities involving the release of plants or organisms into the environment require completion of a USDA permit application.

10.5 Shipping Hazardous Materials

Shipments of hazardous materials such as explosives, compressed gases, flammable solids and liquids, oxidizers, toxic and infectious materials, radioactive materials, corrosive substances, and environmental pollutants are regulated by the Department of Transportation, DOT, regardless of quantity. Employees who offer such materials for shipment as well as those responsible for receiving shipments must be trained in accordance with DOT regulations. Contact Occupational Safety and Health Services for information and assistance with training and shipments of materials that could potentially be regulated.