



## **DEPARTMENT OF GEOLOGICAL SCIENCES AND GEOLOGICAL ENGINEERING**

# **SAFETY MANUAL**

**(Updated February 17, 2022)**

### **IN CASE OF EMERGENCY**

**FROM WITHIN THE UNIVERSITY 36111**  
**FROM OUTSIDE THE UNIVERSITY 613-533-6111**

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## **1.0 SAFETY IN THE LABORATORIES AND SHOP AREAS**

- ALWAYS WEAR PROPER EYE PROTECTION FOR THE TASK YOU ARE CARRYING OUT (e.g. SAFETY GLASSES, PRESCRIPTION GLASSES WITH SIDE SHIELDS, LASER GOGGLES)
- ALWAYS WEAR APPROPRIATE PROTECTIVE CLOTHING
- ALWAYS KNOW THE HAZARDOUS PROPERTIES OF MATERIALS BEING USED
- ALWAYS WASH HANDS THOROUGHLY BEFORE LEAVING THE LABORATORY
- NEVER WEAR OPEN-TOED SHOES, HIGH-HEELED SHOES OR SANDALS
- ALWAYS WEAR LONG PANTS (NO SHORTS, SKIRTS, SHORT DRESSES OR CAPRIS)
- NEVER SMOKE IN THE BUILDING
- NEVER EAT, DRINK OR APPLY COSMETICS IN LABORATORIES
- NEVER PERFORM UNAUTHORIZED EXPERIMENTS
- NEVER ENGAGE IN PRANKS, PRACTICAL JOKES OR OTHER ACTS OF MISCHIEF
- DO NOT BLOCK ACCESS TO EMERGENCY EXITS AND EMERGENCY EQUIPMENT
- ANY WOMAN WHO WORKS IN A LABORATORY WHERE HAZARDOUS SUBSTANCES ARE IN USE AND WHO IS, OR BELIEVES THAT SHE MAY BE, PREGNANT MUST INFORM HER SUPERVISOR

## 2.0 SAFETY OFFICERS

### DEPARTMENT OF ENVIRONMENTAL HEALTH AND SAFETY

Director	Dan Langham	74980	<a href="mailto:dan.langham@queensu.ca">dan.langham@queensu.ca</a>
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Hazardous Materials	Tom Martinek	74976	<a href="mailto:tom.martinek@queensu.ca">tom.martinek@queensu.ca</a>
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OCASP Coordinator	Sandra Jeffers	78064	<a href="mailto:OCASP.Coordinator@queensu.ca">OCASP.Coordinator@queensu.ca</a>
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### DEPARTMENT OF GEOLOGICAL SCIENCES AND GEOLOGICAL ENGINEERING

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Department Manager	Paul Bass	32596	<a href="mailto:pdb@queensu.ca">pdb@queensu.ca</a>
Departmental Safety Officer	Agatha Dobosz	36167	<a href="mailto:agatha.dobosz@queensu.ca">agatha.dobosz@queensu.ca</a>

### FACULTY OF ARTS AND SCIENCE JOINT HEALTH AND SAFETY COMMITTEE

Co-Chair	Terrence O'Reilly	77342	<a href="mailto:oreillyt@queensu.ca">oreillyt@queensu.ca</a>
Co-Chair	Paul Bass	32596	<a href="mailto:pdb@queensu.ca">pdb@queensu.ca</a>

#### Safety Officer Duties and Responsibility:

- Main communication link between their department and EH & S
- Inspect the work place
- Circulate material received from EH & S
- Respond to reports of unsafe conditions
- Ensure deficiencies are corrected
- Ensure that the JH & S committee member is informed, if needed, to investigate accidents, unsafe conditions or work refusals
- Accompany staff from EH & S during their site visits
- Accompany inspectors from outside agencies
- Keep Department Head informed of all issues
- Workers Compensation Accident Information - forward to EH & S
- Ensure staff in the department receive the needed information with respect to:
  - Fire Safety
  - Chemical Safety
  - Mandatory Training
  - Biohazard Safety
  - Radiation Safety

### 3.0 INTRODUCTION

Safety is the responsibility of everyone who works in the Department of Geological Sciences and Geological Engineering. This includes all faculty, staff, graduate students, researchers and visitors to the Department. This manual is intended to cover many of the common or general hazards associated with work in the Department and must be read and adhered to by everyone working in the Department. It cannot be assumed that the warnings or rules laid out in this manual are necessarily complete for dealing with specific chemical hazards; additional information or measures may be required and the appropriate information sources should be consulted.

**It is the responsibility of individual supervisors to ensure that the necessary procedures and protocols are both established and followed in their respective work areas.**

**It is the responsibility of workers to follow prescribed procedures and protocols when dealing with hazards in the laboratory.**

Personal safety depends upon a positive attitude towards safety as well as good, informed judgment on the part of each individual working in the Department.

In addition to the health and safety standards set by the Department of Geological Sciences and Geological Engineering, the **Department of Environmental Health and Safety**, Queen's University, has established a set of policy statements and standard operating procedures for the University. As of **June 2006**, the documents listed in Appendix I have been implemented.

#### **4.0 QUEEN'S UNIVERSITY DEPARTMENT OF GEOLOGICAL SCIENCES AND GEOLOGICAL ENGINEERING ACKNOWLEDGMENT OF RESPONSIBILITY**

Under the Occupational Health and Safety Act, **everyone** has both rights and responsibilities in providing a safe work environment.

The **Department** has responsibility and authority for maintaining appropriate standards for health and safety within the Department. To this end the Department sets out the appropriate standards and procedures in the Department Safety Manual, provides basic training in safety and performs inspections of the workplace.

**Supervisors** are responsible for ensuring that individuals under their supervision have a safe environment in which to work, know and follow the Department safety rules, are made aware of the specific hazards associated with their work, and have available the appropriate procedures and safety equipment for dealing with these hazards.

**Individuals** must work safely according to the procedures outlined by the Department and the individual's supervisor, must maintain a safe working environment through good laboratory practice and housekeeping, and safe field practices and must notify their supervisor or the Department of any defects in equipment or protective devices, or of the existence of hazards in the workplace.

The rights and responsibilities of supervisors and workers, as defined by the **Occupational Health and Safety Act**, are described in Appendix II.

## **5.0 GENERAL DEPARTMENT SAFETY**

- Know and follow safety rules, procedures and protocols
- Be aware of hazards, and the procedures for dealing with those hazards, before you start your work
- Anyone wishing to use any power tools must have the approval of a qualified technician and must have received appropriate training on that equipment prior to any use.
- Fire doors must be kept closed at all times; automatic (self-closing) fire doors must not be blocked
- Familiarize yourself with all safety equipment and procedures in your work area (telephone, exits, fire extinguishers, fire alarms, safety shower, eyewash fountain, first aid kit, evacuation routes)
- Never block emergency exits, emergency equipment or electrical panels
- Post suitable warning signs if a specific hazardous situation exists; include the name and phone number of individual(s) responsible
- Maintain a tidy workplace
- Research laboratories must keep lab doors closed to effect proper ventilation of the lab
- Keep your work area locked when unoccupied to avoid unauthorized entry
- No bicycles, rollerblades or skateboards in the building
- WHMIS training is mandatory for anyone working in a research lab
- Anyone working in a laboratory who becomes pregnant should inform his/her supervisor so that an assessment of potential risks may be carried out

### **5.1. NEW EMPLOYEE/STUDENT SAFETY ORIENTATION CHECKLIST**

Refer to Form I for a copy of the checklist. The checklist is intended to serve as a guide to supervisors for orienting new staff, faculty, students and others (ie. postdoctoral fellows, visitors/volunteers, summer students, fourth year students completing research projects, etc.). The checklist also serves to provide a summary of training received.

### **5.2. RELEASE OF LIABILITY FOR VISITORS AND VOLUNTEERS**

University employees and/or students who undertake activities in laboratories, for example, which are potentially hazardous, are protected by the University liability insurance coverage. Visitors and volunteers, however, expose themselves to personal liability for damages which occur due to their activities. Also, University may be placed at risk since a damage claim resulting from the activities of a visitor may be directed at the University.

In addition, visitors may not be protected under Workers' Compensation. This also means they are able to sue the University and its staff and faculty if they receive injuries while on campus. It is important, therefore, that persons who fall into the category of "visitor" or "volunteer" on campus receive the following formal documentation concerning their private work at Queen's.

- The Department must obtain a waiver/release signed by the visitor (see Form II).
- The visitor should receive a letter from the Department Head setting out the terms, conditions, duration, and description of the private work he or she is to perform while in the Department.
- The visitor or volunteer should be provided with the departmental safety orientation and the checklist should be completed.



- There may be some "visitors" who are on campus for a short period of time (e.g. guest lecturers) for whom it would be inappropriate to obtain a waiver/release or other formal documentation.

### 5.3. WORKING ALONE

Undergraduate students must not work alone in a laboratory at any time. A second person must be present and must assume responsibility for supervision of the undergraduate. The work carried out must be authorized by a faculty member.

For other members of the Department, working alone is usually defined as working in a laboratory outside of normal working hours (8 a.m. to 6 p.m., Monday through Friday) in the absence of any other co-workers. Individuals may work alone if their laboratory work is of a non-hazardous nature and if there is someone else working on the same floor of the building.

If, for some reason, hazardous work must be performed outside normal working hours then the following procedure must be followed:

1. The work must have your supervisor's approval, and
2. A second co-worker must be available in case of emergency, or
3. The Emergency Report Centre (36111) and/or Campus Security (36733) must be contacted to set up a check-in routine with you; they must be contacted once your work is completed.

If you are working late at night, both the Campus Security Escort Service (36080) and the A.M.S. Walk-home Service (39255) are available.

### 5.4. REPORTING OF ACCIDENTS

Minor accidents involving hazardous chemicals or the malfunction and/or breakdown of equipment must be reported to your supervisor. More serious accidents must be reported to the Head of the Department and/or the Department Manager and/or the Department Safety Officer as well as to your supervisor.

All accidents involving personal injury must be reported promptly to your supervisor who is responsible for ensuring that the procedures below are followed. If your supervisor is not immediately available, contact the Department Safety Officer, Department Manager or the Head of the Department.

- Apply first aid; first aid should be given by someone who has had appropriate training
- In the case of minor injuries that cannot be satisfactorily treated by first aid alone, or if there is any doubt, the injured person shall be sent or taken to the hospital emergency room, or doctor of his/her choice. Queen's employees should take along a completed copy of the relevant Workplace Safety & Insurance Board (WSIB) form(s). If this form(s) does not accompany the injured employee to the treatment centre then it must be filled out and sent to the treatment centre as soon as possible.
- In the case of injuries that are more severe, or there is doubt about the severity of the injury, and emergency assistance is required, call 36111 from an internal phone (or 911 from an external phone). A SEVERELY INJURED PERSON MUST NOT BE MOVED without the advice of

medical or ambulance personnel.

- If it is necessary to call an ambulance, indicate the location of the injured person and the location of the nearest appropriate entrance to the building. If possible send someone to that entrance to lead the ambulance personnel to the injured person.
- For all accidents involving critical injury or death:
- Immediately call 36111 for assistance
- As soon as possible, notify your supervisor, the Head of the Department (or Department Manager or Safety Officer), and the Department of Environmental Health and Safety. The latter will notify the appropriate government agencies.
- Do not touch anything associated with the accident, except for the purpose of saving life, relieving suffering or preventing unnecessary damage to equipment or property. The scene of an accident must be examined by the appropriate authorities

## 6.0 UNDERGRADUATE LABORATORIES

The responsibility for safety is shared by all staff and students working in undergraduate laboratories. These laboratories must be operated in a manner that is consistent with the safety procedures of the Department. The following points should be noted:

- safety goggles must be worn in the laboratories while laboratories are in progress
- open-toed shoes or sandals must not be worn
- long pants and a lab coat must be worn to protect exposed skin
- long hair must be tied back or contained by a net, cap or other device
- TAs and staff must be familiar with the experiments being carried out, must be aware of the correct procedures and must be aware of the hazards associated with those experiments
- undergraduates must not work alone in a laboratory
- TAs must ensure that all students under their supervision know where emergency equipment is located, and what the procedures are for dealing with medical and fire emergencies
- chemicals from unlabelled containers are not to be used; unlabelled chemicals should be reported to a TA, lab technician or lab coordinator
- all work areas must be kept clean and tidy
- all accidents must be reported promptly

The best safety precautions include advanced preparation for each laboratory and a clean and organized work space.

## 7.0 OFF-CAMPUS ACTIVITIES

Queen's University has an Off-Campus Activity Safety Policy (OCASP) that is designed to assess risk associated with various off-campus activities such as field work, trips associated with courses, international travel and many other situations. A schematic chart for this risk assessment can be found in Appendix III – Off-Campus Activity Flowchart. The full policy document is available through the Environmental Health & Safety website. Note that in many instances this risk assessment is **mandatory** before an off-campus activity can be carried out. A list of potential hazards has been included in Appendix IV for reference when completing an OCASP submission.

## 8.0 SAFE LABORATORY PROCEDURES AND TECHNIQUES

### 8.1. PROCEDURES AND TECHNIQUES

#### 8.1.1. MANUFACTURED EQUIPMENT OR APPARATUS

All equipment should be maintained and operated as per the manufacturer's instructions and recommendations. Operating manuals for equipment should be kept in the vicinity of the equipment.

#### 8.1.2. GLASSWARE

In general glassware used for standard laboratory procedures is made of borosilicate glass. Prior to carrying out an experiment the following should be done:

- check glassware for cracks, chips and other flaws; these flaws should be repaired before the glassware is used
- select the right glassware for the job: vacuum applications required thick-walled glass while operations carried out under pressure require specially designed glassware
- glassware under pressure or vacuum should be shielded
- if it is necessary to apply pressure to glassware, wear thick leather gloves
- never heat or apply pressure/vacuum to a chemical in a stock bottle; these bottles are made of a soft glass which breaks readily

#### Cleaning Laboratory Glassware

For most cleaning applications, laboratory glassware is soaked in an aqueous detergent solution (e.g. Sparkleen<sup>®</sup>, Alconox<sup>®</sup>) followed by rinsing with de-ionised water and drying. In some situations, more chemically aggressive cleaning solutions are employed; listed below are some of the more commonly encountered cleaning solutions, with the associated hazards:

- Alcohol/base baths: typically 50% aqueous base in an alcohol solution. Removes silicone grease as well as many organic residues. Highly corrosive to skin and eyes, therefore requires appropriate personal protection. Prolonged exposure of glassware to strong base leads to etching, particularly to ground glass joints, and readily destroys scintered glass funnels.
- Acid/Oxidizer baths: historically, **chromic acid** has been used as an oxidizing cleaner however disposal of chromium waste is now problematic; this cleaning solution is no longer recommended for use. **Ammonium persulfate/sulfuric acid** has been used as a metal-free cleaning solution, as has **nitric acid** either alone, or in conjunction with other acids (hydrochloric or sulfuric acid). **Piranha solution** (hydrogen peroxide and sulfuric acid) has been used in the semi-conductor industry however it, like many other acid/oxidizers, is known to react violently if mixed with significant quantities of organic solvents (e.g. acetone). As a consequence of the hazards associated with the use of acid/oxidizer baths, **they** can only be used with approval of your supervisor.

#### 8.1.3. ELECTRICAL EQUIPMENT

In addition to the hazards posed by electrical shock, electrical equipment also presents a source of fire hazard when used in conjunction with flammable substances (see section on **Flammability**). Electrical

hazards can be minimized by the following:

- only trained or qualified individuals should repair or modify electrical equipment
- electric wires should never be used as supports
- unplug equipment by pulling on the plug not the cord
- equipment should be regularly inspected and frayed cords or broken plugs should be repaired
- any equipment failure or overheating should be remedied immediately
- use “C” class fire extinguishers for electrical fires

#### **8.1.4. STATIC ELECTRICITY AND SPARK HAZARDS**

Protection from static discharge must be addressed in particular when handling flammable solvents; this risk is increased during periods of low humidity. Proper grounding of containers and equipment will significantly reduce this risk. Common potential sources of sparks and static discharges are:

- ungrounded metal tanks and containers
- clothing or containers made of plastic or synthetic materials
- high pressure gas cylinders upon discharge
- control systems on hotplates
- brush motors and forced air dryers

#### **8.1.5. UV LAMPS**

Radiation of wavelengths below 250 nm poses a considerable risk to both eyes and exposed skin. Wear UV-absorbing safety glasses and avoid direct eye contact with the UV source; wear protective clothing to prevent burns from UV exposure. Work involving UV irradiation should be carried out in an enclosed work area to prevent exposure of workers to the UV source.

Mercury arc lamps should be cleaned thoroughly before use. Handling with bare hands leaves oil deposits on the surface of the outer glass which form residues that will burn into the glass causing buildup of heat during the operation of the lamp. The lamp may overheat and crack, releasing mercury vapour as a consequence.

#### **8.1.6. LASERS**

The Department of Environmental Health and Safety runs a “Laser Safety Program”. All personnel working in proximity to Class 3b or Class 4 lasers must complete this program before starting work with lasers. The type and intensity of radiation available from a laser varies greatly from one instrument to another. The following general rules should be followed:

- always wear goggles that offer protection against the specific wavelength(s) of the laser in use; no available goggles protect against all laser wavelengths
- never look directly at the beam or pump source
- never view the beam pattern directly; use an image converter or other safe, indirect means
- do not allow objects that cause reflections to be present in or along the beam
- keep a high general illumination level in areas where lasers are in operation; low levels of light cause dilation of the pupils, thereby increasing the danger to the eyes
- display warning signs

### **8.1.7. RADIATION SAFETY AND X-RAY GENERATORS**

The Principal of Queen's University has appointed the University Radiation Safety Committee to carry the advisory responsibility for the overall operation of the University Radiation Safety Program. The details are included in the Terms of Reference of the Committee. It is the policy of Queen's University that all activities involving ionizing radiation or radiation emitting devices be conducted so as to keep hazards from radiation to a minimum. Persons involved in these activities are expected to comply fully with the Atomic Energy Control Act and all its regulations, with the Occupational Health and Safety Act and its regulations regarding X-ray sources, lasers and sound. Radiation Safety Policy and Procedures are available through the Department of Environmental Health and Safety.

X-rays are a hazardous physical agent under the Occupational Health and Safety Act. Any equipment generating X-rays must be operated in accordance with government regulations and appropriate warning signs must be posted.

### **8.1.8. MAGNETIC FIELDS**

NMR spectrometers have superconducting magnets which generate static magnetic fields with high flux densities. Hazards exist from the mechanical forces exerted by these magnetic fields on ferromagnetic tools and equipment and on medical implant devices. Individuals with implanted cardiac pacemakers and similar medical devices should not be exposed to these magnetic fields. Other implanted medical devices such as suture staples, aneurysm clips, prostheses, etc. may also be subjected to adverse effects.

### **8.1.9. COMPRESSED GASES**

Gases used in laboratories are supplied in cylinders at high pressure; lecture bottles are not permitted. In addition to any potential chemical hazards, compressed gases are a high-energy source and therefore hazardous. The following rules must be followed:

- cylinders of all sizes must be restrained from falling by restraining devices
- during storage or transport, the cylinder cap must be in place
- cylinders must only be transported when strapped to a wheeled cart
- no lubricant shall be used when connecting the regulator to the cylinder
- new connections shall be checked for gas leakage
- the cylinder delivery pressure shall be set to zero after the main cylinder valve is closed to prevent a rapid release of compressed gas the next time the cylinder is opened
- empty cylinders shall have the regulators removed, be marked MT, the shipping cap replaced and returned to The loading dock
- unused or partially used cylinders that are of no further use shall be returned to The loading dock
- in the event of a fire, the supply of a combustible gas shall be shut off before any attempt is made to extinguish the flame
- a trap shall be used to prevent the back siphoning of solution when a soluble gas is being employed
- do not expose cylinders to temperatures higher than 50°C
- use toxic, flammable or reactive gases in a fumehood

- use the appropriate regulator for the type of gas
- be aware that special handling procedures are required for certain gases, e.g. acetylene

#### **8.1.10. CRYOGENICS AND COLD TRAPS**

Liquid nitrogen is the most common cryogenic coolant and must be handled with caution. The following points must be taken into account when using liquid nitrogen

- use only a properly vented container
- extreme cold can rapidly cause tissue damage; use appropriate protective equipment
- spills and evaporation in confined spaces such as elevators can cause asphyxiation due to rapid evaporation of nitrogen and displacement of oxygen. Never travel with liquid nitrogen dewars in elevators.
- glass Dewars used as cold traps should be encased to contain glass fragments in the event of implosion
- do not leave liquid nitrogen cold traps open to the air; oxygen may condense from the air and can react explosively with combustible materials

Dry ice is frequently used in conjunction with a cooling liquid. These cooling systems can also cause tissue damage due to extreme cold. The proper choice of a cooling liquid presents problems since a nontoxic, nonflammable, low viscosity, low volatility liquid does not exist. In general isopropanol (flash point 11°C) is preferable to acetone (flash point -18°C) due to a higher flash point but still represents a fire hazard. A 3:2 mixture of ethylene glycol to water which is thinned with isopropanol is an alternative cooling liquid with reduced flammability.

#### **8.1.11. REDUCED PRESSURE OPERATIONS AND VACUUM PUMPS**

- vacuum desiccators should be taped or encased due to the risk of implosion
- glass vacuum lines should be shielded when in use
- cold traps should be placed between apparatus and vacuum pumps to prevent volatiles from entering the pump oil; traps should be cleaned after use
- exhaust from pumps should be vented into a ventilation control system, not into the open lab; this includes venting of PIAB compressed air vacuum apparatus
- pump belt drives must have a guard over the belt to prevent anything from getting caught in the belt

### **8.1.12. DISTILLATIONS AND REFLUX OPERATIONS**

Distillations and reflux operations are common laboratory procedures which present several potential dangers: pressure buildup leading to explosions if closed systems are used, and fire hazards associated with heating flammable substances are two of the most common. A variety of apparatus designs are available to accomplish reflux/distillation operations at atmospheric pressure, under inert atmospheres, under reduced pressure and by the addition of steam. The following general points should be noted when carrying out these operations:

- check the integrity of the system; leaks of flammable materials can lead to fires
- ensure smooth boiling through stirring or the addition of boiling stones (do not add boiling stones to hot liquid)
- choose an appropriate heat source - electric heating mantle, ceramic cavity heater, steam bath or silicone oil bath
- do not heat the heat source above the autoignition temperature of the liquid being distilled/refluxed
- do not distill organic liquids to dryness

### **8.1.13. MICROWAVES**

Microwave radiation is a potentially harmful physical agent. The following general points should be noted when using microwave sources:

- do not attempt to use microwave ovens with the door open
- do not use metal containers in microwave oven
- ensure that seals around doors are clean and undamaged
- microwave equipment should only be modified or repaired by qualified personnel

### **8.1.14. BIOHAZARD SAFETY**

The University Biohazards Committee, on behalf of the University, will determine the nature of biohazardous work in progress or proposed, accredit the facilities on an ongoing basis, assist the design of appropriate laboratories and training of personnel, and serve as an educational resource to members of the University community. The University has adopted the Laboratory Biosafety Guidelines, whether or not the work is externally funded and whether or not the sponsoring agency requires such certification.

Members of the University community who are contemplating, or who are presently engaged in work which might fall within these Guidelines are required to contact the Chair or Secretary of the Committee if they have not already done so.



## 8.2. GENERAL CHEMICAL HAZARDS

### 8.2.1. MATERIAL SAFETY DATA SHEETS

The provision by chemical manufacturers of material safety data sheets (MSDSs) for hazardous materials is one means of communicating information on chemical hazards; chemicals purchased directly from a chemical supplier will be accompanied by an MSDS. In the Department, MSDS binders have been replaced with an online database called ChemWatch and laminated information sheets about the database. Additional information about ChemWatch is available at Queen's University through links on the Department of Environmental Health and Safety Website.

### 8.2.2. CORROSIVITY

Corrosive chemicals cause visible destruction or irreversible alteration to living tissue. Common acids and bases are the most common corrosives encountered, but other chemicals such as Br<sub>2</sub> are also extremely corrosive.

- concentrated acids and bases should always be diluted by addition to water due to the large heat of solution for these compounds
- use appropriate personal protective equipment and fumehood ventilation when working with strong acids and bases, and other corrosive substances
- safety glasses do not provide complete eye protection from chemical splashes; wear appropriate safety goggles or splash shields when working with corrosive substances

NOTE: some specific acids such as HF (extremely toxic) and HClO<sub>4</sub> (powerful oxidizer of organics) require special handling procedures. Consult the appropriate references and your supervisor before working with these chemicals.

### 8.2.3. FLAMMABILITY

The risk of fire in the chemical laboratory is most often associated with two classes of compounds - common organic solvents, and certain metals, metal hydrides and organometallics. For common organic solvents the following should be noted:

- the minimum temperature at which vapours from a substance will ignite in air when exposed to an ignition source (flame, spark, static discharge, etc.) is called the flash point
- a flammable substance has a flash point below 37.8°C
- a combustible substance must be heated at or above 37.8°C to ignite
- bottles of flammable liquids up to 1L in size can be stored anywhere in laboratories; larger quantities must be stored in flammable storage cabinets (e.g. 4L bottles) or in approved safety containers
- the maximum volume of (flammable + combustible) liquids that may be stored in the open lab is 300 litres; the maximum allowable amount of flammable solvents is 50 of the 300 litres
- flammable waste solvents cannot be collected in the open lab in containers larger than 1 litre capacity
- always use ventilation (e.g. fumehoods) which is adequate for the quantity of flammable liquid in use
- always connect (or bond) containers when transferring flammable liquids from metal

containers

- only refrigerators/freezers that are approved for flammable storage can be used in laboratories

Alkali and alkaline earth metals, certain other metals such as aluminum, metals in a finely divided form, metal hydrides and many organometallic compounds can ignite on exposure to air and/or water. The following should be noted when working with this class of compounds:

- store these chemicals in a location separate from other chemicals in the laboratory and in containers appropriate for the purpose
- use equipment appropriate for the hazards associated with these substances including inert atmosphere techniques
- class "D" fire extinguishers (metal fires) must be present in laboratories where these substances are in use; do not use "C" class fire extinguishers (CO<sub>2</sub>) on metal fires

#### 8.2.4. NOXIOUS CHEMICALS

Certain classes of compounds such as **thiols (mercaptans)** and related sulfur-containing compounds are characterized by a particularly noxious odour,

- these compounds must be used with adequate ventilation (fumehoods)
- whenever compounds of this type are used they will be released through the ventilation system into the local atmosphere, consequently both the Department Safety Officer and the Emergency Report Centre must be notified in advance of the use of these chemicals

#### 8.2.5. REACTIVE CHEMICALS

##### Air/Water Reactive

- chemicals which can ignite on exposure to air or water, e.g. certain metallic and organometallic substances, phosphorus
- special handling, storage and disposal procedures must be established in laboratories where these substances are in use (see section on **Flammability** and Appendix V - **Incompatible Chemicals**)

##### Self-Reactive Chemicals

- may be heat, shock or friction sensitive and can react violently as a consequence, e.g. acetylene and acetylides, azides, diazonium salts, nitro compounds, chlorates and perchlorates, peroxides
- special handling, storage and disposal procedures must be established in laboratories where these substances are in use

##### Lachrymators

- substances which react with moisture in the eyes and mucous membranes to cause tear formation, e.g. halogenated aldehydes, ketones and esters
- must be used with adequate ventilation (fumehood) and stored in well sealed containers

## Incompatible Chemicals

Accidental contact of incompatible chemicals can lead to fire, explosion and/or the release of highly toxic substances. The magnitude of the problem usually increases with the quantity of chemicals being stored. Prudent practice requires that incompatible chemicals be stored in separate locations to minimize the risk of accidental mixing. Appendix V **Classes of Incompatible Chemicals** lists some general groups of incompatible chemicals; further information on specific chemicals may be obtained from references such as *Hazards in the Chemical Laboratory*, by L. Bretherick or *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals*, National Research Council, National Academy Press, 1995.

**Oxidizers** (e.g. chromates, halogens, peroxides) and **reducers** (e.g. metals, metal hydrides, phosphorus, sulfur) are incompatible with each other and should be stored in separate cabinets or on separate shelves. Strong oxidizers should also be separated from flammable liquids

### 8.2.6. TOXICITY

A wide range of substances are present in the chemical laboratory which present a risk due to either chronic or acute toxicity; this includes the presence of carcinogens, mutagens and teratogens.

- toxic substances may enter the body by inhalation, absorption, ingestion and/or injection
- appropriate protective measures must be taken to prevent exposure and which are consistent with permissible exposure limits for a specific substance
- where available, antidotes for poisons must be present during usage of these poisons

NO FOOD OR DRINKS ARE TO BE CONSUMED IN LABORATORIES UNDER ANY CIRCUMSTANCES

CONTAINERS/UTENSILS USED FOR THE PREPARATION OR CONSUMPTION OF FOOD OR BEVERAGES MUST NOT BE STORED IN THE OPEN IN LABORATORIES

ANY WOMAN WHO WORKS IN A LABORATORY WHERE HAZARDOUS SUBSTANCES ARE IN USE AND WHO IS, OR BELIEVES THAT SHE MAY BE, PREGNANT MUST INFORM HER SUPERVISOR

### 8.2.7. DESIGNATED SUBSTANCES

The Occupational Health and Safety Act allows a biological, chemical or physical agent, or combination thereof, to be “designated” and its use in the workplace may be either prohibited or strictly regulated. Regular reporting on inventories of these substances may be required. The following are designated substances:

- ACRYLONITRILE
- ARSENIC
- ASBESTOS
- BENZENE
- CARBON DISULFIDE
- CARBON TETRACHLORIDE
- COKE OVEN EMISSIONS
- ETHYLENE OXIDE
- ISOCYANATES
- LEAD
- MERCURY
- SILICA POWDER
- STYRENE
- VINYL CHLORIDE MONOMER

**Acrylonitrile, benzene, carbon disulfide, carbon tetrachloride, isocyanates, styrene, and vinyl chloride monomer** are all volatile organic materials and must be used with adequate ventilation (fumehood) to prevent exposure through inhalation and with appropriate protective equipment to prevent exposure through skin absorption. These materials can be disposed of in the normal liquid organic waste stream (halogenated or nonhalogenated as appropriate).

Substances containing **arsenic, lead or mercury** must be handled in an appropriate manner to prevent exposure through inhalation or absorption. All chemical waste containing arsenic, lead or mercury must be collected and properly labeled for disposal by the Department of Environmental Health and Safety.

**Elemental mercury** is used in many types of apparatus, in particular mercury-filled thermometers. Mercury spills from broken equipment should be cleaned up immediately (mercury spill kits are available from the Department of Environmental Health and Safety). Broken thermometers are collected by lab technicians, who will recover the mercury from the thermometers before disposal.

**Silica powder**, including chromatography grade silica, is a respiratory hazard and should be handled in a fumehood when dry. Used silica should be stored in sealed and labeled containers then sent for disposal by the Department of Environmental Health and Safety.

## 9.0 SAFETY EQUIPMENT AND EMERGENCY PROCEDURES

A variety of protective measures are available for dealing with the hazards present in the chemical laboratory. One of the simplest measures to reduce or eliminate a hazard is to substitute a less hazardous or non-hazardous material for one which presents a high level of risk. For example many older literature procedures may use solvents such as benzene or carbon tetrachloride for routine applications; it is now known that benzene is a potent carcinogen and that carbon tetrachloride can cause serious liver damage. Substitution of these solvents with toluene or dichloromethane may pose less risk if compatible with the procedure.

A second measure is to reduce the scale of an operation to reduce the level of risk. Smaller reactions are less likely to cause serious accidents if something goes wrong; they also produce less waste.

### 9.1. FUMEHOODS

The most common method to prevent exposure to hazardous chemicals by inhalation is to work in a ventilated work space provided in a fumehood. Protection is provided by air flow through the fumehood. Annual inspection and servicing is carried out on fumehoods to ensure proper operation however it is important to note that the protection offered by a fumehood can be compromised if the sash is opened too high or if the airflow is obstructed by equipment or chemicals stored in the fumehood. Keep the following points in mind when using a fumehood:

- keep all apparatus at least six inches from the front of the hood; airflow is less likely to be impeded and vapours are less likely to escape
- don't use the hood to store chemicals and equipment; they restrict airflow
- make sure that the airflow monitor/alarm is functioning properly
- proper fumehood ventilation of laboratories requires that doors to the lab be kept closed
- sash should be kept at a safe operating height

NOTE: it is an offence under the *Occupational Health and Safety Act* to disable any protective device such as the airflow monitor/alarms on fumehoods. Any fumehood without a properly functioning airflow monitor/alarm must not be used.

### 9.2. LOCAL VENTILATION

Flexible ventilation ducts with flared openings can also be used to provide ventilation in local areas, particularly with equipment which, because of size or function, cannot be placed in a fumehood. Any equipment which releases hazardous fumes during operation must have local ventilation.

## 9.3. PERSONAL PROTECTIVE EQUIPMENT

### 9.3.1. EYE AND FACE PROTECTION

The minimum requirement for eye protection is that safety glasses (or prescription glasses) fitted with side shields must be worn in laboratories when hazardous chemicals are in use and when operating rock saws, crushers or polishers. Safety glasses do not provide complete protection to the eyes from spills, splashes or rock chips. Where more protection is required, either safety goggles or a full face shield may be recommended.

### 9.3.2. CLOTHING

Appropriate clothing and shoes are part of your protective equipment. Short pants and open-toed shoes or sandals offer no protection from spills of hazardous chemicals. Shoes that cover the feet completely and long pants or a lab coat must be worn.

### 9.3.3. GLOVES

Gloves are available for a variety of purposes including heat resistant and cut-resistant and in a variety of materials including natural rubber, neoprene, nitrile and vinyl. For gloves intended for chemical protection, each type of material is resistant to only a limited range of chemicals therefore no single type of glove is suitable for all situations. Wearing the wrong type of glove can cause more damage by keeping chemicals in contact with your skin. Consult manufacturer's data before selecting the appropriate type of gloves.

NOTE: Disposable **latex rubber gloves** are permeable or reactive to a variety of common chemicals including benzene, carbon tetrachloride, chloroform, chromic acid, ethyl ether, hexane, methylene chloride, naphtha, nitric acid, styrene, sulphuric acid, tetrahydrofuran, toluene, and xylene. They are **not recommended for use with these chemicals**.

### 9.3.4. RESPIRATORS

Respirators are designed to protect the wearer from hazardous vapours or dust. A wide variety of respirators are available and are designed to deal with different substances in various situations. The use of respirators requires proper selection, fitting and training which must be arranged through the Department of Environmental Health and Safety.

### 9.3.5. HEARING PROTECTION

Routine exposure to noise in excess of 90dB requires the use of hearing protection (i.e. ear plugs, ear muffs); for extended exposure to noise in excess of 80 dB, hearing protection is advised.

## **9.4. EMERGENCY EQUIPMENT**

### **9.4.1. EYEWASH FOUNTAINS AND SHOWERS**

Access to this equipment must not be obstructed in any way. Eyewash fountains should be tested regularly (weekly) to ensure adequate water flow and to remove any rusty water.

If it is necessary to use any eyewash fountain, hold your eyelids open with your fingers and roll your eyes back and forth while washing them. Flush your eyes for at least 15 minutes to ensure removal of the chemical.

If it is necessary to use an emergency shower, activate the shower then remove contaminated clothing as rapidly as possible.

### **9.4.2. FIRE EXTINGUISHERS**

All laboratories are equipped with "ABC" class fire extinguishers (Dry Chemical) which are suitable for most fires except metal fires; those laboratories with significant quantities of pyrophoric metals are also equipped with "D" class extinguishers. These extinguishers are only designed to fight small local fires. Do not attempt to fight large fires; evacuate the building and call for professional fire fighters (telephone 36111 - Emergency Report Center). All use of fire extinguishers must be reported to the Department Safety Officer.

## **9.5. EMERGENCY PROCEDURES MEDICAL EMERGENCY**

Minor accidents involving hazardous chemicals or the malfunction and/or breakdown of equipment must be reported to your supervisor. More serious accidents must be reported to the Head of the Department and/or the Department Manager and/or the Department Safety Officer as well as to your supervisor.

### **9.5.1. MEDICAL EMERGENCY**

All accidents involving personal injury must be reported promptly to your supervisor who is responsible for ensuring that the procedures below are followed. If your supervisor is not immediately available, contact the Department Safety Officer, Department Manager or the Head of the Department.

- Apply first aid; first aid should be given by someone who has had appropriate training
- In the case of minor injuries that cannot be satisfactorily treated by first aid alone, or if there is any doubt, the injured person shall be sent or taken to the hospital emergency room, or doctor of his/her choice. Queen's employees should take along a completed copy of the Worker's Compensation Board "Treatment Memorandum". If this form does not accompany the injured employee to the treatment centre then it must be filled out and sent to the treatment centre as soon as possible.
- In the case of injuries that are more severe, or there is doubt about the severity of the injury, and emergency assistance is required, call **36111** from an internal phone (or 911 from an external phone). A SEVERELY INJURED PERSON MUST NOT BE MOVED without the advice of medical or ambulance personnel.
- If it is necessary to call an ambulance, indicate the location of the injured person and the location of the nearest appropriate entrance to the building. If possible send someone to that

entrance to lead the ambulance personnel to the injured person.

For all accidents involving critical injury or death:

- Immediately call 36111 for assistance
- As soon as possible, notify your supervisor, the Head of the Department (or Department Manager or Safety Officer), and the Department of Environmental Health and Safety. The latter will notify the appropriate government agencies
- Do not touch anything associated with the accident, except for the purpose of saving life, relieving suffering or preventing unnecessary damage to equipment or property. The scene of an accident must be examined by the appropriate authorities

### **9.5.2. FIRE EMERGENCY**

You must be aware of the location and/or use of all fire extinguishers, fire alarm switches and fire exits in your area. If the fire cannot safely be controlled with a fire extinguisher, then the following actions should be taken:

- alert all persons in the area of the fire emergency
- leave the area while closing doors and windows (where this can be done safely)
- activate the nearest fire alarm
- check to ensure that the area has been evacuated then leave the building to the nearest safe location
- phone the Emergency Report Centre (36111)
- be available to guide the Fire Department to the location of the fire

### **9.5.3. CHEMICAL SPILLS**

All spills should be cleaned up promptly, efficiently and properly. All individuals at risk due to the spill should be warned immediately.

If the spill involves nonvolatile, nonflammable and nontoxic material then it should be cleaned up as directed by your supervisor. Most cleanups of liquid spills are facilitated by the use of an absorbent material that will neutralize the liquid where appropriate. Cleanup can then be carried out using a dustpan, brush and appropriate protective equipment. The spill area should be washed following the cleanup.

If a hazardous chemical such as a flammable, toxic or highly reactive substance is spilled, immediately warn everyone in the area. Shut down all equipment and leave the area. Your supervisor should be notified immediately and will be responsible for the proper cleanup of the contaminated area. Any clothing that has been contaminated should be removed as quickly as possible and decontaminated where possible. Consult the appropriate MSDS for spill cleanup procedures.

Waste from chemical spills must be disposed of in an appropriate manner.

## **10.0 WASTE DISPOSAL**

All chemical waste disposal is carried out by the Department of Environmental Health and Safety; sinks and garbage cans are not to be used for hazardous waste disposal. The general procedure for disposing



of waste chemicals is outlined below in Disposal Procedures for Hazardous Chemicals.

Flammable liquids such as common organic solvents must be placed in solvent disposal cans (red with wide mouths and flame arrestor) which are identified as to point of origin. This waste should be collected in separate containers for Halogenated and Non-halogenated waste (<3% halogen content).

Containers which have been used to store chemicals, such as stock bottles, but which are empty may be disposed of with the normal garbage; these bottles should be washed and the labels defaced before they are placed in the garbage.

**Sharp objects** such as syringe needles cannot be disposed of in conventional waste containers. They must be collected in an appropriately labeled ("SHARPS") metal or plastic container for disposal. Separate waste containers are provided for broken glass.

### **Disposal Procedures for Hazardous Chemicals**

All hazardous waste including **chemical, biological and radioactive** waste, will be picked up by an outside contractor directly from laboratories and shops at the request of Queen's employees. Waste needs to simply be labelled, tagged and the appropriate forms must be filled out on the Department of Environmental Health and Safety website to request a pickup.

Process:

- 1) Clearly label waste container/bag for disposal, identifying all constituents and pH if applicable
- 2) Place identifying tape around waste stating
  - a) Container/bag # (simply assign a number starting with 1, then 2 etc)
  - b) Building
  - c) Room number where waste is present
- 3) Place waste in a safe, obvious pickup location within the laboratory, segregate incompatibles
- 4) Fill out the appropriate waste disposal form on the Health and Safety website:  
<http://www.safety.queensu.ca/hazwaste/>
- 5) Waste will be picked up directly from the laboratory

Note

- a) For scheduling, refer to pickup calendar at:  
<http://www.safety.queensu.ca/hazwaste/schedule.pdf>
- b) Solvent containers will be returned to the laboratory the following week

For more information about chemical waste preparation, refer to SOP-CHEM-01 Hazardous Waste Disposal Procedures which can be found on the Department of Environmental Health and Safety website.

## **11.0 EQUIPMENT DISPOSAL**

Equipment that is sent out to be disposed of either by destruction or by recycling must be accompanied by a form certifying that the equipment has had all hazardous materials removed (e.g. mercury-filled thermometers, PCB-filled transformers, radioactive sources). These forms are available from the Department of Environmental Health and Safety, who will arrange for inspection of equipment prior to disposal.

**APPENDIX I – LIST OF DEPARTMENT OF ENVIRONMENTAL HEALTH AND SAFETY POLICIES**



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## APPENDIX II – OCCUPATIONAL HEALTH AND SAFETY ACT

The *Occupational Health and Safety Act* came into effect in Ontario in 1979. The purpose of this Act is to protect workers from health and safety hazards on the job. Both workers and supervisors have responsibilities under the terms of the Act.

### SUPERVISORS AND THEIR DUTIES

#### Definition of a Supervisor

A “supervisor” is defined in the Act as *a person who has charge of a workplace or authority over a worker. A supervisor: is qualified because of knowledge, training, and experience to organize work and its performance, is familiar with the Act and the regulations that apply to the work, and has knowledge of any potential or actual danger to health or safety in the workplace.*

A worker is an employee of the supervisor or their institution or firm. A professor who directs the research of a graduate student, postdoctoral fellow or other research associate is the direct supervisor of that individual if that individual is paid a salary for the research. A graduate student, postdoctoral fellow, or other research associate who does not receive a salary, being supported through other funds, is considered to be under the supervision of the professor who directs the individual’s research.

#### Duties of a Supervisor

*(1) supervisor shall ensure that a worker,*

- (a) works in a manner and with the protective devices, measures and procedures required by this Act and the regulations; and*
- (b) sees or wears the equipment, protective devices or clothing that their employer requires to be used or worn*

*(2) Without limiting the duty imposed by subsection (1), a supervisor shall*

- (a) advise a worker of the existence of any potential or actual danger to the health or safety of the worker of which the supervisor is aware;*
- (b) where so prescribed, provide a worker with written instructions as to the measures and procedures to be taken for protection of the worker; and*
- (c) take every precaution reasonable in the circumstances for the protection of a worker.*

A supervisor also has special responsibilities in dealing with accidents involving personal injury or death; see REPORTING OF ACCIDENTS.

## WORKERS AND THEIR DUTIES

### Definition of a Worker

A “worker” means *a person who performs work or supplies services for monetary compensation, which includes faculty, staff, teaching assistants, lab demonstrators, post- doctoral fellows, research associates, technicians, technologists, graduate students but NOT undergraduate students taking courses or visitors to the Department.*

### Duties of a Worker

The duties of a worker are:

*(1) worker shall,*

*(a) work in compliance with provisions of this Act and the regulations,*

*(b) use or wear the equipment, protective devices or clothing that their employer requires to be used or worn;*

*(c) report to their employer or supervisor the absence of or defect in any equipment or protective device of which they are aware and which may endanger themselves or another worker; and*

*(d) report to their employer or supervisor any contravention of this Act or the regulations or the existence of any hazard of which they know.*

*(2) worker shall,*

*(a) remove or make ineffective any protective device required by the regulations or by their employer, without providing an adequate temporary protective device and when the need for removing or making ineffective the protective device has ceased, the protective device shall be replaced immediately;*

*(b) use or operate any equipment, machine, device or thing or work in a manner that may endanger himself/herself or any other worker; or*

*(c) engage in any prank, contest, feat of strength, unnecessary running or rough or boisterous conduct.*

### Students

Undergraduate students taking courses and unpaid graduate students are not employees (workers) under the Act. It is however the policy of the Department of Geological Sciences and Geological Engineering that the lab coordinators in undergraduate courses and research directors of graduate students shall act as the direct supervisors of these students, and shall assume the same responsibilities towards the students doing laboratory work under their direction as if the students were employees, AND the students shall act as workers and follow the duties of a worker.

Right to Refuse or to Stop Work Where Health or Safety are in Danger:

*(1) worker may refuse to work or do particular work where he or she has reason to believe that,*  
*(a) any equipment, machine, device, or thing the worker is to use or operate is*  
*likely to endanger himself, herself or another worker;*

*(b) the physical condition of the workplace or the part thereof in which he or she*  
*works or is to work is likely to endanger himself, or herself; or*

*(c) any equipment, machine, device or thing he or she is to use or operate or the*  
*physical condition of the workplace or the part thereof in which he or she works or*  
*is to work is in contravention of this Act or the regulations*  
*and such contravention is likely to endanger himself, herself or another*  
*worker.*

*(2) Upon refusing to work or do particular work, the worker shall promptly report the*  
*circumstances of the refusal to the worker's employer or supervisor who shall forthwith*  
*investigate the report in the presence of the worker and, if there is such, in the presence of one*  
*of;*

*(a) committee member who represents workers, if any;*

*(b) health and safety representative, if any; or*

*(c) a worker who because of knowledge, experience and training is selected by a trade union that*  
*represents the worker, or if there is no trade union, is selected by the workers to represent them,*  
*who shall be made available and who shall attend without delay.*

The *Occupational Health and Safety Act* can be found at the following Web address:

[http://www.e-laws.gov.on.ca/html/statutes/english/elaws\\_statutes\\_90o01\\_e.htm](http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90o01_e.htm)

# APPENDIX III – OFF-CAMPUS ACTIVITY FLOWCHART

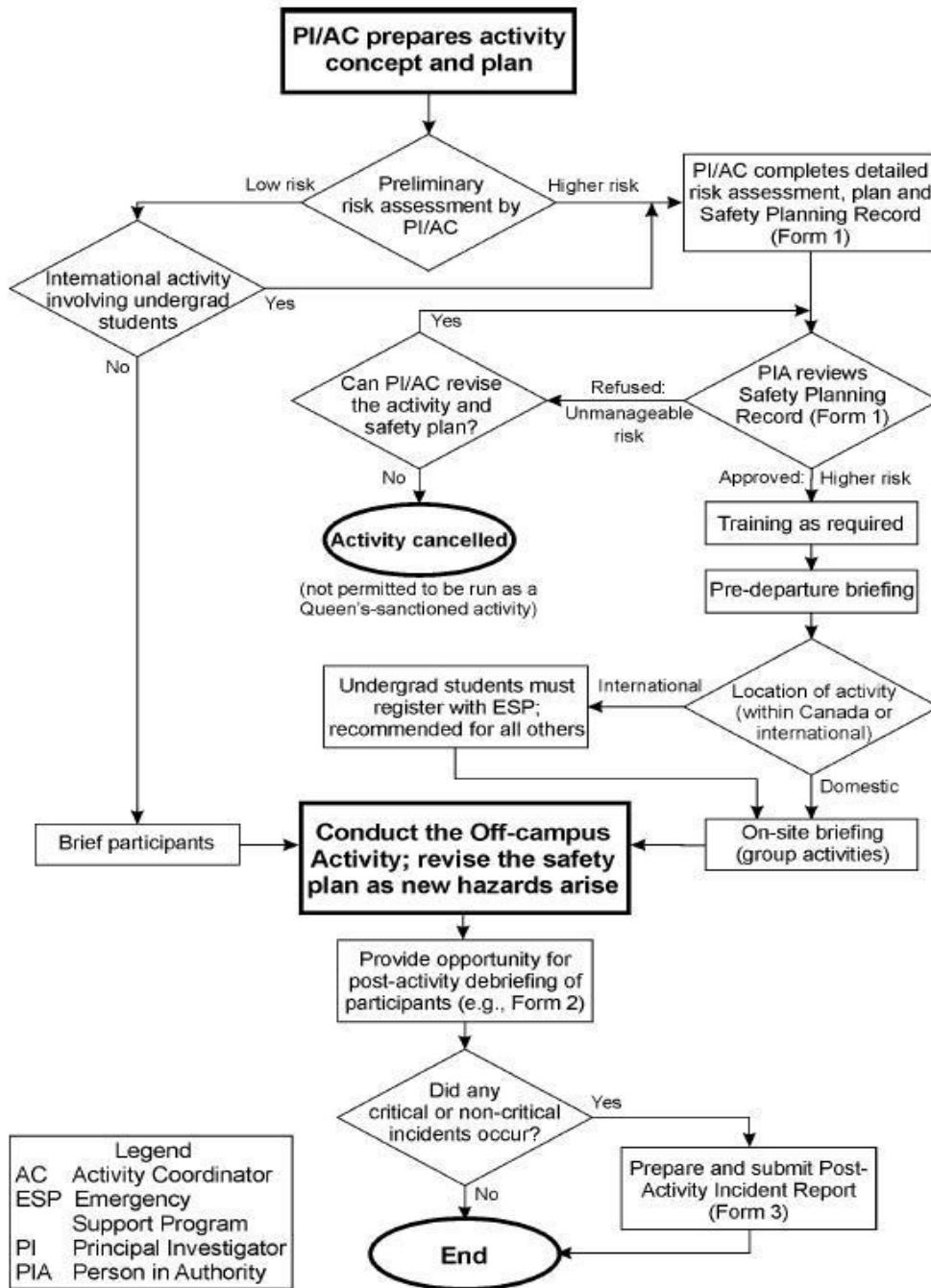


Figure 1. Flow chart showing principal planning stages and decision points defined in the Policy.



## **APPENDIX IV – POTENTIAL HAZARDS FOR OFF-CAMPUS ACTIVITY FORM**

### **Potential Hazards and Risks one might encounter while participating in off campus activities that should be identified during the OCASP process:**

#### **Remote locations (i.e. Northern Ontario, Arctic)**

- Wild animals (bears, wolves, dogs etc.)
- Cold and wet conditions, hypothermia
- Thin ice
- Intense sun and heat
- Getting lost or disoriented in unfamiliar locations
- Arduous hikes and long working days
- Rugged terrain
- Vehicular accidents while travelling to and from the activity location as well as while participating in the activity – all terrain vehicles, vans etc.
- Watercraft accidents – Canoes, kayaks or motorized boats. Risk management plans should note who will be operating watercraft and whether they have the appropriate certification.
- Swimming, scuba diving or snorkeling – If participants will be participating in any of these activities it should be noted on their OCASP record as well as a risk management plan (i.e. travel in pairs, no water activities during bad weather). It should also be noted that the students will confirm with their travel insurance provider that they will be covered under their insurance if they are injured while participating in these activities.
- Insects – stings, bites, various diseases/illnesses (i.e. malaria, lyme disease, tick-borne encephalitis)
- Infectious disease – hepatitis, tuberculosis, meningitis, influenza etc.
- Poisonous plants and flowers – poison ivy, wild parsnip, water hemlock, giant hogweed etc.
- Crime
- Firearms used for hunting or protection from wild animals. The activity may not require any of the faculty, staff or students to carry firearms; however, firearms may be much more prevalent in the activity location than what the students are used to.
- Natural disasters – heavy rain/snow, lightning storms, flash floods, forest fires, earthquakes, tornadoes etc.
- Nutritional concerns – Fresh food may be expensive or not readily available, vegetarian or other health related special diets may be difficult to follow.
- Limited medical facilities – Depending on their location they may be hours from a full medical facility which could mean significant delays in acquiring medical aid for serious illnesses or injuries. They may require emergency air evacuation to the nearest full medical facility.

#### **Domestic activities within urban cities etc.**

- A number of the potential hazards noted for remote locations would also apply to activities taking place in urban cities – such as crime, weather related hazards, vehicular accidents, watercraft accidents, insects and poisonous plants.
- Roadside activities – Some research or course activities may occur along roadsides and inattentiveness can lead to accidents with oncoming traffic.
- Distraction due to various electronic devices.
- Personal Protective Equipment – Will the participants be required to use PPE (i.e. safety glasses, hearing protection, hard hats, appropriate clothing).
- Unsafe rock faces – Falling rock, slipping or falling off rock cuts resulting in strains, broken bones, etc.
- Medical conditions – If there are participants with life threatening medical conditions or allergies it should be noted on the group record, not the student's personal details (unless they agree to disclose to the group) but that there will be a student carrying an epi pen if necessary. If there is someone with a severe nut allergy, this should definitely be noted so other participants do not bring nut products with them.

#### **Activities taking part outside of Canada**

- Terrorism – This is a potential hazard that really should be noted for travel to a large number of countries, especially after the number of serious attacks over the past couple of years.
- Crime – This is especially important if travelling to an area with higher levels of crime, particularly violent crime, and because the participants may stand out as tourists to the region.
- Civil/political unrest or ongoing demonstrations (especially violent demonstrations).
- Women's safety – If travelling to an area where violent and sexual assaults against women (especially foreign women) have increased.
- Regulations on what can/cannot be brought into the host country or taken out of it. This could be related to foreign or domestic currency or medication. Some prescription medication may be legal in Canada but not in the host country (i.e. narcotics to treat anxiety/depression or diabetic syringes).
- Besides a passport is there anything else the participants will be required to have with them? This could be a visa or work permit or if the student is an international student at Queen's will they have the appropriate documentation to re-enter Canada at the conclusion of the activity.
- Travel to the USA – Executive Order Protecting the Nation from Foreign Terrorist Entry into the United States = will this affect any of your participants?
- Local Laws and Culture – Are there any local laws or cultural norms that are significantly different from what the participants would be used to in Canada or that would result in a heavy penalty (especially the death penalty) that your participants should be aware of? This could be related to religion, ethnicity, sexual orientation or clothing.
- Natural disasters – If you are travelling to an area with a history of tornadoes, hurricanes, earthquakes, monsoons etc. it should be noted on the OCASP record.
- Emergency air evacuation – It should be noted on all OCASP records for out of country travel that it is the responsibility of each individual participant to ensure their travel insurance provider will adequately cover them for their host country and for their personal

health circumstances. Emergency air evacuation can be extremely expensive so each participant should ensure this is covered under their policy.

**Communication strategy** – It is a very good idea to address how the group will be communicating with each other while they are participating in off campus activities as well as any steps that should be followed in the event of an emergency situation (i.e. will the Group Leader be carrying a cell phone that participants should be contacting and is there a central rendezvous location in an emergency). This is particularly important when travelling outside of Canada.

**Other Documents that might be relevant to the activity or location** – Are there any additional documents such as a third party waiver or site specific rules and regulations that all of the participants are expected to abide by? If the group leaders (usually faculty or staff) and/or the participants are required to review a waiver or terms of condition etc. that is specific to the site, it should be noted on the OCASP record. At QUBS all participants are required to sign a document that details acceptable behaviour and rules around boating, fires etc. when that arrive at QUBS. This should be noted.

**Some common industry-specific hazards and risks – Below is some examples of industry-specific hazards that may or may not be relevant to your activities.**

- Site specific hazards (i.e. underground mine)
- Working with unfamiliar or heavy machinery
- Cranes, hoists, rigging devices, scaffolds, work platforms or tunnels
- Working in confined spaces or in areas with low ventilation
- Working with, or near, highly combustible substances, explosives, gases, or other chemic or radioactive materials.
- Toxic atmospheres or lack of/overexposure to oxygen
- Electrical shock or hazardous noise (i.e. fracturing, power generators)

## APPENDIX V – CLASSES OF INCOMPATIBLE CHEMICALS

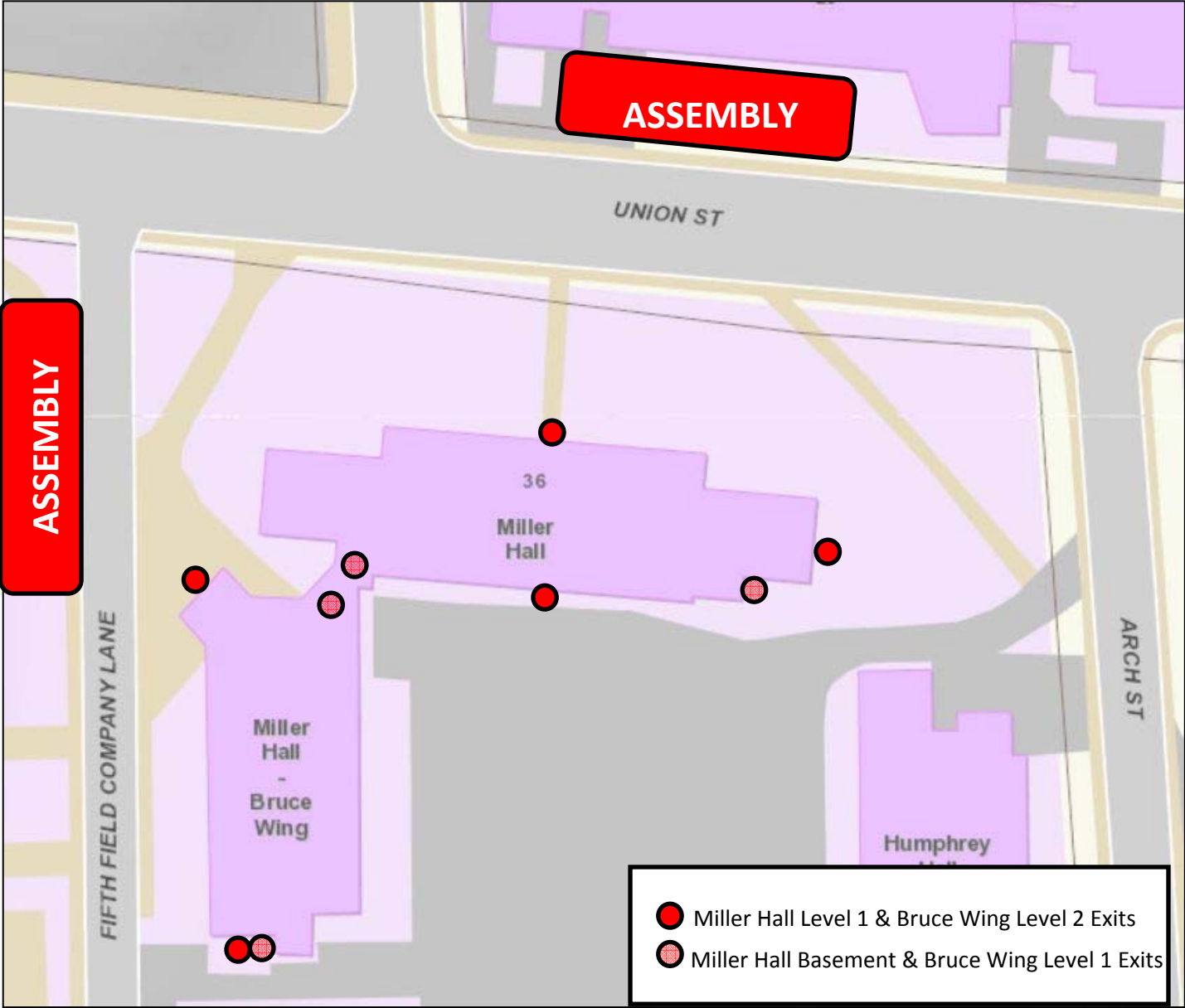
Class of Chemicals	Incompatible with
Alkali and alkaline earth carbides, hydrides, hydroxides, metals, oxides and peroxides	Water, acids, halogenated organic compounds, halogenating agents, oxidizing agents
Azides, inorganic	Acids, heavy metals and their salts, oxidizing agents
Cyanides, inorganic	Acids, strong bases
Nitrates, inorganic	Acids, reducing agents
Nitrites, inorganic	Acids, oxidizing agents
Organic acyl halides, anhydrides	Bases, organic hydroxy and amino compounds
Organic halogen compounds	Group IA and IIA metals, aluminum
Organic nitro compounds	Strong bases
Oxidizing agents (chlorates, chromates, chromium trioxide, dichromates, halogens, halogenating agents, hydrogen peroxide, nitric acid, nitrates, perchlorates, peroxides, permanganates, persulfates)	Reducing agents, ammonia, carbon, metals, metal hydrides, nitrites, organic compounds, phosphorus, silicon, sulfur
Reducing agents	Oxidizing agents, arsenates, arsenites, phosphorus, selenites, selenates, tellurium salts and oxides
Sulfides, inorganic	Acids

Source: "Prudent Practices in the Laboratory: Handling and Disposal of Chemicals", National Research Council, National Academy of Sciences, Washington, 1995.

**APPENDIX VI – MILLER HALL & BRUCE WING EVACUATION PLAN**

**When the Fire Alarm Sounds:**

- 1) **Notify others** in the immediate area that there is a “Fire”
- 2) **Activate** nearest wall-mounted fire alarm pull station
- 3) **Leave** the building promptly via the nearest exit. **DO NOT USE THE ELEVATOR**
- 4) **Assemble** across Union Street in front of Beamish-Munro Hall/Goodwin Hall
- 5) **Phone** the Emergency Report Centre at 36111 or 911
- 6) **Do not re-enter** the building until authorized by the Fire Department



**FORM I – EMPLOYEE & STUDENT SAFETY ORIENTATION CHECKLIST**



## Employee/Student Safety Orientation Checklist

Employee		Staff/ Student #	
Supervisor		Phone	
Safety Officer	Agatha Dobosz	Phone	Ext 36167
Trainer	Agatha Dobosz	Phone	Ext 36167

This checklist is intended to serve as a guide to supervisors for orienting new staff, faculty, students and others (i.e. post doctoral fellows, visitors/volunteers, summer students, 4th year students doing research projects, etc.) and to assist them in carrying out their work safely. This checklist also serves to provide a summary of training received. Certificates for WHMIS, Radiation Safety, First Aid, CPR courses must be kept on file within the Department.

This checklist is required to be completed with all new employees and students within the first two weeks of their arrival in the Department and the signed checklist must be kept on file in the Department. The Departmental Safety Officer should be informed that this orientation has been completed.

All pertinent safety information can be found on the Queen's University Department of Environmental Health and Safety website <http://www.safety.queensu.ca/>

Please initial when completed, if the section is not applicable to your worksite enter N/A



## Employee/Student Safety Orientation Checklist

Topic	Initials (trainer)	Initials (employee/ student)	Comments
<p><b>Emergency Evacuation:</b> Walk through the appropriate emergency evacuation route, indicate secondary evacuation route.</p>			
<p><b>Fire Alarm Pull Stations:</b> Show where fire alarm stations are located and instruct in their use.</p>			
<p><b>Portable Fire Extinguishers:</b> Show location of portable fire extinguishers. Emphasize that they are only to be used if they are trained, and on small fires. Fire alarm should be activated FIRST.</p>			
<p><b>First Aid Kits:</b> Show location of first aid kits and refer to “Responding to Emergencies” procedure.</p>			
<p><b>Responding to Emergencies:</b> Go over the booklet ‘<i>Your Guide to Responding to Emergencies</i>’ available at <a href="http://www.queensu.ca/security/emergency/emergency-booklet.pdf">http://www.queensu.ca/security/emergency/emergency-booklet.pdf</a></p>			
<p><b>Reporting Unsafe Conditions:</b> Unsafe conditions or acts must be reported to the supervisor or safety officer. The student/employee should take responsibility for correcting unsafe conditions when feasible (e.g. remove tripping hazard).</p>			
<p><b>Incidents and Near Misses:</b> Report all incidents or near misses to supervisor/safety officer. Employee incident report must be completed and forwarded to EH&amp;S.</p>			
<p><b>Workplace Safety and Insurance Board:</b> All work-related injuries/illnesses are covered by WSIB. Injuries must be reported to supervisor/safety officer immediately.</p>			





## Employee/Student Safety Orientation Checklist

Topic	Initials (trainer)	Initials (employee/ student)	Comments
<p><b>Warning Signs/Labels:</b> Discuss the meaning of all warning signs and labels used in the work area.</p>			
<p><b>Personal Protective Equipment:</b> Explain the care and use of all PPE and when it is required to wear PPE.</p>			
<p><b>Working in Hot Environments:</b> Discuss Queen's University's Policy and Department's procedures.</p>			
<p><b>Footwear Policy:</b> Discuss Queen's policy and specific types of footwear to be used it the worksite.</p>			
<p><b>Food and Drink:</b> Discuss Queen's and Department's policies. Point out areas where food and drink may be consumed.</p>			
<p><b>Working Alone:</b> Instruct that if hazardous work must be performed outside normal working hours then:</p> <ul style="list-style-type: none"> <li>- The work must have supervisor's approval.</li> <li>- If a second co-worker is not present then Security or your supervisor should be notified.</li> <li>- Discuss Security's '<i>Lone Worker</i>' program.</li> </ul>			
<p><b>Physical Requirements:</b> Discuss all physical requirements of the job (lifting, climbing etc.).</p>			



## Employee/Student Safety Orientation Checklist

Topic	Initials (trainer)	Initials (employee/ student)	Comments
<b>General and Chemical Laboratory</b>			
<p><b>Environmental Safety &amp; Security</b> Lab doors must be closed at all times and locked when the lab is unoccupied.</p>			
<p><b>Safety Shower/Eyewash:</b> Show the location of the eyewash and safety shower and how to operate each of them.</p> <p>DO NOT pull the handle of the safety shower during this orientation.</p>			
<p><b>Lab Coats/Gloves:</b> Wear lab coats and gloves in the halls when transporting hazardous material. Discuss the 'one glove method'.</p>			
<p><b>WHMIS</b> All employees who work with or work in close proximity to chemicals must attend Queen's University's WHMIS training and annual refresher training (EH&amp;S website) must be completed.</p> <p>If they have already obtained training at Queen's University. (Indicate date under Comments).</p> <p>The student is registered to obtain training on (date) _____</p>			
<p><b>Handling Reagents:</b> Given clear instructions regarding the lab rules (Chemical and Biohazard Module required) for handling reagents.</p>			



## Employee/Student Safety Orientation Checklist

<p><b>Chemical Spill:</b> Show location of spill kits and instructions.</p>			
<p><b>Chemical Disposal:</b> Instruct in the safe handling and disposal of dangerous substances (e.g. acids, phenol, formalin, etc.).</p> <p><a href="http://www.safety.queensu.ca/hazwaste">http://www.safety.queensu.ca/hazwaste</a></p>			
<p><b>CHEMFFX:</b> All MSDS's are now on-line. Visit <a href="http://www.safety.queensu.ca/chemffx">http://www.safety.queensu.ca/chemffx</a> to complete training and link to CHEMFFX.</p> <p>NOTE: If MSDS is missing or out of date contact Ben Feigen at <a href="mailto:ben.feigen@queensu.ca">ben.feigen@queensu.ca</a></p>			
<p><b>VERTERE:</b> Discuss the Queen's Inventory programme. Go through Vetere website <a href="https://apps.hechmet.ca/">https://apps.hechmet.ca/</a></p> <p>If necessary add new employee/student to the Vetere Inventory Management System. (Contact Ben Feigen at <a href="mailto:ben.feigen@queensu.ca">ben.feigen@queensu.ca</a> )</p>			



## Employee/Student Safety Orientation Checklist

Topic	Initials (trainer)	Initials (employee/ student)	Comments
<b>Radiation Laboratory Safety</b>			
<p><b>CNSC:</b> Make student/employee aware of the regulations that govern the use of radioisotopes in Canada (Sealed Source Training protocol).</p>			
<p><b>Security:</b> Instruct student/employee in the security requirements regarding radioactive material and the requirement to report any breaches in security.</p>			
<p><b>Authorized User:</b> The employee/student has been listed as an authorized user on the supervisor's radioisotope permit.</p> <p>They may not work unsupervised with radioactive materials until authorized by permit holder Dr. Ian Moore.</p>			
<p><b>Lab Specific Training:</b> Clearly instruct regarding lab rules (i.e. in-house procedures) for radioisotope work.</p> <ol style="list-style-type: none"> <li>1. Registered with Health Canada</li> <li>2. Read instruction manual for instrument</li> <li>3. Signed on Sealed source training record</li> <li>4. Record use of instrument in log book</li> </ol>			
<p><b>Permit:</b> The employee/student has been instructed in and has read all the special requirements listed on the permit ECV002.</p>			



## Employee/Student Safety Orientation Checklist

Topic	Initials (trainer)	Initials (employee/ student)	Comments
<b>Biohazard Laboratory Safety Training</b>			
<p><b>The employee/student may not work unsupervised with biohazardous materials until completion of the requirements below.</b></p>			
<p><b>Biosafety Manual:</b> Read the Queen's Biosafety Manual <a href="http://www.safety.queensu.ca/biocom/manual/bioman.pdf">http://www.safety.queensu.ca/biocom/manual/bioman.pdf</a></p>			
<p><b>Queen's Biosafety Certification:</b> Complete quiz or other training required <a href="http://www.safety.queensu.ca/cours">http://www.safety.queensu.ca/cours</a></p>			
<p><b>Lab Specific Training:</b> Obtain instruction regarding lab rules, lab-specific procedures and any inventory records required for biohazards.</p>			
<p><b>Biosafety SOPs:</b> Read Queen's Biosafety SOPs that apply to the laboratory. <a href="http://www.safety.queensu.ca/pol.htm#biopol">http://www.safety.queensu.ca/pol.htm#biopol</a></p>			
<p><b>Permit:</b> Read the lab biohazard permit including the risk assessment.</p>			
<p><b>Medical Surveillance:</b> Understand the medical surveillance required for the biohazards in this lab.</p>			



## Employee/Student Safety Orientation Checklist

Topic	Initials (trainer)	Initials (employee/ student)	Comments
<p><b>Health Status:</b> Know what changes in health status (including pregnancy) might increase susceptibility to the biohazards in your lab. Remember to inform your supervisor if these occur so that changes can be made for your safety if necessary.</p>			
<p><b>Immunization:</b> Obtain any recommended immunizations or serum titre testing.</p>			
<p><b>Exposure Response:</b> Know the emergency first aid for a biohazard exposure and the location of KGH OHS and KGH Emergency.</p>			
<p><b>Decontamination:</b> Know the decontamination procedures associated with various techniques using biohazardous material.</p>			
<p><b>Disposal:</b> Instruct the student/employee in the safe handling and disposal of biohazardous waste.</p>			
<p><b>Spills and other Biohazard Releases:</b> Know how to respond to a biohazard spill or other release from containment (e.g. due to failure of a centrifuge tube or Biological Safety Cabinet malfunction).</p>			
<p><b>Authorized User:</b> The student/employee must be listed as an authorized user on the supervisor's biohazard permit.</p>			



## Employee/Student Safety Orientation Checklist

List ALL formal training the employee/student has completed or circle the training that is a requirement to do his/her work.

Type of Training	Registration Date for Training	Completion Date for Training	Student/Worker's Initials	Certificate on File?
WHMIS				
Radiation Safety				
First Aid				
Ladder Safety				
Transportation of Dangerous Goods				
*Fieldwork Module				
*Fabrication Module				
*Chemical and Biohazard Module				
Hoist and Crane				

\* Keys to laboratories will not be issued and OCASP plans will not be approved until the appropriate module(s) is completed. Most graduate students will require the completion of at least one module.

Name of Employee/student (please print): \_\_\_\_\_

Employee/student's Signature: \_\_\_\_\_

Name of Supervisor (please print): \_\_\_\_\_

Supervisor's Signature: \_\_\_\_\_

Name of Person Providing Orientation (please print): \_\_\_\_\_

Trainer's Signature: \_\_\_\_\_

Date: \_\_\_\_\_

**NOTE: The completed checklist must be returned to Megan Rhymer, Department Manager.**

**FORM II – RELEASE OF LIABILITY**



**Release of Liability**

In consideration of Queen's University at Kingston permitting me to work as a visitor at the

\_\_\_\_\_  
(name of department and laboratory - if applicable)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

for the purpose of the following activities

\_\_\_\_\_  
\_\_\_\_\_  
and

in acknowledgement of the fact that my activities on University property, while being conducted with the consent of the Department Head, \_\_\_\_\_, are not being performed at the request or on behalf of the University, I, \_\_\_\_\_, hereby release Queen's University, its officers, employees, agents, students and volunteers from any claim or action whatsoever for damages, loss or injury suffered by me or any claim brought against me arising as a result of the said activities unless such damages, loss or injury are due to a negligent act or omission of Queen's University, its officers, employees, agents, students or volunteers.

Dates of visiting period:

from \_\_\_\_\_ to \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Witness

Visitor

\_\_\_\_\_  
Date