camj
nano · micro · macro

Safety Awareness

May 2019

Department of Mechanical and Mechatronics Engineering

UNIVERSITY OF WATERLOO
FACULTY OF ENGINEERING

UNIVERSITY OF WATERLOO
FACULTY OF ENGINEERING

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Availability: Mon – Fri;
9am – 3pm

Outline

- Need for safety
- What is required of you; a brief review
- Results of HOUSE keeping metric
- Focus for upcoming term
  - Training and SOPs
  - Chemicals
  - Lab Organization
  - New Installations
- Emergency Procedures
- Leaving CAMJ
- Resources

Our need for safety

1. Morality and ethics
2. The obligations of an Engineer

MORAL

3. Policy 34 - Health, Safety and Environment
4. Ontario's Occupational Health and Safety Act*

REGULATORY

5. Civil law – You or an individual (even a student) can be sued
6. Reduced costs – accidents cost tremendous amounts of time and money

COST

IT IS YOUR LIFE AND HEALTH

Requirements of UW students - summary

Ontario's Occupational Health and Safety Act

Policy 71 – Student Discipline

Policy 34 - Health, Safety and Environment

Follow all laws

Wear required PPE

Report safety issues

Report any violations

Don't alter safety devices

Work safely

No silly nonsense

3 Principles

1) Never proceed until you've been trained AND you feel comfortable

2) Report every safety *concern*

3) Take responsibility for your own safety

CAMJ Lab Rules:

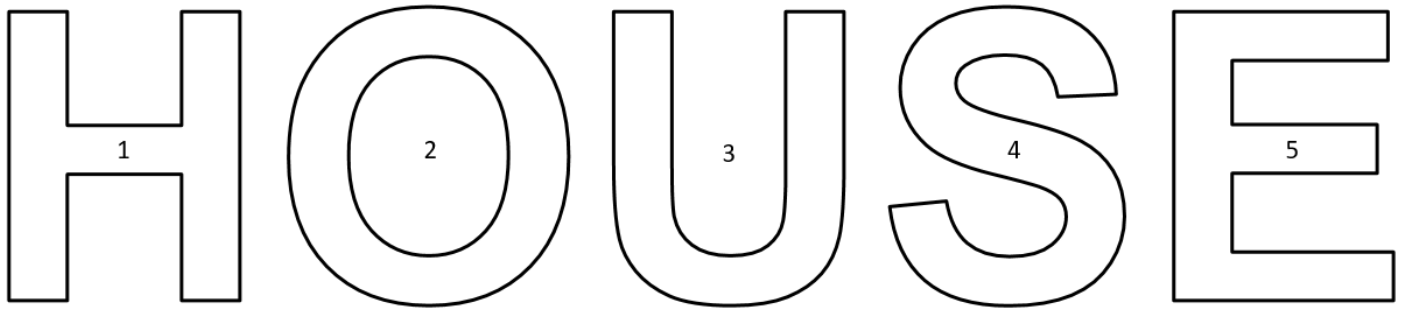
- **No food or drink**
- **Dress appropriately for the work:**
  - No open toed shoes, high heels, or platforms in labs
  - No shorts if perform acid etching or arc welding
  - Wear safety glasses, lab coat and gloves when handling chemicals
- **Orientation arranged by Lab Manager**
- **Read SOP** (Standard Operating Procedure)
- **Participate in Chemical Inventory**
- **Report safety issues immediately** to Supervisor and Lab Manager
- **Maintain a clean and orderly working environment**

IMPROVEMENTS IN LABS

Results of HOUSE keeping Process

Room: _____ Month: _____

Resp: _____



Green – Lab was found clean

Red – Lab not found clean

Inspection is to take place on every Tuesday

- □ Equipment, benches and tables are clear
- □ Walkway and aisles are clear
- □ Work areas are tidy and free from clutter and garbage
- □ Electrical panels are clear – no items placed 3.0 feet in front
- □ Room is organized – it is clear where items belong
- □ Tools are stored in tool boxes
- □ Emergency phones are clear – nothing blocking access to the phone
- □ No unattended work pieces – all work pieces are stored and labelled
- □ Waste Disposal – Garbage bins and scrap metal are less than 80% full
- □ No unattended chemicals – all chemicals are labeled and properly stored

Process Confirmation

1	2	3	4	5

Green – Process was completed

Red – Process not completed

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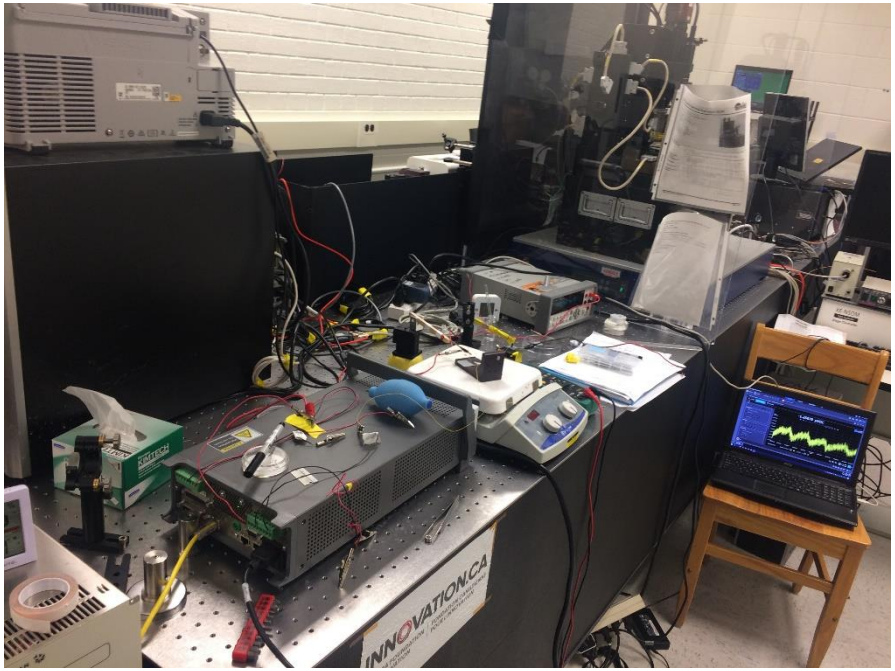
E3-2118A Microjoining lab

Before

After

E3-2168 Femtosecond laser lab

Before



After

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E3-2103B Medical Material lab

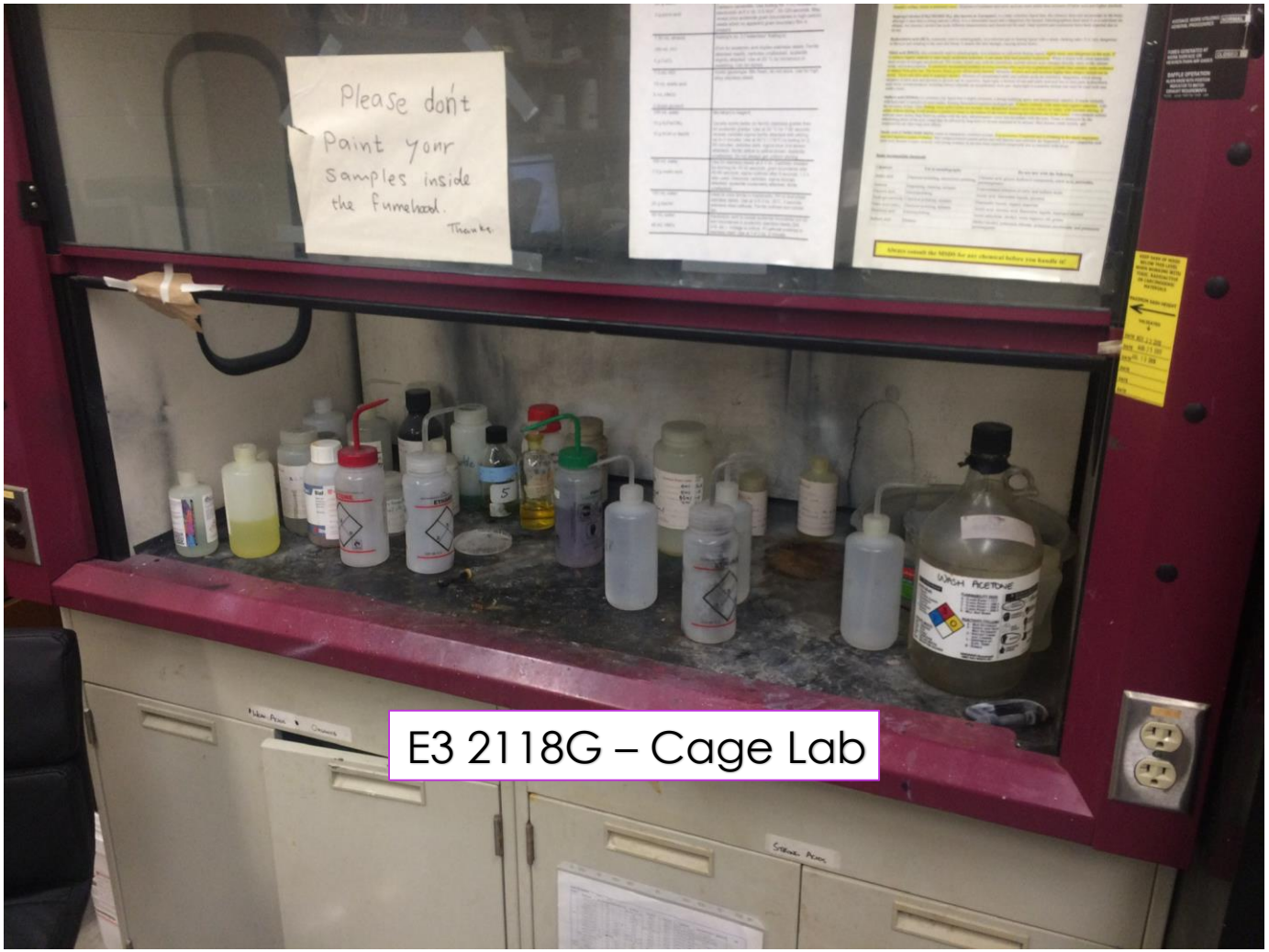
Before

After

Before

After

Before:


Please don't
Paint your
samples inside
the fumehood.
Thanks.
E3 2118G – Cage Lab

After:


SAFEAIRE
Please don't
Paint your
samples inside
the fumehood.
Thanks.

FUTURE DIRECTION AND FOCUS

Focus for upcoming term

Training & SOPs	Chemicals
New Installations	Lab Organization

TRAINING & SOPS

Lab Hazard Training

- SO1001 Employee safety orientation
- SO1081 Workplace violence awareness
- SO2017 WHMIS 2015
- **Links to modules can be found on the Safety Office website under Training: https://uwaterloo.ca/safety-office/training/training-programs**
- **Training modules specific to your lab must be completed before using the labs – this will be determined at your orientation – to be completed on annual basis**

UWaterloo Training Matrix

Employee Training Matrix

			Training Frequency (years)#	Graduate Students/Post Docs/Visiting Scholars
General	SO1001	Employee Safety Orientation		M
	SO1081	Workplace Violence		M
	SO2017	WHMIS 2015	5	M
	SO1100	Supervisor Safety Awareness		
	SO1003	Supervisor's Safety Training	5	
	SO1007	Inspecting the Workplace		
	SO1012	Incident Investigation		
	SO1038	First Aid, Emergency 1-Day	3	
	SO1039	First Aid, Standard 2-Day	3	
	SO1040	Fire Warden Training		
	SO1041	Emergency Spills Training		
	SO1022	Transportation of Dangerous Goods	3	
	SO1019	Job Safety Analysis		
Hazard Specific	SO1061	Asbestos Awareness		1
	SO2015	Asbestos Training Type I and Type II		1
	SO1023	Confined Space Entry		1
	SO1036	Elevated Work Platforms	3	
	SO1026	Fall Protection		1
	SO1027	Forklift Training	3	
	SO1025	Hazardous Energy Control		1
	SO1051	Hearing & Eye Protection		1
	SO1035	Inspection of Slings and Chains		1
	SO1057	Laboratory Support Worker	3	
	SO1050	Ladder Safety		1
	SO1031	Manual Materials Handling		1
	SO2020	MOL Working at Heights	3	1
	SO1056	Office Ergonomics		1
Research	SO1069	Biosafety		1
	SO1030	Cryogenic and Compressed Gas Safety		1
	SO1010	Lab Safety		1
	SO1066	Laser Safety Theory		1
	SO1013	Radiation Safety Open Sources		1
	SO1015	Radiation Safety Sealed Sources		1
	SO2016	Safe Chemical Handling		1
	SO1011	X-ray Safety		1

New Student Orientation & Lab Orientation

CAMJ New Student Orientation

Welcome to CAMJ! *Complete this form with the Lab Manager and submit it to the Lab Manager*

Name: _____ Project: _____

Start Date: _____ Supervisor: _____

POSITION (CHECK ONE):

☐ Co-op Student ☐ PhD ☐ Visiting Scholar
☐ Research Assistant ☐ Post Doc ☐ Full time staff
☐ MASC

Work Area

LABS YOU WILL WORK IN (CHECK ALL THAT APPLY):

☐ E3-2103B Medical Materials Processing Lab
☐ E3-2107 Welding Lab (Storage)
☐ E3-2116 Laser Processing Lab
☐ E3-2118A Microjoining Characterization Lab
☐ E3-2118K&F Arc Welding Lab
☐ E3-2118G Cage Lab
☐ E3-2118J Resistance Spot Welding Lab
☐ E3-2165/E3-2171 Wire Bonding Lab
☐ E3-2168 Femtosecond Laser Nanojoining Lab
☐ E3-2169 Microsystems Packaging Lab

Training

REQUIRED TRAINING COURSES:

With the Lab Manager, determine the courses that you need to complete. Initial once you have completed the training:

Training	Initial	Training	Initial
☒ SO1001 Employee Safety Orientation	_____	☐ SO1010 Lab Safety	_____
☒ SO1081 Workplace Violence	_____	☐ SO1066 Laser Safety Theory	_____
☒ SO2017 WHMIS 2015	_____	☐ Eye Exam	_____
☐ SO1061 Asbestos Awareness	_____	☐ Practical Laser Training	_____
☐ SO1051 Hearing & Eye Protection	_____	☐ SO2016 Safe Chemical Handling	_____
☐ SO1050 Ladder Safety	_____	☐ SO1011 X-ray Safety	_____
☐ SO1031 Manual Materials Handling	_____	☐ Metallographic Standard Practices	_____
☐ SO1056 Office Ergonomics	_____	☐ ASTM E2014	_____
☐ SO1069 Biosafety	_____	☐ ASTM E407	_____
☐ SO1030 Cryogenic & Compressed Gas	_____	☐ ASTM E3	_____

By signing, I indicate that I have completed the required training and am capable to work safely within the labs. I understand that before seeking keys to the labs I must present this completed and signed form to my supervisor.

Trainee Print _____ Signature: _____

Lab Manager Print _____ Signature: _____

Work Place Orientation

NAME: _____ DATE: _____

LABS COVERED:

☐ E3-2103B ☐ E3-2107 ☐ E3-2116 ☐ E3-2118A
☐ E3-2118K&F ☐ E3-2118G ☐ E3-2118J ☐ E3-2165/E3-2171
☐ E3-2168 ☐ E3-2169

WORK AREA CHECKLIST

Signs & Labels	
First Aid Emergency	☐
Fire/Evacuation	☐
Emergency Lockdown	☐
Hazardous Materials Spills	☐
Phone, 911 procedure	☐
Lab Hazards Form and	☐
Hazardous Waste Disposal	☐
HSE Bulletin Board	☐
HOUSE Keeping Process	☐

First Aid Stations/Kits	
Location	☐
First Aiders	☐

Fire Extinguishers	
Location	☐
Type	☐

Doors and Exits	
Locations	☐
Applicable Interlocks	☐
Alternate Fire Exit	☐

Lighting	
Location	☐

Personal Protection	
Required Footwear	☐
Eye Protection	☐
Gloves	☐
Hearing Protection	☐
Welding Helmets	☐

Emergency Wash	
Eye Wash Location	☐
Emergency Shower Location	☐

Natural Gas	
Location	☐
Shut off valves	☐

Electrical	
Panels Locations	☐
Lockout/Tagout procedures	☐
Clearance Requirements	☐

Equipment	
Pre-use Inspection records	☐
Guards	☐
SOPs	☐
Warning Indication Lights	☐
Equipment Specific Hazards	☐

Ventilation	
Temperature	☐
Dust Control	☐
Fume Control	☐

Compressed Gas Cylinders	
Location	☐
Types	☐
Regulators	☐
Cylinder carts used	☐

Chemical Storage	
Locations	☐
Storage System	☐
Flammable Liquid Cabinets	☐
MSDS Locations	☐
WHMIS Label Requirements	☐
Location of standard labels	☐
Inventory	☐
Refrigerator Location	☐
Freezer Location	☐

Hazardous Waste	
Segregation Requirements	☐
Disposal Procedure	☐
Proper Storage	☐

Spill Kits	
Location	☐
Type	☐

Waste Containers	
Location	☐
Broken Glass Location	☐

Fume Hood	
Ventilated Cabinets	☐
Flow Alarm	☐

Pressure/Vacuum Vessels	
Location	☐
Emergency Valves	☐

Signature of Trainee: _____

Signature of Trainer: _____

Equipment Specific Compentency Training (personnel)

You must be trained on equipment prior to using it. Training must be documented

You must be trained by an authorized trainer

This term we are updating our list of authorized trainers

Will be tied into SOP of equipment

CAMJ Equipment/tasks Training Record

Ali Akbar Shokati: (September 2015-Aguest 2019)

Supervisor: Norman Zhou, John Wen Telephone: 5197291624

Training Record (3 level)

Beginner (B), Independent (I) and Master (M) – Only master level allow to train the students.

Training start date	Equipment/tasks	Master sign-off date	Master signature (initialized by trainee)
	Optical microscope		
	Chemical handling		
	Nanomaterials Handling		
	Tube Furnace		

Know your Laboratory

1. **Be aware** of your surroundings
2. Know where the safety gear is **<u>before you need it</u>**
   a) **exits**
   b) **phones for 911** – UW and private cell
   c) **fire alarm system** - pull stations
   d) **fire extinguishers**
   e) **eye wash stations** and emergency showers

3. Know where to look for **SOP**s and **SDS**s
4. **Know who to Report** safety concerns and accidents to

SOP review

- Reviewed SOP for random piece of equipment (wear tester)
  - Determined how to remove toxic chemical and replace with harmless substitute
  - Determined how to redesign cover to prevent access to pinch point
  - Determined how to add engineering control to prevent access to pinch point while equipment was in use
- Need to review SOPs of all equipment

CHEMICALS

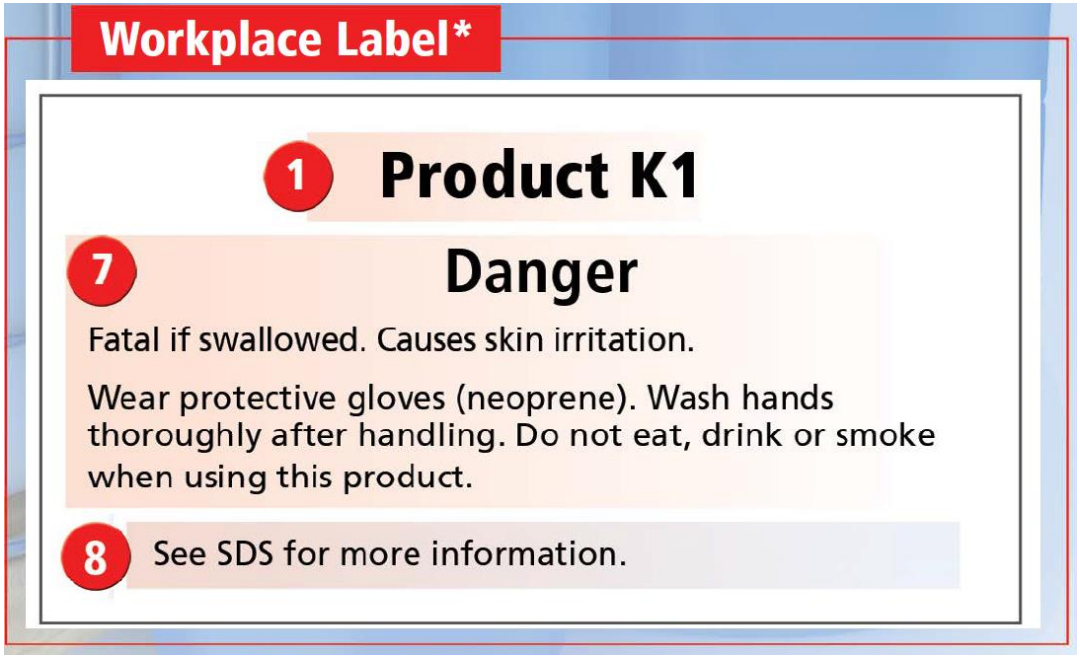
Chemicals Hazards and WHMIS

1. WHMIS training is mandatory. **We need to apply the training**
2. Elements of WHMIS:
   - **Labels** – indicate hazards
   - **Safety Data Sheets (SDS)** – details of the hazards
   - **Worker Education** – general and specific training on the chemicals being used
3. **BEFORE** using a chemical you must know what the Safety Data Sheet (SDS) says.
   - How do I protect myself?
   - What should I do in an emergency?
   - How do I dispose of the chemical?

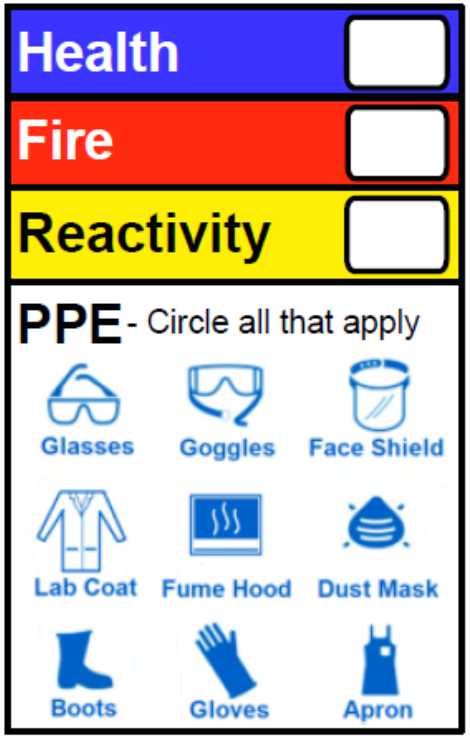
Workplace label requirements

As per your WHMIS 2015 training

1. Product Identifier
2. Safe Handling Requirements
3. Reference to Safety Data Sheet



Printed Label Templates are available



Chemical:	
SIGNAL WORD Use only one ☐ **DANGER** ☐ **WARNING**	
Safe Handling Precautions:	
Name:	**Date:**
Conc:	**Prof:**

See SDS for more information

Chemical Use in CAMJ Labs

- Apply WHMIS training – Read SDS
- Label contents – give concentrations.
- Clean up glassware within 24 hours
- Chemical cabinet – make sure to put back the chemical after use in the same location

Chemical Storage

1. Segregate chemicals by Classification.

2. Apply WHMIS training Read SDS – be aware of storage requirements (ex. fridge)

- Use ventilated cabinet for volatile, toxic chemicals
- Use approved flammable storage cabinet for flammable liquid.
- Use secondary tray for corrosive liquid.
- Waste: no mixing of waste – max 80% of the container – waste disposal-label properly (environmental building – Mr. Greg Friday)

Chemical Manipulation

1. Apply WHMIS training – Read MSDS – be familiar with the chemical
   - Wear PPE.
   - Communicate with other students, make them aware
2. Be prepared for chemical spill –*before* you start the experiment.
3. Use proper equipment
4. Use buddy system (ex. HF).
5. Have waste container ready for disposal (before starting).
6. Clean up.

Chemical Procurement

Check chemical inventory for stock or substitute

If none available you must get permission from the Lab Manager before ordering

Review SDS for specific requirements

Order the **minimum quantity** required

Obtain: **(a)** quote from the provider(s),
(b) Hard copy updated MSDS – get approval
(c) submit to Denise for processing.

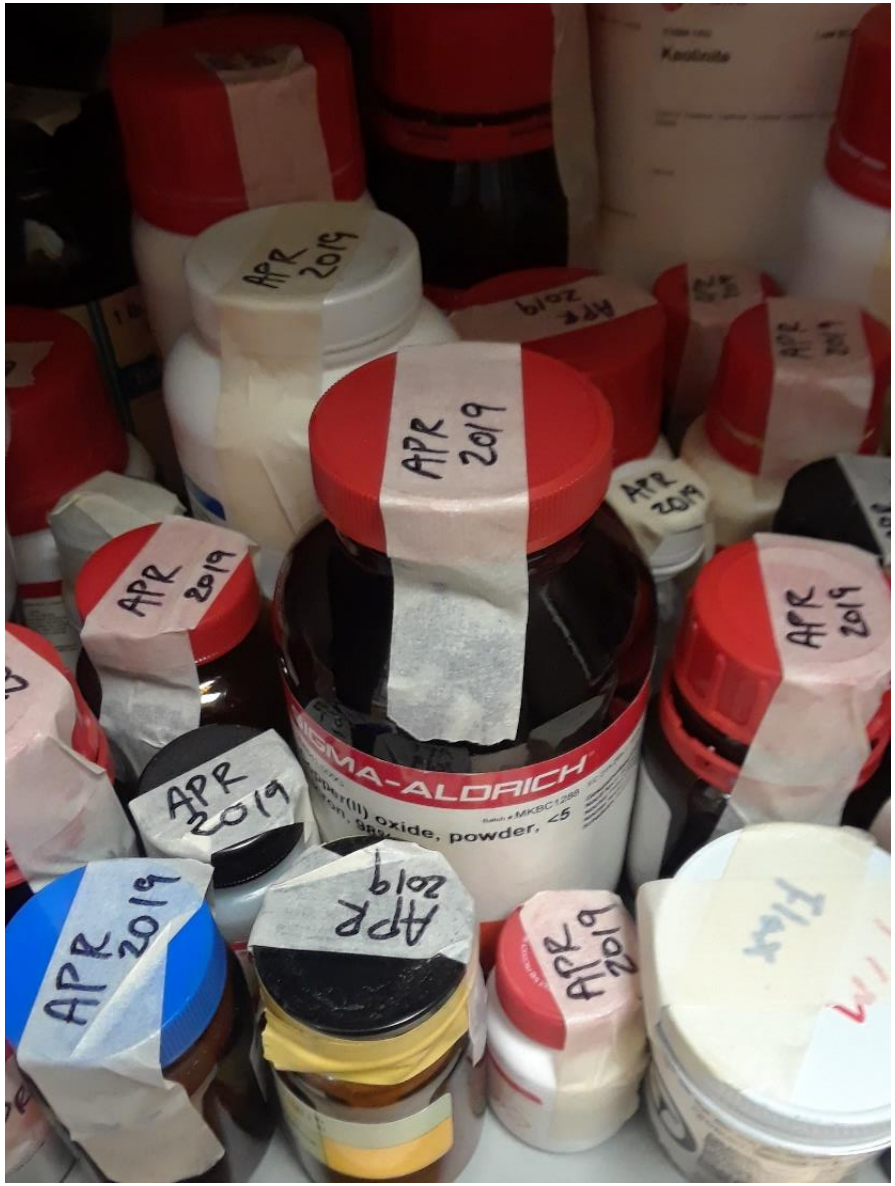
It is the your responsibility to:

(a) inform lab manager (update inventory)

(b) Put MSDS in proper binder

note, it is illegal to have substance without MSDS in the lab.

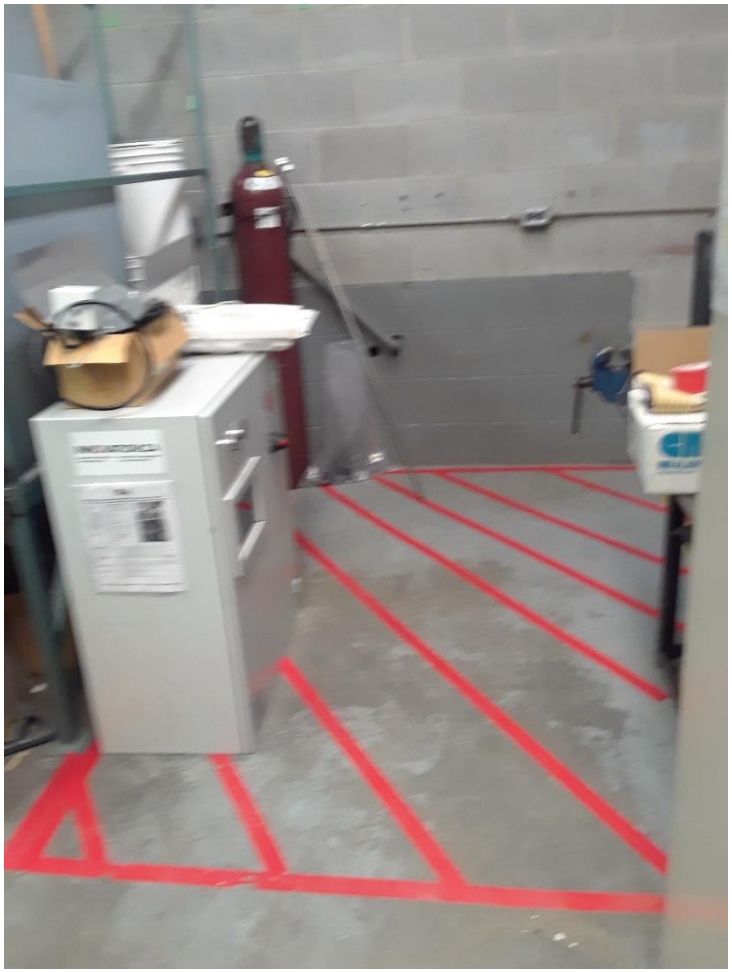
551


APR 2019
SIGMA-ALDRICH

LAB ORGANIZATION

Red tag process

- Lean Manufacturing
- 5s Methodology – SORT
- A way to deal with unused equipment
- A systematic approach which aims to minimize disruption to students and professors



Storage bins

- 5 Gallon bins are back in stock.
- Labels are available too
- First come, first serve
- We can order more if we need

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Name: _____

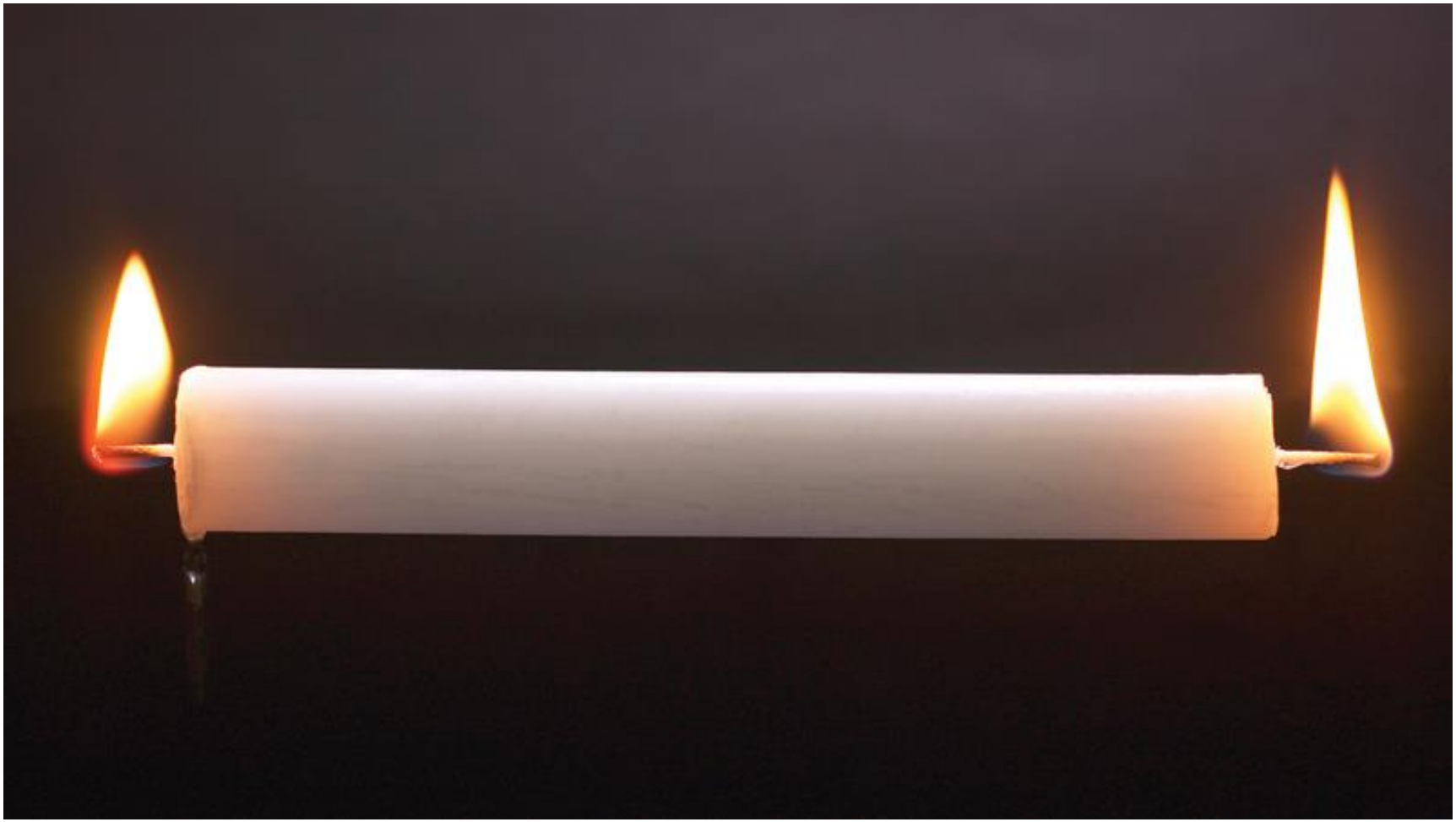
Project: _____

Prof: _____

Date Prepared: _____
(YYYY-MM-DD)

NEW INSTALLATIONS

Consider previous discussion on SOP review



New installations

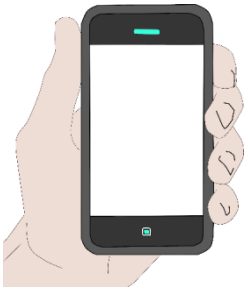
- Hybrid Laser Welder
- Friction Stir Welder
- Plasma Welder
- Metal 3D Printer
- Etc.

EMERGENCY PROCEDURES

Calling 911 when an accident happens

Calling 911 from a UW wired phone (*BEST PRACTICE*)

- Call goes to the Waterloo Region Emergency Services (Fire, Ambulance, Police)
- UW Police are electronically notified of the location of the call
- UW Police will immediately dispatch an officer to your location and will bring the Emergency Services to you when they arrive.



Calling 911 from a cell phone

- Call goes to the Waterloo Region Emergency Services
- UW Police are not notified
- This can cause serious delays in Emergency Services getting to you as they need UW Police to find you

If you use a cell phone to call 911, you must also call the UW Police at 519-888-4911 (Add this number to your cell phone)

Reporting an accident/incident

- **The following steps must be followed in the event of an injury or incident at work:**

1) Obtain **first aid** or appropriate **medic**
2) As soon as possible **report** the inju
3) With your supervisor, complete the **incident and investigation report** and send the report to the Safet

Get Help FIRST!

After you are treated, report

You and supervisor complete the incident report together

In addition to reporting injuries, **or near misses** that have a poten
Incidents of this type could potentially have caused:

Report Near Misses

- Loss of life
- Fire or explosion
- Critical injuries (e.g., broken arms/legs, amputation, severe bleeding, blindness, severe burns)
- Equipment or property damage

If applicable, file a **Workplace Safety and Insurance Board (WSIB)** claim and participate in return to work.

Communication: Safety Alerts & Bulletins

SAFETY ALERT

Incident Description:

A personal laptop being used to control a piece of equipment in E3-2137 spontaneously caught fire. An employee in the lab quickly extinguished the fire with the fire extinguisher.
No one was injured.
Laptop battery was found to have a re-call which was unknown to user.

Action:

If you are using a personal laptop on campus **check your laptop for battery recalls** and take action according to the manufacturer recommendations
Review the location of fire extinguishers in your lab and evacuation procedures

Questions?

For more information contact your Lab Supervisor

UNIVERSITY OF WATERLOO   camj nano-micro-macro   Posted: Dec 2018
Post until: Jan 30, 2019

camj nano-micro-macro bulletin

Why is there tape on all of the chemicals in the lab?

After taking the chemical inventory we found a total of 551 chemicals in the labs. We are evaluating the frequency of their use. In order to determine which chemicals we need to keep all chemicals inside of CAMJ labs have had a piece of masking tape placed on them with a date.

What this means for you:

- Chemicals that we use and need frequently will continue to be stocked and ordered
- Chemicals which are not being used will be identified and disposed of
- A chemical inventory will be circulated to check and see where chemicals are located

Action: Begin participating in the frequency of chemical use evaluation:

- Use chemicals as needed
- If the chemical has a piece of tape remove the tape before use (throw tape in garbage)
- Only remove tape from chemicals that you use
- Before purchasing chemicals check the chemical inventory to see if it is in stock
- Consider using an alternative chemical which is in stock before purchasing a new one

Questions?

For more information contact Daniel Westerbaan; Dwesterb@uwaterloo.ca

UNIVERSITY OF WATERLOO   camj nano-micro-macro   Posted: Feb 2018
Post until: Feb 28, 2019

LEAVING CAMJ

Leaving CAMJ?

- **<u>1 to 2 week</u> before departure: Decommission check list – work with Dan Westerbaan & your supervisor**

Transfer of both knowledge and assets.

Student Decommission Check List

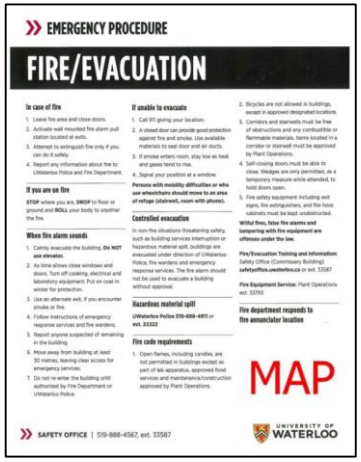
Student Name	
Project Name	
Project Start Date	
Project End Date	
Group Leader Signature	

Item	General Requirements	Note
1	Chemicals – empty mixed acid, make sure all container are labelled and stored. Dispose any waste. Transfer responsibility of remaining chemicals to:	
2	House clean – clean, tidy lab work space and desk, clean all the glassware you have used. Dispose any damaged glassware if you have not do so.	
3	Specimen: remove any specimen (or hand over any specimen to next student if project is continuous) and properly dispose or stored (make sure it is clearly labelled if need to be stored)	
4	Leave clear instruction of SOP for the equipment you use, including manuals locations, MFG contact name, etc. Return safety equipment, such as laser protective glasses, etc.	
5	Return any borrowing equipment, book, etc. (make sure you let your teammate know who is the owner of the stuff, if it required to be used for the project)	

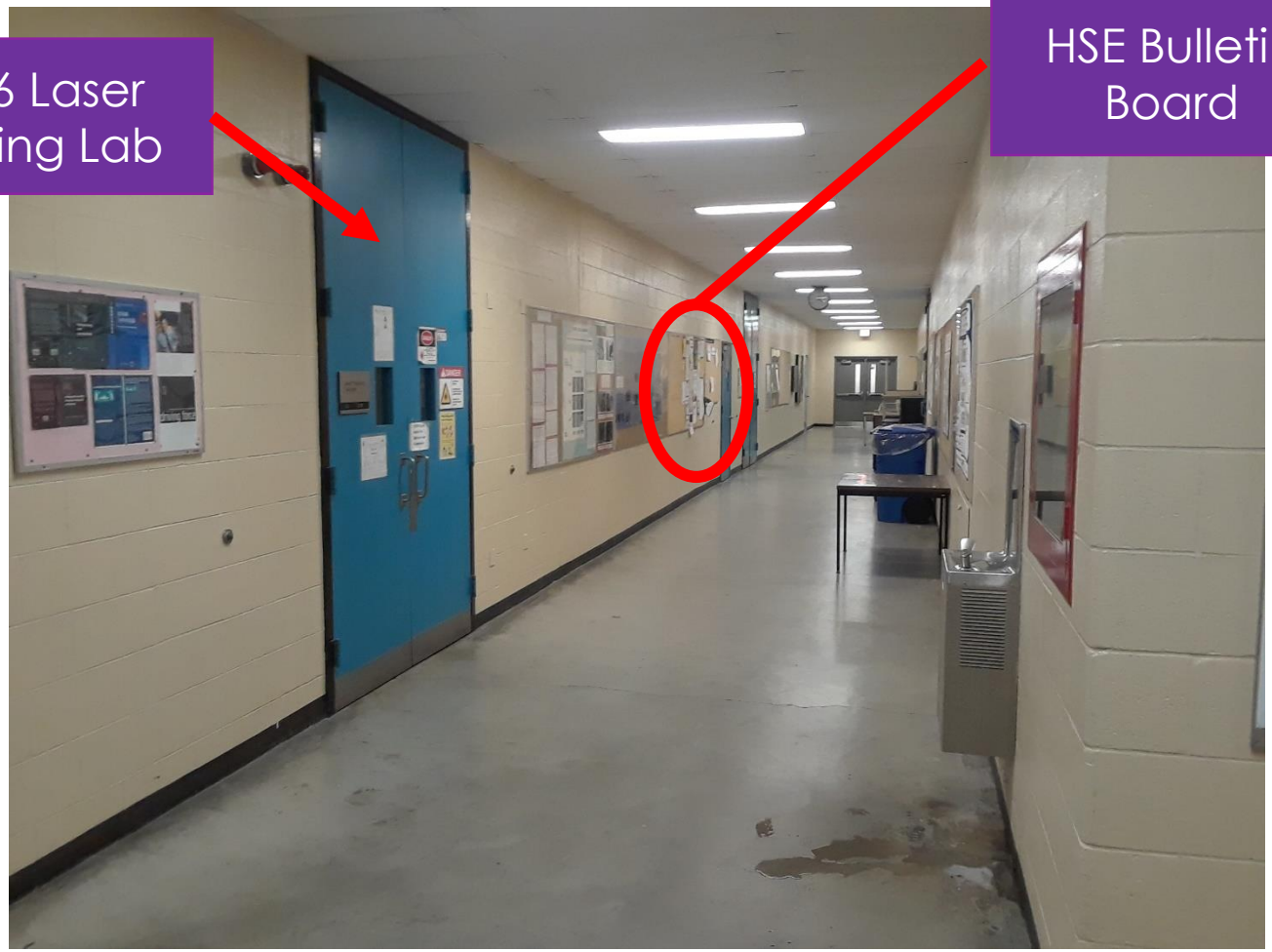
RESOURCES

Departmental Health, Safety and Environment Bulletin Boards

- First Aid Emergency Procedures
- Fire/Evacuation Emergency Procedures
- Occupational Health and Safety Act
- WSIB "In Case of Injury at Work" form #82
- Joint Health and Safety Committee Membership
- Waterloo Policy #34
- Documents from Joint Health and Safety Committee and other health, safety and environment notices



Departmental Health, Safety and Environment Bulletin Boards



Resources for safety

- **Your Supervisor**: Your supervisor knows your workplace and has responsibility to inform you of the health and safety hazards that you may encounter. **Daniel Westerbaan E3 3105, Ext 39130, Cell 647 385 5202**
- **Safety Office**: The Safety Office provides consultation and support services to the University community on matters relating to environmental and occupational health and safety.
- **Joint Health and Safety Committee**: This committee has many responsibilities across the entire campus, as they work to inform the Waterloo community on how to improve health and safety. These duties include: organizing inspections, identifying dangerous situations, and making recommendations.
- **Departmental Health and Safety Coordinators** play an important role within each department, advising on health and safety procedures as they apply to each department. These individuals receive safety training and should be able to answer safety questions or concerns you have that are specific to your work or department. **Michael Herz E3-2111**

Laboratory Leaders

Rafael Ribeiro

E3-2118 K&F

Chris DiGiovanni

E3-2118 J

Luqman Shah

E3-2118 G

Shasvat Rathod

E3-2169

Jiayun Feng

E3-2168

Pablo Enrique

E3-2107

Amirali Shams

E3-2103 B

Hadi Razmpoosh

E3-2116

Erick (Di) Xu

E3-2118A

E3-2171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DOES IT REALLY HAPPEN?

Incidents – Chlorine gas exposure – Feb, 2017 (Lesson Learned)

- Two students intend to clean the autoclave (with lid)using HCl and H2O2 mixture in the fumehood. The reaction resulted Cl2 gas emission via exothermic reaction (15 ml HCl and 5 mil of H2O2).
- However, the mixture was taken out of the fumehood for ultrasonic shaking. The Cl2 gas generated from the mixture was not extracted properly and released to the room, causing injury. Students experience difficulty breathing and dry throats. Campus police were called.
- Upon arrival of police, the two student were sent to grand river Hospital via ambulance. Both released after 6.5 hour observation. Safety officer arrived the lab and met the police outside the lab, find faint of odour of Cl smell. Seal the lab. Removed the waste jug to ESF. Second day the Lab reopened.

What went wrong

- **What Needed to be done:**
- **SOP required for chemical mixing.**
- ***The two strong chemicals should be diluted 1st and let set aside for sometime to cool off, then mixing can be performed. If excessive heat is generated an ice bath can be used to reduce the vapor. All work should be done in fumehood.***
- **7% NaOH solution (1L) should have been prepared before hand in case it was required to neutralize the reaction.**

Chemical safety – Lessons Learned

Problem	CAP
1) Explosion of	y class, no acid/water/Nit
2) Chemical su	entified in all organization iss t)
3) Chemical no	material need to date of mixing. n unknown. You
4) Explosion up	nto your strong solvent (slowly).
5) Un labelled	date, ownership
6) Fumehood malfunction	Check air flow indicator, fume hood functionality.