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## Introduction to General Safety Plan

The following guidelines outlined in this document form the basis safe laboratory practices; however, specific rules will vary by location. It is imperative that laboratory specific Standard Operating Procedures [detailed in **Laboratory Documentation and Upkeep Appendix A**] are developed in order to complete this safety plan for each lab.

Laboratories wherein multiple chemicals are in use, that have safety features one would expect to have in a chemistry laboratory (fume hoods, eye wash stations) and/or where chemical processes are on the laboratory scale (manipulated by individuals, not industrial processes) are designated chemical laboratories. For these laboratories, a **Chemical Hygiene Plan** is required in addition to the **General Safety Plan**. If you are unsure whether your laboratory falls under this category, please contact Occupational Safety (7-2118) in order to make a proper determination. To request a **Chemical Hygiene Plan**, contact the Department of Physics' safety officer.

### 1.0 Responsibility and Training

#### *1.1 Responsibility*

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.

##### *1.1.1 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. Close calls must also be investigated and reported if they are found to have had the potential for personal injury or property damage.
- 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.

### *1.1.2 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.

### *1.2 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.

#### *1.2.1 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.

#### *1.2.2 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, 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.

### *1.2.3 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 judgment 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 OSHS immediately regardless of cause.

## **2.0 General Safety**

### *2.1 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.

#### *2.1.1 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 inclusion in hazards assessment/SOP. Once the appropriate PPE has been determined, its use is mandatory.

### 2.1.2 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.

### *2.1.3 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.

### *2.1.4 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.

### *2.1.5 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.

### *2.1.6 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.

Open-toed shoes or sandals should never be worn in the laboratory.

### *2.1.7 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.

### *2.2 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, 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.

### *2.3 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.

### *2.4 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.

### **3.0 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 supersedes the Right to Know Law in chemical laboratories.

#### *3.1 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.

#### *3.2 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.

*3.3 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 liquefied 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.

## **4.0 Electrical Safety**

### *4.1 Portable Equipment, Tools, and Appliances*

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.

### *4.2 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 ([http://www.sas.it.mtu.edu/fm/oshs/lockout\\_program/index.htm](http://www.sas.it.mtu.edu/fm/oshs/lockout_program/index.htm)).

### *4.3 Electrical Welding Equipment*

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

### *4.4 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.

#### *4.5 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 ([http://www.sas.it.mtu.edu/fm/oshs/electrical\\_program/index.htm](http://www.sas.it.mtu.edu/fm/oshs/electrical_program/index.htm)).

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.

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