Laboratory Health & Safety

WATERLOO ENGINEERING

engineering.uwaterloo.ca

Department of Mechanical and Mechatronics Engineering

Laboratory Health and Safety Manual

Contacts, Regulations and Guidelines
for
Undergraduate Students

This manual and regulations are applicable to:
All Undergraduate students working or conducting experimental work in the Department of Mechanical and Mechatronics Engineering.

Everyone must sign a Health and Safety Declaration sheet; otherwise, permission to be in the Labs or Students' Workshop will be refused.

The Lab Health & Safety Manual is available from the ME and MTE Current Student Web pages or:
http://www.mme.uwaterloo.ca/undergrad/mechanical/documents/**2012MaySafetyManualandMaps**.pdf

Lab Health & Safety Manual and On-Line Safety Quiz

The MME Lab Health & Safety Manual

is available from the ME and MTE Current Student Web pages or:

http://www.mme.uwaterloo.ca/undergrad/mechanical/documents/**2012MaySafetyManualandMaps**.pdf

The MME Online Safety Quiz

is also recommended for students and visitors working in the labs and can be found at:

http://www.safetyoffice.uwaterloo.ca/hse/online_training/MTE/MTE.html

Contacts in Emergency Situations

Telephone Numbers:

• Fire, Ambulance, Police	**911**
• Security/ UW police	**22222**
• Plant Operations	33793
• On-Campus Health Services	84096
• Poison Information Centre	6-519-749-4220
• Director of Safety - Kevin Stewart	35814
• Safety Office	33587
• Chemical spills and radiation exposure	**22222**
• Dept. of MME - Marlene Dolson (E5-3051)	33328
• Dept. of MME Chair - Fathy Ismail (E5-3027)	84522
• Laboratory Director- Mike Herz (E3-2111)	33026

WATERLOO ENGINEERING

People Trained in First Aid

- Andy Barber Ext. 32104 in E3-2111B
- Debbie Collins Ext. 31407 in E5-3031
- Mike Collins Ext. 33655 in ERC-3009
- Yuguan Ding Ext. 33766 in E3-2117C
- Marlene Dolson Ext 33328 in E5-3051
- Richard Gordon Ext. 35124 in E3-2137D
- Mike Herz Ext. 33026 in E3-2111
- Donna Kellendonk Ext 33343 in E5-3022
- Celia McGill Ext. 38045 in E3-3167
- Robert Wagner Ext 33727 in DC-1705
- Mike Willson Ext. 33711 in E2-2354B

WATERLOO ENGINEERING

Accidents: Small Injuries

- Can be handled at our primary **First Aid Station in E3 - 2108H**.
- Contact **Department staff** who are trained in First Aid.
- In any situation requiring more care than a First Aid Kit can provide or if unsure, call for help and/or call **UW Police at 22222**.

WATERLOO ENGINEERING

Accidents: Severe Injuries

- **Call 911 on your cell phone**, then call **UW Police at (519) 888- 4911** so they can guide the Emergency Services to your location **OR,**
- **Call 911 on any Campus phone.** The UW Police will automatically know your phone location and immediately dispatch an Officer.
- Someone should wait near the phone from which the call was made to direct the officer to the scene.

WATERLOO ENGINEERING

Accidents: Uncertain?

Call the UW Police at ext. 22222.

They will help with any issue

or dial 911 for you.

WATERLOO ENGINEERING

Know Your Surroundings

- When you first walk into a lab, you should familiarize yourself with the surrounding area and equipment
- Know the locations of eye/face washes and showers (see maps).
- E3-2101 Eye/Face Wash/Drench Hose
- E3-2105 Eye/Face Wash/Drench Hose
- E3-2118E Eye/Face Wash and Shower Combination

- E3-2126 Men's Washroom - Showers
- E3-2137 Eye/Face Wash/Drench Hose

WATERLOO ENGINEERING

Accidents: Reporting

All accidents, no matter how small, must be reported within 24 hours to the Lab Director, Michael Herz, or the Mechanical and Mechatronics Engineering Department Secretary.

This is a Government (Worker's Compensation Act) requirement and could result in a FINE if ignored.

WATERLOO ENGINEERING

Fires

If you discover a fire:

1) Actuate the nearest wall mounted fire alarm.

1) Do not attempt to extinguish the fire.

2) Close the window(s) if possible.

3) If possible, shut down the experiment or turn off associated services.

4) Do not waste time gathering personal belongings.

FIRES (Cont'd)

6) Vacate the area and close door(s).

7) Leave the building by the most direct route.

   WALK, DO NOT RUN. DO NOT USE AN ELEVATOR.

8) Report to the Fire Department if anyone is suspected of still being in the building after the general evacuation.

9) Obey the Fire Wardens posted at all exit doors.

Safety Practices in the Laboratory

- Safe practice is an attitude and a knowledgeable awareness of potential hazards.
- Safety is a mutual responsibility and requires the full co-operation of everyone in the laboratory.
- All students and instructors must observe safety precautions and procedures.

WATERLOO ENGINEERING

Safety Practices in the MME Laboratory

- Thoroughly acquaint yourself with the location and use of safety facilities in the laboratory.
- Become familiar with safety precautions and emergency procedures *before* undertaking any laboratory work.
- Familiarize yourself with the operation of all equipment and all hazards involved, *before* commencing an experiment.

WATERLOO ENGINEERING

Safety Rules for all Mechanical & Mechatronics Engineering Laboratories

The practice of safety in the laboratory requires:

A. The desire on the part of the individual to protect themselves and their associates and

B. The need to follow a set of rules.

The following rules must be rigidly and impartially enforced.

Non-compliance may result in dismissal or suspension from the laboratory.

WATERLOO ENGINEERING

Safety Rule #1

The beginning of safe operation is an understanding of what is to be done and how the equipment operates. It is your responsibility to familiarize yourself with the experiment, equipment, recording facilities, etc., *before* beginning the actual work, so that you are not forced into panic actions.

Seek advice, if necessary, from technicians (in the Student Machine Shop, the Supervisor).

The Laboratory Director, Technicians and the Student Shop Supervisor have full authority to stop any work which, in their judgment, is considered unsafe.

WATERLOO ENGINEERING

Safety Rule #2

***Never* operate equipment alone**; make certain that others present know how to react in an emergency.

This is especially important when working in the evening or at night; operate a **‘buddy system’** in case an emergency arises.

Always warn others of possible hazards, and **never engage in horseplay**.

WATERLOO ENGINEERING

Safety Rule #3

Some equipment (machine tools, presses, furnaces, etc.) present special hazards.

Consider the consequences of every move before you make it.

Remove all tools, specimens, etc., that may fall between, or be in the way of, or fly off, rotating or moving parts.

Safety Rule #4

If something goes wrong, **do not panic**.

Think, take your time, and then act.

You *must* know how to **stop** a machine in an emergency before you start it.

Never try to retrieve a situation by reaching between moving parts, or by grabbing hot, corrosive, etc., surfaces.

WATERLOO ENGINEERING

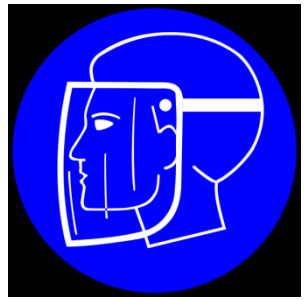
Safety Rule #5

Safety glasses must be worn during any cutting, grinding, chipping or sawing operations on all materials such as concrete, ferrous and non-ferrous metals and alloys, ceramics, plastics, wood, etc.

Splash goggles and face guards must be worn if there is a possibility of a liquid jet erupting, or solid debris flying, or intense heat radiation.

Safety glasses, splash goggles & face guards are available in:

Manufacturing Lab,	E3-2137;
High Pressure Lab,	E3-2105;
Materials Lab,	E3-2119;
Thermal Lab,	E3-2108;
Engineering Student Shop,	E5-1101D



WATERLOO ENGINEERING

Safety Rule #6

Special glasses are required in specific areas:

Welding goggles for arc or oxyacetylene welding.

Laser goggles when working with a laser. These are specific to individual laser wave lengths. There are several high power (Class III or Class IV) laser units in the labs which could cause severe eye and tissue damage. Remove all reflecting objects such as rings, medallions, etc.

Note: Laser Safety Program (Ian Fraser at Ext. 36268).

WATERLOO ENGINEERING

Safety Rule #7
Clothing and Protective Footware

Protective footwear must be worn in all labs and machine shop areas. **Open-toed footware is not permitted** in labs or machine shops.

If arc welding, any exposed skin should be covered to prevent burns from radiation and welding goggles/masks must be used. A leather apron should be worn, when appropriate, to prevent burns from metal splatter.

Safety hats must be worn when there is a chance of objects falling, or cutting or bruising your head on projectiles. Hats are available in the Fluids Lab, and from the Lab Director.

WATERLOO ENGINEERING

Safety Rule #7

Clothing and Protective Footware

Appropriate gloves must be worn when working with corrosive fluids, hot furnaces, sharp objects, etc. Gloves are available or may be requested from the Technicians.

Ear protection must be worn in high noise areas. They are available from Richard Gordon, E3-2137A.

Respirator masks are available for work in an atmosphere that contains noxious fumes and/or particulates, but several days notice may be required by the Lab Technicians to order this type of equipment.

WATERLOO ENGINEERING

Safety Rule #7
Clothing and Protective Footware

When working around equipment with moving parts, it is imperative that:

- long hair be covered in a net or tied up,
- no ties are worn,
- loose clothing is tied back, and
- jewelry is removed

'A true tragedy'; Yale student asphyxiated in lathe accident at chemistry lab late at night, medical examiner rules (Wednesday, April 13, 2011)

WATERLOO ENGINEERING

Safety Rules #8 - #11

8. **Use tongs, grips, holders**, etc. for placing specimens and workpieces into hot, or potentially dangerous equipment.

9. **Maintain an orderly work area at all times**. If you spill something, wipe it up (or get it cleaned up) immediately.

10. If equipment is to be left in operation unattended, **a sign must be posted**, with the names of the operator and supervisor together with phone numbers.

11. Unless otherwise instructed, return all tools, equipment and unused specimens to the designated area or person, switch off equipment and pull plugs from electrical outlets.

WATERLOO ENGINEERING

Safety Rules #12 - #13

12. **Report all equipment faults, breakage, or unsafe conditions** to the Laboratory Technicians immediately, who will inform the Laboratory Director within 24 hours.

13. **Before using any chemicals or other potentially hazardous materials**, a student must learn its properties, hazard ratings, and safe handling procedures.

    Some useful references are available in E3-2119D in the Materials Lab. If in doubt, a student must consult his/her Supervisor, Lab Director or Laboratory Technicians, before proceeding.

WATERLOO ENGINEERING

Safety Rules #14 - #16

14. **The smoking of cigarettes**, cigars, or pipes is forbidden throughout all University of Waterloo buildings and within 15 metres of a building entrance.

15. **The consumption of alcohol** is forbidden throughout the University of Waterloo premises, except in licensed rooms.

16. **Bicycles and the use of skate boards and roller blades** are prohibited inside all University of Waterloo buildings.

WATERLOO ENGINEERING

Electrical Equipment

The “Ontario Hydro yellow label” signifies that the equipment meets certain government standards. In general, it gives assurances that:

1) Proper grounding has been established
2) There are no bare terminals
3) Insulation is adequate
4) C.S.A. approval requirements have been met

Equipment built specifically for research must also meet these requirements.

WATERLOO ENGINEERING

Electrical Equipment (continued)

The biologic dangers and thresholds of electric current:

D.C. and low-frequency A.C. travels through the body.

Current Thresholds:

Pain	12 mA
"Let-go" current threshold is	16 mA
Respiratory paralysis	25-100 mA
Probable death	100 mA

High frequency a.c. travels over the tissue surface.

WATERLOO ENGINEERING

Electrical Equipment (continued)

The biologic dangers and thresholds of electric current:

Normal dry skin: will give about 10 kΩ between the hands.

Using **V = I×R :**

If R = 10 k Ω -> I = 120 V/10,000 Ω

= 12 mA through the body

i.e., probably painful

Any sweat or water on the hands: will greatly reduce this resistance, and increase current flow **by a factor of ten**.

If R = 1 kΩ -> I = 120 V/1,000 Ω

= 120 mA

i.e., **Probable Death !**

WATERLOO ENGINEERING

Electrical Equipment (continued)

The rule is: **do not touch live equipment !**

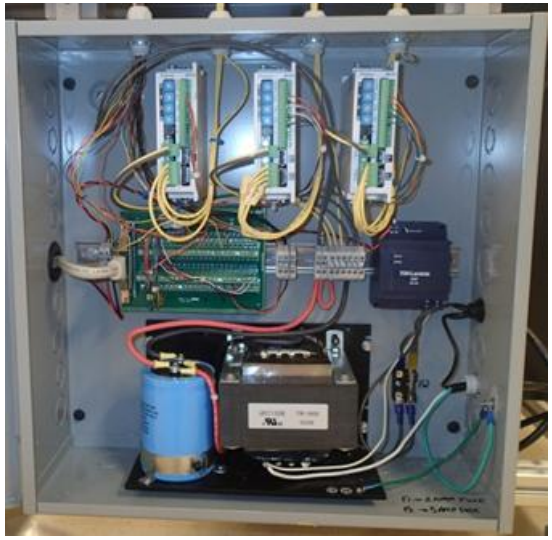
If you must do so, keep one hand in your pocket, so that current does not travel through the body across the heart. This improves the chances of survival.

- keep hands dry and never stand in water!
- use rubber shoes and stand on a rubber mat
- be very careful to discharge all capacitors, especially those associated with CRT tubes, i.e., in video terminals, etc.

WATERLOO ENGINEERING

Inspection and Approval of Electrical Circuits and Projects Built in MME

1) All electrical circuits or devices that are built or modified and that require a voltage **than 30 V OR draw more than 100 VA** **MUST** be inspected by a qualified department technician and receive CSA approval before being powered up.



2) All electrical circuits or devices that require a voltage source of **less than 30 V AND draw less than 100 VA** are not **required** to be inspected, providing that the circuit or device is powered by either batteries or by a CSA approved power supply.

WATERLOO ENGINEERING

Noise

Noise may not be a significant problem at the University of Waterloo, but you will be aware of it in industry.

The average noise level to which a person is subjected in industry has been rising at a rate of around1 dB/year. Most people do not notice the increased noise levels.

Millions of people suffer from hearing loss later in life from work conditions and, more recently, leisure noise (particularly snowmobiles, and rock music and ear phones).

Be Safe this Term!

Questions?

WATERLOO
ENGINEERING