SAFETY IN SCIENCE LABORATORIES

Student Manual*

Madonna University College of Natural and Social Sciences

2018-19

GENERAL SAFETY RULES FOR STUDENT SAFETY IN THE LABORATORY

1. Students should never work in a laboratory or laboratory preparation room without appropriate supervision. Students working outside normal class times must obtain prior approval from the appropriate Science faculty member and ensure that MU Public Safety has been notified. During normal business hours, notification and access are obtained through the Science & Math Administrator, who will notify MU Public Safety through the Astra Database. Outside of normal business hours, the student can request access through the appropriate Science faculty member or by calling MU Public Safety. Note that MU Public Safety will only grant access to students who have obtained prior approval from their faculty member.

2. Please understand that safety requirements and procedures may change over time, in different courses and from one institution to the next. Students have a responsibility to follow the directions provided by this safety manual, their course laboratory manual and their instructor. Students have the right to refuse to perform a task that poses a risk to their health and well-being. If a student refuses to perform a task, the instructor will review the hazard risks with the student to address their concerns. If necessary, the issue will be elevated to the Departmental Chairperson or CNSS Academic Dean to determine the appropriate course of action.

3. To the best of their abilities, students have a responsibility to work safely; to report safety incidents, near-misses, spills, breakage and unsafe practices; to refrain from unsafe practices; to ask questions when they are unsure of how to proceed and to take their role in ensuring the safety of themselves and their peers seriously.

4. Safety responsibilities for students include (but are not limited to):
    a. Never working without appropriate notification and supervision.
    b. Wearing appropriate attire and personal protective equipment (PPE) at all times.
    c. Becoming familiar with all safety equipment and devices in their laboratory.
    d. Using only approved materials and equipment, and only performing approved experiments.
    e. Asking questions if unsure how to proceed.
    f. Notifying the instructor or other appropriate personnel of safety hazards.
    g. Using proper waste disposal methods for hazardous and contaminated materials.

5. Safety Data Sheets (SDS) and the Right to Know
    a. Students have a right to be aware of the hazards involved in their laboratory exercises as well as the appropriate steps to take to minimize risk. To the best of their abilities, instructors will communicate the inherent hazards to students and ensure that students understand and follow safety procedures in their laboratories. Students have a responsibility to follow directions and to ask questions if they do not understand how to proceed. Besides verbal explanation, your lab manual will contain important information regarding how to work safely.
    b. Students may also obtain a copy the Safety Data Sheet (SDS) for the substances they are handling upon request. These sheets are also generally available online.
    c. The State of Michigan Right to Know Law is located at: www.michigan.gov/documents/lara/lara_miosha_cetsp22_379146_7. doc

6. Students should alert their instructor if they have a health condition which might affect their ability to work safely (e.g., no sense of smell) or which might place them at additional risk for harm due to

exposure to hazardous substances (e.g., immune deficiency, pregnancy or nursing). The instructor will respect student confidentiality and work with them to provide a suitable solution.

SPECIFIC SAFETY RULES FOR STUDENT SAFETY IN THE LABORATORY

1. Please note that these laboratory safety requirements are intended to apply to students in all Madonna University Chemistry, Biology, Forensic Science and Biomedical Science courses. Specific courses or programs within these disciplines may have additional safety requirements. Some of the specific safety rules listed below may not apply to lab courses in Physics, Dietetics or other specific disciplines. Students should consult their laboratory manual or instructor for more information.

2. **Laboratory Supervision**

In most instances, students will complete their work during the assigned laboratory hours. Where students are required to conduct lab work outside of normal hours to complete a course assignment, conduct research or serve as a student lab assistant, they are required to ensure that the appropriate faculty member and MU Public Safety have been notified. Their faculty member has responsibility to ensure that the student is ready to work independently, has adequate instruction and is monitored appropriately. Students working outside normal lab session hours without direct supervision are permitted to perform low-risk activities only. (See Appendix A for examples of low-risk activities or consult the instructor for guidance).

Student Lab Assistants and Student Researchers Only: Where there is low or moderate risk for hazard, student lab assistants and student researchers may work in the laboratory outside of regular business hours with prior approval from the appropriate faculty member, as long as the appropriate notifications are made to Madonna University Public Safety. The instructor is responsible to insure the student is ready to work independently in the laboratory. Student employees will not engage in activities of high risk without a responsible faculty member present in the laboratory. When student employees are engaged in low or moderate risk activities, periodic monitoring should take place at least once every 2 hours.

3. **Safety Incidents and Emergencies**
    a. There are wall phones located throughout the building. In the event of an emergency, dial **5-4-4-2** on a wall phone to reach MU Public Safety or dial **9-1-1** from any phone.
    b. In the event that students need to evacuate a laboratory, they should proceed to the hallway door immediately and exit the building. If the hallway door is inaccessible, an alternate exit should be used.
    c. First aid kits are located in each lab for treating minor injuries. Instructors and students assisting others should don gloves prior to rendering treatment. Medication should not be administered unless directed to do so by qualified medical personnel.
    d. Students need to report all *safety incidents* and *near-misses*, or if they feel ill during or immediately after a lab session. (Reporting near-misses allows potential safety problems to be corrected before someone does get injured).
    e. *Safety incidents* include all laboratory-related injuries or illnesses involving students which require first aid measures or involve loss of consciousness, inability to complete the class session, days away from class, inability to complete the course, permanent injury or death. Laboratory-

related injuries and illnesses that are diagnosed by a physician or licensed health care professional must also be reported.

f. *Near-misses* are unplanned events which did not result in injury, illness or damage, but had the potential to do so. Only a fortunate break in the chain of events prevented an injury, fatality or damage from occurring.
g. The instructor and/or MU Public Safety will need to collect information relating to the incident and may need to ask questions regarding the student's health. The purpose for collecting this information is to prevent future occurrences. The information will be collected and used in a manner which protects the student's confidentiality to the extent possible.
h. To the extent possible, the instructor will need to take steps to preserve the scene of the incident and identify any witnesses in order to facilitate the subsequent root-cause investigation. If the potential exists that students in another lab course are at risk of a similar hazard requiring additional safety measures be taken, the instructor or Department Chair will notify other faculty immediately.
i. The instructor will complete a Student Laboratory Injury and Illness Report Form within 24 hours and submit it to the Lab Administrator within 7 days. The student will be provided with a complete copy of the report.

4. <u>Personal Hygiene</u>

a. Contact lenses must be removed prior to entering the laboratory whenever hazardous liquids will be handled.
b. Long hair must be tied back. Dangling or exposed jewelry or clothing items must be removed.
c. Non-essential head coverings (e.g., baseball caps) should not be worn in the laboratory. Essential head coverings should be covered with a disposable bouffant cap during the lab session.
d. Appropriate fully-enclosed footwear is required. Shoes should not have openings at the toe, back or top which allow exposure to spilled substances. Flip-flops and sandals are not allowed in the laboratory at any time.
e. The combination of pants, socks and shoes should ensure that no areas of the leg, ankle or foot are exposed to hazardous substances. Shorts and skirts are not permitted. Note that nylons and Spandex leggings do not provide sufficient protection from hazardous chemicals and should not be worn.
f. The lab is not an appropriate place to apply makeup, lip balm, eye drops, handle contact lenses, comb hair or perform other personal grooming activities. Students should remove their PPE, wash their hands thoroughly and exit the laboratory before conducting such activities
g. In general, cellphones should not be used in the laboratory. Where cellphones use is incorporated into lab activities (e.g., taking photos of results, researching information) students should take steps to avoid contamination with hazardous substances. Cellphones should not be handled with gloves or placed onto benchtops or other contaminated surfaces. Phone calls, texts and other communications should not take place during lab sessions.
h. Food or drink are not allowed in any laboratory. If the student needs food or drink for medical reasons, they should remove their PPE, wash their hands thoroughly and exit the laboratory first.
i. Never sniff or taste lab substances for any reason. Do not use lab glassware or equipment as a food container or in the preparation of food products inside or outside the laboratory.
j. Students must wash their hands thoroughly before exiting the laboratory for any reason.
k. Students are required to bring lab coats and eye protection to every lab session.
l. Lab coats and gloves are not to be worn outside of the laboratory. To avoid contaminating their personal belongings, students are encouraged to transport their lab coat inside a separate bag.

5. **Personal Protective Equipment (PPE)**
    a. Always wear appropriate (ANSI Z87 rated) goggles or safety glasses when working in the laboratory. Contact lenses and ordinary spectacles are not considered eye protection devices.
    b. Goggles are required when the potential for hazardous liquids to be splashed into the eye exists. At other times, safety glasses with appropriate coverage are acceptable. Splash hazards most often occur when pouring or pipetting liquids, as well as when opening bottles or tubes containing liquids under pressure.
    c. A fully buttoned-up lab coat must be worn when working in the laboratory. Lab coats must fit appropriately (knee length in the torso and wrist length at the sleeves). An apron may be worn over a lab coat to provide additional protection, but is not a replacement for a lab coat.
    d. Gloves should be worn when handling hazardous substances. Latex and nitrile gloves are available in all laboratories. If you develop a skin rash or other symptoms associated to wearing gloves, notify your instructor immediately. Your instructor will work with you to find a suitable alternative.
    e. Gloves should be worn when handling organics, concentrated acids or bases and any unknown substances. In certain courses where only highly diluted acids or bases are used, containers may be handled without gloves. The need for gloves can be determined by consulting the Safety Data Sheet for that substance. When in doubt, gloves should be worn. Gloves are always required when handling blood products or any body fluids/materials which could facilitate the transfer of blood-borne pathogens.
    f. Students should wash their hands after removing gloves.
    g. Masks or respirators must be worn when hazardous particulates or fumes may become airborne and/or as a barrier to biological contamination of the nose and mouth. Note: masks and respirators alone may not provide complete protection, and may place a strain on the lungs or heart when worn for prolonged periods of time. Hazardous substances that can potentially become airborne should be processed inside a ventilation hood or containment chamber wherever feasible. Students should work with their instructor or the CNSS Lab Administrator to select the appropriate mask/respirator and to ensure that it is worn properly. Biological masks are appropriate protection from contamination, but provide no protection from hazardous particulates or fumes.

6. **Safety Stations and Equipment**
    a. There are safety stations (eye wash and safety shower) located in the science laboratories. In addition, there are handheld eyewash devices located in the sinks in rooms S204 and S209.
    b. Lab activities involving the use of hazardous substances must not be conducted when the safety station for that lab is not functional (e.g., the water is turned off).
    c. No obstacles (e.g., carts) are allowed to block the path to a safety station.
    d. If a hazardous substance reaches the eye, the student should proceed immediately to the eyewash station to flush their eyes. Place your face above the eyewash station and press the lever to activate the flow of water. Water will flow from 2 or 4 jets, allowing both eyes to be rinsed simultaneously.
    e. Flush the eye(s) for ten minutes or more to ensure that it is properly rinsed.
    f. If the student is exposed to a hazardous substance that reaches, or will potentially reach the skin, the student should proceed immediately to the safety shower. Stand underneath and pull the handle down fully to drench the affected area. If hazardous substances are on lab coats or

clothing, they should be removed immediately. Stay under the safety shower for at least ten minutes, or until directed by emergency personnel.

g. Some substances may not cause pain or burning right away, so students should utilize the safety station immediately - regardless of the sensation felt. In other instances, the sensation of pain or burning is immediate and may make the trip to the safety station difficult. If you see a fellow student struggling to reach the safety station, please ensure that you are wearing your PPE and then guide them there.

7. Ventilation Hoods

a. Ventilation hoods should be used when hazardous fumes or particulates may become airborne.
b. Examples of hazardous fumes and particulates include (but are not limited to) concentrated acids and bases, flammable and/or toxic organics, harmful or noxious vapors produced during the course of a reaction, or whenever the outcome of a reaction is unknown.
c. Hoods should not be allowed to become cluttered with bottles and other materials, as these objects create turbulence and reduce the effectiveness of ventilation.
d. Students should not raise the vertical sash higher than 15 inches (marked with an arrow) while working, as this removes their splash protection and creates turbulence which allows fumes to enter the laboratory.
e. Students using the horizontal sash should not stand in front of the open space, as this removes their splash protection and creates turbulence which allows fumes to enter the laboratory. Students using the horizontal sash should stand with their arms reaching around the sash on both sides to provide maximum protection.
f. Hazardous substances should be kept at least 6 inches inside the hood (marked with tape) to minimize turbulence.
g. Students should not crowd around the ventilation hood while working, as this creates turbulence which could cause hazardous vapors to enter the laboratory.
h. The control panels on the ventilation hoods are equipped with an alarm to notify users when the air flow is insufficient for safe operation. There is a mute button for the alarm but the hood must not be utilized until it has resumed proper air flow (~100 ft/minute). Note that raising the sash too high can activate the alarm.

8. Waste and Hazardous Substance Disposal

a. Hazardous biological and medical waste must be disposed in the appropriate containers. Red containers marked ‘Biohazard’ are available in areas where these materials are handled.
b. Gloves and other items directly contaminated with biological or medical hazards should be disposed as biological/medical waste as well.
c. Chemical waste should be placed in the appropriate container only. Hazardous reactions can occur when chemicals are mixed inappropriately.
d. Each laboratory where chemicals are used contains an Eco-Funnel system inside a ventilation hood to contain organic chemical waste. Please notify the instructor if the bottle is full.
e. If solid organic waste is generated, it should be placed in the appropriate container.
f. Inorganic liquid waste should be disposed in the appropriate container as provided by your instructor.
g. Some substances (e.g., ethidium bromide) have special disposal requirements. Do not place these substances in the containers provided for other substances.

h. In many instances, water-soluble neutral substances may be flushed down the lab drain with copious amounts of water. The appropriate Safety Data Sheet (SDS) should be consulted prior to this type of disposal.
i. Note that the lab sinks in the Franciscan Center are connected to a chemical trap system which prevents them from mixing with the sanitary sinks. Potentially hazardous substances should not be poured down any drain that does not have a blue-colored drain underneath.

9. <u>Spills and Breakage</u>

a. All spills, glass breakage and equipment damage must be reported to the instructor immediately. Nearby lab activities must stop temporarily while the cleanup is in progress. Students should not engage in any clean up activity without direction from the instructor.
b. Instructions will be provided in your lab manual, posted near the chemicals and/or demonstrated by your instructor. Your instructor will direct you how to proceed.
c. Small spills can be readily handled in the laboratory. However, if a large spill of a hazardous substance occurs (e.g., concentrated acids or bases, volatile organics) it will be necessary to evacuate all students in the lab immediately. The potential for damage to lungs, eyes and other organs exists with many materials when spilled outside the hood.
d. The control panels on the ventilation hoods possess a button marked "Purge/Emergency." Pressing this button causes the hood to create maximum air flow. This is intended to be used for emergency ventilation in the event of a large spill. If possible, this button should be activated, and the vertical sash raised to full height before exiting the laboratory.
e. Small acid spills can be neutralized using sodium bicarbonate, which is located throughout the Chemistry labs. Once the acidity is neutralized (as evidenced by a lack of bubble formation), the solid material can be disposed as solid waste and the surface washed clean with copious amounts of water. Large acid spills, especially those involving concentrated acids, may produce hazardous fumes.
f. There are spill kits available for large spills, as well as spills of bases and organic substances. These kits are located in rooms S104 (Biology Prep), S202 (Chemistry Prep), S208 (Physical Chemistry Lab) and S210 (Genetics lab). These kits contain neutralizing compounds for acids and bases, as well as loose inert absorbent materials, absorbent pads and pillows for all manner of substances, including organic solvents. They also contain thick rubber gloves, goggles and an N95 respirator.
g. Note that N95 respirators protect from airborne particulates, but not from corrosive fumes or volatile organics. When high concentrations of hazardous fumes or particulates are present, the area must be evacuated immediately. If the space cannot be readily ventilated to allow prompt clean up, MU Public Safety must be notified.
h. The absorbent pads can be used to soak up small spills. The absorbent pillows can be used to prevent large spills from spreading further.
i. Before pouring any neutralizing compound or inert absorbent powder, the N95 respirator, thick gloves and lab coat should be donned.
j. Acid/base spills can be neutralized with the appropriate neutralizing compound. Organics can be absorbed by the loose inert absorbent material
k. After the spill has been neutralized and/or absorbed, it should be swept up with the broom and dust pan provided. All recovered waste should be placed in the bag provided, returned to the orange bucket and sealed. The bucket should be placed in a ventilation hood for safe storage. Notify the CNSS Lab Administrator to arrange disposal.

l. Most broken glass can be cleaned up with a broom and dustpan and disposed in the appropriate glass waste box.
m. Broken glass which is contaminated with biological hazards should be disposed in the appropriate (red) biological sharps container.
n. Broken glass which is contaminated with hazardous chemicals (e.g., heavy metals) will require special disposal methods. The instructor or CNSS Laboratory Administrator will perform these cleanup activities.

10. Handling and Transporting Hazardous Chemicals

a. Students should not hand carry bottles of hazardous liquids between rooms.
b. Carts and bottle carriers are available for safe transport of hazardous liquids.
c. It is acceptable to hand carry small quantities (1 liter or less) of hazardous liquids within the same room. However, a cart or bottle carrier is recommended for larger quantities.
d. When hand carrying small bottles of hazardous liquids, grip the bottle with both hands, including one hand underneath. Gloves and other PPE must be worn
e. Students should not attempt to pour hazardous liquids from a large bottle (~ gallon) directly into a small container, even with a funnel. Small amounts of liquid should be transferred using a pipet or poured into a medium-sized beaker then transferred to the smaller container.
f. Label every primary and secondary container every time. Never use a chemical whose identity you do not know. It is dangerous to guess the identity of a chemical in a container that is not clearly labelled.

11. Electrical Hazards

a. Hotplates, stirrers, water baths and other electrical devices should not be used if there is damage to the electrical cords. If damage is observed, please notify your instructor immediately.
b. Please unplug the hotplate when finished. Allow it to cool fully before placing it on the cart. If you are at the end of your lab session, simply leave it in place, unplugged. The lab assistant will move the hotplate after it has cooled. (Placing the hotplate on a cart before it has cooled will cause the electrical cords to become melted, creating the risk of fire and electrical shock).

12. Gas Cylinders

a. Gas cylinders are vulnerable to breakage where the valve meets the top of the tank. If this happens (e.g., if the tank falls over and breaks off the valve) the compressed gases can turn the cylinder into a powerful missile.
b. Never transport a gas cylinder by rolling or dragging it. Always transport cylinders on a the two-wheel cart designed for this purpose (secured in place with a chain or strap).
c. Once in place, cylinders must be strapped or chained to the appropriate wall mount.
d. Before operating a gas cylinder, ensure that you understand the operation of the valves and gauges. Never open a gas cylinder without verifying that the outlet valve is closed.

13. Fire Extinguishers

a. Fire extinguishers are located in every laboratory as well as in the hallways.
b. Students should not attempt to extinguish a fire, but should evacuate the room immediately and notify MU Public Safety. If the fire can be extinguished by a single person, your instructor may choose to perform this task.

c. In the event that it is absolutely necessary to extinguish a fire, remember the acronym **PASS:**

PULL

AIM

SQUEEZE

SWEEP

d. Pull the pin from the handle; Aim at the base of the fire; Squeeze the handle and Sweep from side to side.
e. Always stand with your back to an exit. Do not allow yourself to become boxed in by the flames.
f. Most fire extinguishers contain sufficient extinguishing agent for 10 seconds. If the fire is not extinguished in this time, or if the smoke becomes excessive, retreat immediately.
g. If you are successful in extinguishing the fire, you will need to notify MU Public Safety anyway to assess the situation. Do not resume activities until MU Public Safety has determined it is safe to return.

14. Gas Leaks

a. In the event of a gas leak, evacuate the area immediately and notify Public Safety.
b. If adjacent spaces are occupied, notify those occupants to evacuate as well.
c. There are gas shutoff valves located outside each laboratory. If feasible, remove the plastic cover and rotate the handle to shut off the gas for that room.
d. Do not resume activities until MU Public Safety has determined it is safe to return.

15. Automated External Defibrillator (AED)

a. Automated External Defibrillators (AED) are located in the hallway on each floor.
b. In the event that someone suffers a cardiac emergency, you should contact MU Public Safety or call 9-1-1 before anything else.
c. Remove the AED from the cabinet and bring it to where the person is located. If available, instruct someone else to direct emergency personnel to the person needing assistance.
d. There are faculty members who are trained in CPR and emergency response, who can administer the AED if available. However, AEDs are designed to be used by ***anyone*** with minimal CPR training.
e. Once the lid on the device is opened, it provides audio instructions on how to proceed. Users do not need to decide whether defibrillation is necessary. It will not discharge (provide electrical shock) unless the appropriate conditions are met.

APPENDIX A

LABORATORY SUPERVISION

The following list is not exhaustive and is intended to provide examples only. Please consult with the CNSS Laboratory Administrator if you have any questions in determining the appropriate risk level for a laboratory activity.

LOW RISK FOR HAZARD

- Laboratory set up activities which involve handling glassware, lab equipment, casts, models, inert materials and sealed containers of dilute chemicals.
- Processing Data
- Feeding Flies

MODERATE RISK FOR HAZARD

- Aliquoting or mixing dilute working solutions.
- Working with preservatives (e.g., formalin)

HIGH RISK FOR HAZARD

- Handling known carcinogens or teratogens (e.g., ethidium bromide).
- Handling concentrated acids or bases (e.g., sodium hydroxide pellets)
- Using sharp implements (e.g., scalpels)
- Performing dissections
- Handling human body fluids, tissues or microorganisms

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