Dry Lab Risk Management Training

PLEASE NOTE:

In order to obtain a certificate for this training, you must:

1) View the entire presentation
2) Complete the quiz at the end of the presentation
3) Obtain a minimum of 75% on the quiz

Introduction & General Safety Policies

PART 1

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Why should we care about health and safety? To avoid accidents like the following from happening.

Court Bulletin

Farm Equipment Repair Shop Fined $70,000 After Worker Killed in Tire Explosion

January 19, 2015 4:55 P.M. Ministry of Labour

BROCKVILLE, ON - Feenstra's Equipment Ltd., a business that provides sales, service and repair of new and used agricultural equipment, has pleaded guilty and has been fined $70,000 after a worker was killed while inflating a tire.

On October 18, 2013, an employee of the business, located in Athens, Ontario, was directed to replace a tire on a wagon. The worker was a licensed tire technician. The rim of the tire was removed and the worker started to mount the replacement tire on the rim. However, the flange of the rim of the wheel was bent in a number of places beyond the allowable variations and there were a number of places where the tire could come off the rim. It was then noticed that the replacement tire had some damage; a patch was installed over the damaged area, a tube was placed inside the tire to assist in securing the patch, and the tire was put on the rim and made ready to inflate.

The worker obtained a two-way non-locking air chuck to inflate the tire, which was then connected to a black air hose connected to the shop's air supply; the **non-locking air chuck meant that the worker needed to be close to the tire during inflation.**

As it was inflating, the tire came off the rim and the air pressure caused the wheel assembly to fly up, striking the worker in the hands and head, resulting in his death.

A locking air chuck on an extension hose with an inline pressure gauge allows a worker to not hold the valve stem while inflating a tire and use of it would have been a reasonable precaution on the part of the employer.

Feenstra's Equipment Ltd., pleaded guilty to failing, as an employer, to take every precaution reasonable in the circumstances for the protection of a worker at a workplace as required by the Occupational Health and Safety Act

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Eric Leighton

Leighton, 18, died and several other classmates were injured on May 26, 2011 when a metal drum (containing peppermint oil) he was cutting in shop class at Mother Teresa Catholic High School exploded.

http://www.cbc.ca/news/canada/ottawa/eric-leighton-killed-when-cleaning-agent-ignited-inquest-hears-1.2584223

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Why a **dry lab risk management training** course ?

- All laboratories can be inherently dangerous places, and the attitudes and actions of those who work in the laboratory determine their own safety and that of their colleagues and ultimately of the community.
- Laboratory equipment and design has become more sophisticated and safer, but safe and proper utilization still depends on properly trained and genuinely concerned personnel, who are safety conscious at all times.

Code of Ethics of Canadian Professional Engineers

[https://engineering.uottawa.ca/governance/engineering-code-ethics]

Professional engineers shall conduct themselves in an honourable and ethical manner. Professional engineers shall uphold the values of truth, honesty and trustworthiness and **safeguard human life and welfare and the environment**. In keeping with these basic tenets, **professional engineers shall**:

- **Hold paramount the safety, health and welfare of the public and the protection of the environment and promote health and safety within the workplace**;

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ATTENTION!
DON'T LEARN
SAFETY BY
ACCIDENT

Application

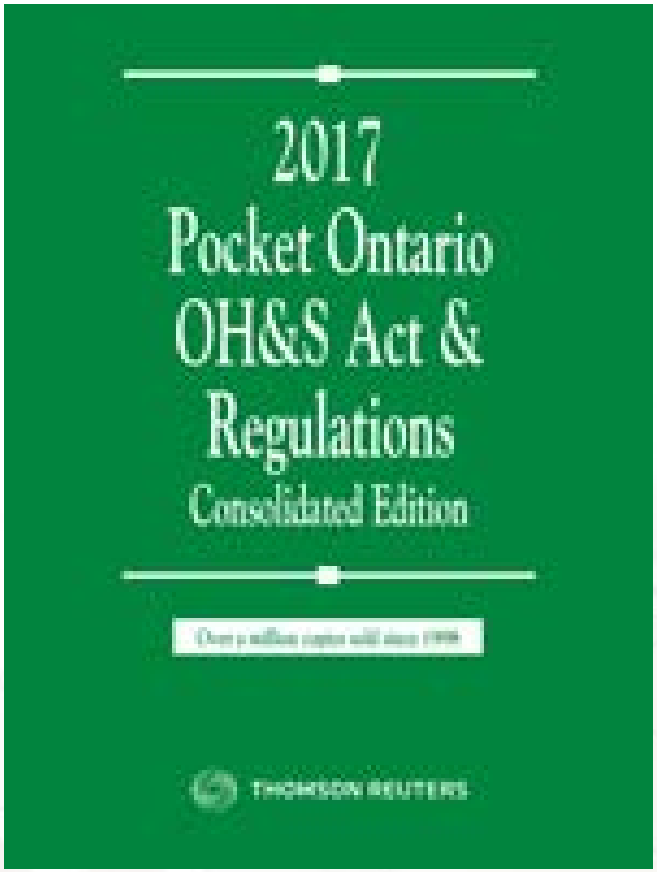
- Applicable to all users of your respective lab :
  - Students
  - Technical Officers
  - Professors and Researchers
  - Other staff
  - Visitors

- Applicable to all rooms associated with the respective lab including:
  - Teaching labs.
  - Research labs.
  - Student space (both Graduate and Undergraduate).

Objectives

- Provide healthy, safe and enriching environment;
- Clarify roles and responsibilities;
- Specify safe work procedures (including PPE policies);
- Specify training requirements;
- Ensure users are trained in safe operation of equipment;
- Ensure users are trained in procedures related to incidents;
- Support implementation and enforcement of policies and procedures.

Health & Safety in Ontario



Regulation 858:
1.This Act applies to every person who is employed as a member of the academic staff of a university or related institution.

OH&SA § 27(2):
"A **Supervisor** shall take every precaution reasonable … for the protection of a worker."

OH&SA § 28(1)(a):
"A **Worker** shall work in compliance with this Act."

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Bill 18- Stronger Workplaces for a Stronger Economy Act, 2014

[https://www.ola.org/en/legislative-business/bills/parliament-41/session-1/bill-18]

- Received Royal Assent on November 20, 2014
- Schedule 4. Occupational Health and Safety Act

The definition of "worker" in subsection 1 (1) of the *Occupational Health and Safety Act* is repealed and the following substituted:

"**worker**" means any of the following, but does not include an inmate of a correctional institution or like institution or facility who participates inside the institution or facility in a work project or rehabilitation program:

1. A person who performs work or supplies services for monetary compensation.
2. A secondary school student who performs work or supplies services for no monetary compensation under a work experience program authorized by the school board that operates the school in which the student is enrolled.
3. **A person who performs work or supplies services for no monetary compensation under a program approved by a college of applied arts and technology, university or other post-secondary institution**
4. A person who receives training from an employer, but who, under the *Employment Standards Act, 2000*, is not an employee for the purposes of that Act because the conditions set out in subsection 1 (2) of that Act have been met.
5. Such other persons as may be prescribed who perform work or supply services to an employer for no monetary compensation; ("travailleur")

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Ontario Ministry of Labour

http://www.labour.gov.on.ca/english/hs/

Health and Safety

- **All workers have the right to return home each day safe and sound.**
- Preventing work-related illness and injury is the most important job at any workplace.

Health & Safety at Work

Prevention Starts Here

Ontario's Occupational Health and Safety Act gives workers rights. It sets out roles for employers, supervisors and workers so they can work together to make workplaces safer.

Improve Health and Safety:

- Find out about your Joint Health and Safety Committee or Health and Safety Representative.
- Talk to your employer, supervisor, workers, joint health and safety committee or health and safety representative about health and safety concerns.

Call the Ministry of Labour at 1-877-202-0008

Report critical injuries, fatalities, work refusals anytime.
Workplace health and safety information, weekdays 8:30am – 5:00pm.
Emergency? Always call 911 immediately.

Find out more:
ontario.ca/healthandsafetyatwork

Workers have the right to:

- Know about workplace hazards and what to do about them.
- Participate in solving workplace health and safety problems.
- Refuse work they believe is unsafe.

Workers must:

- Follow the law and workplace health and safety policies and procedures.
- Wear and use the protective equipment required by their employer.
- Work and act in a way that won't hurt themselves or anyone else.
- Report any hazards or injuries to their supervisor.

Employers must NOT take action against workers for following the law and raising health and safety concerns.

Employers must:

- Make sure workers know about hazards and dangers by providing information, instruction and supervision on how to work safely.
- Make sure supervisors know what is required to protect workers' health and safety on the job.
- Create workplace health and safety policies and procedures.
- Make sure everyone follows the law and the workplace health and safety policies and procedures.
- Make sure workers wear and use the right protective equipment.
- Do everything reasonable in the circumstances to protect workers from being hurt or getting a work-related illness.

Supervisors must:

- Tell workers about hazards and dangers, and respond to their concerns.
- Show workers how to work safely, and make sure they follow the law and workplace health and safety policies and procedures.
- Make sure workers wear and use the right protective equipment.
- Do everything reasonable in the circumstances to protect workers from being hurt or getting a work-related illness.

Ontario

http://www.labour.gov.on.ca/english/hs/pubs/poster_prevention.php

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Ontario OHSA Worker's Fundamental Rights

[https://www.labour.gov.on.ca/english/hs/faqs/rights.php]

1. **The Right to Know** about hazards in their work and get information, supervision and instruction to protect their health and safety on the job
2. **The Right to Participate** in identifying and solving workplace health and safety problems either through a health and safety representative or as a worker member of a joint health and safety committee.
3. **The Right to Refuse** work that they believe is dangerous to their health and safety or that of any other worker in the workplace. (protected against discriminatory procedures and reprimands) (Sections 43-47)

University of Ottawa Safety Policies

OCCUPATIONAL HEALTH AND SAFETY (Policy 77)

The University of Ottawa recognizes its legal and moral responsibilities in health and safety for the University community by ensuring sound and safe conditions in all its activities.

"7. The University is also responsible for providing all of its students with a safe and healthy work and study environment. While students are not subject to provincial legislation on occupational health and safety, the University abides by the principles of this legislation in the case of students."

ENVIRONMENTAL MANAGEMENT & SUSTAINABILITY (Policy 72)

The purpose of this Policy is to ensure that the University fulfils its legal obligations for the protection of the environment and sustainable practices, through the appropriate assignment of responsibilities throughout the University, and establishment of directives, procedures and standards.

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http://www.uottawa.ca/about/policies-and-regulations

Roles and Responsibilities
The University Framework

- Based on Internal Responsibility System (Procedure 14-1)
  - Employer
    - Supervisor (control over worker)
    - Worker (monetary compensation, or not)
  - Health and safety committees
    - Inspections
  - Training (workers' right to know)
- Strict liability (due diligence required to prove innocence) – a reverse onus
- Regulatory fines/criminal prosecution C-45

14-1: Internal Responsibility Procedure

"4. The **University** has a general duty to **take every precaution reasonable** in the circumstances to **protect health and safety and prevent accident, incident, occupational disease and injuries in its workplace**. "

- The **University**, as the employer, having regard for the protection of workers, without limiting the requirements imposed by applicable health and safety legislation, must ensure the following:
  - that equipment, materials and protective devices are provided, and maintained in good condition, and that they are used as prescribed under the applicable health and safety legislation
  - that information, instruction, and supervision are provided to workers to protect their health or their safety
  - that workers are provided with written instructions as to the measures and procedures to be taken for the protection of workers, where prescribed in applicable health and safety legislation;

http://www.uottawa.ca/about/procedure-14-1-internal-responsibility-procedure-health-and-safety-issues

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Reference: *Policy 77 and Procedure 14-1*

Responsibilities- brief

- **Supervisors** – responsible for ensuring compliance with all directives, procedures, standards and guidelines established by the University, their faculty or by government agencies.

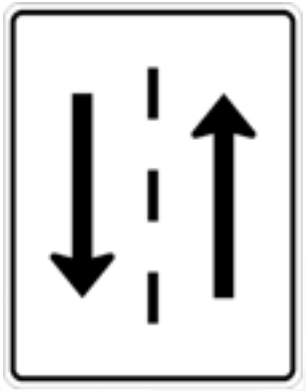
- **Workers** – responsible for complying with all directives, procedures and standards established by the University, their faculty or by government agencies.

- **Students** – responsible for conducting themselves in a proper manner to ensure their own safety as well as that of others and must adhere to University procedures and directives on health and safety.

Ensuring a safe workplace & limit liability/ Roles & Responsibilities

Employer

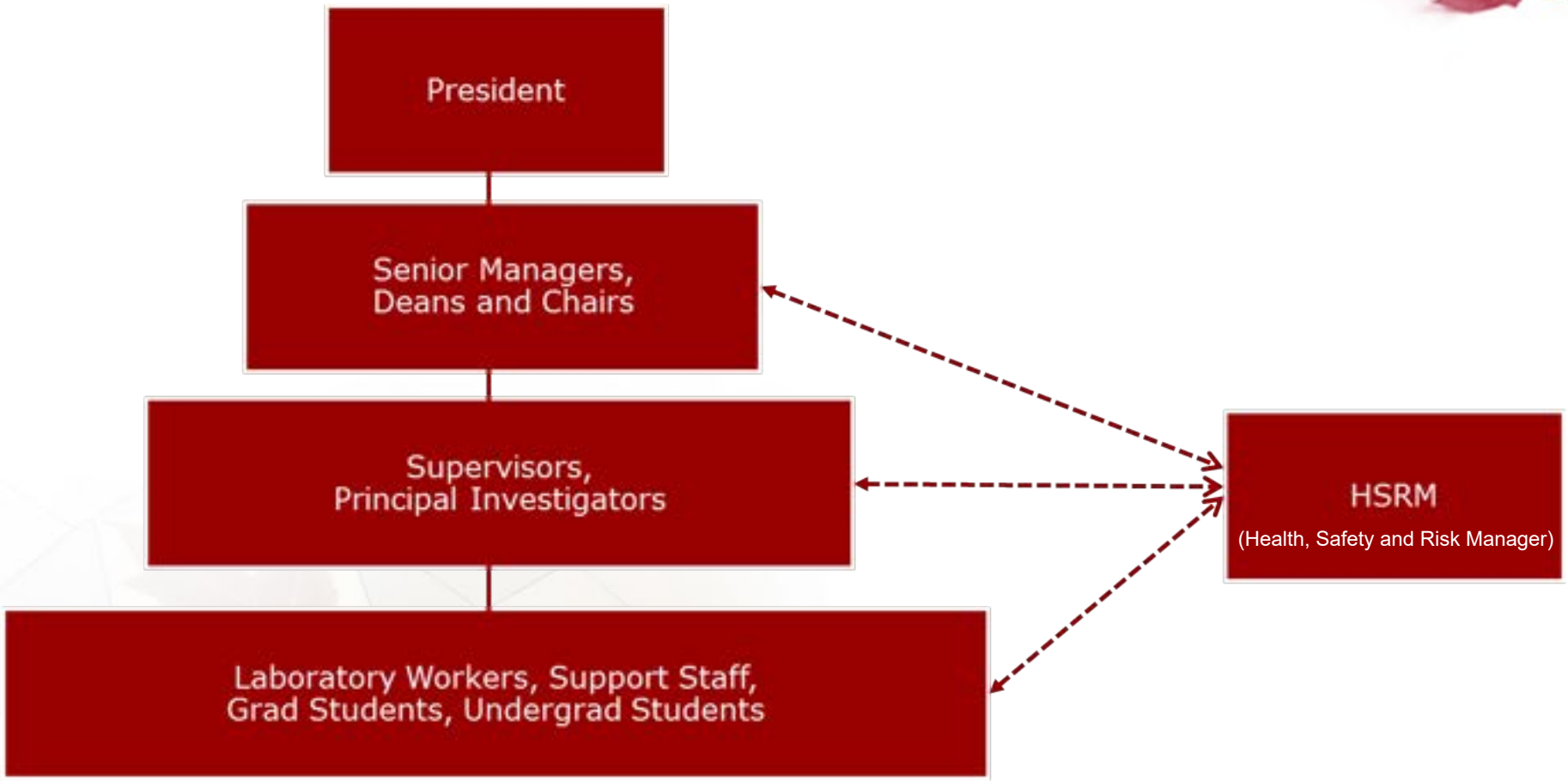
- protect workers
- provide equipment, materials and protective devices which is maintained in good condition, and used as prescribed under the applicable health and safety legislation
- provide workers information, instruction, and **competent** supervision to protect their health & safety
- provide workers with written instructions; take measures and procedures to protect workers, where prescribed in applicable health and safety legislation



Employee
(worker, supervisor, student)

- know legal obligations under occupational health and safety laws and standards
- know hazards existing in workplace
- know how to effectively reduce or eliminate workplace hazards
- provided with appropriate training

Responsibility and Accountability



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Worker's/ Student's Responsibilities

- Know and comply with regulations (e.g. OH&S Act and Regulations)
- Carry out a **PROJECT HAZARD (RISK) ASSESSMENT** of the experiment or protocol
- Use and wear personal protection and safety equipment as required by the employer
- Follow safe work procedures
- Report hazards that endanger workers
- Report any injury or illness immediately
- Report unsafe acts and unsafe conditions

- **Shall not**:
  - Engage in pranks that endanger workers
  - Endanger others or the worker
  - Disable protective devices

Enforcement

- **UOttawa Policy 2d –**
  Disciplinary Measures for Reprehensible Acts

  [https://www.uottawa.ca/administration-and-governance/policy-2d-disciplinary-measures-reprehensible-acts]

  - Reprehensible Act:
    - disobedience, violation of security rules, carelessness at work, slander that could destroy the reputation of a staff member, sexual harassment, refusal to comply with the policies, directives and procedures of the University
  - Disciplinary measures:
    1) Verbal warning
    2) Written warning
    3) Suspension without pay (X2)
    4) Demotion
    5) Dismissal

Enforcement (cont'd)

- Escalation procedures:
  - Reminder
  - Warning
  - Meeting with Technical officer & Supervisor
  - Meeting with Lab Director or Chair
  - Temporary loss of lab privileges
  - Permanent loss of lab privileges
- **Handled on case-by-case basis; severity of the incident may warrant the bypassing of stages / steps**
- You are responsible for your actions!

Section 217.1- Criminal Code of Canada (Bill C-45, the "Westray Bill")

- **Affects all organizations and individuals who direct the work of others, anywhere in Canada**.
  - organizations = federal, provincial and municipal governments, corporations, private companies, charities and non-governmental organizations.
- "**217.1** Every one who undertakes, or has the authority, to direct how another person does work or performs a task is under a legal duty to take reasonable steps to prevent bodily harm to that person, or any other person, arising from that work or task."
- Bill C-45 also added Sections 22.1 and 22.2 to the Criminal Code imposing criminal liability on organizations and its representatives for negligence (22.1) and other offences (22.2).

An engineer directs other people to work through project design, supervision and decision making at various levels.

[Ref.: http://www.ccohs.ca/oshanswers/legisl/billc45.html]

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Christmas Eve 2009

Update on the Metron Construction Case: Project Manager Convicted of Criminal Negligence by *John Agioritis* and *Jean Torrens*

Wednesday September 16, 2015

At a recent MLT workshop on Occupational Health and Safety Law, we told you about the unfortunate case of *R v Metron Construction Inc.*,where four workers were killed and one was seriously injured on Christmas Eve at a Toronto construction site when a suspended swing stage scaffolding they were standing on collapsed. Three of the fatally injured workers including the supervisor had marijuana in their system. Only one worker was secured with fall arrest protection. The company pled guilty to criminal negligence causing death and ultimately receiveda $750,000 fine.

Metron Construction's Project Manager, Vadim Kazenelson, was also recently found guilty under s. 217.1 of the *Criminal Code* on four counts of criminal negligence causing death and one count of criminal negligence causing bodily harm: *R. v. Kazenelson*, 2015 ONSC 3639. His sentence is expected on October 16, 2015.

The Court found that everyone working on a swing stage must be protected from the danger of a fall. Shortly before the accident, the Project Manager noticed there was a shortage of lifelines on the swing stage and asked the supervisor "where the lifelines were?" The foreman told him "not to worry". The Project Manager said and did nothing else in relation to the lifelines. Seven people boarded the swing stage, including the Project Manager and supervisor. When the swing stage collapsed, the Project Manager was holding on to the single lifeline secured to a worker and managed to scramble to safety on a nearby balcony during the collapse. The worker wearing the lifeline also survived. The other five workers were either injured or killed.

of their injuries. His actions constituted "wanton and reckless disregard for lives and safety of his workers" and were criminally negligent under s. 217.1 of the *Criminal Code*.

The facts in the *Metron* series of cases are somewhat exceptional, but the Court's ruling in the Project Manager'scase suggests that supervisors and project managers need to take reasonable steps after noticing safety deficiencies in the workplace. Merely raising an issue with a subordinate, without doing anything more to rectify it, may not be enough to satisfy the duty to take reasonable steps to prevent harm to a worker.

- 4 workers died
- 1 worker seriously injured

[Ref.: http://westernemployerscounsel.com/blog/post/update-on-the-metron-construction-case-project-manager-convicted-of-criminal-negligence/]

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Metron Construction Tragedy (*cont'd*)

On January 11, 2016:

- **Project manager sentenced to 3.5 years imprisonment:**
  - 4 counts of criminal negligence causing death
  - 1 count of criminal negligence causing bodily injury

- **Previous charges:**
  - Metron (employer) – 1 criminal negligence = $200K; Court of Appeal increased fine to $750K
  - Metron CEO – pleaded guilty to 4 *OHSA* offences = $22.5K/count
  - Swing N' Scaff (scaffolding company) – *OHSA* fine = $350K
  - Swing N' Scaff Director – *OHSA* fine = $50K

Training Requirements

- Prior to being provided access to the Laboratory, Users are advised to complete generic training courses as well as site / project specific training for the work that the user(s) will conduct. These are **minimum** requirements and include:
  - uOttawa WHMIS for laboratory workers (online)
  - uOttawa Worker Health & Safety Awareness (online)
  - uOttawa Dry Lab Risk Management (this course) or Lab Safety (online) training

- Additional, **specialized** training may also be required for equipment such as overhead cranes, lift trucks, etc.

- Training registration is available on the ORM website at: http://www.uottawa.ca/services/ehss/register.htm.

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Training Requirements

Mandatory:

- WHMIS 2015 (Workplace Hazardous Materials Information System) for laboratory workers
- Lab Safety or Dry Lab Risk Management
- Orientation Safety Training (online)
  (https://engineering.uottawa.ca/sites/default/files/health-and-safety-orientation-and-access-form.pdf)
- *Worker Health and Safety Awareness (ASAP)
- *Supervisor Health and Safety Awareness (ASAP), if supervising students (e.g. TA)
- Specific training (as required):
  - Biosafety
  - Radiation Safety
  - Laser Safety
  - Overhead crane
  - Working at heights
  - Welding

Consult: https://web30.uottawa.ca/hr/web/en/type/risk

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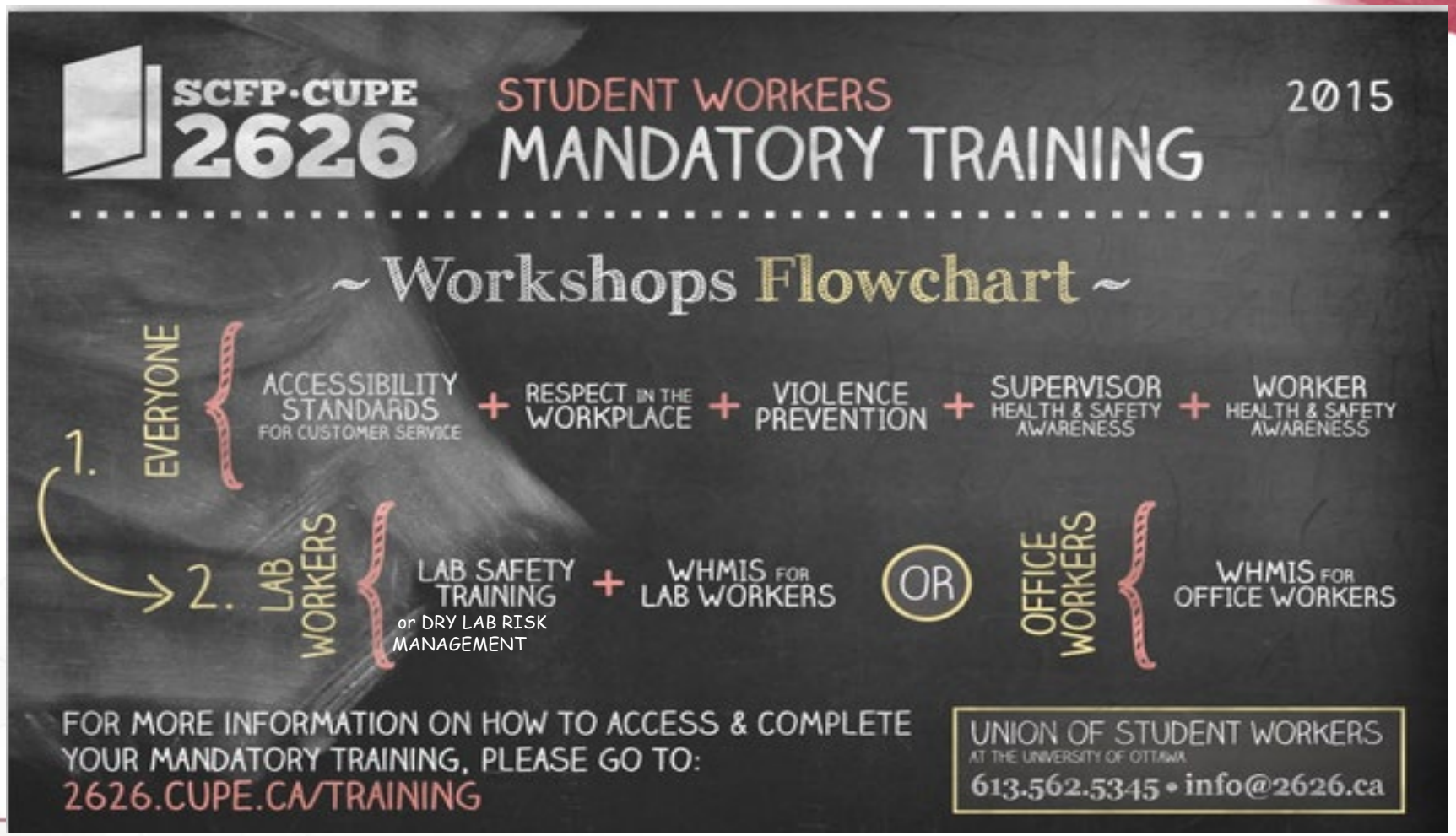
* MOL requirement

Training Requirements - Students



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Access Requirements

- Keys are issued following successful completion of the required courses and orientation.

- uOttawa key control policy http://web5.uottawa.ca/admingov/policy_35.html

- Speak with the Departmental Administration:
  - Bring proof of course completion (WHMIS, Lab Safety/Dry Lab Risk Management, Worker Health & Safety Awareness)
  - Complete form with help of technical officer
  - Provide $20 deposit

After-Hours Policy / Working Alone

- **Strongly encouraged that work (including research) be conducted during regular business hours**
- If unavoidable:
  - Discuss with your supervisor and obtain written permission / authorization for that request.
  - Upon arriving to uOttawa, identify yourself to Protection Services at 141 Louis-Pasteur (Lees Ave. campus Protection Office)
    - Present your student card, destination, and anticipated duration
- consult the directive on working alone at http://www.uottawa.ca/services/ehss/docs/Directiveaccesslabafterhours.pdf

Personal Protective Equipment (PPE)

- Definition:
  - ***PPE**: The personal devices worn by individual workers in order to protect themselves from hazards. PPE is the last protection option available to a worker.*
- Last resort for protection – does not remove the hazard
- Many types of equipment available for use in the labs:
  - Hard hats
  - Gloves
  - Protective eyewear
  - Safety boots
  - Respiratory protection
  - Protective aprons/ clothing
- "why do we wear PPE?" video: https://www.youtube.com/watch?v=KgkvxUtczLA

Reference: UOttawa Guidelines document: *Personal Protective Equipment (PPE)*

http://orm.uottawa.ca/sites/orm.uottawa.ca/files/ppe-guideline.pdf (*English version)*

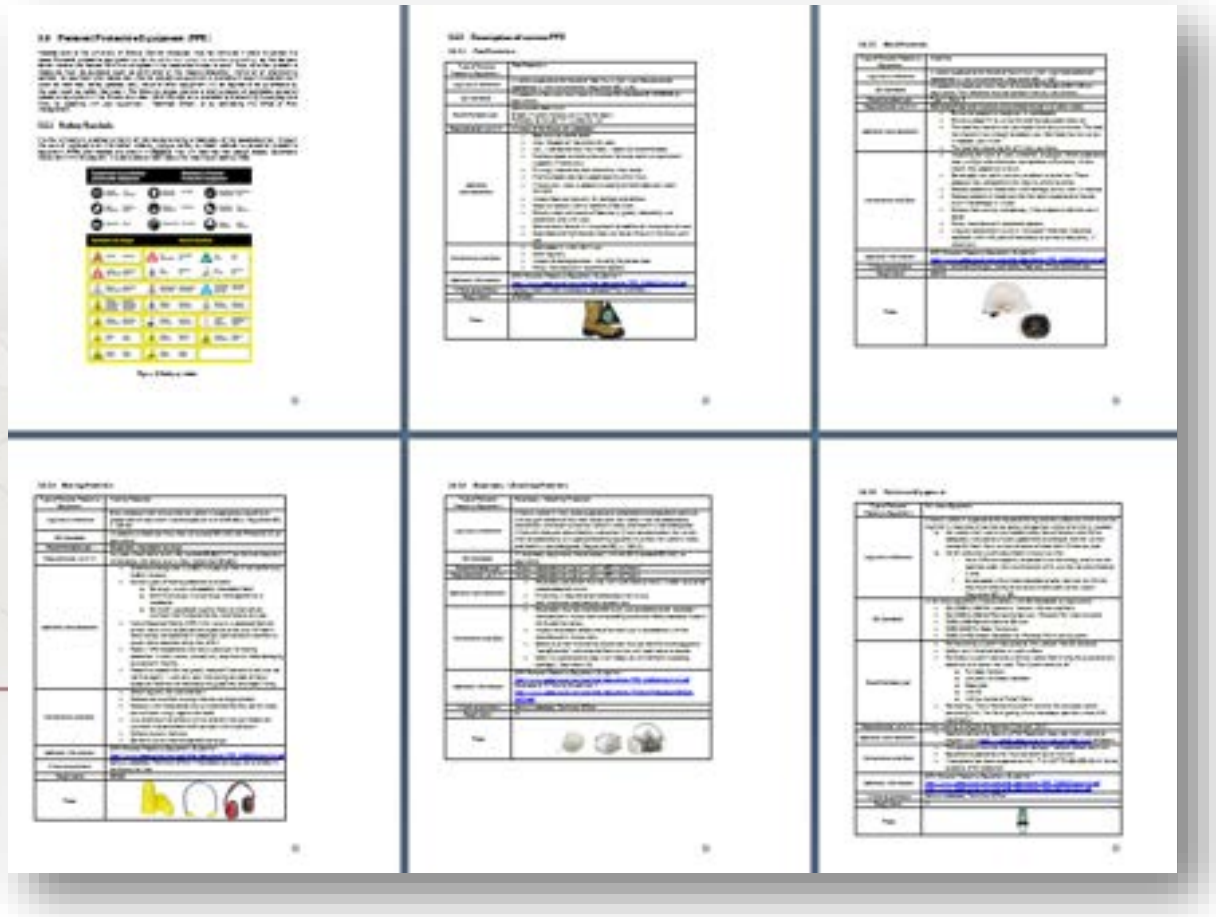
https://bgr.uottawa.ca/sites/orm.uottawa.ca/files/epi-ligne-directrice.pdf (version *française)*

Personal Protective Equipment (PPE)

- University's practice to inform all individuals entering a laboratory of the associated risk, through the use of signage and information sheets. Various safety symbols related to PPE and hazards are shown below.

Personal Protective Equipment (PPE)

- No person is exempt – hazards do not discriminate!
- Subsequent slides deal with specific PPE
- More information can be found in the U of Ottawa's Guideline re: PPE, your lab's Safety Manual or by speaking with your Technical Officer



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Head Protection

- Hard hat, **Type II Class E** recommended
- Ensure meets CSA Z94.1 approval (usually stamped under brim)
- Avoid painting / placing stickers / colouring your hat.
- Take proper care and maintenance; do not leave lying around, exposed to dirt and possible damage

➢ Required in situations where an overhead hazard is present.

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Eye & Face Protection

- Ensure meets CSA-Z94.3-09 (or ANSI Z87.1-2010) approval (look for stamp on side arm of glasses or upper corner of lens) – lots of knock-offs
- Prescription eyewear is not suitable
- Care and maintenance

- Required in situations where an eye hazard is present
  - Impacts, splashes, UV radiation, lasers (requires specific eyewear)
  - Side shields

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uOttawa Eye Protection Policy

"Persons exposed to an eye or face hazard from physical objects, chemical substances, harmful radiant energy and nuisance dust, **shall wear Safety Eyewear**."

- **Use appropriate safety glasses**

(SEE: https://www.youtube.com/watch?v=0DYgLlWzYqk&list=PLAaiq7apU7kcio2skZ9bfFyrGKzT7vIod&feature=player_detailpage)

- "Avoid use of contact lenses"

(**SEE**:**https://www.ccohs.ca/oshanswers/prevention/contact_len.html**)

- Goggles for liquids
- Safety glasses for explosion risks
- **Wear at all times in labs**

(SEE :https://www.youtube.com/watch?feature=player_detailpage&v=5TqQT9Pfh_Q)

Source: https://i.redd.it/3e5wuqsoef921.jpg, and https://singletrackworld.com/forum/topic/one-for-the-angle-grinder-users/

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Respiratory Protection

- Likely limited to n-95's and dust masks.
- Ensure meets CSA Z94.4 approval (look for stamp on mask)
- Fitted properly for maximum effectiveness (fit testing).
- Care and maintenance.
- Further protection should be deployed in consultation from ORM (i.e. cartridge-masks, supplied air, etc.).

- Required?
  - Various – dependant on type of work

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Hearing Protection

- Many different types; ensure you choose the appropriate one.
  - Earmuffs
  - Roll-down plugs
  - Headbands
- Ensure meets CSA Z94.2 approval (look for stamp)
- **Noise reduction rating** – be aware of this value; typically under optimum circumstances
- Care and maintenance

➢ Required where noise levels may exceed 85 dB(A)* - if you have to shout at a 1m distance, the noise level is likely higher than 85 dB(A).

* **80 dB (A) at uOttawa**

Exposure Time	Decibel Level (dBA)
16 hours	82
8 hours	85
4 hours	88
2 hours	91
1 hour	94
30 minutes	97
15 minutes	100

[adapted from: https://www.labour.gov.on.ca/english/hs/pubs/noise/gl_noise_4.php]

Examples of Noise Levels	
Noise source	**Decibel Level (dBA)**
jet engine at 30.5m away	130
rock concert	120
car horn	110
chainsaw	100
lawn mower	90
city traffic	70
dishwasher	60
refrigerator	40
whispering	30

[source: https://www.ontario.ca/page/noise-our-environment]

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Safety Gloves

- Minimizes contact with hazardous agent
- Use appropriate gloves
- PVC, latex, rubber, nitrile, polypropylene
- Check resistance chart (https://science.uottawa.ca/en/faculty-services/health-safety/msds-internet-resources/glove-guide)
- **Do not wear gloves in hallways, elevators or in stairwells**

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Foot Protection

- Closed-toed, closed heel shoes must be worn in labs & shops at all times
- Refer to CSA Z195-14 standard (look for stamp, sewn tag)
- Shoes must cover entire foot
- Construction boot type recommended, with **tag sewn on**, not glued
- Ensure footwear is comfortable.
- Take good care of them and maintain them in good condition.

➢ Verify if (steel-toe) foot protection is required in your lab.

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Fall Arrest Equipment

- Working at heights (typically > 3 metres).
- Specialized training required.
- Harness must be properly fitted & worn
- Take proper care of harness and maintain it in good condition.

➢ Required when working at heights of more than 3 m (10 ft.)

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Protective Clothing

- Required especially under certain circumstances; however generally recommended at all times.
- Example:
  - Welding aprons.
  - Lab coats.
  - Reflective vests.
  - **Long pants / sleeves**
- Avoid cuffed clothing, as much as possible

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Lab Coats

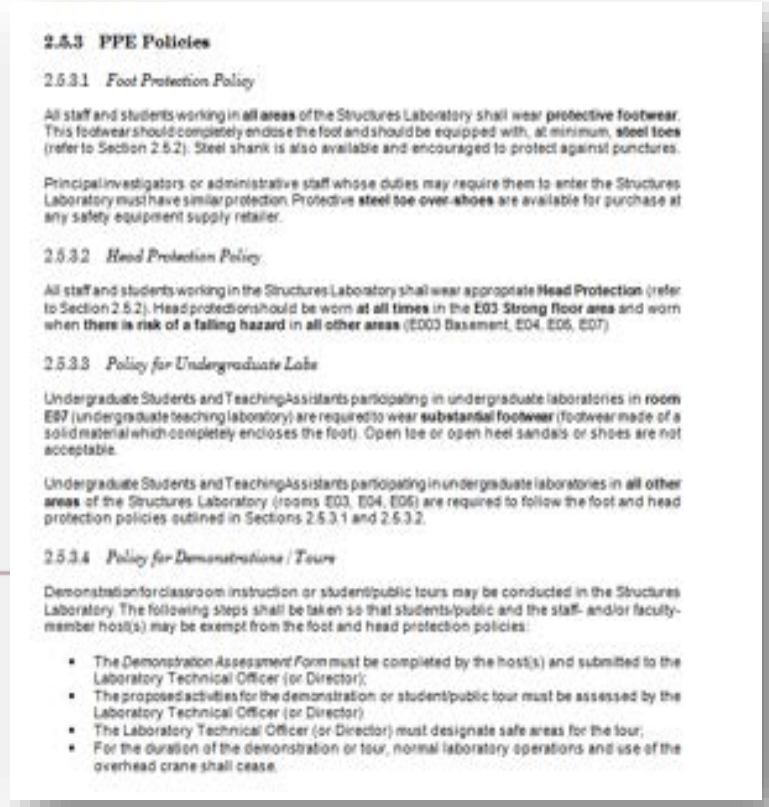
- Protect clothing
- Protect body
- Should have snaps
- Non-flammable fabric
- Do **NOT** wash with regular clothing
- Do **NOT** wear in elevators or public areas

See Lessons Learned- PPE/ Laboratory Coats :

https://www.youtube.com/watch?feature=player_embedded&v=LI7Pkj7x2mE

PPE policies

- Please review PPE policies in the lab safety manual
  - **Foot protection** policy
  - **Head protection** policy
  - Policy for **Undergraduate labs**
  - Policy for **Demonstrations /Tours**



2.5.3 PPE Policies

2.5.3.1 *Foot Protection Policy*

All staff and students working in **all areas** of the Structures Laboratory shall wear **protective footwear**. This footwear should completely enclose the foot and should be equipped with, at minimum, **steel toes** (refer to Section 2.5.2). Steel shank is also available and encouraged to protect against punctures.

Principal investigators or administrative staff whose duties may require them to enter the Structures Laboratory must have similar protection. Protective **steel toe over-shoes** are available for purchase at any safety equipment supply retailer.

2.5.3.2 *Head Protection Policy*

All staff and students working in the Structures Laboratory shall wear appropriate **Head Protection** (refer to Section 2.5.2). Head protections should be worn **at all times** in the **E03 Strong floor area** and worn when **there is risk of a falling hazard** in **all other areas** (E003 Basement, E04, E06, E07)

2.5.3.3 *Policy for Undergraduate Labs*

Undergraduate Students and Teaching Assistants participating in undergraduate laboratories in **room E07** (undergraduate teaching laboratory) are required to wear **substantial footwear** (footwear made of a solid material which completely encloses the foot). Open toe or open heel sandals or shoes are not acceptable.

Undergraduate Students and Teaching Assistants participating in undergraduate laboratories in **all other areas** of the Structures Laboratory (rooms E03, E04, E06) are required to follow the foot and head protection policies outlined in Sections 2.5.3.1 and 2.5.3.2.

2.5.3.4 *Policy for Demonstrations / Tours*

Demonstration for classroom instruction or student/public tours may be conducted in the Structures Laboratory. The following steps shall be taken so that students/public and the staff- and/or faculty-member host(s) may be exempt from the foot and head protection policies:

- The *Demonstration Assessment Form* must be completed by the host(s) and submitted to the Laboratory Technical Officer (or Director);
- The proposed activities for the demonstration or student/public tour must be assessed by the Laboratory Technical Officer (or Director)
- The Laboratory Technical Officer (or Director) must designate safe areas for the tour;
- For the duration of the demonstration or tour, normal laboratory operations and use of the overhead crane shall cease.

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Lab Tours

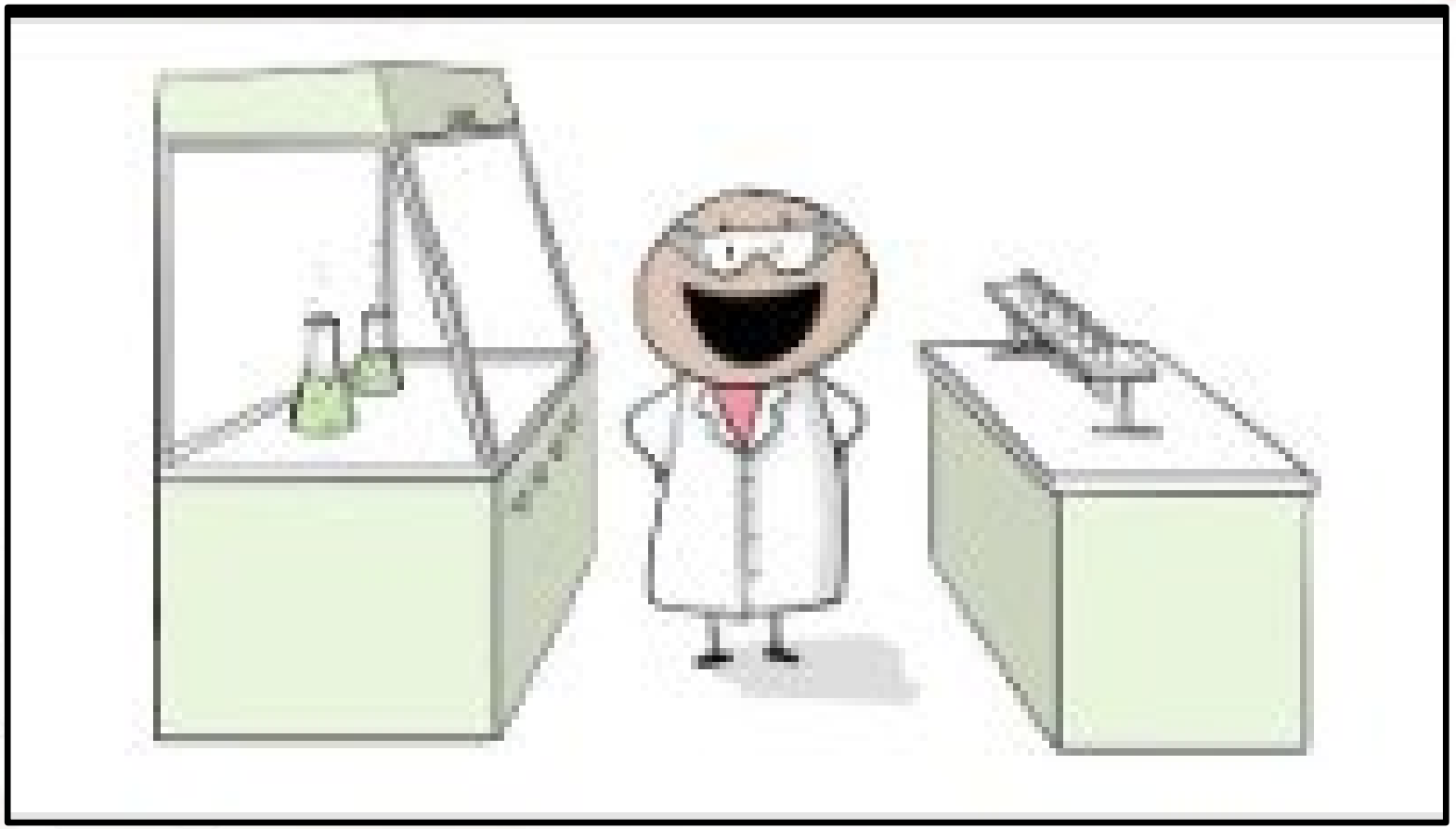
- Situations may arise when tours are provided to visitors, researchers, etc.
- Tour must be planned. The host(s) of the demo/ tour must arrange with the Technical Officer; the request is assessed by the Technical Officer.
- Technical Officer will physically designate safe areas for the tour.
- Normal lab operations **must cease** for the duration of the demo/ tour.

Project Life Cycle

- Planning
- Hazard/Risk Assessment
- Execution
- Clean-up

Project Hazard/ Risk Assessment

Source: https://www.youtube.com/watch?v=mYTaITYUEKE



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Project Hazard/ Risk Assessment
Four questions to answer:

- What are the hazards?
- What are the worst things that could happen?
- What do I need to do to be prepared?
- What are the prudent practices, protective facilities/equipment, and personal protective equipment needed to minimize the risk?

Hazard vs. Risk

- **Hazard**: any source of potential damage, harm, or adverse health effect on something or someone under certain conditions at work
- **Risk**: chance or probability that a person will be harmed or experience an adverse health effect if exposed to a **hazard**; can also apply to situations with property/equipment loss

Risk = (Probability of Occurrence) x (Consequence of Outcome)

http://www.ccohs.ca/oshanswers/hsprograms/risk_assessment.html

Prioritizing Risk (Risk Matrix)

Risk = (Probability of Occurrence) x (Consequence of Outcome)

Probability	Consequence					
		1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
	5 Certain	HIGH	HIGH	EXTREME	EXTREME	EXTREME
	4 Likely	MEDIUM	HIGH	HIGH	EXTREME	EXTREME
	3 Possible	LOW	MEDIUM	HIGH	EXTREME	EXTREME
	2 Unlikely	LOW	LOW	MEDIUM	HIGH	EXTREME
	1 Rare	LOW	LOW	MEDIUM	MEDIUM	HIGH

[Source: Minerva: Risk Management Module – Master]

Project Hazard/ Risk Assessment

- **Aim:**
  - to **remove** a **hazard** or **reduce** level of its **risk** by adding precautions or control measures

- **Key points:**
  - Identify & understand hazards (e.g. info contained in MSDS)
  - Identify & assess risks (analyze/ evaluate risks associated with hazards)
  - Determine appropriate ways to eliminate/control hazards

- **Importance:**
  - Creates awareness of hazards & risks
  - Identifies who may be at risk
  - Determines if existing control measures are adequate or not
  - Prevents injuries/illnesses when done at design or planning stage
  - Prioritizes hazards & control measures

Source: http://www.ccohs.ca/oshanswers/hsprograms/risk_assessment.html

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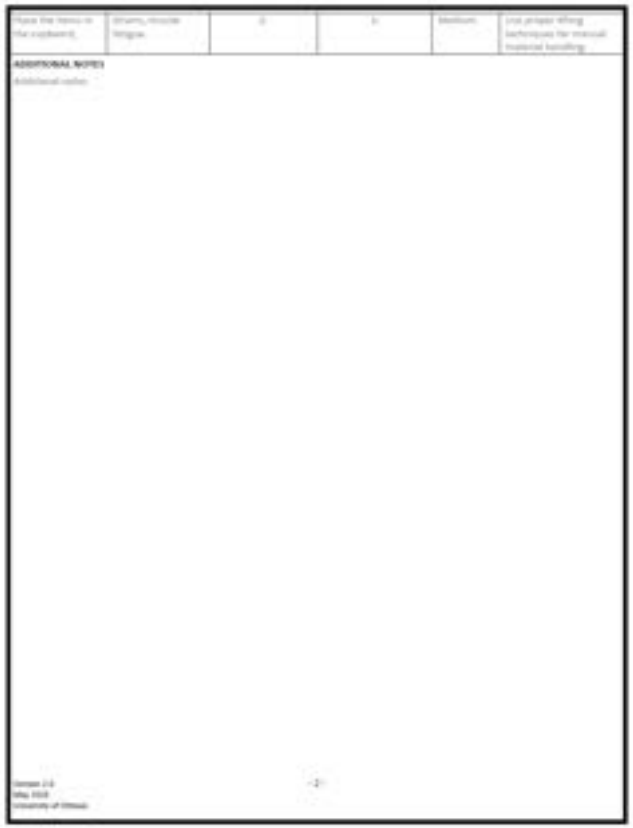
Project Hazard/ Risk Assessment Form

- Template available for general projects; intended to assist users in identifying existing hazard

- Complete before start of project with help of supervisor and technical officer.


Project Hazard Analysis – University of Ottawa



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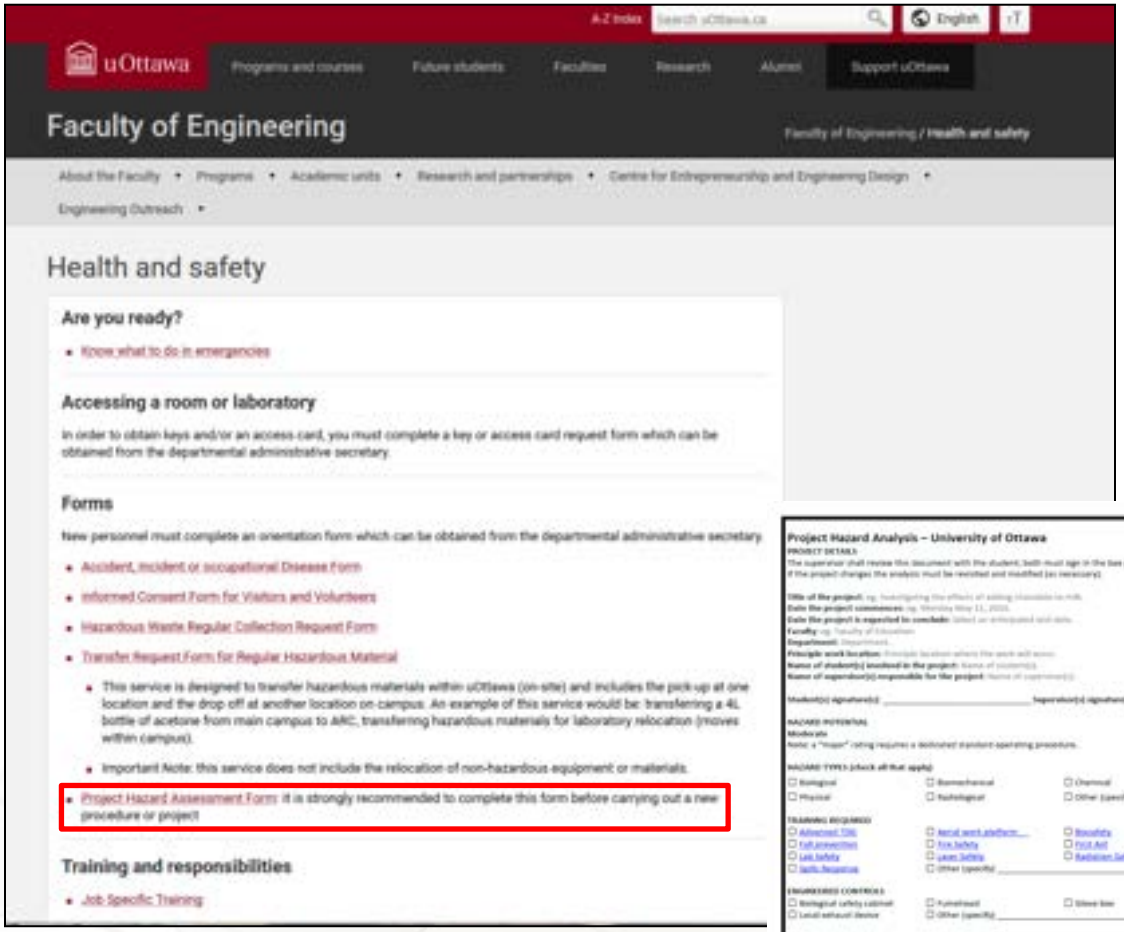
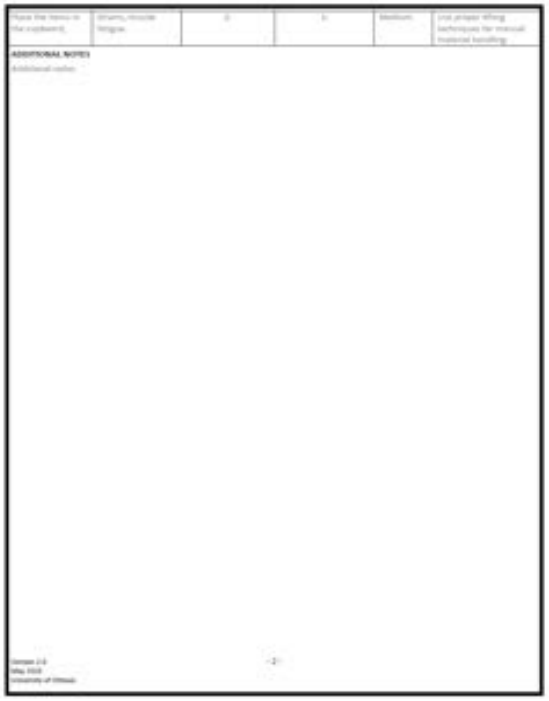
Project Hazard/ Risk Assessment Form





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Specific Projects

- Some project may require special measures; for example:
  - clearing of the areas during testing.
  - special access to the lab to observe projects.

- Respect your colleagues' projects – work together.

Emergency Situations

- It is not the primary responsibility of Protection Services / Physical Resources Service / Office of Risk Management to save your research project (People, Property, Environment).

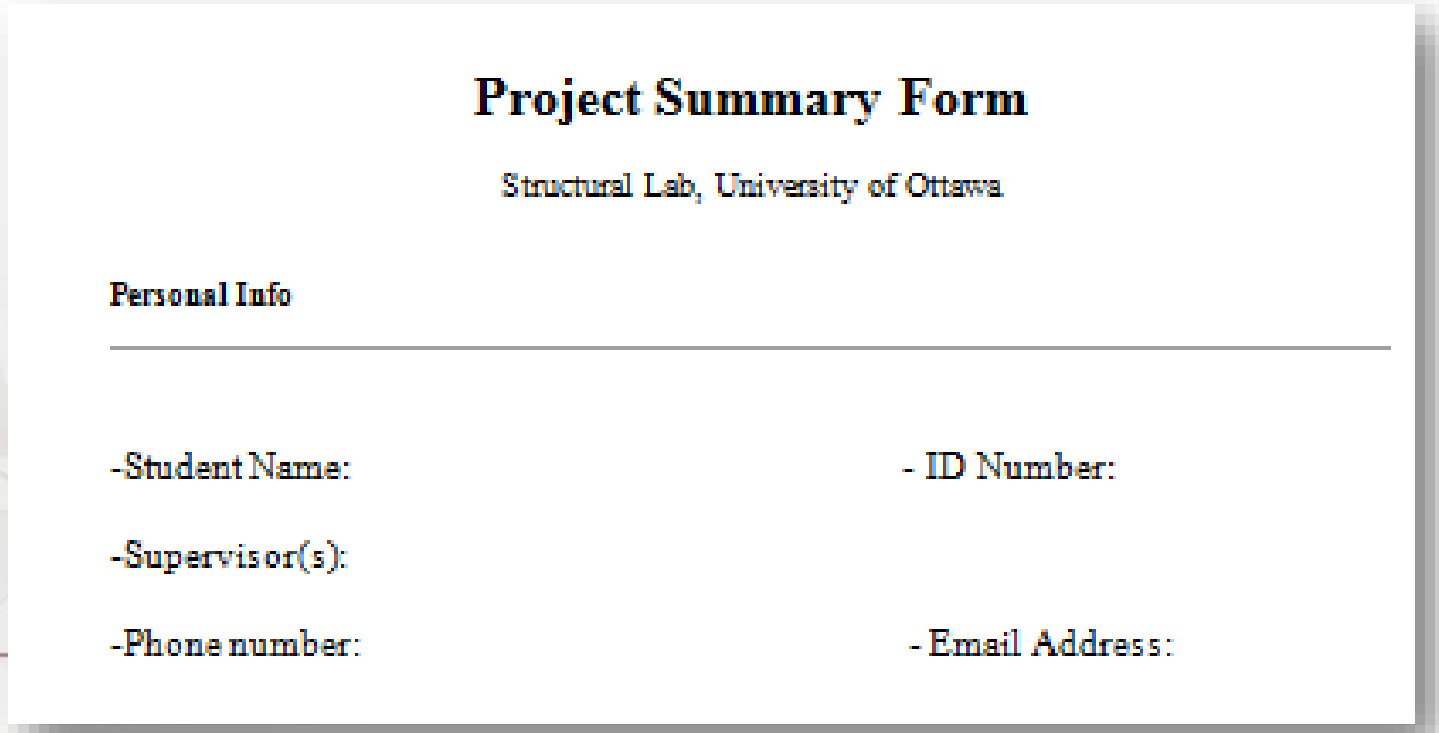
- Every effort will be made to minimize impacts on your project – however there may be situations where this is not possible / more information is required.

- Examples: major flooding, fire, vandalism, etc.

- Leave contact information and / or instructions in the event of an emergency

Project summary form

- Recommended to leave a project summary form near your test specimen(s) / project.



Project Summary Form

Structural Lab, University of Ottawa

Personal Info

-Student Name: - ID Number:

-Supervisor(s):

-Phone number: - Email Address:

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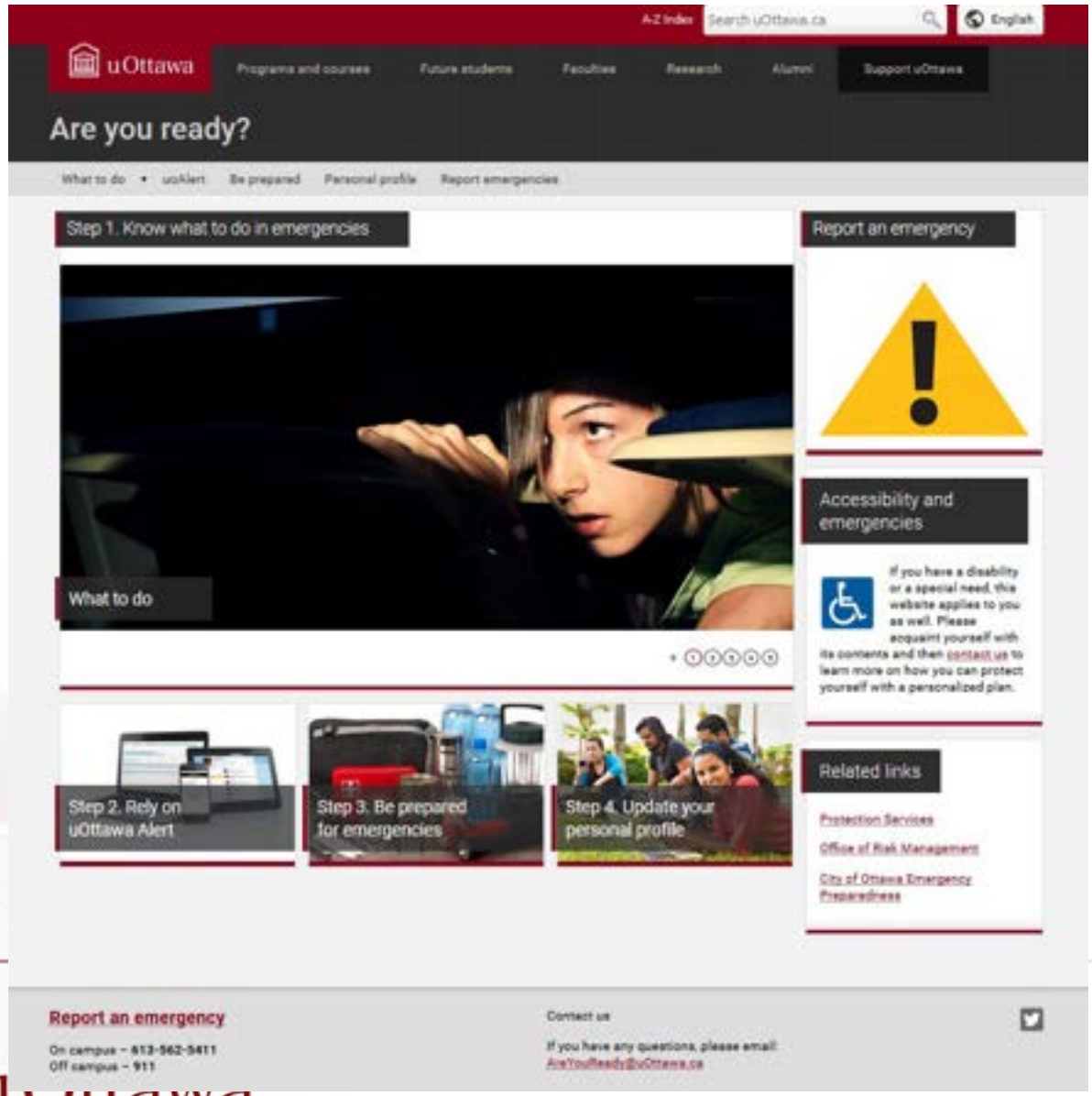
Before Leaving the Lab

- Turn off
  - ✓ Gas
  - ✓ Water
  - ✓ Power lines
  - ✓ Other non necessary equipment
- Clean your work area
- Return ALL chemicals to storage
- Lower fume hood sash
- Wash your hands
- Check overnight operations:
  - ✓ Supplies are sufficient
  - ✓ Waterlines are adequately clamped & if water is left running, **ensure appropriate containers are in place**
  - ✓ Description of the process posted
  - ✓ Emergency contacts posted

What to do in emergencies at uOttawa



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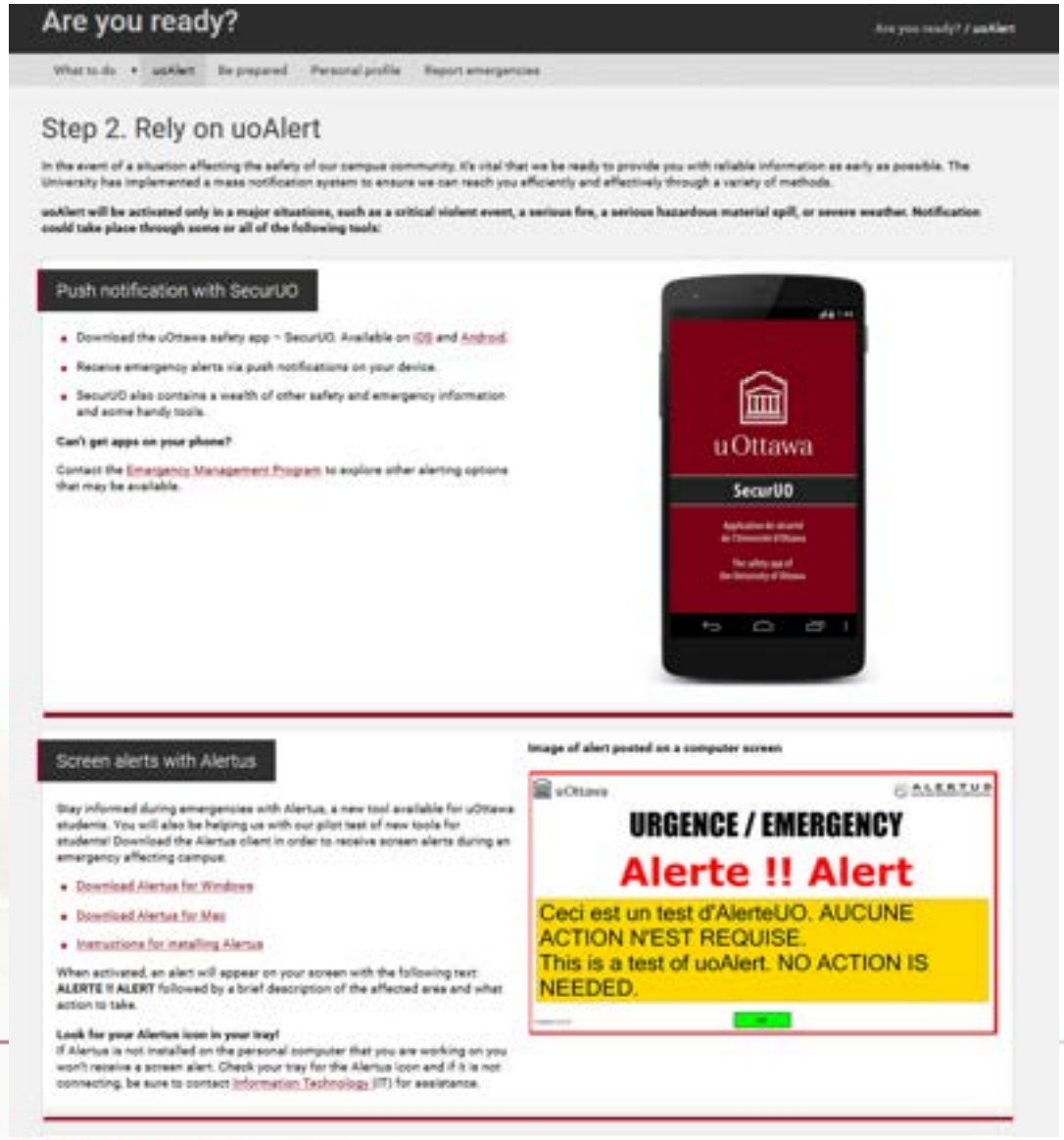
What to do in emergencies at uOttawa (cont'd.)



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Accidents / Incidents

- **Accident** – events causing injury, illness (or even death), or involving exposure(s), either acute or chronic, to harmful substances.

- **Incident** – event resulting in damage, or potential damage to property and/or the environment (such as a fire, spill, breakage, etc.).

- **Occupational illness** – a health problem or illness caused by exposure to a workplace health hazard, either acute or chronic.

Reporting of Accident / Incidents

- Report to your supervisor.
- If immediate threat, contact Protection Services (x**5411**).
- Complete the Accident / Incident / Occupational Illness form https://web30.uottawa.ca/v3/riskmgmtfrm/aioreport.aspx?lang=en, (**EVEN IF PROTECTION IS CONTACTED and ATTENDS THE SITE OF THE INCIDENT/ACCIDENT**) and submit the completed, printed, and signed form to the Health, Wellness and Leave sector within 24 hours of the incident
- Critical injuries – contact Protection **IMMEDIATELY!**

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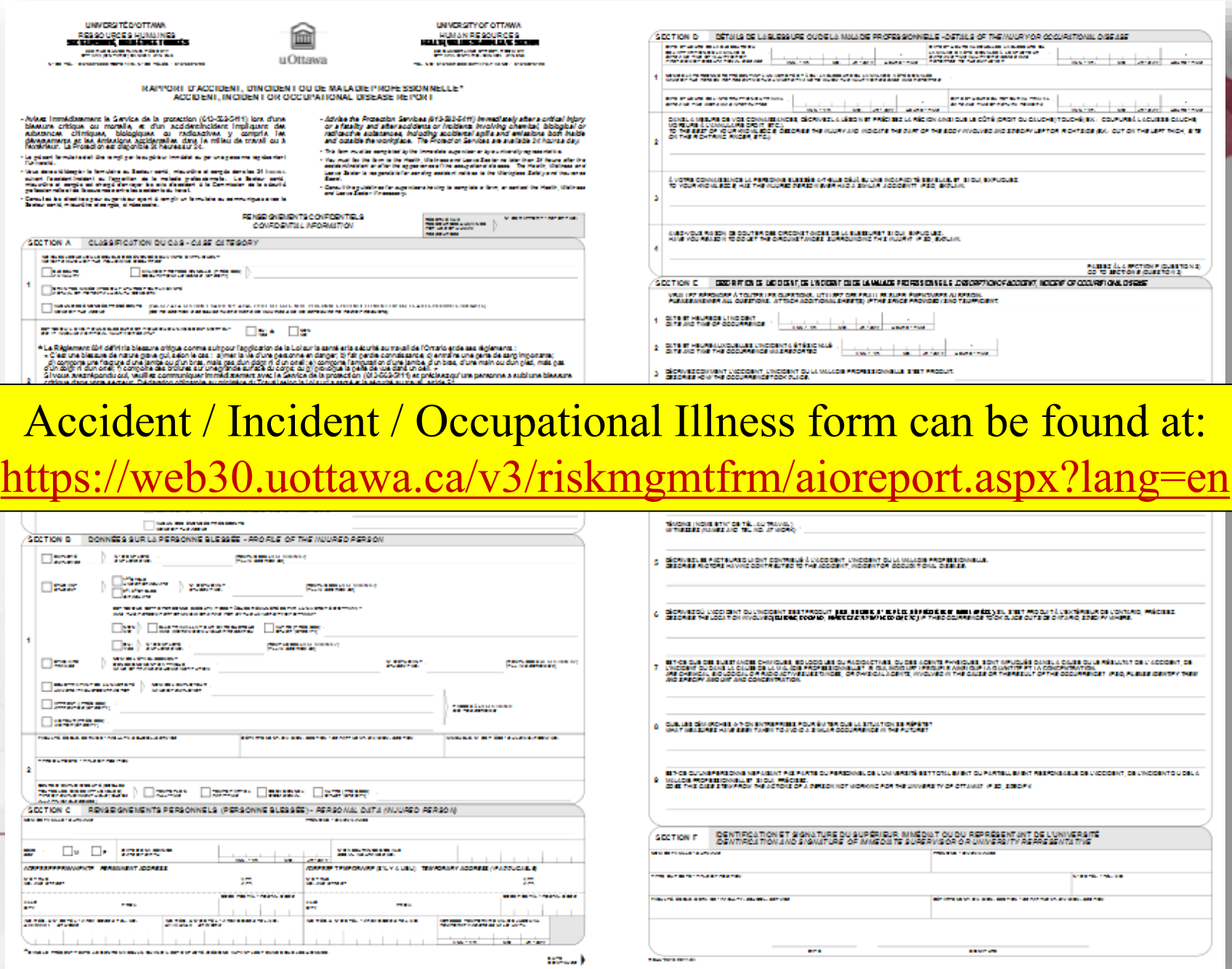
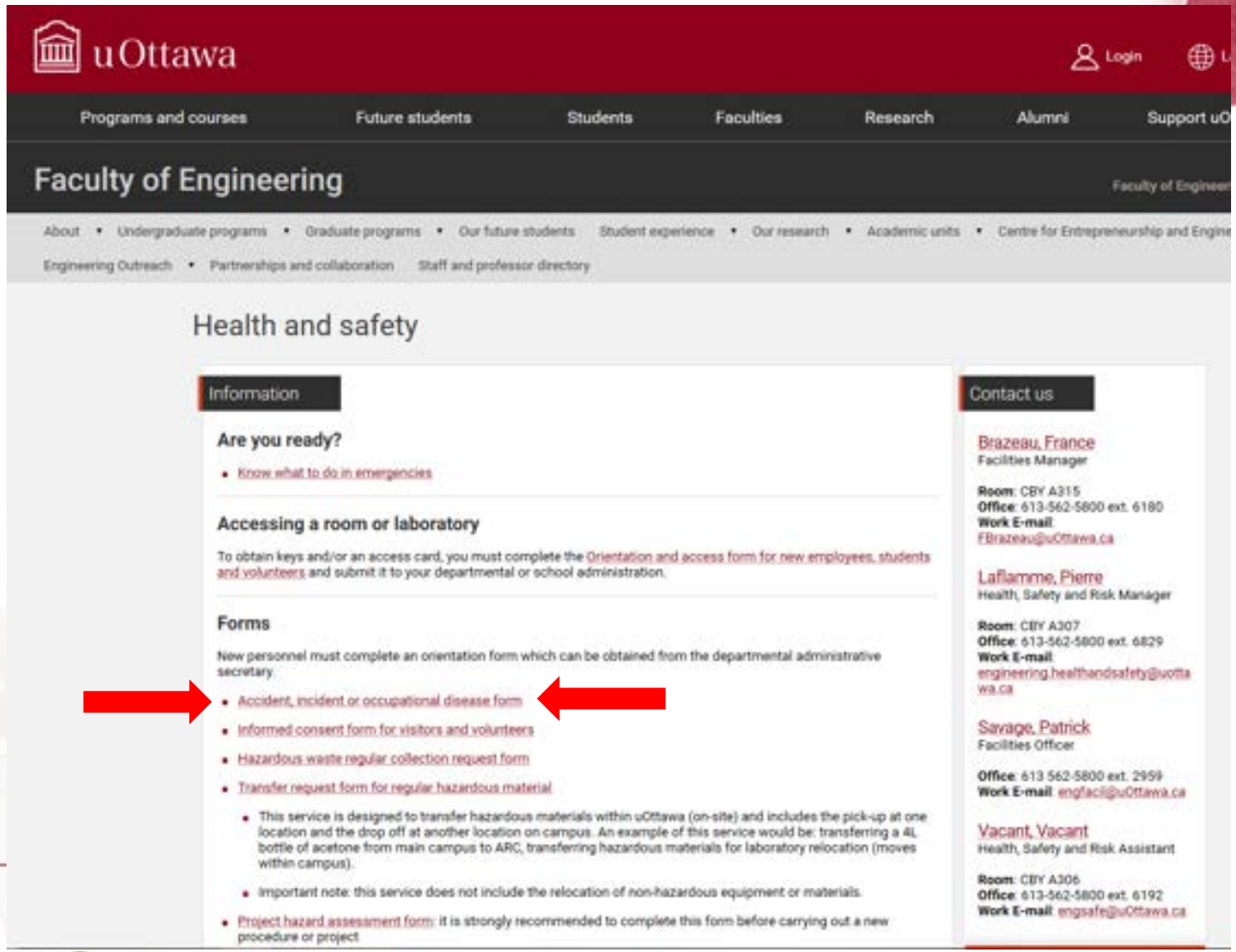


Accident / Incident / Occupational Illness form can be found at:
https://web30.uottawa.ca/v3/riskmgmtfrm/aioreport.aspx?lang=en

Accident/ Incident/ Occupational Illness Form



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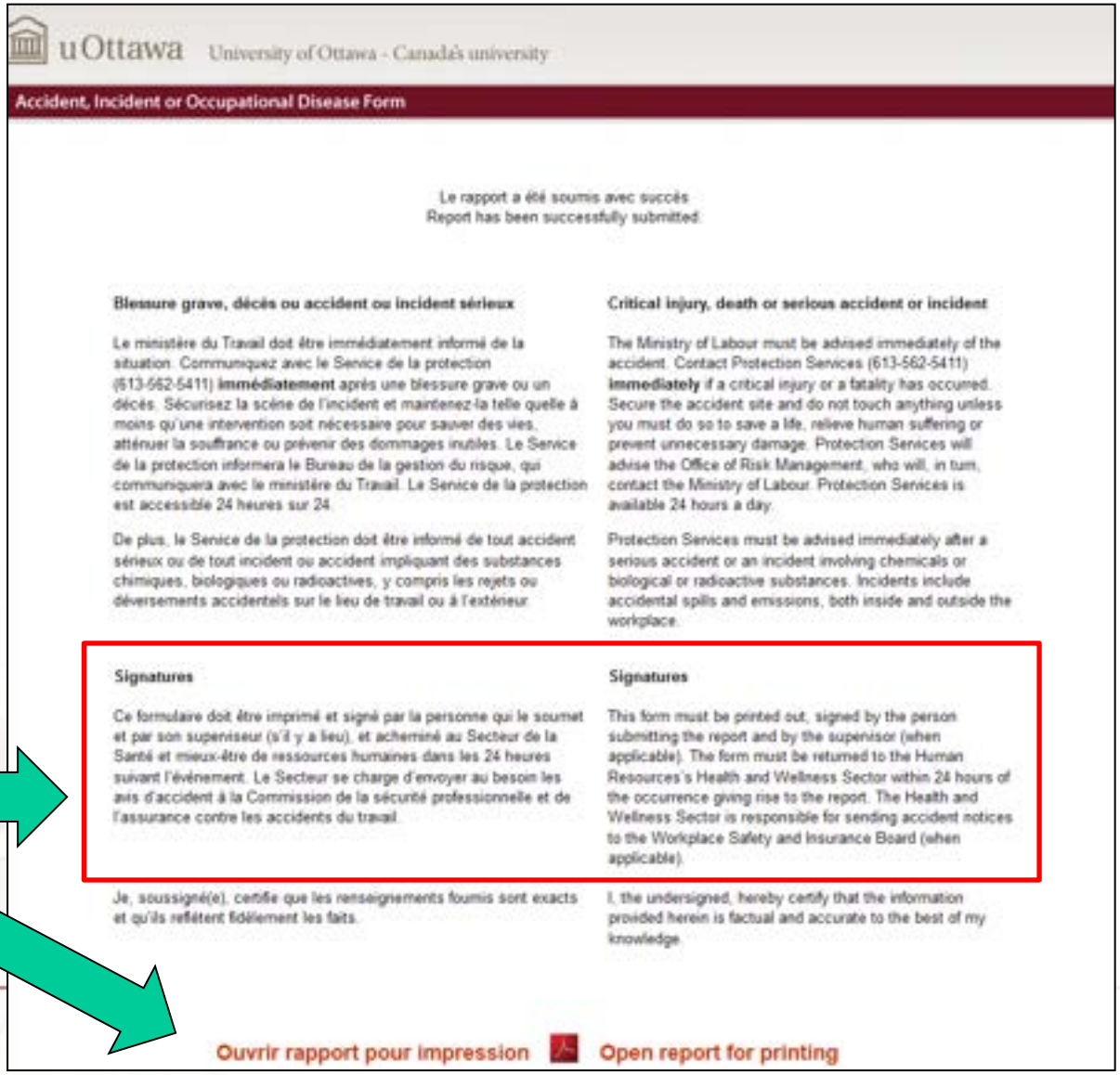
Accident/ Incident/ Occupational Illness Form



uOttawa University of Ottawa - Canada's university

Accident, Incident or Occupational Disease Form

Le rapport a été soumis avec succès
Report has been successfully submitted.

Blessure grave, décès ou accident ou incident sérieux

Le ministère du Travail doit être immédiatement informé de la situation. Communiquez avec le Service de la protection (613-562-5411) **immédiatement** après une blessure grave ou un décès. Sécurisez la scène de l'incident et maintenez-la telle quelle à moins qu'une intervention soit nécessaire pour sauver des vies, atténuer la souffrance ou prévenir des dommages inutiles. Le Service de la protection informera le Bureau de la gestion du risque, qui communiquera avec le ministère du Travail. Le Service de la protection est accessible 24 heures sur 24.

De plus, le Service de la protection doit être informé de tout accident sérieux ou de tout incident ou accident impliquant des substances chimiques, biologiques ou radioactives, y compris les rejets ou déversements accidentels sur le lieu de travail ou à l'extérieur.

Critical injury, death or serious accident or incident

The Ministry of Labour must be advised immediately of the accident. Contact Protection Services (613-562-5411) **immediately** if a critical injury or a fatality has occurred. Secure the accident site and do not touch anything unless you must do so to save a life, relieve human suffering or prevent unnecessary damage. Protection Services will advise the Office of Risk Management, who will, in turn, contact the Ministry of Labour. Protection Services is available 24 hours a day.

Protection Services must be advised immediately after a serious accident or an incident involving chemicals or biological or radioactive substances. Incidents include accidental spills and emissions, both inside and outside the workplace.

Signatures

Ce formulaire doit être imprimé et signé par la personne qui le soumet et par son superviseur (s'il y a lieu), et acheminé au Secteur de la Santé et mieux-être de ressources humaines dans les 24 heures suivant l'événement. Le Secteur se charge d'envoyer au besoin les avis d'accident à la Commission de la sécurité professionnelle et de l'assurance contre les accidents du travail.

Signatures

This form must be printed out, signed by the person submitting the report and by the supervisor (when applicable). The form must be returned to the Human Resources's Health and Wellness Sector within 24 hours of the occurrence giving rise to the report. The Health and Wellness Sector is responsible for sending accident notices to the Workplace Safety and Insurance Board (when applicable).

Je, soussigné(e), certifie que les renseignements fournis sont exacts et qu'ils reflètent fidèlement les faits.

I, the undersigned, hereby certify that the information provided herein is factual and accurate to the best of my knowledge.

Ouvrir rapport pour impression | Open report for printing

Important!

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Reporting of Accident / Incidents (cont.)

- All accidents, incidents, and occupational illnesses (including spills) must be followed-up on.

- Supervisors must:
  - investigate the incident,
  - determine the root cause, and
  - ensure that appropriate control measures are implemented and / or revised (as appropriate).

Spills

- Must be safely cleaned and reported. Supplies used will be replenished if reported using the uOttawa spill form.

- Any product used in the lab should be able to be cleaned up by those working in the lab.

- If a spill clean-up is beyond the capabilities of the lab personnel, or the spilled material is not known, contact Protection Services at ext. **5411** for assistance.

Spill Kits

- Be adequate for your spill (plan for worst-case scenario)

- Where are they?
  - Should be hung on the wall near the entrance door
- **Important to take Spill Response training* to learn about:**
  - What's inside
  - How to use it
  - What to do with it after it's been used

*** Spill Response training: for more info, see**
https://orm.uottawa.ca/environmental-management/hazardous-materials-technical-services

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First Aid

- Designated personnel throughout all buildings.
- Locate the nearest stations and trained personnel close to you.
- If a situation is beyond the capabilities of a first aider, or no first aider is available, contact Protection Services at ext. **5411**.

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Emergency Equipment

- Eyewash station.
- Emergency showers.
- First aid kits.
- Spill kits.
- Fire extinguishers.

- Access to these areas must be kept as clear as possible.
- Activation of these installations requires that a report be submitted.

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Would you use this eyewash station?

Source: https://ohsinsider.com/spot-the-safety-violation-would-you-wash-out-your-eyes-here/

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Risks due to Hazardous Materials

- Compressed Gases
- Flammable and Combustible
- Oxidizers
- Toxic
- Corrosive
- Reactive
- Nanoparticles

GHS (Globally Harmonized System)/
(target date for implementation in Canada: June 1, 2015)

"WHMIS 2015"

- Goal:
  - the same set of rules for classifying hazards, and the same format and content for labels and safety data sheets (SDS) will be adopted and used around the world.
- Benefits:
  - Promoting regulatory efficiency.
  - Facilitating trade.
  - Easing compliance.
  - Reducing costs.
  - Providing improved, consistent hazard information.
  - Encouraging the safe transport, handling and use of chemicals.
  - Promoting better emergency response to chemical incidents.
  - Reducing the need for animal testing.

[Ref.: http://www.ccohs.ca/oshanswers/chemicals/ghs.html]

SDS (MSDS) *Should not be older than 3y*

THE CLOROX COMPANY

SAFETY DATA SHEET

Issuing Date January 5, 2015 **Revision Date** June 12, 2015 **Revision Number** 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product Name Clorox® Regular-Bleach1

Other means of identification

EPA Registration Number 5813-100

Recommended use of the chemical and restrictions on use

Recommended use Household disinfecting, sanitizing, and laundry bleach

Uses advised against No information available

Details of the supplier of the safety data sheet

Supplier Address
The Clorox Company
1221 Broadway
Oakland, CA 94612

Phone: 1-510-271-7000

Emergency telephone number

Emergency Phone Numbers For Medical Emergencies, call: 1-800-446-1014
For Transportation Emergencies, call Chemtrec: 1-800-424-9300

Section 1- Identification

Section 2- Hazard Identification

Section 3- Composition/Information on Ingredients

Section 4- First Aid Measures

Section 5- Fire Fighting Measures

Section 6- Accidental Release Measures

Section 7- Handling and Storage

Section 8- Exposure Control/ Personal Protection

Section 9- Physical and Chemical Properties

Section 10 – Stability and Reactivity

Section 11- Toxicological Information

Section 12- Ecological Information

Section 13- Disposal Considerations

Section 14- Transport Information

Section 15- Regulatory Information

Section 16- Other Information

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uOttawa Office of Risk Management (ORM):
http://www.uottawa.ca/services/ehss/msds.htm

WHMIS 1988 vs. WHMIS 2015 Symbols

[Source: workplacesafetynorth.ca]

WHMIS 1988 Hazard Class	WHMIS 1988 Symbols	WHMIS 2015 Symbols	WHMIS 2015 Hazard Class
A			**Gas Cylinder** Gas Under Pressure
B Division 1 to 6			**Flame** Flammable, Self-reactive, Pyrophoric, Self-heating, In Contact with Water Emits Flammable Gases, Organic Peroxide
C			**Flame Over Circle** Oxidizing Gases, Liquids, Solids
D1			**Skull and Crossbones** Acute Toxicity (fatal or toxic) **Exclamation Mark** Irritation (skin or eyes), Respiratory or Skin Sensitization, Specific Target Organ Toxicity
D2			**Health Hazard** Carcinogenicity Mutagenicity Reproductive Hazards **Exclamation Mark** - same as above
D3			**Biohazardous Infectious Materials**
E			**Corrosion** Skin/Eye Corrosion/Irritation Corrosive to Metals
F			**Exploding Bomb** Self-reactive, Explosive, Organic Peroxide
N/A	N/A		**Health Hazard** Aspiration Hazard, Specific Target Organ Toxicity (Single Exposure, Repeated Exposure)
N/A	N/A	Appropriate symbol required	Physical Hazards Not Otherwise Classified, Health Hazards Not Otherwise Classified

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WHMIS 2015 Labels

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Proper (WHMIS) labels

NOT ACCEPTABLE!
DOES NOT MEET WHMIS STANDARDS

To comply, workplace labels must have:

1. Product Identifier
7. Safe Handling Precautions
8. Reference to SDS

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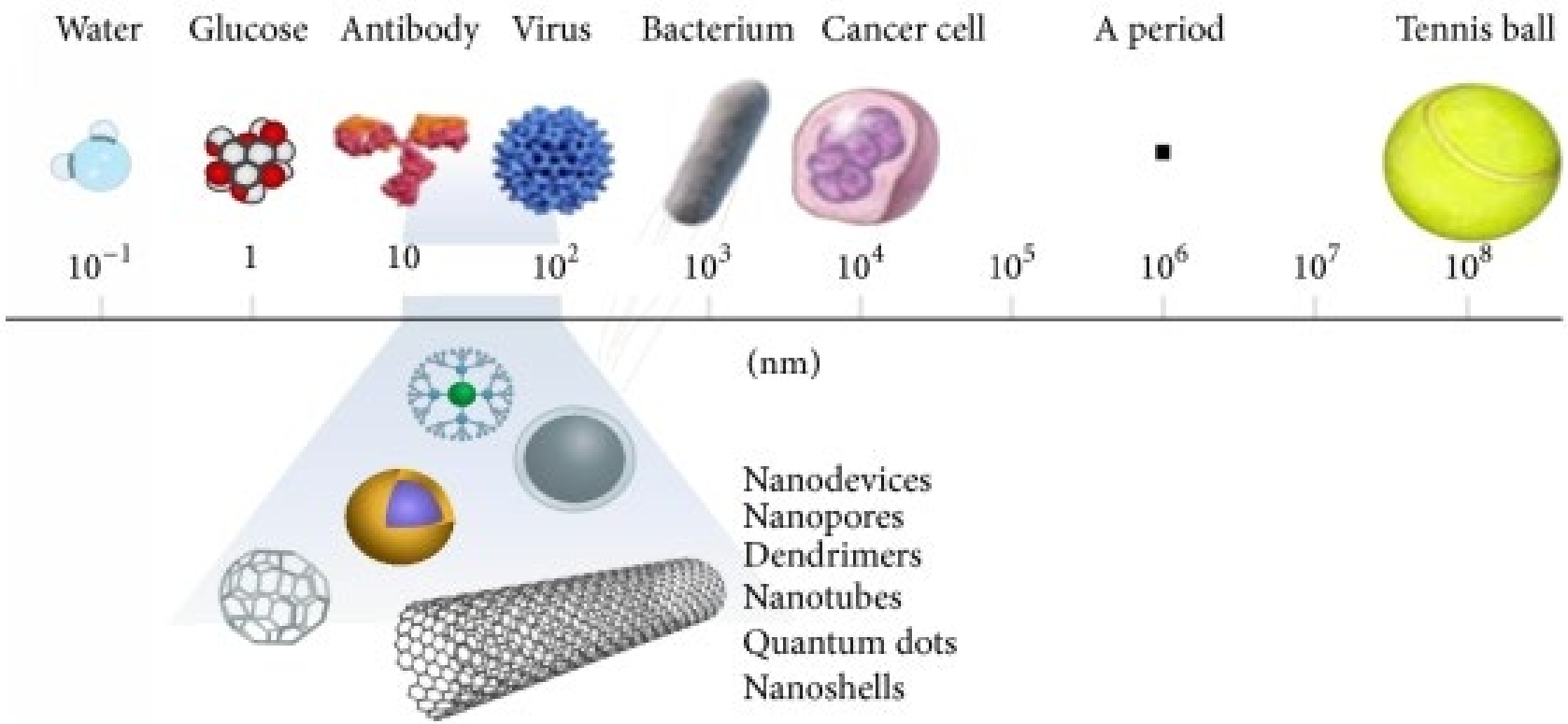
General Rules for Handling Hazardous Materials

- All Containers, pipes, process vessels and storage areas must be labeled
- All labels must identify the product and hazards associated with its use
- Read the label at least three times before using the products
  - when removing from storage
  - before opening the container
  - before actual usage
- Inventory:
  - Date containers when opening for the first time
  - Maintain up to date inventory *
  - Regularly dispose of surplus materials
  - Keep on hand only those products that you have room to store properly
- Stick to the procedures
- Keep your workplace neat and organized
- Develop an attitude of safety awareness

Nanomaterials

- Invisible to the naked eye (like a virus particle)
- Hazards not all clearly identified & understood
- Take extra precautionary measures for **full** protection:
  - work in fume hood, wear safety goggles, face mask (N95), lab coat, gloves



[Source: https://www.researchgate.net/figure/A-size-comparison-of-nanoparticle-with-other-larger-sized-materials_fig3_275064304]

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Hydrofluoric (HF) acid

Safety Slide 1 – Hydrofluoric (HF) Acid Hazards

Note the flame pattern on my left leg caused by the splatter from acid hitting my right leg.

Right leg showing burns (white is calcium gluconate).

Used for etching of Si or SiO_2

$Si + 4HNO_3 \rightarrow SiO_2 + 2H_2O + 4NO_2$

$SiO_2 + 6HF \rightarrow H_2SiF_6 + 2H_2O$

- HF is less dissociated than most acids and deeply penetrates the skin.
- Symptoms of exposure may be delayed for up to 24 hours, even with dilute solutions.
- HF burns affect deep tissue layers, are extremely painful, and disfiguring.
- The highly reactive fluoride ion circulates throughout the body and can cause multiple organ toxicity, including heart arrhythmias and death, if not treated.

http://www.emsworld.com/web/online/Education/Hydrofluoric-Acid-/5$12949
http://www.oseh.umich.edu/guidelines/hashp.shtml
http://ehs.mit.edu/site/content/hydrofluoric-acid

1

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[Source: http://web.mit.edu/cohengroup/safety/hf020911.pdf]

Rules for Handling Compressed Gases

- **Gas cylinders must be properly secured**.
- When no longer in use or during transport - shut valves, relieve gas in regulator, remove regulator and cap.
- Gas cylinders must be labeled like all other containers
- Corroded lecture bottles or cylinders should not be stored or used.
- Check hoses, tubing and regulators daily.
- Return empty cylinders ASAP – gain lab space!
- Mark empty gas cylinders as "EMPTY"
- **NO propane indoors!**

  (CSA B149.2-10)

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Cylinders on the loose

Source: https://www.youtube.com/watch?v=Q1auoy_6C6Y&feature=youtu.be

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DIY: Mixing Compressed Gases/ U of Hawaii/ March 3,2016

[Source: http://cen.acs.org/articles/94/web/2016/04/Spark-pressure-gauge-caused-University.html]

70% Hydrogen,
25% Oxygen,
5% Carbon Dioxide

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Chemical Storage

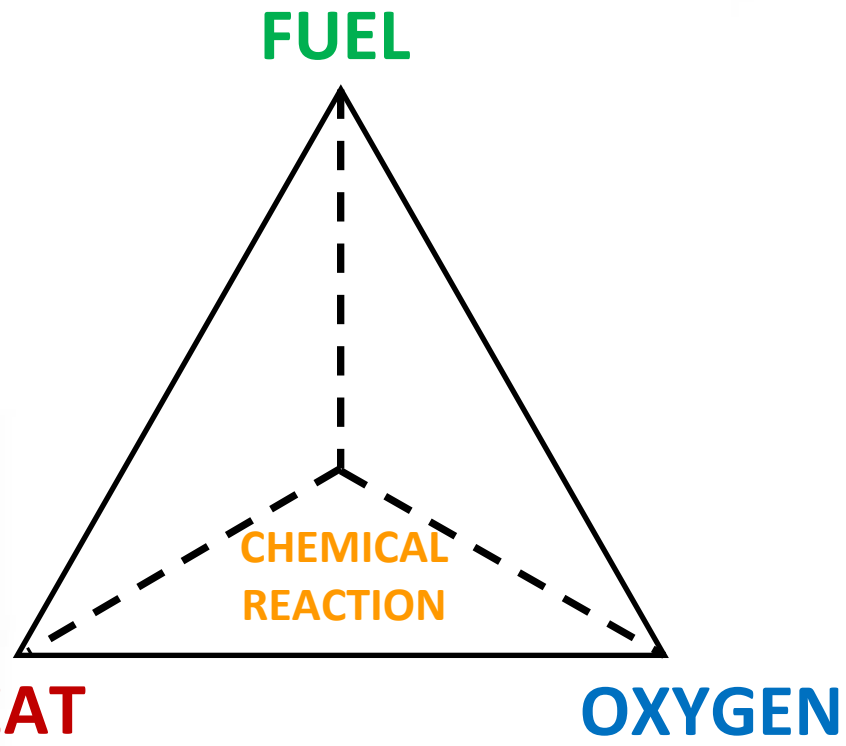
- **Not all chemicals can be stored together**
  (e.g. oxidizers & flammables)
- Respect the chemical.
- Verify its properties and CURRENT MSDS prior to using it (MSDS must be from last 3 years) – MSDS available online: Engineering Health & Safety website; ORM
- Hard copies
- WHMIS training
- **Do not store chemical products in your locker.**
- Follow department rules as to what can and cannot be brought into the building (including building materials, tools, personal items, etc.).
- Only stock what you need – excess material creates extra work / potential fire load.

FIRE PREVENTION AT WORK

- EXITS – keep pathways clear
  - Clearances, Signage, Emergency Lighting
- FLAMMABLE LIQUIDS
  - Fire rated storage, clean up leaks & spills
- VENTILATION of fume sources
  - Battery banks, motorized equipment, backup generators, fuel or paint storage
- SAFETY PROCEDURES
  - Equipment, welding, soldering, electronics
- EXTINGUISHERS
  - Must be in plain view, of the appropriate type and **FREELY ACCESSIBLE (24/7)**
  - Of adequate capacity, checked monthly

METHODS OF EXTINGUISHING – FIRE TETRAHEDRON

- Starvation
- Smothering
- Cooling
- Stopping the chemical chain reaction



Remove any one of these and the fire will stop

[source: https://www.ccohs.ca/teach_tools/phys_hazards/fire_safety.html]

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FIRE CLASSIFICATIONS

[https://www.ccohs.ca/teach_tools/phys_hazards/fire_safety.html]

Ordinary combustibles, such as paper, wood, most rubber, plastics and textiles. Think: A for things that make Ash when burned.

Flammable liquids, such as oil, gasoline, solvents. Think: B for things that Boil.

Energized circuits, such as all electrical equipment and computers. Think: C for things which have an electrical Current.

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FIRE CLASSIFICATIONS (cont'd)

Class D

[https://www.ccohs.ca/teach_tools/phys_hazards/fire_safety.html]

- **Class D**: Class D Extinguishers are designed for use on flammable metals and are often specific for the type of metal in question. These extinguishers generally have no rating nor are they given a multi-purpose rating for use on other types of fires.

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Fire Extinguishers

- Attend faculty training
- Extinguish fire only if feel comfortable
- ABC for regular fires
- D for metal induced fires
- Pull fire alarm

- Located next to exit, mounted to wall bracket

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UPON DISCOVERY OF FIRE

- ☑ Take your keys and immediately leave the danger area by the nearest safe exit and stairwell; **DO NOT** use elevators.
- ☑ Close all doors along the way and warn others as you encounter them.
- ☑ Activate the nearest manual fire alarm or notify Protection Services at x.5411 from a safe location.

- ☑ **ONLY AFTER** you have done the above...
  - You may make a "Fight or Flight" Analysis
  - **IF YOU HAVE ANY DOUBT - DO NOT FIGHT THE FIRE!**

- ☑ Gather at the designated meeting place outside.
- ☑ Obey all instructions from Protection Services, members of the Fire Alarm Evacuation Team ("yellow hats") or the Ottawa Fire Department.
- ☑ Re-enter the building only when the Fire Alarm Evacuation Team or Protection Services officers have authorized you to do so.

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Material(s) Storage

- Keep work areas clean.
- Be organized.
- Remove debris, scraps, shavings, swarfs, etc. frequently – do not place your hand / fingers in the operating area.
- Reduce, reuse, and recycle materials; as practical

  uOttawa Recycling Coordinator - ext. 3997.

Project Life Cycle

- Planning
- Execution
- **Clean-up**

Post-Research Activities

- Project does not cease with results – all things generate some form of waste.
- Do not leave unwanted projects behind – the student and PI are responsible to remove the experiment at the earliest convenience.
- Helps minimize clutter / historical projects and maximizes the use of the space in the lab.
- Cradle-to-grave management.

Waste & Disposal

- Almost everything generates some form of waste
  - Scrap wood
  - Concrete
  - Plaster
  - Steel
  - Old / previous year's projects

- Clean up, AND dispose of waste in an approved fashion:
  - Garbage
  - Recycling
  - Compost
  - Hazardous waste

- **NOTHING goes down the drain!**

NOTHING goes down the drain! (CBY D114)

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NOTHING goes down the drain! (STEM 0018 and 00018)

Waste & Disposal

- Someone must handle that waste after you (disposal, transport, etc.).
- Segregate AND **label** your waste (deface the current label if applicable).
- Consult the MSDS if required.

Regular waste:

- Campus pick-up are on pre-set schedule.
- Have your Departmental Admin. contact ext. 2222 for special and / or large requests.

Waste & Disposal (cont'd)

- Ensure that you label your waste containers and clearly identify the substance or material that is inside
- Add the information **ASAP** and not when you're ready to have it picked up for disposal

Faculty of Engineering:

- "Room" Service; Tuesday afternoons, from 1:30 – 4:00
- Complete on-line form found on the Faculty of Engineering/ Health & Safety website
- Questions? Contact enviro@uottawa.ca , Engineering HECHMET technician, or Faculty HSRM

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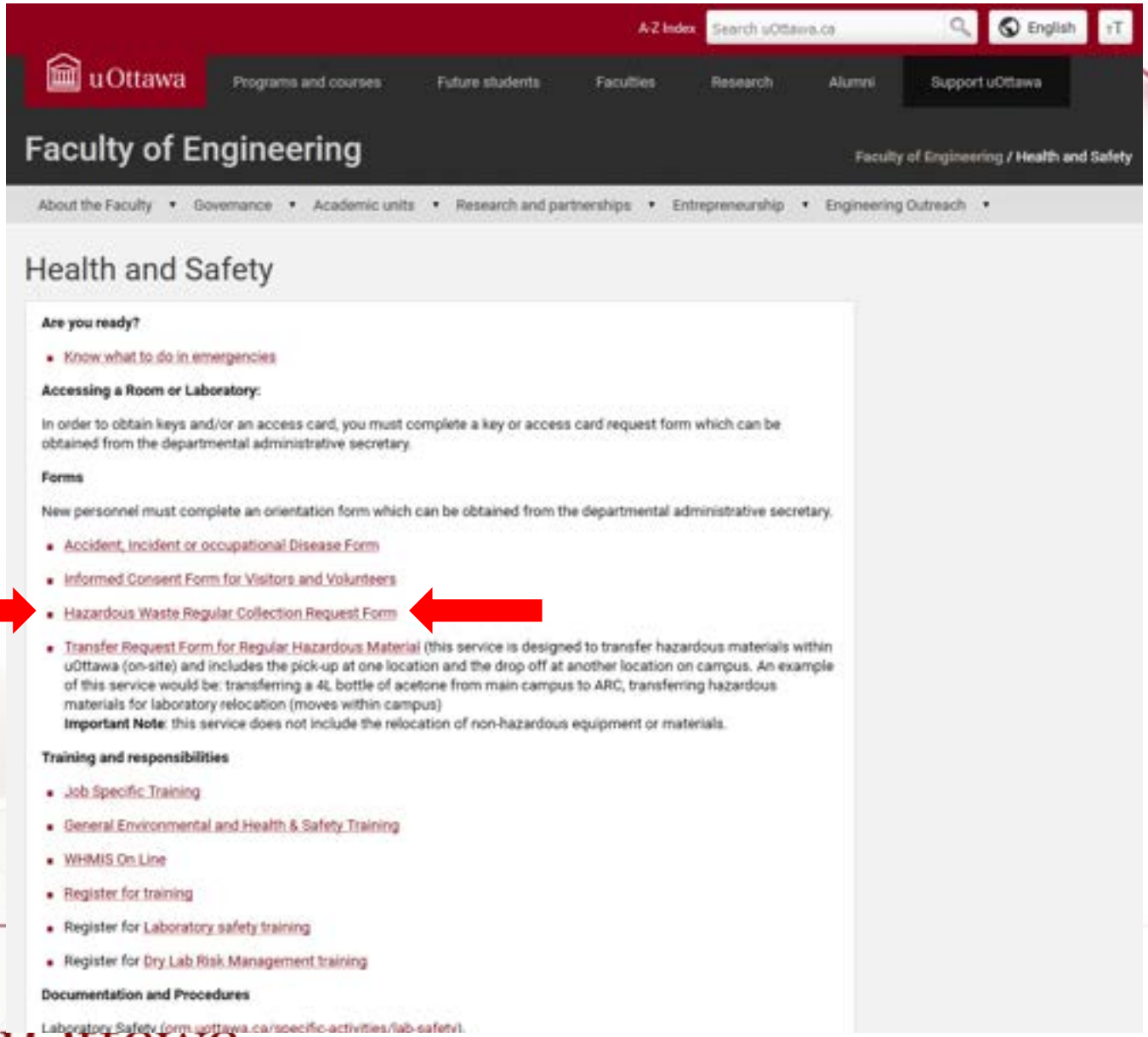
Hazardous Waste Regular Collection Request Form



A-Z Index | Search uOttawa.ca | English | rT

uOttawa | Programs and courses | Future students | Faculties | Research | Alumni | Support uOttawa

Faculty of Engineering

Faculty of Engineering / Health and Safety

About the Faculty | Governance | Academic units | Research and partnerships | Entrepreneurship | Engineering Outreach

Health and Safety

Are you ready?

- Know what to do in emergencies

Accessing a Room or Laboratory:

In order to obtain keys and/or an access card, you must complete a key or access card request form which can be obtained from the departmental administrative secretary.

Forms

New personnel must complete an orientation form which can be obtained from the departmental administrative secretary.

- Accident, Incident or occupational Disease Form
- Informed Consent Form for Visitors and Volunteers
- Hazardous Waste Regular Collection Request Form
- Transfer Request Form for Regular Hazardous Material (this service is designed to transfer hazardous materials within uOttawa (on-site) and includes the pick-up at one location and the drop off at another location on campus. An example of this service would be: transferring a 4L bottle of acetone from main campus to ARC, transferring hazardous materials for laboratory relocation (moves within campus)
  Important Note: this service does not include the relocation of non-hazardous equipment or materials.

Training and responsibilities

- Job Specific Training
- General Environmental and Health & Safety Training
- WHMIS On Line
- Register for training
- Register for Laboratory safety training
- Register for Dry Lab Risk Management training

Documentation and Procedures

Laboratory Safety (orm.uottawa.ca/specific-activities/lab-safety)

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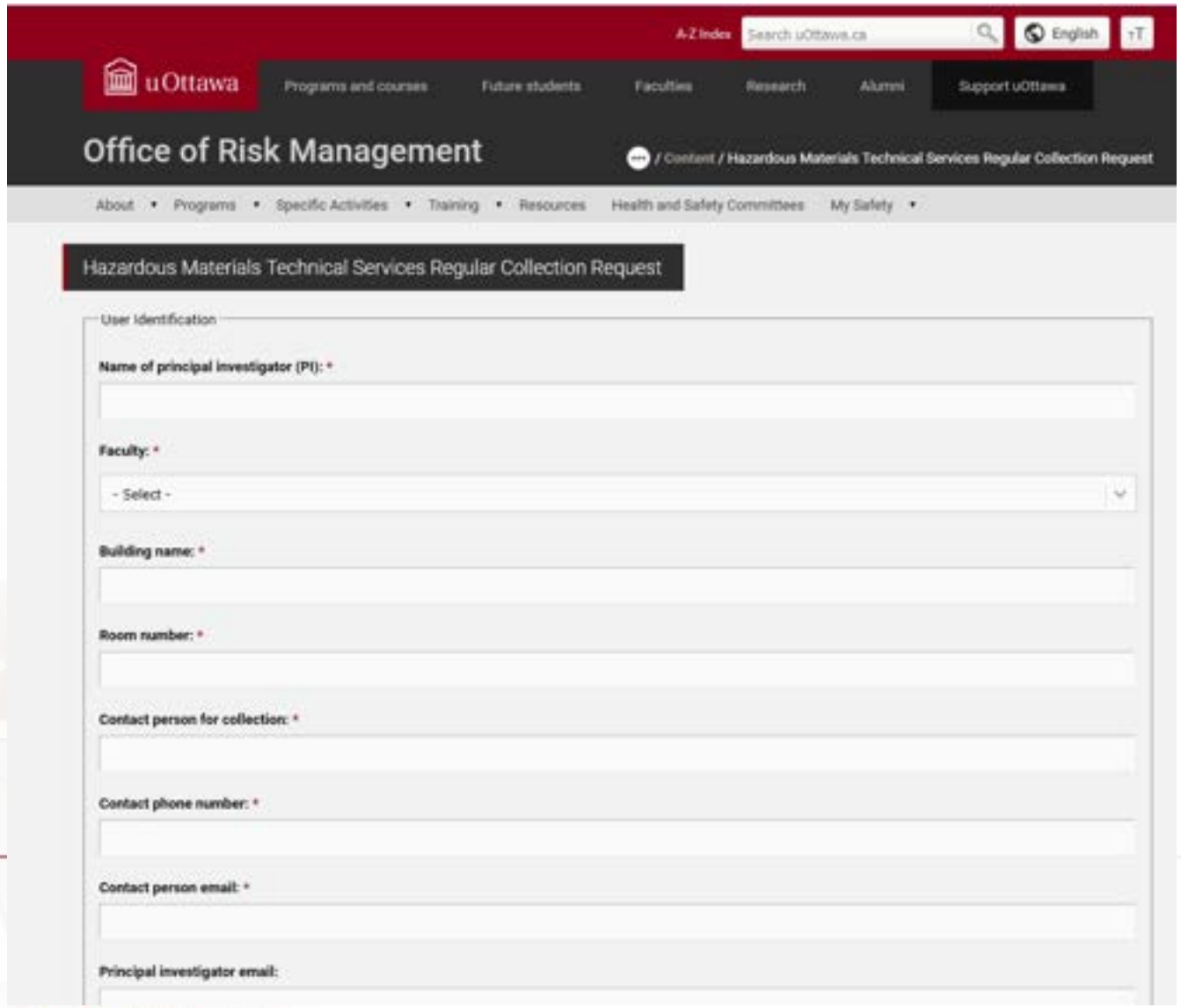
Hazardous Waste Request Form (example)

http://orm.uottawa.ca/content/services-techniques-gestion-matieres-dangereuses-demande-collecte-reguliere



Hechmet – Chemical Inventory

- All chemicals and equipment are affixed with a barcode and part of the HECHMET online inventory system, “VERTERE”
- All newly-acquired chemicals and equipment must have a barcode sticker and entered in the inventory
- Before disposing chemical containers, or equipment, remove barcode sticker and place on “ORM Barcode Disposal Sheet” usually found on the back of lab door

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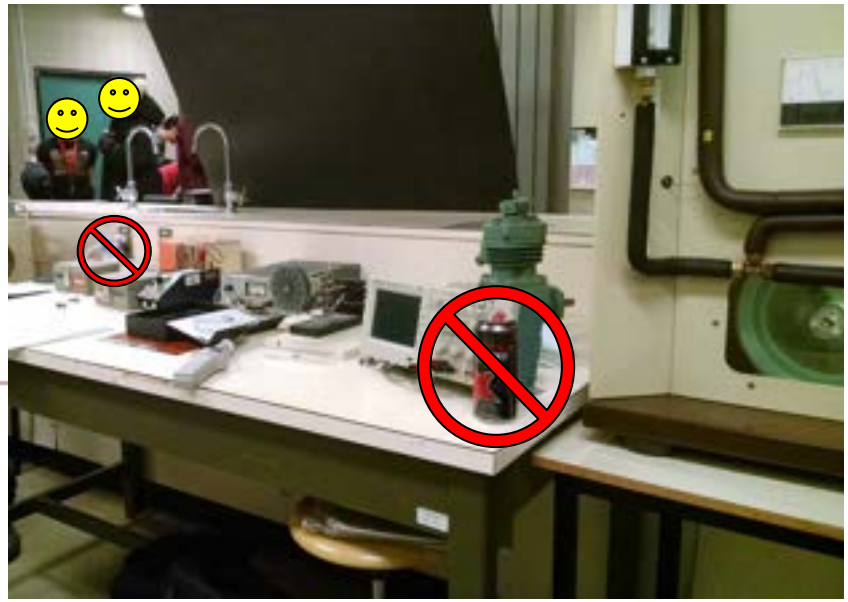
General Rules

- **NEVER** eat, smoke, or drink in a laboratory.
- On the consumption of food and drink:
  - Not to be consumed inside the lab!
  - Enclosed office within the lab is acceptable.



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General Rules (cont'd)

- **Never** store chemicals or other materials in refrigerators used for food
- **Never** store lab material/specimens in food containers, lockers, offices
- **Always use protective clothing / equipment where specified**.
- **Keep work areas clean and organized**
- **Chemical spills** should be cleaned up immediately (refer to MSDS)
- **Do NOT pour any chemicals or lab material (e.g. soil, sand) in sinks; USE appropriate containers**
- **Avoid** accumulation of rubbish that provides a ready source of fuel for fire
- **Ensure** chemicals are stored in the appropriate place, in secure containers with correct labelling (WHMIS)
- **Never** hold tools in your mouth
- **Do not wear** loose fitting garments, jewellery, hair, near moving equipment – remove jewellery prior to operating powered equipment
- **Never** use a broken, or defective tool – inform the Technical Director or your supervisor

Small Appliances

- Guideline:
https://www.uottawa.ca/facilities/sites/www.uottawa.ca.facilities/files/small-appliances-guideline-final.pdf

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End of Part 1

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Guidelines to Safe use of Tools and Equipment

PART 2

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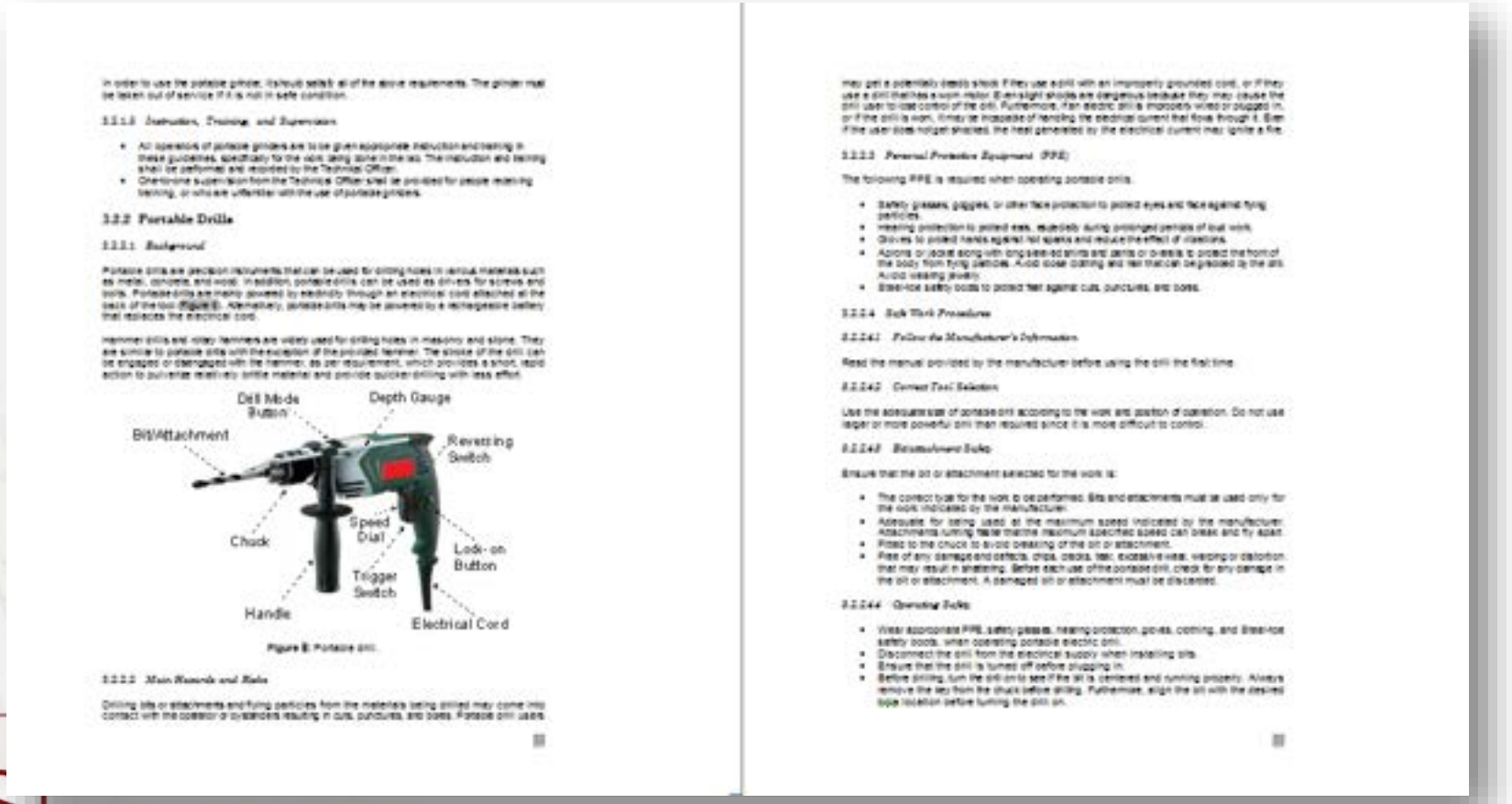
Please read safety manual

- This session only provides a brief overview, please read the details in the safety manual!



3.2.2 Portable Drills

Drill Mode Button
Depth Gauge
Bit/Attachment
Reversing Switch
Speed Dial
Chuck
Lock-on Button
Trigger Switch
Handle
Electrical Cord

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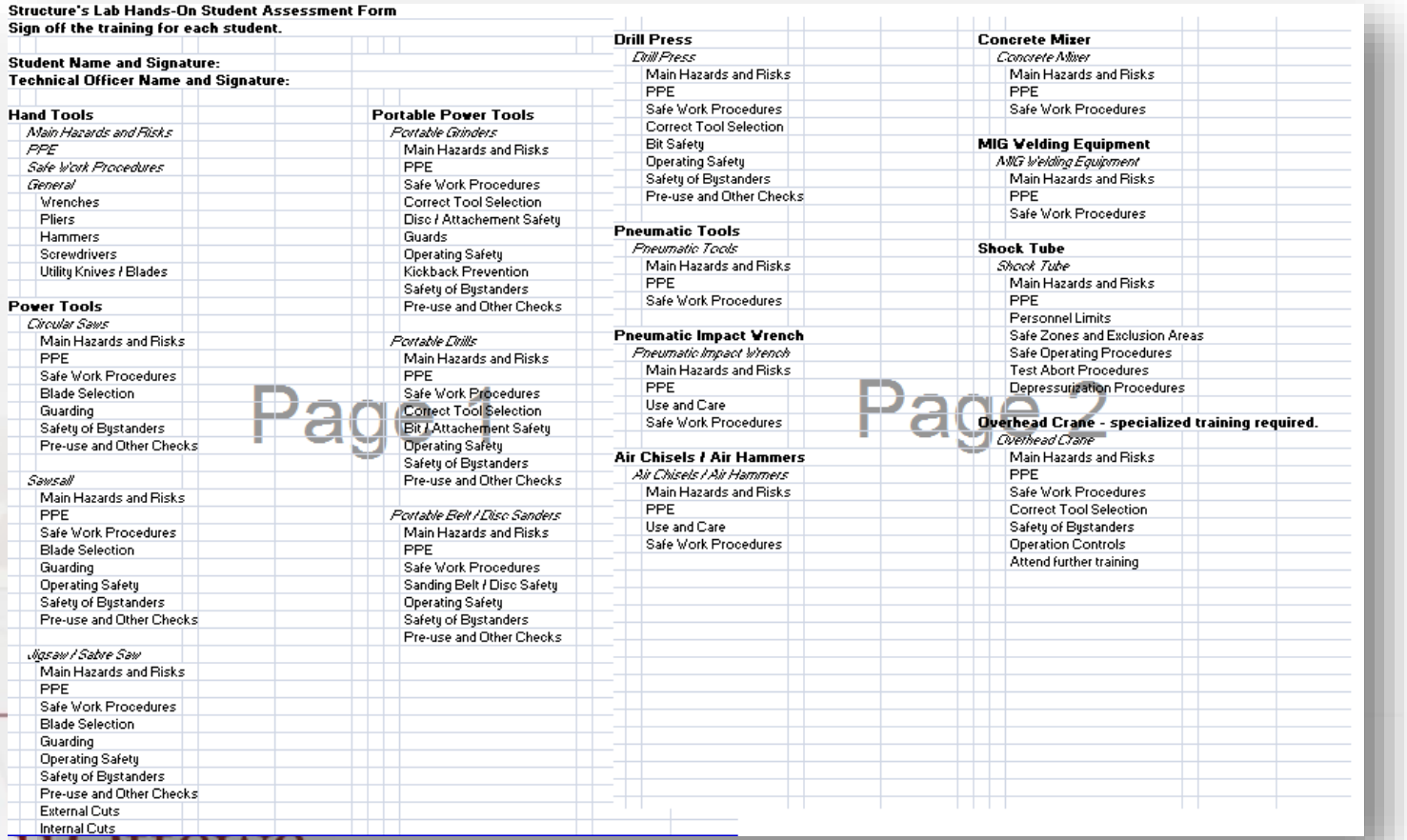
Hands-on training form

- Must complete training before using tools and equipment
- Checklist/Form for record-keeping



Structure's Lab Hands-On Student Assessment Form
Sign off the training for each student.

Student Name and Signature:
Technical Officer Name and Signature:

Hand Tools
- *Main Hazards and Risks*
- *PPE*
- *Safe Work Procedures*
- *General*
  - Wrenches
  - Pliers
  - Hammers
  - Screwdrivers
  - Utility Knives / Blades

Power Tools
- *Circular Saws*
  - Main Hazards and Risks
  - PPE
  - Safe Work Procedures
  - Blade Selection
  - Guarding
  - Safety of Bystanders
  - Pre-use and Other Checks
- *Sawsall*
  - Main Hazards and Risks
  - PPE
  - Safe Work Procedures
  - Blade Selection
  - Guarding
  - Operating Safety
  - Safety of Bystanders
  - Pre-use and Other Checks
- *Jigsaw / Sabre Saw*
  - Main Hazards and Risks
  - PPE
  - Safe Work Procedures
  - Blade Selection
  - Guarding
  - Operating Safety
  - Safety of Bystanders
  - Pre-use and Other Checks
  - External Cuts
  - Internal Cuts

Portable Power Tools
- *Portable Grinders*
  - Main Hazards and Risks
  - PPE
  - Safe Work Procedures
  - Correct Tool Selection
  - Disc / Attachement Safety
  - Guards
  - Operating Safety
  - Kickback Prevention
  - Safety of Bystanders
  - Pre-use and Other Checks
- *Portable Drills*
  - Main Hazards and Risks
  - PPE
  - Safe Work Procedures
  - Correct Tool Selection
  - Bit / Attachement Safety
  - Operating Safety
  - Safety of Bystanders
  - Pre-use and Other Checks
- *Portable Belt / Disc Sanders*
  - Main Hazards and Risks
  - PPE
  - Safe Work Procedures
  - Sanding Belt / Disc Safety
  - Operating Safety
  - Safety of Bystanders
  - Pre-use and Other Checks

Page 1

Drill Press
- *Drill Press*
  - Main Hazards and Risks
  - PPE
  - Safe Work Procedures
  - Correct Tool Selection
  - Bit Safety
  - Operating Safety
  - Safety of Bystanders
  - Pre-use and Other Checks

Pneumatic Tools
- *Pneumatic Tools*
  - Main Hazards and Risks
  - PPE
  - Safe Work Procedures

Pneumatic Impact Wrench
- *Pneumatic Impact Wrench*
  - Main Hazards and Risks
  - PPE
  - Use and Care
  - Safe Work Procedures

Air Chisels / Air Hammers
- *Air Chisels / Air Hammers*
  - Main Hazards and Risks
  - PPE
  - Use and Care
  - Safe Work Procedures

Concrete Mixer
- *Concrete Mixer*
  - Main Hazards and Risks
  - PPE
  - Safe Work Procedures

MIG Welding Equipment
- *MIG Welding Equipment*
  - Main Hazards and Risks
  - PPE
  - Safe Work Procedures

Shock Tube
- *Shock Tube*
  - Main Hazards and Risks
  - PPE
  - Personnel Limits
  - Safe Zones and Exclusion Areas
  - Safe Operating Procedures
  - Test Abort Procedures
  - Depressurization Procedures

Overhead Crane - specialized training required.
- *Overhead Crane*
  - Main Hazards and Risks
  - PPE
  - Safe Work Procedures
  - Correct Tool Selection
  - Safety of Bystanders
  - Operation Controls
  - Attend further training

Page 2

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Hand / Manual Tools

- Use the right tool for the job.
- Work areas are for work – not for horseplay.
- Broken tools must be brought to the attention of your technical officer / supervisor.
- Store tools properly and keep them maintained as required – treat them as you own.

Additional information:
http://www.ccohs.ca/oshanswers/safety_haz/hand_tools/general.html

Power Tools and Equipment

- Each has its own hazards – **a full orientation must be completed and signed off by the technical director / supervisor prior to first use**.
- Properly orient yourself to the equipment you will be using.
- If unsure, do not use equipment, and speak with your supervisor / technical director / TA.
- Do not wear jewellery or loose clothing when operating mechanical equipment; long hair must also be tied back

Mechanical Hazards

- Yale University physics student Michele Dufault died from accidental "**asphyxia due to neck compression**" when her hair became tangled in a lathe in the lab's machine shop
- The accident occurred at 2:30 a.m. while she was working alone

HIGHER EDUCATION

[*Nature* **472:**270-271 (April 21, 2011)]

A death in the lab

Fatality adds further momentum to calls for a shake-up in academic safety culture.

BY RICHARD VAN NOORDEN

In the early hours of 13 April, undergraduate students working at Yale University's Sterling Chemistry Laboratory made a shocking discovery. There in the lab's machine shop was the dead body of 22-year-old undergraduate student Michele Dufault, her hair tangled in a lathe. She had apparently died of asphyxiation in an accident described by Richard Levin, president of Yale in New Haven, Connecticut, as a "true tragedy".

ever-present tension between research freedom and safe working conditions in academia. And it underscores the slow pace of change since another high-profile laboratory fatality led to similar soul-searching less than three years ago.

In late 2008, 23-year-old research assistant Sheharbano Sangji sustained horrific burns in a lab fire at the University of California, Los Angeles (UCLA), and died of her injuries 18 days later. Sangji's death — in very different circumstances from Dufault's — resulted

(http://www.nature.com/news/2011/110418/pdf/472270a.pdf)

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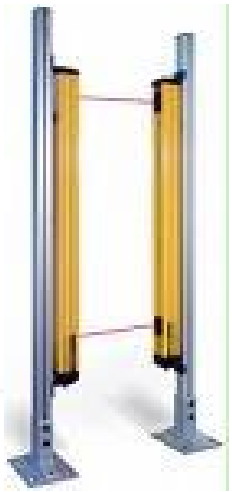
Mechanical Hazards

- Mechanical hazards such as this open drive belt must be guarded
- No loose clothing
- Tripping and slipping



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Safety Guards for Mechanical Hazards

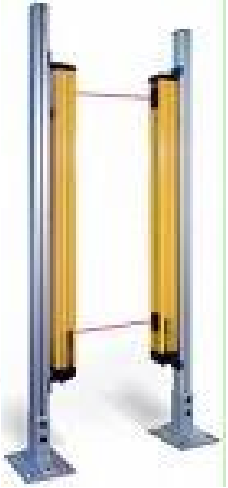
OH&S Act Reg. 851:

- **s. 25**:

  An in-running nip hazard or any part of a machine, device or thing that may endanger the safety of any worker **shall be equipped with and guarded by a guard or other device that prevents access to the pinch point**. R.R.O. 1990, Reg. 851, s. 25.

- **s. 26:**

  A machine **shall be shielded or guarded** so that the product, material being processed or waste stock **will not endanger the safety of any worker**. R.R.O. 1990, Reg. 851, s. 26.



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Emergency Stop

Ontario Regulation 851; s. 27

An emergency stop on a power-driven machine shall:

- be conspicuously identified; and
- be located within easy reach of the operator.

- Think of it as using your handbrake on your vehicle; not to be used as a regular stop.

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Lock Out / Tag Out (LOTO)

- Intended to de-energize equipment and remove all residual force – prevents accidental start-up of equipment when being serviced.

- Used primarily by Physical Resources for electrical work; however does have implications everywhere.

- uOttawa LOTO procedure under revision:

http://www.uottawa.ca/services/immeub/eng/lockout.htm

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Electrical Safety

- uOttawa guideline: https://orm.uottawa.ca/sites/orm.uottawa.ca/files/electrical-guideline.pdf
- Equipment must be approved / certified (CSA; ESA) – verify prior to purchase.
- Periodically inspect cords and plugs of equipment for damage – do not use if plugs or cords are damaged – report the damage to the technical officer / supervisor.
- Keep cords / plugs away from wet locations (water and electricity do not mix).
- All electrical equipment used in wet locations must be equipped with ground fault circuit interrupters (GFCI)
- **Circuit breaker panels** must be **easily accessible**, clearly marked, and **kept clear of items within a one-metre radius**

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Electrical Safety

[Ref.: https://www.mtccc.com/wp-content/uploads/2021/01/17_Permission_to_Show.pdf]

Electrical Safety Authority

Ontario's Electrical Product Approval Requirements

Before an electrical product or piece of electrical equipment is used, sold, displayed or advertised for sale in Ontario, it must be approved by an accredited certification or inspection body. The item must carry the official mark or label of the agency which indicate that the product has been independently assessed for safety. *See the list of recognized marks and labels on the back of this card.*

LOOK FOR THE MARK OR LABEL

before you buy, install or use an electrical product.

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Electrical Safety

[Ref.: https://www.mtccc.com/wp-content/uploads/2021/01/17_Permission_to_Show.pdf]

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Electrical Safety

Physiological Effects due to Electricity

[Ref.: 20140620- Minerva Electrical Safety Modules with logos]

- The human body must become a part of an electric circuit for a physiological effect to occur.
- There must be a current flow from one point of the body to another point of the body, i.e., not an open circuit.
- The **magnitude of current** is critical in determining the **severity**
- Phenomenon:
  - Electric stimulation of excitable tissue
  - Resistive heating of tissue
  - Electrochemical burns and tissue damage for direct current and very high voltages

Electrical Safety

Nominal Human Response to Current Magnitudes

Current (60 Hz) rms	Physiological Phenomena	Feeling or lethal incidence
< 1mA	None	Imperceptible
1 – 10 mA	Perception threshold	Mild to painful sensation
10 mA	Paralysis threshold of arms	Cannot release hand grip
30 mA	Respiratory paralysis	Stoppage of breathing, frequently fatal
75 mA	Fibrillation threshold 0.5%	Heart action discoordinated (probably fatal)
250 mA	Fibrillation threshold 99.5%	Heart action discoordinated (probably fatal)
4 A	Hearing paralysis threshold	Heart stops for duration of current passage
> 5A	Tissue burning	

** This data is approximate and based on a 68 kg person*

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Ref: R. H. Lee," The Other Electrical Hazard: Electric Arc Blast Burns," IEEE Trans. Industrial Applications, 1A-18 (3): p246, 1982

Electrical Safety

- Do not pull on cables, or create tension / stress.
- Do not connect in a series, **NO "daisy-chain"**

  (e.g. power bar, to extension cord, to outlet) = **overloading!**
- **No in-house modifications** (call 2222 for assistance from an electrican)
- Never remove the 3rd prong (grounding prong).
- Never insert a 3-prong outlet into a 2-prong receptacle (i.e. on older extension cords).
- Use polarized plugs (one bigger than the other).
- Verify with your supervisor prior to using personal electrical equipment (e.g. iPod / cell phone charger, personal heaters, etc.).
- Report any problems to your supervisor / technical director / TA.

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Pneumatic Tools & Air Gun Nozzles

- **Regulation 851** (Ontario OH&S Act & Regs)

  66. A compressed air or other compressed gas blowing device **SHALL NOT** be used for blowing dust or other substances,

  (a) from clothing worn by a worker except where the device limits increase in pressure when nozzle is blocked; or

  (b) in such a manner as to endanger the safety of any worker

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Welding Equipment

- **Hazards** – Burns, fires, intense UV light, dangerous gases, etc

***** DO NOT TOUCH HOT METAL WITH BARE HANDS *****

- **Special PPE** – Welding jacket, welding helmet with safety glasses, welding beanie, welding gloves, hearing protection, respiratory protection OR work in a well ventilated area, flash protection for bystanders, fire extinguisher
- **Training requirements –**MIG Welding Course offered by the Mechanical Engineering Machine Shop

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Concrete Mixer

- **Hazards**
  - Exposure to cement dust can irritate eyes, nose, throat and the upper respiratory system.

- **PPE/Training requirements**
  - Steel toes shoes
  - Safety goggles
  - Proper gloves
  - Mask or respirator

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Cement Dust

Hazard:

- Exposure to cement dust can irritate eyes, nose, throat and the upper respiratory system.
- Skin contact may result in moderate irritation to thickening/cracking of skin to severe skin damage from chemical burns.
- Silica exposure can lead to lung injuries including silicosis and lung cancer.

NOTE: Silica (SiO_2) is a designated substance!

(*A **designated substance** is a biological, chemical, or physical agent or combination considered so hazardous that worker exposure is prohibited, regulated, restricted, limited or controlled.* Ref.: https://www.wsps.ca/resource-hub/articles/designated-substances-how-changes-to-regulations-will-affect-you)

Solutions:

- Rinse eyes with water if they come into contact with cement dust and consult a physician.
- Use soap and water to wash off dust to avoid skin damage.
- Wear a P-, N- or R-95 respirator to minimize inhalation of cement dust.
- Eat and drink only in dust-free areas to avoid ingesting cement dust (i.e. **OUTSIDE THE LAB!)**

[Ref.: https://www.osha.gov/publications/publication-products?publication_title=concrete+manufacturing]

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Material & Concrete testing equipment

- **Hazards**
  - Concrete fragments may come into contact with the operator resulting in eye injuries, or cuts
  - other hazards: crushing, pinch-points

- **PPE/Training requirements**
  - Safety glasses, goggles, and face protection
  - Proper Gloves

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Concrete Lab Cleaning

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Concrete Lab Cleaning

- **After using the concrete mixer:**
  - Clean concrete residue from the inside of the concrete mixer
  - Clean concrete residue from wheel barrows
  - Clean and sweep the concrete lab floor area
  - Move concrete residue for drying and proper disposal
  - Place concrete cylinders/beams in appropriate storage area
  - **Do NOT pour liquid concrete in floor drain!**

- PPE:
  - Steel toe shoes
  - Proper gloves
  - Eye protection

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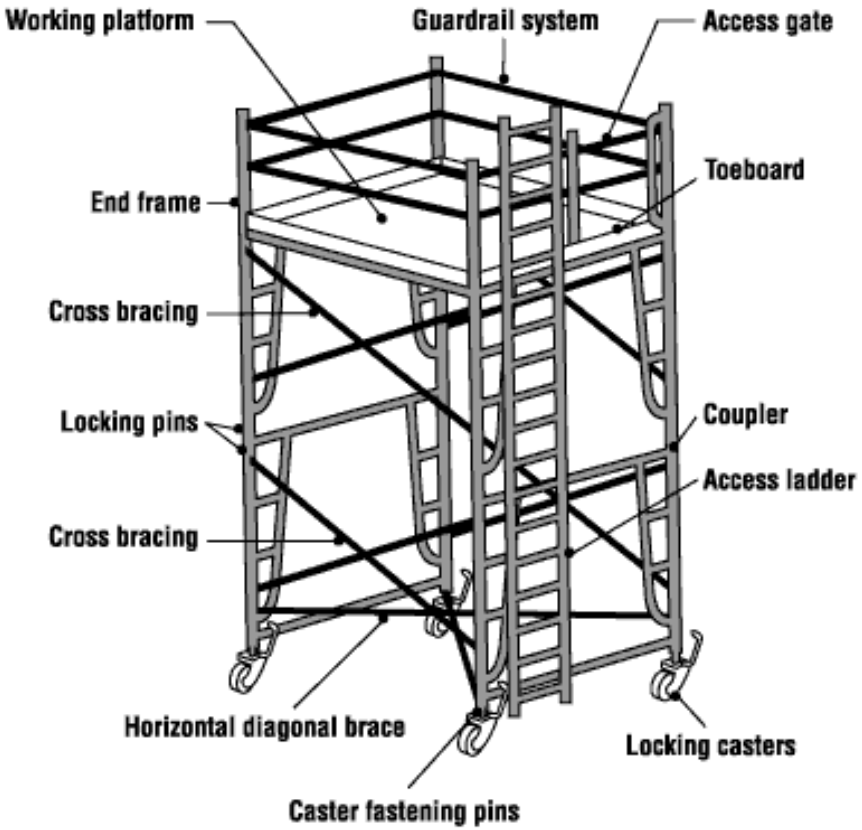
Ladder and Scaffolds

- Must receive training / instruction

- For further information consult the following links:
  - http://www.ccohs.ca/oshanswers/safety_haz/ladders/portable.html
  - http://www.ccohs.ca/oshanswers/safety_haz/platforms/scaffolduse.html



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Quiz

- To successfully complete this awareness workshop, you must log in and complete the knowledge assessment. Only then will your grade be entered in the system.

- This workshop is the first step in the training cycle. Follow your faculty requirements, including site-specific equipment training.

Thank you!

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