ELG 4912
Safety and Risk Management in Engineering: it concerns YOU!

Faculty of Engineering

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http://engineering.uottawa.ca/health-and-safety
Why should we care about health, safety and managing risks?
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Accidents/Incidents Regarding Electrical Engineering and Computer Science:

- Delta Airlines Computer Systems Failure (Aug. 8, 2016)
- Denver International Airport Baggage Handling System
- Therac-25
- Stuxnet
Delta Airlines Computer Systems Failure (August 8, 2016)

- ISSUE = a failed “switchgear”
- some critical systems and network equipment did NOT switch to backup system
- IT dates to 1990’s
- system handles: flight dispatching, crew scheduling, passenger check-in, airport departure info displays, ticket sales, frequent-flier programs
- Canceled more than 650 flights (ca. 10% of total daily flights for that day), grounded 1000’s of passengers,
- millions of $$ lost revenue & damage
Denver Airport Baggage Handling System


- 1990’s; world’s largest automated airport baggage handling system
- system failed on several accounts
- **Causes:**
  - time allowed for development was insufficient
    - contractual conditions of agreement & scope of work prepared in 3 working sessions
    - insufficient time to **develop in-depth understanding of work involved, and risks**
  - excluded stakeholders from discussions (= a losing strategy!)
  - significant changes in specifications were made after project began
  - decisions made too late
  - **risk management failures** due to time constraints (e.g. electrical)
  - change in leadership
Issues resulted from:

1. The underestimation of complexity
2. A lack of planning resulting in subsequent changes in strategy
3. Excessive schedule pressure
4. Lack of due diligence
5. Making firm commitments in face of massive risks & uncertainty
6. Poor stakeholder management
7. Communications breakdowns
8. People working in silos
9. Poor design
10. Failure to perform risk management
11. Failure to understand the implication change requests might have
12. Lack of management oversight
Therac-25: “death by software”  

- computerized radiation therapy machine (a medical linear accelerator)
  - shallow tissue treated with accelerated e⁻‘s
  - e⁻ beam converted to X-ray photon for treating deeper tissue

- 6 incidents of massive overdoses (June 1985 and January 1987) resulting in 3 deaths
  - 500 rads (radiation absorbed dose) = whole-body radiation causing death in 50% of cases
  - one patient estimated to have received 1-2 doses (localized area) ranging betw. 15 000-20 000 rads
Therac-25 (cont’d)

- Atomic Energy Commission Ltd (AECL) together with CGR developed Therac-25
  - advantage = computer controlled (PDP11)
- this software was more responsible for maintaining safety in contrast to software for previous machines
  - Therac-20:
    - independent protective circuits for monitoring electron-beam scanning
    - mechanical interlocks for policing machine and ensuring safe operation
    - AECL decided to rely on computer to control similar features in Therac-25 (save $$)

- PROBLEMS:
  - Used design features & modules from Therac-6 for Therac-25 (!)
  - Software developed by 1 person; very little software documentation produced during development
  - Similar problems later detected with Therac-20 software, but hardware safety interlocks prevented accidents and injuries
Stuxnet (cyberwarfare)

- A malicious computer worm jointly built by Americans & Israelis (Bush admin.)
- Specifically targets programmable logic controllers (PLCs) that allow the automation of electromechanical processes controlling machinery
  - on factory assembly lines, amusement rides, centrifuges for separating nuclear material
  - alters frequency of motors which affects rotational speed
  - masks monitoring systems
- Targets machines using Microsoft Windows OS & networks, then Siemens Step7 software
- Ruined almost 20% of Iran’s nuclear centrifuges
- Introduced to target via infected USB drive
  - Modifies codes
  - Gives unexpected commands to PLC, returns loop of normal OS values feedback to users
- 1\textsuperscript{st} malware to spy on and subvert industrial systems
- 1\textsuperscript{st} to include a PLC rootkit
“Defense-in-depth” multi-layered prevention approach

layers include:

- Policies and procedures
- Awareness and training
- Network segmentation
- Access control measures
- Physical security measures
- System hardening (patch management)
- System monitoring
- Anti-virus
- Intrusion prevention system

Standards & best practices ALL recommend:

- Start with a risk analysis & control system security assessment
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?
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

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

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

<table>
<thead>
<tr>
<th>Probability</th>
<th>1 Insignificant</th>
<th>2 Minor</th>
<th>3 Moderate</th>
<th>4 Major</th>
<th>5 Catastrophic</th>
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<tbody>
<tr>
<td>5 Certain</td>
<td>HIGH</td>
<td>HIGH</td>
<td>EXTREME</td>
<td>EXTREME</td>
<td>EXTREME</td>
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<tr>
<td>4 Likely</td>
<td>MEDIUM</td>
<td>HIGH</td>
<td>HIGH</td>
<td>EXTREME</td>
<td>EXTREME</td>
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<tr>
<td>3 Possible</td>
<td>LOW</td>
<td>MEDIUM</td>
<td>HIGH</td>
<td>EXTREME</td>
<td>EXTREME</td>
</tr>
<tr>
<td>2 Unlikely</td>
<td>LOW</td>
<td>LOW</td>
<td>MEDIUM</td>
<td>HIGH</td>
<td>EXTREME</td>
</tr>
<tr>
<td>1 Rare</td>
<td>LOW</td>
<td>LOW</td>
<td>MEDIUM</td>
<td>MEDIUM</td>
<td>HIGH</td>
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</tbody>
</table>
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/ Risk Assessment Form (cont’d)
Project Hazard/ Risk Assessment
Why should we care about health, safety and managing risks?

**Code of Ethics of Canadian Professional Engineers**

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;

**Code de Déontologie des Ingénieurs Canadiens**

L’ingénieur(e) doit se conduire avec dignité et dans le respect de la déontologie. Il/Elle doit être franc, honnête et loyal et assurer la protection de l’environnement, de la vie humaine et du bien-être des personnes. En accord avec ces principes, l’ingénieur(e) doit :

- Privilégier la sécurité, la santé et le bien-être publics, de même que la protection de l’environnement, et promouvoir la santé et la sécurité au travail;
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 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.”
Bill 18- Stronger Workplaces for a Stronger Economy Act, 2014

• 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”)
Ontario OHSA Worker’s Fundamental Rights

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)
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.

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.

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

**Reference:** Policy 77 and Procedure 14-1

Roles & Responsibilities

Employer

- know legal obligations under occupational health and safety laws and standards
- know hazards existing in workplace
- provided with appropriate training
- provided with appropriate training
- 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)

- 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
- 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
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
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.

http://www.ccohs.ca/oshanswers/legisl/billc45.html
Training Requirements

- WHMIS (Workplace Hazardous Materials Information System) for laboratory workers
- Lab Safety or Dry Lab Risk Management
- Orientation Safety Training
- 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

Consult: https://web30.uottawa.ca/hr/web/en/type/risk
Training Requirements - Students

**SCFP-CUPE 2626**

**STUDENT WORKERS MANDATORY TRAINING**

~ Workshops Flowchart ~

1. **EVERYONE**
   - Accessibility Standards for Customer Service
   - Respect in the Workplace
   - Violence Prevention
   - Supervisor Health & Safety Awareness
   - Worker Health & Safety Awareness

2. **LAB WORKERS**
   - Lab Safety Training
   - WHMIS for Lab Workers

   OR

   **OFFICE WORKERS**
   - WHMIS for Office Workers

For more information on how to access & complete your mandatory training, please go to:

2626.CUPE.CA/TRAINING

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**SCFP-CUPE 2626**

**FORMATIONS OBLIGATOIRES POUR LES ÉTUDIANT.E.S-EMPLOYÉ.E.S**

~ Organigramme des ateliers ~

1. **TOUS LES EMPLOYÉ.E.S**
   - Normes d'accessibilité pour les services à la clientèle
   - Respect en milieu de travail
   - Prévention de la violence
   - Sensibilisation à la santé et à la sécurité pour les superviseurs
   - Sensibilisation à la santé et à la sécurité pour les employé.e.s

2. **EMPLOYÉ.E.S DE BUREAU**
   - Sécurité en laboratoire ou "DRY LAB RISK MANAGEMENT"

   OU

   **SIMDUT POUR EMPLOYÉ.E.S DE BUREAU**

Pour accéder aux ateliers et compléter les formations obligatoires, consultez:

2626.SCFP.CA/FORMATIONS
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)

- **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

- [https://www.youtube.com/watch?v=KgkvxUtczLA](https://www.youtube.com/watch?v=KgkvxUtczLA)

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


Eye & Face Protection

• Ensure approved (CSA or ANSI) – lots of knock-offs
  – e.g. safety glasses must meet CSA Z94.3 or ANSI Z87.1 criteria
• Prescription eyewear not suitable
• Care and maintenance

➢ Required in situations where an eye hazard is present
  – Impacts, splashes, UV radiation, lasers (requires specific eyewear)
  – Side shields
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
  (https://www.youtube.com/watch?v=ODYgLIWzYqk&list=PLAaiq7apU7kcio2skZ9bfFyrGKzT7vIod&feature=player_detailpage)

• “Avoid use of contact lenses”?

• Goggles for liquids

• Safety glasses for explosion risks

• Wear at all times in labs
  (https://www.youtube.com/watch?feature=player_detailpage&v=5TqQT9Pfh_Q)
Which type/which hazard?
Which type/which hazard?
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

https://www.youtube.com/watch?v=L17Pkj7x2mE
Safety Gloves

- Minimizes contact with hazardous agent
- Use appropriate gloves
- PVC, latex, rubber, nitrile, polypropylene
- Check resistance chart
- Do **NOT** wear gloves in halls or elevators
Respiratory Protection

- Likely limited to n-95’s and dust masks.
- 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
Hearing Protection

• Many different types; ensure you choose the appropriate one.
  – Earmuffs
  – Roll-down plugs
  – Headbands

• 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).
Are you ready?

Step 1. Know what to do in emergencies

Step 2. Rely on uOttawa Alert

Step 3. Be prepared for emergencies

Step 4. Update your personal profile

Report an emergency

Accessibility and emergencies

If you have a disability or a special need, this website applies to you as well. Please acquaint yourself with its contents and then contact us to learn more on how you can protect yourself with a personalized plan.

Related links

- Protection Services
- Office of Risk Management
- City of Ottawa Emergency Preparedness

Contact us

If you have any questions, please email: AreYouReady@uOttawa.ca

What to do
Step 2. Rely on uoAlert

In the event of a situation affecting the safety of our campus community, it’s vital that we be ready to provide you with reliable information as early as possible. The University has implemented a mass notification system to ensure we can reach you efficiently and effectively through a variety of methods.

uoAlert will be activated only in a major situations, such as a critical violent event, a serious fire, a serious hazardous material spill, or severe weather. Notification could take place through one or all of the following tools.

Push notification with SecurUO

- Download the uOttawa safety app — SecurUO. Available on iOS and Android.
- Receive emergency alerts via push notifications on your device.
- SecurUO also contains a wealth of other safety and emergency information and some handy tools.

Can’t get apps on your phone?

Contact the Emergency Management Program to explore other alerting options that may be available.

Screen alerts with Alertus

Stay informed during emergencies with Alertus, a new tool available for uOttawa students. You will also be helping us with our pilot test of new tools for students! Download the Alertus client in order to receive screen alerts during an emergency affecting campus:

- Download Alertus for Windows
- Download Alertus for Mac
- Instructions for installing Alertus

When activated, an alert will appear on your screen with the following text: ALERTE !! ALERT followed by a brief description of the affected area and what action to take.

Look for your Alertus icon in your tray!

If Alertus is not installed on the personal computer that you are working on you won’t receive a screen alert. Check your tray for the Alertus icon and if it is not connecting, be sure to contact Information Technology (IT) for assistance.

URGENCE / EMERGENCY

Alerte !! Alert

Ceci est un test d’AlerteUO. AUCUNE ACTION N’EST REQUISE. This is a test of uoAlert. NO ACTION IS NEEDED.
Reporting of Accident / Incidents

- Report to your supervisor.

- If immediate threat, contact Protection Services (x5411).


- Critical injuries – contact Protection IMMEDIATELY!
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

Training and responsibilities

- Job Specific Training
- General Environmental and Health & Safety Training
- WHMIS Course for Office Workers
- New at U of O?
- WHMIS Online
- Register for training
- Register for Laboratory safety training
- Register for Dry Lab Risk Management training
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]
# SAFETY DATA SHEET

**The Clorox Company**

**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-Bleach
- **Other means of identification**
- **EPA Registration Number**: 5813-100
- **Recommended use 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**: For Medical Emergencies, call: 1-800-446-1014  
  For Transportation Emergencies, call Chemtrec: 1-800-424-9300

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### Sections

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

uOttawa Office of Risk Management (ORM):  
[http://www.uottawa.ca/services/ehss/msds.htm](http://www.uottawa.ca/services/ehss/msds.htm)
## WHMIS 1988 vs. WHMIS 2015 Symbols

[workplacesafetynorth.ca]

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>![image]</td>
<td>![image]</td>
<td><strong>Gas Cylinder</strong></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Gas Under Pressure</strong></td>
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<tr>
<td>B</td>
<td>![image]</td>
<td>![image]</td>
<td><strong>Flame</strong></td>
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<tr>
<td>Division 1 to 6</td>
<td></td>
<td></td>
<td><strong>Flammable, Self-reactive, Pyrophoric, Self-heating, In Contact with Water Emits Flammable Gases, Organic Peroxide</strong></td>
</tr>
<tr>
<td>C</td>
<td>![image]</td>
<td>![image]</td>
<td><strong>Flame Over Circle</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Oxidizing Gases, Liquids, Solids</strong></td>
</tr>
<tr>
<td>D1</td>
<td>![image]</td>
<td>![image]</td>
<td><strong>Skull and Crossbones</strong></td>
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<td></td>
<td></td>
<td></td>
<td><strong>Acute Toxicity (fatal or toxic)</strong></td>
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<td>![image]</td>
<td>![image]</td>
<td><strong>Exclamation Mark</strong></td>
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<td></td>
<td><strong>Irritation (skin or eyes), Respiratory or Skin Sensitization, Specific Target Organ Toxicity</strong></td>
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<tr>
<td>D2</td>
<td>![image]</td>
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<td><strong>Health Hazard</strong></td>
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<td><strong>Carcinogenicity</strong></td>
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<td><strong>Reproductive Hazards</strong></td>
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<td><strong>Same as above</strong></td>
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<td>D3</td>
<td>![image]</td>
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<td><strong>Biohazardous Infectious Materials</strong></td>
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<td><strong>Corrosion</strong></td>
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<td><strong>Skin/Eye Corrosion/Irritation</strong></td>
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<td><strong>Corrosive to Metals</strong></td>
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<td><strong>Exploding Bomb</strong></td>
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<tr>
<td>N/A</td>
<td>![image]</td>
<td>![image]</td>
<td><strong>Health Hazard</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Aspiration Hazard, Specific Target Organ Toxicity (Single Exposure, Repeated Exposure)</strong></td>
</tr>
<tr>
<td>N/A</td>
<td>![image]</td>
<td>![image]</td>
<td><strong>Appropriate symbol required</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Physical Hazards Not Otherwise Classified, Health Hazards Not Otherwise Classified</strong></td>
</tr>
</tbody>
</table>
WHMIS 2015 Labels

1. **Product Identifier**
The product name exactly as it appears on the container and on the Safety Data Sheet (SDS).

2. **Hazard Pictograms**
Hazard pictograms determined by the hazard classification of the product. In some cases, no pictogram is required.

3. **Signal Words**
*“Danger” or “Warning” are used to emphasize hazards and indicate the severity of the hazard.

4. **Hazard Statements**
Brief standardized statements of all hazards based on the hazard classification of the product.

5. **Precautionary Statements**
These statements describe recommended measures to minimize or prevent adverse effects from exposure to the product, including protective equipment and emergency measures.

6. **Supplier Identifier**
The company which made, packaged, sold or imported the product, and is responsible for the label and SDS.

7. **Safe Handling Precautions**
May include pictograms or other supplier label information.

8. **Reference to SDS**
If available.

---

**Product K1 / Produit K1**

### Danger

**3.** Fatal if swallowed. Causes skin irritation.

**4.** Mortel en cas d’ingestion. Provoque une irritation cutanée.

**5.** Pictograms:
- Wear protective gloves.
- Wash hands thoroughly after handling.
- Do not eat, drink or smoke when using this product.

**6.** Supplier Identifier:
ADC Chemical Co., 123 rue Anywhere St., Mytown, ON N0X 10Z (1234) 456-7890

---

**Supplier Label**

**1.** Supplier Label

**2.** Product K1 / Produit K1

### Danger

**3.** Fatal if swallowed. Causes skin irritation.

**4.** Mortel en cas d’ingestion. Provoque une irritation cutanée.

**5.** Pictograms:
- Wear protective gloves.
- Wash hands thoroughly after handling.
- Do not eat, drink or smoke when using this product.

---

**Workplace Label**

**1.** Workplace Label

**2.** Product K1

### Danger

**3.** Fatal if swallowed. Causes skin irritation.

**4.** Wear protective gloves (neoprene). Wash hands thoroughly after handling. Do not eat, drink or smoke when using this product.

**5.** See SDS for more information.

---

---

**Etiquettes du SIMDUT 2015**

1. **Identificateur de produit**
Celui qui apparaît sur le contenant et sur la fiche de données de sécurité (FDS).

2. **Pictogrammes de danger**
Les pictogrammes de danger sont déterminés par la classification du produit en fonction des dangers. Dans certains cas, aucun pictogramme n’est requis.

3. **Mentions d’avertissement**
Les mentions “DANGER” ou “AVERTISSEMENT” sont utilisées pour signaler l’existence d’un danger potentiel et indiquer la gravité ou le degré relatif de ce danger.

4. **Mentions de danger**
Les mentions au pluriel signalent tous les dangers potentiels prêts dans la classification du produit en fonction des dangers.

5. **Conseils de prudence**
Ces conseils s’intègrent aux mesures recommandées afin de réduire ou de prévenir les effets nocifs à la suite d’une exposition au produit, y compris les mesures d’urgence et l’équipement de protection requis.

6. **Identificateur de fournisseur**
Celui qui apparaît sur le contenant ou d’autres documents fournis par le fournisseur.

7. **Précautions à prendre pour une manipulation sans danger**
Peut comprendre des pictogrammes ou d’autres renseignements figurant sur l’étiquette du fournisseur.

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**étiquette du lieu de travail**

1. **Produit K1**

### Danger

**3.** Mortel en cas d’ingestion. Provoque une irritation cutanée.

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*Les exigences à cet égard peuvent varier. Consultez votre sphère de compétence.*
Proper (WHMIS) labels

Two workers were washing trucks and trailers at a beer store distribution centre. One of them found a liquor bottle filled with methanol windshield washer fluid. But the bottle still had the liquor label on it. Both workers drank from the bottle; one took the bottle home and finished it. He later died from methanol poisoning.

The company pleaded guilty to failing to acquaint a worker with a hazard in the handling, storage or use of a liquid chemical agent. The court fined it $175,000 [Brewers Retail Inc., Govt. News Release, Feb. 15, 2013].

1. Product Identifier
2. Safe Handling Precautions
3. Reference to SDS
Electrical Safety


• 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).

• GFCI’s.
Small Appliances

Guideline:
### Energy Use of Common Appliances

<table>
<thead>
<tr>
<th>Product</th>
<th>Active (watts)</th>
<th>Idle (watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desktop computer</td>
<td>75</td>
<td>5</td>
</tr>
<tr>
<td>Laptop</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>Monitor – CRT</td>
<td>61</td>
<td>2</td>
</tr>
<tr>
<td>Monitor – LCD 19”</td>
<td>35</td>
<td>1</td>
</tr>
<tr>
<td>Inkjet printer</td>
<td>8.9</td>
<td>3.2</td>
</tr>
<tr>
<td>All-in-one printer</td>
<td>15.2</td>
<td>9.1</td>
</tr>
<tr>
<td>Coffee maker</td>
<td>1100</td>
<td>70</td>
</tr>
<tr>
<td>Microwave</td>
<td>1500</td>
<td>n/a</td>
</tr>
<tr>
<td>Toaster</td>
<td>1050</td>
<td>n/a</td>
</tr>
</tbody>
</table>
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.
Electrical Safety

**Recognized Certification Markings**

- UL
- UL US
- ULC
- CSA
- ETL
- ETL us
- NSF
- O-TL
- QAI
- Intertek
- Nemko
- SGS
- ILAC
- TUV
- USTC
- USPC

**Recognized Field Evaluation Markings**

- CSA
- C
c
- UL
- ULC
- ETL
- ETL us
- NSF
- O-TL
- QAI
- Intertek
- Nemko
- SGS
- ILAC
- TUV
- USTC
- USPC

**Look for the Mark or Label**

before you buy, install or use an electrical product.
Electrical Safety
Major Electrical Hazards

**Electric shock**: a sudden physiological stimulation when human body is a part of an enclosed current loop.

**Arc**: the light and heat released from an electrical breakdown that is due to electrical current ionizing gases in the air.

**Blast**: an explosive or rapid expansion of air with tremendous pressure and temperature, which is caused by arcs sometimes.
Electrical Safety
Physiological Effects due to Electricity

• 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

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

### Nominal Human Response to Current Magnitudes

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

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

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Electrical Safety

- Do not pull on cables, or create tension / stress.
- Do not connect in series ("daisy chain") (e.g. power bar, to extension cord, to outlet) = overloading!
- **No in-house modifications** (call 2222 for assistance from an electrican)
- Extension cords are for **temporary use**
- **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.
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.
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
Enforcement

• 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!
# Notable Contacts

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection Services</td>
<td>Ext. 5411 (emergency)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ext. 5499 (general)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Technical Officer / Director</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lab Manager</td>
<td></td>
</tr>
<tr>
<td>Dr. Jacques Beauvais</td>
<td>Dean</td>
<td><a href="mailto:jacques.beauvais@uottawa.ca">jacques.beauvais@uottawa.ca</a></td>
</tr>
<tr>
<td>France Brazeau</td>
<td>Facilities Manager</td>
<td><a href="mailto:engfacil@uottawa.ca">engfacil@uottawa.ca</a></td>
</tr>
<tr>
<td>Patrick Savage</td>
<td>Facilities Officer</td>
<td><a href="mailto:engfacil@uottawa.ca">engfacil@uottawa.ca</a></td>
</tr>
<tr>
<td>Health &amp; Safety Committee Member</td>
<td>Verify with your respective union or association</td>
<td></td>
</tr>
<tr>
<td>Pierre Laflamme</td>
<td>Health, Safety and Risk Manager</td>
<td><a href="mailto:engsafe@uottawa.ca">engsafe@uottawa.ca</a></td>
</tr>
<tr>
<td>Bouba Mohamadou</td>
<td>Health, Safety and Risk Assistant</td>
<td><a href="mailto:engsafe@uottawa.ca">engsafe@uottawa.ca</a></td>
</tr>
<tr>
<td>Graham Nelson</td>
<td>Health &amp; Safety Specialist</td>
<td><a href="mailto:gnelson@uottawa.ca">gnelson@uottawa.ca</a></td>
</tr>
</tbody>
</table>
Merci !
Thank you!

QUESTIONS?