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INTRODUCTION

The Department of Civil Engineering is committed to McMaster University's Workplace and Environmental Health and Safety Policy which states: "Students are required by University policy to comply with all University health, safety and environmental programs and policies". This Policy is reviewed by the Central Joint Health and Safety Committee annually and is signed by our University President.

It is your responsibility to understand McMaster University's Risk Management system, which is founded in the best practices that meet or exceed the requirements of the Ontario Occupational Health and Safety Act (OHSA) and Environmental Protection Act, as well as other statutes. The Risk Management Manuals (RMMs) contain programs and policies in support of the Risk Management System, and are available from https://hr.mcmaster.ca/employees/health_safety_well-being/our-safety/risk-management-manuals-rmms/.

You should be familiar with McMaster University Lab Manual 2019 (available from <https://hr.mcmaster.ca/app/uploads/2019/07/2019-McMaster-Lab-Manual.pdf>), which contains specific information regarding university training requirements, WHMIS, Safety Data Sheets (SDS), Chemical spills and handling, laboratory upkeep, hazardous waste management, and lab-related emergencies.

This Laboratory Safety Manual describes the application of McMaster's Workplace Environmental Health and Safety Policy to the Department of Civil Engineering laboratories and applies to all people present in Civil Engineering laboratory spaces including students, visitors, and staff.

CHAIN OF REPORTING FOR SAFETY TRAINING AND RESPONSIBILITY

For all courses involving a lab, you will be provided with a health and safety lecture at the beginning of the first lab. **You are responsible for ensuring that you fully understand this safety information.** The lab technician is responsible for ensuring that all equipment is in good working order. In the event of an emergency, notify your Teaching Assistant (TA) and the Lab Technician. They are trained to, and responsible for, calling medical aid if needed. If they are not immediately available dial 88 on the lab telephone.

Anyone aware of a hazard or a concern must report the situation one level up according to the reporting chain in Figure 1. In case this person is not available, either contact the person delegated in their absence or the person two levels up. **You are expected to know this chain of reporting.**

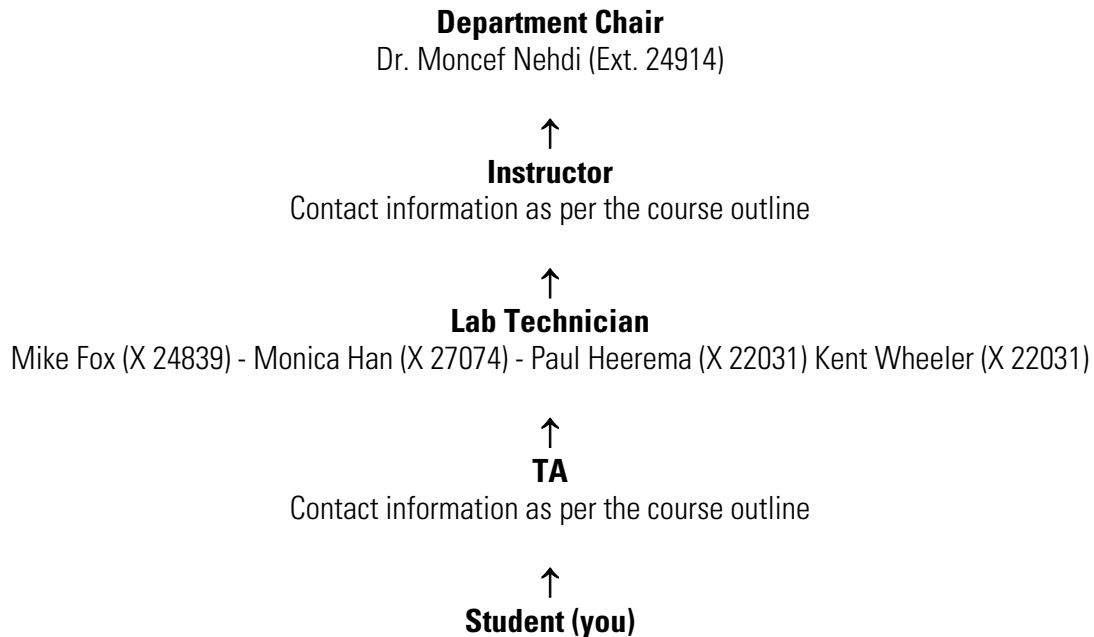


Figure 1. Reporting Chain for Hazards and Concerns.

GENERAL RULES – ALL CIVIL ENGINEERING LABS

1. Everyone in the lab is responsible for their own safety as well as the safety of others.
2. Always conduct yourself in a responsible manner while in the laboratory.
3. Follow all written and verbal instructions carefully. If you do not understand a direction or part of a procedure, **ask your TA or Lab Technician before proceeding with the activity.**
4. **Never work alone** in the laboratory. No student may work alone without the presence of a TA or lab technician.
5. Perform only those experiments indicated by the lab manual or your TA/Lab Technician. Carefully **follow all instructions**, both written and oral. Unauthorized experiments are not allowed.
6. **Observe the requirements for food and drink specific to each laboratory as posted on the safety information sign on the door.** If in doubt, **do not eat food, drink beverages, or chew gum in the laboratory.** Do not use laboratory glassware as containers for food or beverages.
7. **Be prepared** for your work in the laboratory. Read all procedures thoroughly before entering the laboratory. Never fool around in the laboratory. Horseplay, practical jokes, and pranks are dangerous and prohibited.

8. Observe good housekeeping practices. Work areas should be always kept clean and tidy. Keep backpacks and overcoats out of traffic areas.
9. **Be alert** and always proceed with caution in the laboratory. Notify the TA or lab technician immediately of any unsafe conditions you observe.
10. Labels and equipment instructions must be read carefully. Set up and **use the equipment as directed** by your lab manual.
11. Experiments must be always monitored in-person. Do not wander around the room, distract other students, startle other students, or interfere with the laboratory experiments of others.
12. **Dress appropriately** for each laboratory activity as outlined by the lab supervisor and door signage for each lab space.
13. **Report all accidents** (spill, breakage, etc.) and injuries (cut, burn, etc.) to the TA or Lab Technician immediately.
14. **Cell phones, ear buds, and headphones are prohibited** when present in lab spaces. These devices are distracting and thereby increase the potential for an accident to occur. You will be informed when ear plugs are required for hearing protection.
15. Do not store food and drinks in laboratory refrigerators.

Accident and Emergency Procedures

- Know the locations and operating procedures of all safety equipment including: first aid kit(s), eye wash station, and fire extinguisher.
- Know where the fire alarm and the exits are located.
- Know what to do if there is a fire drill during a laboratory period. Ensure all electrical equipment is turned off.
- In the case of an accident, notify your TA and the Lab Technician immediately. In the case of an emergency, they will dial **88** from a laboratory phone. If the TA or Lab Technician is unavailable, use the lab phone to dial **88** yourself, or 905-522-4135 (Security).

GEOTECHNICAL & ENVIRONMENTAL SYSTEMS LABORATORY SAFETY

- Glasses or safety glasses/goggles must be worn when conducting experiments in the lab.
- Contact lenses are not to be worn in the lab.
- No short (i.e., above the knee) pants or skirts are permitted in the lab – lab coats must be worn over top of your clothing in these instances.
- Closed-toe shoes must be worn at all times.
- No loose clothing is allowed.
- Long hair must be tied back.
- Disposable latex or Nitrile gloves must be worn when working with hazardous chemicals
- Heat resistant gloves must be worn to remove hot items from the drying oven (as indicated by the laboratory instructor).

Geotech Lab Safety

- **Do not** attempt to adjust pressurized test apparatus at any time – the improper disconnect of air lines may lead to uncontrolled discharge and flailing of unsecured lines.
- **Always** be aware of the pinch points associated with the equipment used in your lab.
- Dust masks and hearing protection are supplied and **must** be used when required.

Environmental Systems Lab Safety

- The yellow liquid in the COD (chemical oxygen demand) vial contains sulfuric acid, mercury, and dichromate. Note that dichromate is one of the strongest oxidizing agents. If you spill the liquid from the COD vial, do not try to clean it yourself. Notify the TA or lab supervisor immediately so that the spill can be removed using designated cleaning cloth.

APPLIED DYNAMICS LABORATORY SAFETY

- Glasses or safety glasses/goggles must be worn when conducting experiments in the lab
- Contact lenses are not to be worn in the lab.
- No short (i.e., above the knee) pants or skirts are permitted in the lab – lab coats must be worn over top of your clothing in these instances.
- Closed-toe shoes must be worn at all times.
- Hard hats and safety glasses are supplied when required and must be used.
- Green Patch safety shoes/boots must be supplied by the student when applicable.
- No loose clothing is allowed.
- Long hair must be tied back.
- Gloves must be worn when working with hazardous chemicals or hot items removed from the drying oven (as indicated by the laboratory instructor).
- Always be aware of the pinch points associated with the equipment used in your lab.

Electrical Safety

McMaster Civil Engineering labs are provided with Ground Fault Circuit Interruption (GFCI) where the proximity of water may create an electrical hazard. This is no substitute for careful, responsible actions – always be mindful of overspray and spills. Water increases hazards associated with electrical equipment and creates slip hazards.

The following information, supplied by Tektronix Inc., should be read, and understood by all electronic experimenters, technicians, and engineers.

Most of us think that a shock of 10 kV would be more deadly than one of 100 V. This is not so. People have been electrocuted by ordinary 110 Volt appliances and by voltages as low as 42 Volts DC. The real measure of the degree of shock is not the voltage applied, but rather the amount of current forced through the body, and that need not be very much.

Voltage is important only because its level and the body resistance between the points of contact determine how much current flows (remember Ohms law). Since resistance varies greatly, it is impossible to predict a dangerous voltage. The resistance may vary from 1000 Ohms for damp skin to 500 000 Ohms for dry skin. The resistance under the skin may only be

a few hundred Ohms. Also, the contact resistance may decrease with time such that a fatal current is reached rapidly.

Any amount of current over 10 mA can produce a painful to severe shock. A current as low as 30 mA is very dangerous and painful, and the victim cannot let go of the circuit. Currents above 100 mA can produce severe burns, unconsciousness, and even death. Ventricular fibrillation of the heart usually occurs. Above 200 mA, the muscular contractions are so severe that the heart is often forcibly clamped during the shock.

Regard all voltage sources (even some batteries) as potential killers. When working around electrical equipment, make sure you know where you are with respect to the voltage sources. Kill all power before touching any electrical circuit.