

UW CHEMICAL ENGINEERING *LABORATORY “SAFETY-FIRST”* *FUNDAMENTALS*

FALL - 2018

WATERLOO
ENGINEERING

engineering.uwaterloo.ca



AGENDA

1. **ChE Safety Program** – *Safety Manual, Safety Training, Declaration Page, Safety Report, Risk Assessments*
2. **Lab Safety** – *Chemicals and PPE, Fumehoods, Equipment Hazards*
3. **Transportation Safety** – *Rubber gloves in hallways, chemicals in double-containment*
4. **Hazard Reporting / Incident Reporting / Incident Investigation**



UW – CHE “SAFETY FIRST” FUNDAMENTALS

Tom Dean, P. Eng.

E6 4020

Ext. 31166

Director – Technical Operations

Chair – ChE Safety Committee, Chair – ESPC Committee

Services Provided:

➤ ***Manage the “Technical Support” Team in Chem. Eng.***

- ***IS / IT / Electrical / Computer Support***
- ***Analytical Lab Support***
- ***Mechanical Tech Support***
- ***Glass Blowing Services***
- ***Shipping / Receiving Services***
- ***Waste Handling Services***
- ***Undergrad Lab Support***



UW – CHE “SAFETY FIRST” FUNDAMENTALS

Ralph Dickhout

E6 3102

Ext. 33311

Analytical Chemist

Manager of Analytical Services and Lab Safety

Services Provided:

- **Shared Departmental Laboratory: maintenance and user orientation**
- **Chemical analysis and materials testing**
- **Analytical chemistry troubleshooting**
- **Method/protocol development**
- **Instrument installation, testing and maintenance**
- **Analytical quality control and data interpretation**
- **Chemical and general laboratory safety**
- **Analytical software installation and testing**
- **Equipment purchasing assistance**
- **General chemistry consultation**

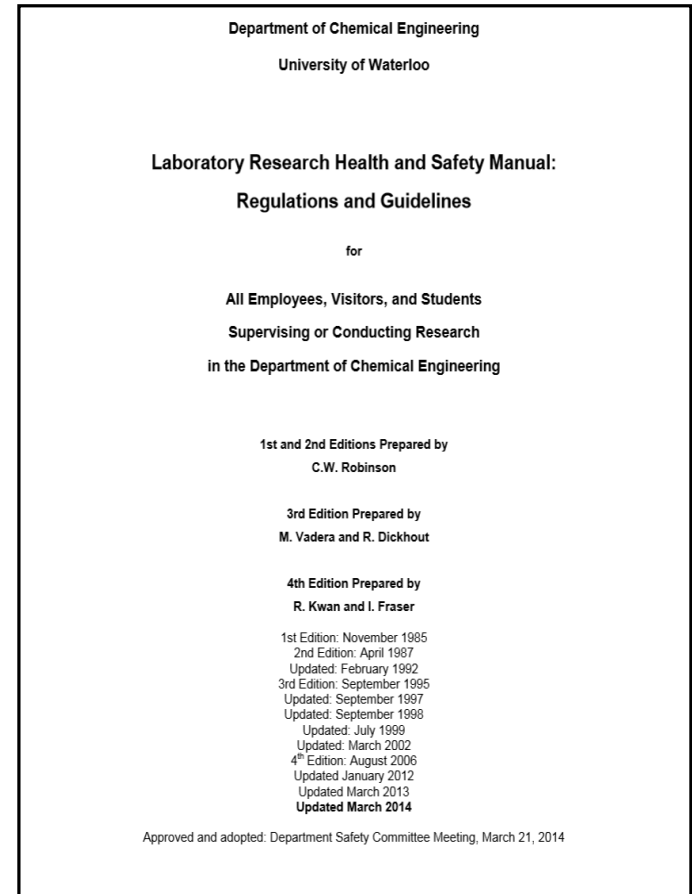


UW – CHE “SAFETY FIRST” FUNDAMENTALS

Lab Safety Information and Requirements:

A. ChE Safety Manual:

- *Accessed from ChE Website*
- *80 pages with graphics (PDF)*
- ***NEW: Web-Based version***
- *Updated annually*
- *Required reading by all ChE Researchers*



UW – CHE “SAFETY FIRST” FUNDAMENTALS

B. Mandatory Safety Training:

<u>Group</u>	<u>On-line Safety Course *</u>				
	<u>Safety Orientation</u>	<u>Violence Awareness</u>	<u>WHMIS 2015</u>	<u>Lab Safety</u>	<u>Bio Safety</u>
Admin. Staff	X	X	X		
Grads	X	X	X		
Visitors	X	X	X		
Tech. Staff	X	X	X		
Faculty	X	X	X		
Lab Workers & Supervisors	X	X	X	X	
Bio Workers & Supervisors	X	X	X	X	X

*plus any applicable hazard-specific training modules (e.g. compressed gases, x-ray etc.)

- Valid for 5 years
- ALSO “Safe Chemical Handling” classroom course for all lab workers now mandatory **NEW**

C. Safety Declaration Sheet:

- **Lab workers only**
- **Part of ChE Safety Manual**
- **Confirms Training, Policy 34**
- **Confirms plan to create “Safety Assessment Report”**

Please complete your portion of this form and bring it to your supervisor.

A) Researcher's Declaration

I acknowledge receipt of a copy of the Laboratory Research Health and Safety Manual: Regulations and Guidelines, which sets forth the health and safety rules and practices to be followed in the Department of Chemical Engineering. I declare that I have studied the contents of this *Manual* and, in particular, I am thoroughly familiar with and fully understand those sections of the *Manual* designated as being of particular importance.

I also acknowledge that I received "WHMIS for UW Employees", "Laboratory Safety at UWaterloo", "HSE Orientation for Employees" and "Workplace Violence Awareness" training on (date) _____ from the University of Waterloo.

I understand that as long as I am a visiting researcher, Postdoctoral Fellow, a registered graduate student, an employee, or an undergraduate student researcher (as defined in section 3.3.2) in the Department of Chemical Engineering, I am responsible for obeying the safety rules, in addition to the requirements of **University of Waterloo Policy #34** and the **Ontario Occupational Health and Safety Act** and any later amendments or regulations thereof. I also understand that I must continually endeavour to be self-informed about all health and safety aspects of my research work and to exercise good judgement in the application of safe working practices in order to prevent accidents which may cause injury to either myself or to others. I am also aware that I am responsible for informing my supervisor in advance of using any new chemicals, materials, equipment, or procedures which may be of a hazardous or potentially-hazardous nature.

Signature _____ Date _____

Name (print) _____ Status (Grad, VS, RA, etc.) _____

B) Supervisor's Acknowledgement

1. I have discussed the relevant sections of this *Manual* and other project-related health and safety background information with the above-named individual, who has been requested to prepare and submit to me a Safety Assessment Report (as described in section 3.1 of the *Manual*). The individual will not be allowed into the laboratory unsupervised until the report has been approved by me.

Report due date _____

2. I acknowledge that I have read the above-named individual's Safety Assessment Report, and I consider it to be satisfactory for the prescribed research.

Signature _____ Date _____

Name (print) _____

Distribution of copies of this declaration (3)

- Original attached to hard copy of safety report for researcher in lab
- Scanned copy for supervisor
- Scanned copy for rdickhou@uwaterloo.ca (departmental files)

UW – CHE “SAFETY FIRST” FUNDAMENTALS

D. Research Safety Report:

- *Lab workers only*
- *Outlined in ChE Safety Manual*
- *Specific to actual research project*
- *Completed and approved before working in the lab*
- *Framework for subsequent formal risk assessments (next slide)*
- *Any changes require supervisor approval*
- *DEPARTMENTAL REQUIREMENT!*



University of Waterloo
Department of Chemical Engineering

Health and Safety Report:
Characterization of Potato Chip Process Water

Laurin YYYYYYY
20XXXXXX

Vasily ZZZZZZ
20XXXXX

Chris AAAAAAA
20XXXXX

Supervisor: Dr. William Anderson

E. Laboratory Risk Assessments ****NEW****

- *Form obtained from the Safety Office website:
<https://uwaterloo.ca/safety-office/programs-and-procedures/laboratory-safety>*
- *Complete one form for each lab operation/experiment*
- *Every new procedure needs a new risk assessment*
- *Requires approval by supervisor*
- *Attach initial assessment(s) to research report*
- *submit (approved) updates/add-ons as you progress in your research*
- *Electronic copies of all documents submitted to me for departmental files*
- **DEPARTMENTAL REQUIREMENT!**

F. Nano Risk Assessments **NEW**

- *Worksheet obtained from the Safety Office website:*
<https://uwaterloo.ca/safety-office/programs-and-procedures/laboratory-safety/nanomaterials>
- *Determines containment requirements*
- *Attach initial assessment(s) to research report*
- *submit updates/add-ons as you progress in your research*
- *DEPARTMENTAL REQUIREMENT!*

2. Lab Safety: Working with Chemicals:

- *Ensure proper PPE to minimize exposure*
- *Read and understand current (M)SDS*
- *Be prepared to properly deal with a possible spill (Waterloo-specific)*
- *Know where the spill kits are*
- *Make sure Safety Report identifies the SOP and that it is in the lab*
- *Store reagents properly!!*
- *Every container must be labeled according to **WHMIS2015 rules***
- *Segregate chemical waste and do not “stock-pile”*
- *Rubber gloves for handling specific lab apparatus/materials only; remove when finished procedure*



Lab Safety: (Material) Safety Data Sheets ((M)SDS):

- *Consult the sheet **BEFORE** you start working with a chemical*
- *Hard copies must be available in lab for chemicals used regularly*
- *Soft copies stored on local media for everything else*
- *(M)SDS must be no older than 3 years.*
- *(M)SDS must be of the exact same formulation as the material you are working with*



Lab Safety: Personal Protective Equipment - PPE

Per (M)SDS, Safety Office and Safety Manual requirements

e.g.,

- *Lab Coat and Closed-toe Shoes (no sandals, flip-flops)*
- *Nitrile Gloves when appropriate*
- *Safety Glasses or Face Shield*
- *Respirators are not allowed in UW labs*



UW – CHE "SAFETY FIRST" FUNDAMENTALS

Lab Safety: Fumehoods

- *Exhausts toxic or hazardous materials*
- *Calibrated for 100 fpm with sash open < 18"*
- *Flammables and Corrosives storage under hood*
- *Some have gas nozzles*
- **DO NOT USE IF ALARMING**
- *CLOSE SASH when not in use*



Lab Safety: Hazardous Equipment

Possible Hazards:

- *Burns, Extreme Burns, Freeze*
- *Toxic or Corrosive*
- *Entanglement*
- *Cuts, Pinches, Crushes*
- *Flying debris*
- *Bio-exposure*
- *Laser Lights*
- *X-rays*
- *Slips, Trips, Falls*



Lab Safety: Hazardous Equipment Documentation

- *Safety Stickers on Equipment*



UW – CHE "SAFETY FIRST" FUNDAMENTALS

Lab Safety: Hazardous Equipment Documentation

- **Standard Operating Procedures (SOP's)**
- **Focus on Safe Operation, not skills**
- **Common Lab SOP's:**
 - **Compressed Gas Cylinder Handling**
 - **Fumehood Operation**
- **Equipment Specific SOP's:**
 - **Machine Lathe**
 - **Bandsaw**
 - **Table Saw**
 - **Etc.**

Compressed Gas Cylinder Handling Standard Operating Procedure (SOP)

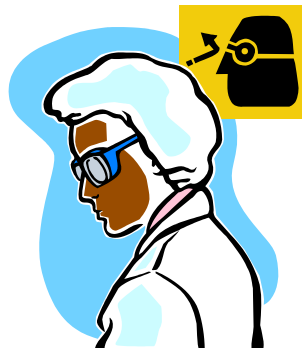
Name	Compressed Gas Cylinder Handling
Description	A gaseous substance that is contained under high pressure in a steel cylinder
Location	E6 – Bottle Vault and Research Labs
SOP Creation Date	2013-Feb-22
SOP Created By	Victoria Marchand
SOP Revision Date	2013-Jun-07
SOP Revised By	Zehra Hameed
SOP Online Location	Che SharePoint https://chesp.uwaterloo.ca/sites/safety
Equipment Owner	Chemical Engineering
Authorized Trainers	Bert Habicher, Tom Dean
Support Technicians	Bert Habicher



Significant Hazards	<ul style="list-style-type: none">• High pressure - sudden uncontrolled release of contents, possibly causing projectiles• Suffocation with oxygen-displacing or toxic gases• Frost bite from cryogenic gases• Fire/explosion from flammable gases• Toxicity from toxic gases
Administrative Controls	Considered safe to operate alone for trained individuals
Engineering Controls	<ul style="list-style-type: none">• Regulators• Pressure relief valves
PPE Required	<ul style="list-style-type: none">• Closed toe shoes• If handling cryogenic gases, you must wear;<ul style="list-style-type: none">▪ Insulated gloves▪ Full face shield▪ Lab coat
Relevant Standards and Codes	<ul style="list-style-type: none">• "Cryogenics and Compressed Gases." <i>Safety Home</i>. <http://www.safetyoffice.uwaterloo.ca/hse/cryogenics-compressed-gas/cryo-comp-gas.html>.
Relevant MSDS	<ul style="list-style-type: none">• Relevant to type of Compressed Gas being used• Located on the safety label of the cylinder in hatched box
Accident Procedure	<ul style="list-style-type: none">• Warn people of accident and move to a safe location to call for emergency help• All accidents are to be reported to <u>Your Supervisor, the Department Safety Office and the Department Chair</u>• Seek first aid assistance if any injury occurs and if necessary, seek medical assistance by dialing the appropriate emergency contact number which can be found on the <u>First-Aid Poster</u>• If the cylinder is dropping, let it fall if it is at an angle of approximately 22 degrees or less• A notification MUST be posted on the Compressed Gas Bottle indicating that it should not be used until the cause of the accident is identified• A list of First-Aid trained people is readily available in the lab
Emergency Shutdown Procedure	N/A

3. Transportation Safety: Chemicals

- ***Any chemicals in glass containers must use 'Double Containment Method'***
- ***Effective 01-OCT-14***
- ***Per Safety Office Bulletin*** →



Safety Requirements for Transporting Chemicals between Rooms and Buildings

Chemicals in glass bottles must be placed in secondary containers made of non-breakable material when transported between rooms, within buildings or on campus. Should the original container leak or fail, the secondary containment will help avoid chemical spills. A spill in a public area can be liable to fines or legal action by the Ministry of the Environment. Bottle Tote Safety Carriers and Chemical Resistant Secondary Containment Bins are available for purchase from Chem Stores (also Fisher or VWR). Other options must be chemical resistant and designed for safe transport of acids, alkalis, and solvents.

Please Note: Do not transport regulated materials in a personal vehicle or by bicycle. Personal insurance may not provide coverage for incidents involving hazardous materials.

Bottle Tote Safety Carriers - designed for the safe transport of acids, alkalis, and solvents. Carry only one tote per person. If transporting two totes, two people are required, one person to open doors. Alternatively, a cart with containment bin can be used. The small carriers can accommodate 500mL or 1L bottles. The large carriers accommodate bottle sizes to 4L. Totes may be used indoors and outdoors



Totes may be used indoors and outdoors

Chemical Resistant Secondary Containment Totes - must be used as a means of containment when glass bottles containing chemicals are transported using a lab cart (recommend Rubbermaid 68.1L size). Do not use bins without a cart. Segregate incompatible chemicals by using separate containment bins or by transporting separately. Ensure the height of the bin is greater than 1/2 the height of the largest bottle. Use the containment bin with lid securely in place whenever possible.

Chemical Resistant Lab Carts - shelf cart can be purchased from a safety supply store. Other carts with a lip edge (minimum 1 inch or 2.5 cm high) may also be used and must be in good condition. (eg. Supplier Tenaquip, Rubbermaid cat# 450088 ergonomic model or equivalent; must have minimum 500 lb. capacity). The cart/bin combination is for indoor use only.



The cart/bin combination is for indoor use only

Effective October 1, 2014
Without adequate secondary containment requirements,
Chem Stores will refuse sale

Transportation Safety: Compressed Gases

- *Must be trained – Praxair classroom plus On-Line course*
- *Compressed gases moved on approved carts only with caps on*
- *Now ordered online through Central Stores*
- *Delivered to your location*



Transportation Safety: Hazardous Waste

- *Ch.E. Shipping & Receiving provides the researcher with a place to bring waste chemicals*
- *Labelled in full, using official labels, prior to arrival*
- *Clean and free of contaminants on the outside surface and transported without the use of gloves*
- *Secondary containment (using a plastic tub) required during transport*
- *You will be asked to classify the waste as either acid, base, flammable, oxidizer or toxic; **follow waste segregation guideline from Safety Office website***
- *For bio-waste containers, yellow bag inside must be tied closed*
- ***Scheduled times:** 1:00 pm to 1:20pm Tue – DWE 1510
2:00pm to 2:20pm Tue - E6 1022*



Transportation Safety: Disposable Nitrile Gloves

- ***DO NOT WEAR THEM IN THE HALLWAYS, or AROUND THE LAB IN GENERAL***
- ***TASK-SPECIFIC ONLY AND THEN INTO THE GARBAGE***
- ***“HELP ELIMINATE CONTAMINATION”***



UW – CHE "SAFETY FIRST" FUNDAMENTALS

4. Hazard, Incident and Investigation Reporting

- ***A “HAZARD” is an “unsafe Condition”***
- ***It could cause Injury***
- ***Use Hazard Report Form***
- ***Formal method to inform Supervisor***
- ***“Preventive Action” – to prevent Injury***

WATERLOO
ENGINEERING

UNIVERSITY OF WATERLOO		HAZARD REPORT	
<small>Use this to report health and safety hazards or concerns to supervision for corrective action. Report unsafe buildings and grounds conditions directly to Plant Operations Department at ext. 33793 (24 hr service).</small>			
HAZARD IDENTIFICATION			
SECTION A: COMPLETED BY EMPLOYEE			
NAME:	DATE:	NAME OF SUPERVISOR:	
LOCATION OF HAZARD (BUILDING, ROOM, AREA):			
DESCRIPTION OF HAZARD/CONCERN:			
SUGGESTION CORRECTIVE ACTION:			
EMPLOYEE SIGNATURE:			
HAZARD ASSESSMENT AND CONTROL			
SECTION B: COMPLETED BY SUPERVISOR			
<small>Loss Potential if not corrected:</small>			
SEVERITY: <input type="checkbox"/> SEVERE <input type="checkbox"/> SERIOUS <input type="checkbox"/> MINIMAL		PROBABILITY: <input type="checkbox"/> HIGH <input type="checkbox"/> MEDIUM <input type="checkbox"/> LOW	
ACTION PLAN TO CONTROL HAZARD: (include what, how and who will implement the corrective actions):			
SIGNATURE ONCE COMPLETE:		DATE:	
FOLLOW UP			
EMPLOYEE(S) ADVISED OF RESULT: <input type="checkbox"/> YES <input type="checkbox"/> NO			
FURTHER ACTION REQUIRED? EXPLAIN WHAT AND BY WHOM:			
<input type="checkbox"/> Referral to Faculty/Dept. management for action		<input type="checkbox"/> Referral to Safety Office	
<small>Retention: 2 years in Department Disposition: Secure Destruction</small>			
<small>Safety Office February 2012 (HS60)</small>			

UW – CHE "SAFETY FIRST" FUNDAMENTALS

Incident Reporting

- ***An “Incident” is any occurrence which was not planned with the potential to cause damage or injury***
- ***All incidents must be immediately reported as described in the UWSO procedure***
- ***For your benefit in case of injury***

WATERLOO
ENGINEERING

UNIVERSITY OF WATERLOO		INJURY / INCIDENT REPORT	
Last Name		First Name(s)	
Campus Extension		Sex <input type="checkbox"/> Male <input type="checkbox"/> Female	
Home Phone #:		Status <input type="checkbox"/> Full Time Employee <input type="checkbox"/> Part Time Employee <input type="checkbox"/> Graduate Research Assistantship	
Department/Faculty		Were you an employee at time of injury/incident? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Date and Time of Injury/Incident Day Month Year <input type="checkbox"/> am <input type="checkbox"/> pm		Occupation	
Date and Time Reported Day Month Year <input type="checkbox"/> am <input type="checkbox"/> pm		Name of Supervisor	
Type of Incident <input type="checkbox"/> Near Miss <input type="checkbox"/> No Treatment <input type="checkbox"/> Dept. First Aid <input type="checkbox"/> Medical Aid		Specify location and name of health care provider <input type="checkbox"/> Family Physician <input type="checkbox"/> Health Services <input type="checkbox"/> Chiropractor / Physiotherapist	
Loss Potential if not corrected: SEVERITY: <input type="checkbox"/> SEVERE <input type="checkbox"/> SERIOUS <input type="checkbox"/> MINIMAL		Date Health Care received: _____	
Injury/incident location (building, room #, parking lot, etc.).		<input type="checkbox"/> Walk-in / Urgent Care Clinic <input type="checkbox"/> Emergency <input type="checkbox"/> Other	
What happened to cause the injury/incident?			
Explain what you were doing and the effort involved. Identify the size, weight and type of equipment or materials involved.			
What conditions and/or actions contributed to the injury/incident?			
Body part(s) involved (specify right or left side).			
Names and phone number of witnesses.			
Action taken by self/department to prevent recurrence. <input type="checkbox"/> Reviewed job procedure and instruction <input type="checkbox"/> Repaired or replace equipment/facilities <input type="checkbox"/> Reported unsafe conditions to Plant Operations(x33793) <input type="checkbox"/> Reviewed Personal Protective Equipment <input type="checkbox"/> Conduct Incident Investigation – report to follow <input type="checkbox"/> Other			
Explain			
Is there lost time from work due to this injury/incident? <input type="checkbox"/> Yes <input type="checkbox"/> No If "yes" complete this section.			
Date and Time Last Worked Day Month Year <input type="checkbox"/> am <input type="checkbox"/> pm		Working Hours for Last Day Worked	
Sched. Hours for Week of Injury Sun Mon Tues Wed Thurs Fri Sat		Total Hours Per Week	
Injured Person's Signature		Supervisor/Department Signature	
Date Returned To Work		Extension	

Forward within 1 day to Safety Office, Commissary Room 105 or Fax #519-886-8082. If completion is delayed, contact the Safety Office at ext. 33587 to make a preliminary report. Retain copies for departmental records.
Information collected under the authority of the Occupational Health & Safety Act, Workplace Safety & Insurance Act and UW Policy #34 Health, Safety & Environment.
Safety Office February 2012

Incident Investigation Report:

- ***All incidents must be investigated by the Supervisor and an Incident Investigation Report completed as described by the UWSO***
- ***Helps to prevent propagation of bad lab practice and reoccurrence of incidents, with “Corrective Actions” applied.***

UNIVERSITY OF WATERLOO		INCIDENT INVESTIGATION REPORT	
DEPARTMENT:		LOCATION OF INCIDENT:	
DATE OF INCIDENT:	TIME:	DATE REPORTED:	TIME:
INJURY OR ILLNESS OTHER INCIDENTS			
INJURED'S NAME:	OCCUPATION:	AREA OF INJURY/ILLNESS:	
NATURE OF INJURY/ILLNESS:	TIME ON TASK:		
PERSON REPORTING INCIDENT:	OBJECT/EQUIPMENT/SUBSTANCE INVOLVED:	PERSON WITH MOST CONTROL OF OCCUPATION:	
PROPERTY DAMAGE			
PROPERTY DAMAGE TO:	NATURE OF DAMAGE:	COST	<input type="checkbox"/> ESTIMATED <input type="checkbox"/> ACTUAL
TYPE OF CONTACT:		CONTACT WITH:	
<input type="checkbox"/> STRUCK AGAINST	<input type="checkbox"/> SLIP/TRIP	<input type="checkbox"/> OVEREXERTION	<input type="checkbox"/> ELECTRICITY
<input type="checkbox"/> STRUCK BY	<input type="checkbox"/> FALL ON SAME LEVEL	<input type="checkbox"/> REPETITION	<input type="checkbox"/> HEAT/COLD
<input type="checkbox"/> CAUGHT IN/ON	<input type="checkbox"/> FALL TO BELOW	<input type="checkbox"/> BODILY REACTION	<input type="checkbox"/> NOISE
RISK			
EVALUATION OF LOSS POTENTIAL IF NOT CORRECTED:			
SEVERITY: <input type="checkbox"/> SEVERE <input type="checkbox"/> SERIOUS <input type="checkbox"/> MINIMAL	PROBABILITY: <input type="checkbox"/> HIGH <input type="checkbox"/> MEDIUM <input type="checkbox"/> LOW		
DESCRIPTION			
DESCRIBE HOW THE EVENT OCCURRED:			
IS THERE A WRITTEN SAFE WORK PROCEDURE OR JOB HAZARD ANALYSIS FOR THIS JOB/TASK?			
<input type="checkbox"/> YES <input type="checkbox"/> NO			
HAS THIS WORKER RECEIVED TRAINING RELEVANT TO THE ACTIVITY INVOLVED?			
<input type="checkbox"/> YES <input type="checkbox"/> NO			
WITNESSES TO THE INCIDENT (NAME AND CONTACT NUMBER):			

UW – CHE "SAFETY FIRST" FUNDAMENTALS

Lab Safety Inspections:

- **Each term by Dept. Lab Safety Groups**
- **Monthly by Lab Supervisor**
- **Annually by UW Joint Committee**
- **Results reviewed by Dept. Safety Committee**
- **Findings are to be corrected RIGHT AWAY!!**
- **Any unsafe operation may result in a LAB SHUTDOWN until the problem is resolved!!**



WATERLOO
ENGINEERING

Chemical Engineering Lab Inspection Form - Fall Term																	
Group: _____				Supervisor: _____				Building & Room #: _____									
Departmental Inspection attendees: _____								Date: _____									
Use item numbers to comment on unsatisfactory items (other side of page) <input type="checkbox"/> reserved for Safety Committee (SC) Record findings as: (X) Unsatisfactory (blank) Satisfactory or Not Applicable (*) Carryover from last inspection (V) corrected																	
SC Supervisor			S O N D			SC Supervisor			S O N D			SC Supervisor			S O N D		
Signs & Labels						Natural Gas Shut Off Valves						Compressed Gas Cylinders					
1. First Aid Emergency						38. Accessible						71. Secured					
2. Fire / Evacuation						39. Identified						72. Properly Marked					
3. Emergency Lockdown						40. Electrical						73. Properly Stored					
4. Hazardous Materials Spills						41. Panels Accessible/Identified						74. Proper Regulators					
5. Phone 911 Label						42. Wire Condition						75. Cylinder carts used					
6. Lab Hazard Form						43. Proper Grounding						76. Adequate Type					
7. Hazardous Waste Disposal						44. Adequate Outlets						77. Labelled Broken Glass Container					
8. No Chemicals into Sink						45. Extension Cords temporary use only						78. Clean					
First Aid Stations/Kits						46. C.S.A. Approved						Laboratory Benches					
9. Stocked						47. Electrical panels are accessible						79. Good Condition					
10. Accessible						48. GFI's used in wet areas						80. Adequate Space					
11. Regularly Inspected						49. Locking/Tagout procedures						81. Adequate Number					
12. First Aiders' Names						50. Equipment						82. Adequate Type					
Fire Extinguishers						51. Pre-use inspection record						83. Clean					
13. Seal Unbroken						52. Good Condition						84. Good Condition					
14. Accessible						53. Ventilation						85. Face Velocity Tested					
15. Proper Type						54. Dust Control						Pressure & Vacuum Vessels					
16. Regularly Inspected						55. Fume Control						87. Safety Valves					
General						56. Equipment maintained						88. Vent Lines					
17. Phone Access						57. Guarding adequate						89. Inspection Certificate					
Floors and Aisles						Chemical Storage						90. Shielding					
18. Clean						58. Identification						91. Tying Clamps					
19. Aisles Clear						59. Segregated by Type						92. Clean					
20. Good Condition						60. Flammable Liquids Stored properly & less than 5L container size						93. Inspect Rotors					
21. Doors and Exits						61. MSDS Available						Refrigerators					
22. Accessible						62. WHMIS Labels						94. Type					
23. Identified						63. Dented Permitted						95. Labels					
Lighting						64. Suitable & Labelled Refrigerator						Training					
24. Adequate						Hazardous Waste						96. WHMIS Training					
25. Operating Properly						65. Proper Segregation						97. Compressed Gas					
26. Emergency Shower/Eye Wash						66. Procedure						98. Equipment Specific					
27. Accessible						67. Regular Disposal						99. Lifting devices					
28. Within 10 sec travel time						68. Proper Storage						100. Laboratory Training					
29. Clearly Identified						69. Spill Kits						101. Other training (specify)					
30. Good Condition						70. Stocked											
Personal Protection												Other Items					
31. Footwear																	
32. Eye Protection																	
33. Gloves																	
34. Hearing Protection																	
35. Fall protection																	
Safety Program Participation																	
36. X-ray equipment																	
37. Lasers																	
38. Radioactive materials																	
39. Bio-hazardous materials																	

See other side for action items and comments →

Signed - Safety Coordinator: _____ Date: _____

Signed - Supervisor - September: _____ Date: _____

Signed - Supervisor - October: _____ Date: _____

Signed - Supervisor - November: _____ Date: _____

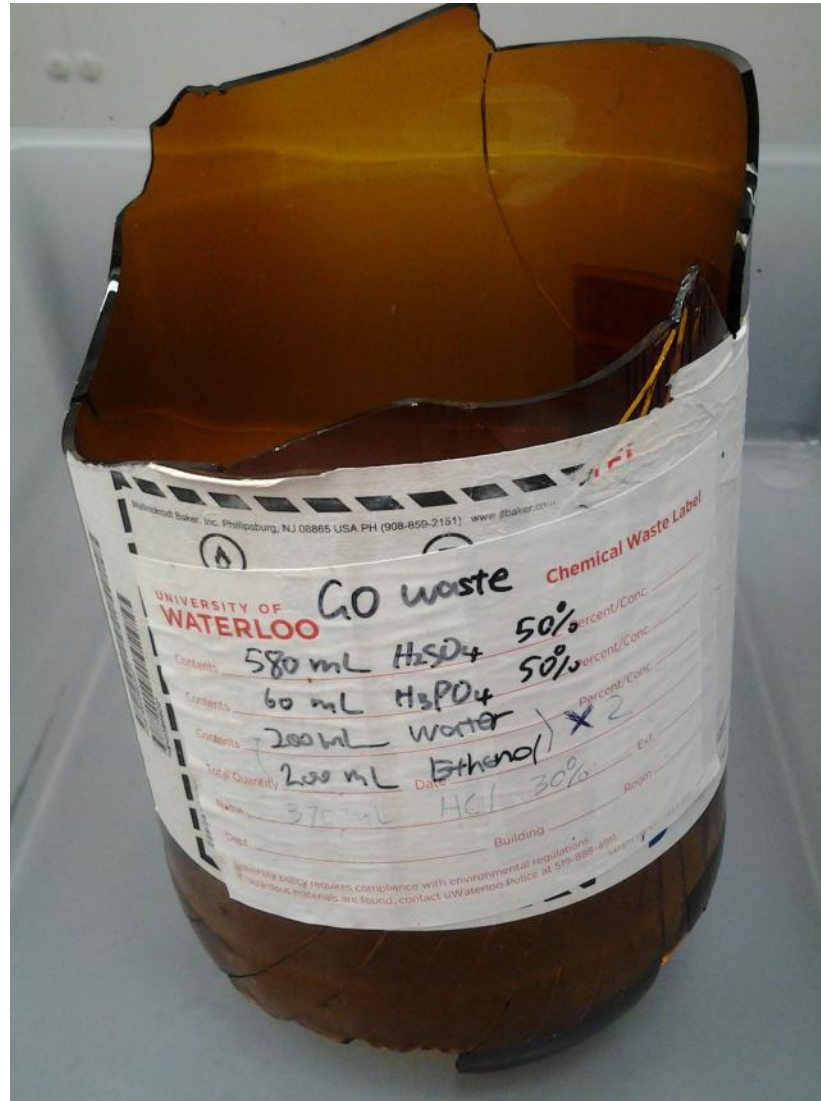
Signed - Supervisor - December: _____ Date: _____

DWE fridge explosion; 1980s



UW – CHE "SAFETY FIRST" FUNDAMENTALS

Spot the problem:



UW – CHE "SAFETY FIRST" FUNDAMENTALS

Spot the problems:



WATERLOO
ENGINEERING

UW – CHE "SAFETY FIRST" FUNDAMENTALS

Spot the problem.....



WATERLOO
ENGINEERING

UW – CHE "SAFETY FIRST" FUNDAMENTALS

Saving the best for last.....



WATERLOO
ENGINEERING

**The Incident:**

Several ml of carbon disulfide were being heated directly on a hotplate in a fume hood. The solvent ignited. The fire was put out with a fire extinguisher. Nobody was injured.

Immediate Follow-up:

An incident report was completed, but not within the 24-hr period required by the Safety Office. Researchers felt the fire happened because the hotplate “went out of control”.

Root Causes:

CS₂ flash point = -30 C; auto-ignition = 90 C; LEL= 1.3%. This highly flammable Class I solvent ignited either because the hotplate became too hot and/or the vapor (much heavier than air) came in contact with a spark from the hotplate. Researcher was relying on the control knob setting for an accurate indication of temperature. *Flammables should NEVER be heated directly on a hotplate.*

Follow-up Actions:

An incident investigation report was initiated in order to determine why this happened and how to modify procedures to prevent a recurrence. Safety Office personnel came in to meet with representatives and to facilitate a solution. Workers will now either use a Rotovap or will heat in a proper Pyrex vessel with proper venting in a water bath. A thermometer will be used in the bath to establish temperature stability first. A non-sparking hotplate must be used. Alternatively, the solvent can be “blown down” at room temperature with a stream of clean nitrogen directed at the top of the vessel.



CANOLA OIL IN OIL BATHS



The use of canola oil in oil baths on hot plates is to be discontinued in Chemical Engineering due to its flammability at high temperatures. The fume hood damage above was caused by an over-heated hotplate left unattended. The glass dish broke and the oil was completely consumed in a flash fire. The sash was cracked and the back panel burned through. Had the researcher been working there with the sash up at the time he could have been seriously injured. Alternatives such as water, sand or silicone oil in a metal pan are required. Ensure that the hotplate is electrically sound and relatively new. The temperature must be monitored continuously.



The Incident:

Contaminated waste laboratory glassware and plasticware dumped in blue bin in E6. Volatile chemicals were still emanating from container residue.

Immediate Follow-up:

Department notified by e-mail as to the proper procedures for discarding used or broken labware.

Root Causes:

Lack of awareness on the part of some lab researchers regarding proper disposal procedures. Failure to read and understand rules located on the blue bin itself.

Follow-up Actions:

New signage to be placed at eye level above bins. Department safety manual to be updated.





Transporting chemicals to and from labs:

Be aware that carrying any type of chemical, batches of samples, liquid nitrogen or biological agents on the stairs in E6 (or in any other UW building) is unsafe and is prohibited. If you should happen to slip or trip, the results could be disastrous.

Use the elevator for all chemical transportation between floors. A rubber bucket (below left) is acceptable for short distances. A heavy-duty lab cart is better, especially if you have several bottles to move and need to go any distance.



The Incident:

UCLA student Sheri Sangji was working with the pyrophoric t-BuLi. She used an improper plastic syringe with a short needle to dispense ~50 ml. The liquid spontaneously ignited and ejected as a fireball onto her person. This also caused Sheri to knock over a bottle of pentane which fed the fireball. A postdoc heard Sheri scream and saw that she was on fire. He tried wrapping his lab coat around her, but that caught fire also.



Another postdoc called 911 and ran to find her supervisor. When he arrived, Sangji was sitting on the floor with her arms outstretched, shaking. Her synthetic sweatshirt had burned away, and large blisters were beginning to form on her abdomen. The skin was separating from her hands.

Immediate Follow-up:

Sheri was treated at a specialized burn centre for the next 18 days where she was at first conscious and in great pain. Then her organs began to fail, and on 16-Jan-09, she died. A doctor later testified she had suffered second- and third-degree burns to nearly half her body. Sangji was buried in Toronto, a short drive from her parents' house.

Root Causes:

Sheri was not properly trained and was using improper equipment (plastic instead of glass - wrong type of needle) in a flawed procedure. There is no evidence that she had read the safety bulletin from the chemical supplier. She was not issued a lab coat.

Follow-up Actions:

The D.A. charged Sheri's supervisor with four felony labour code violations, and if convicted, he could go to prison for four years. The case is the first criminal prosecution of an American academic for a lab accident. UCLA has been ordered to implement a comprehensive safety program.



Beveled-tip syringe needles are for piercing septa only!

There have been several cases of needle sticks in labs recently. Note that if you are using a syringe with a sharp needle for measuring out small amounts of liquids that are being dispensed into an open container, you do not need to use a syringe. You should be using preferably a micro-pipettor or, if necessary, a square/blunt-tip syringe needle meant for the purpose.



VS.



Do not confuse a *PARR HIGH PRESSURE REACTOR* with a *PARR DIGESTER*. They are two different things.

The reactor (on the left) is used for organic chemical reactions in a fume hood or cabinet.

The digester (on the right) is for doing mineral acid digestions of solids **ONLY**.

Several groups in Ch.E. have been found to be using flammable solvents in Parr digesters which they then place inside ovens at elevated temperatures. If these should ever overheat and release their contents through the escape valve, a serious explosion could result.

Anyone considering using either of these apparatuses needs to perform a risk assessment as described on the Safety Office website first.

Organic Peroxides

Some researchers may be using organic liquids that can form explosive organic peroxides over time. Examples of these are tetrahydrofuran, ethyl ether and isopropyl alcohol. These chemicals need to be monitored and **not forgotten**. Always read and follow recommendations on the SDS that comes with a new chemical. Write the date you receive the material right on the bottle; store it properly and **for no longer than recommended**.

If the liquid contains an inhibitor that slows down peroxide formation it can be kept longer, but it is a very good idea to test it periodically. There are strips available from Chemistry Stores for this purpose. If the test indicates > 25 ppm peroxides, dispose of it by transporting to the nearest campus waste facility in the usual manner for chemical waste.

If you observe crystals forming or a layer of different density liquid in the bottle or deposits around the neck, please contact Greg Friday at gfriday@uwaterloo.ca or ext. 35755 for removal.

Consult this website for more information:

https://www.ccohs.ca/oshanswers/chemicals/organic/organic_peroxide.html



Thank you and stay safe in the lab!

