College of Biological Science

Health & Safety Handbook

2011 Edition

UNIVERSITY of GUELPH

CHANGING LIVES
IMPROVING LIFE

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1. Introduction

This handbook provides an overview of the safety program in the College of Biological Science (CBS). Although it touches on many of the hazards that are commonly encountered in the biological sciences, it is far from comprehensive. The handbook is complemented by safety training (both general and specific) and a variety of other references and resources.

Across the college we contend with different risks and hazards on a daily basis. Our researchers and educators work on the leading edge of science - to keep you safe, the college does its best to equip you with the knowledge to anticipate, recognize and avoid undue risks. Make sure you understand the nature of the hazards in your work and what must be done to control them.

2. Responsibility for Safety

Everyone at the University of Guelph has a stake in maintaining a safe environment. At work, at school and at home, each one of us is accountable for our own actions. When we take on positions of authority, we assume some additional responsibility for the safety of those under our supervision as well.

This handbook covers the basics – if you need specific information on any aspect of the legislation, departmental procedures, or the controls necessary for the various physical, chemical, biological or radiological hazards, more detailed resources are available and are discussed in further detail below.

The University of Guelph operates under the Ontario Occupational Health & Safety Act (RSO 1990 c.O.1) (OSHA), http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90o01_e.htm, which is administered by the Ministry of Labour. The central premise of OHSA is the **Internal Responsibility System**, which prescribes certain rights and responsibilities for workers, supervisors and employers.

All employees of the University of Guelph have 3 fundamental rights under the OHSA:

- The right to **know**.
- The right to **participate**.
- The right to **refuse** unsafe work.

In addition, employees have some common responsibilities under the Act:

- Follow safe work practices & wear protective equipment when appropriate.
- Report all hazards or defects that could become hazards.
- Avoid putting your safety or the safety of others in jeopardy.

As well, when you are in a position of authority you are required to:

- Ensure people under you are following safe work practices and using the correct protective equipment.
- Point out potential hazards so people are aware of dangers in the workplace.
- Take every reasonable precaution in the circumstances to protect the health and safety of those under you (i.e., exercise due diligence).

Be aware that the Ministry of Labour is an enforcement agency. Inspectors have right of entry, power to issue orders, to ticket and to lay fines against individuals and the institution. It is also important to note that in 2004 the Criminal Code was amended to allow the crown to pursue criminal charges against corporations and individuals in cases where there is reckless disregard for safety resulting in injury or death.

3. Safety Resources

It is good to have questions. The college wants you to think critically and understand the hazards you face and the precautions required to protect your health and well being.

The best place to start is with your supervisor. Issues that can't be easily addressed can be raised to the department chair, departmental safety committees, the Environmental Health & Safety department, or other resources across campus.

For up to date information on the college safety program, access the CBS Safety website at: www.uoguelph.ca/cbs/safety.

The University's Environmental Health and Safety department (EHS) also has a useful website (www.uoguelph.ca/ehs), where you can access all University safety policies, register for safety training sessions, and review resources and guidance on many aspects of the University's environmental, health and safety programs.

For further information on University security and emergency preparedness, check out the websites of Campus Community Police (www.police.uoguelph.ca) and the Fire Prevention Office (www.fire.uoguelph.ca).

The Ontario Occupational Health & Safety Act (RSO 1990, c.O.1) and provincial occupational health and safety regulations are available on line at www.e-laws.gov.on.ca. The Canadian Centre for Occupational Health & Safety has many great resources for workplace safety and can be accessed at www.ccohs.ca.

Hardcopies of required and essential information are posted on the EHS Bulletin Boards across campus, including:

- University of Guelph Environmental Health & Safety Policy.
- Referral to Ontario Occupational Health & Safety Act.
- Contact information for Central and Local Safety Committees.
- 'Injury at Work' (a.k.a., Form 82) which is a document from the WSIB that lays out the 4 steps to be taken post-injury.
- All relevant Ministry of Labour Notices or Orders.

You are always welcome to discuss any safety or environmental issue with the University of Guelph EHS Department.

3.1. Safety Committees

Each department in CBS has a safety committee. These committees help support the safety program on campus by identifying hazards, raising safety issues, and conducting workplace inspections.

In addition to our Departmental Committees (also called Local Committees), the university has a Central Joint Health and Safety Committee. The Central committee has representatives of all employee groups on campus, as well as representatives from management. The responsibilities laid out in the OHSA are accomplished by both the local and the central committees; the focus of the local committees is to conduct inspections, identify hazards and support local safety programs. Members of the central committee fulfill other requirements such as conducting accident investigations, attending to work refusals, and submitting formal recommendations to the employer.

These committees exist to represent your interests, and the interests of your colleagues. If you have an issue you would like the committee to investigate, feel free to contact the appropriate committee chair – current contact information is posted on the CBS Health & Safety website at: http://www.uoguelph.ca/cbs/safety/cbs_ehs_cmtes.html . The committee is always happy to help.

4. Safety Training

Everyone has to learn from someone, so don't be afraid to ask for help. Training is a critical component of any safety program – no one can reasonably expect you to do the right thing if you haven't been given instruction and expectations are not clear.

The training available to personnel in CBS can be subdivided into two categories: general or specific. General training is provided by the College, the University EHS Department, and external 3rd parties, and includes courses like WHMIS, Laboratory Safety, Radiation Safety, and First Aid/CPR. These courses may be offered in class or on-line. As well general training courses are offered by the Office of Research on human testing and animal care which you may be required to attend, depending on the nature of your work. These courses also include safety components. Please refer to the following websites for more details:

www.uoguelph.ca/ehs/courses/ for courses offered by EHS;

www.uoguelph.ca/research/acs/teaching/teaching.shtml for training on animal care; and

www.uoguelph.ca/research/humanParticipants/ for information on human testing.

Job-specific training is the responsibility of each lab or work group. This includes on-the-job demonstration of equipment, lab methods and experimental techniques. Some departments offer training on operation of certain pieces of equipment, or certain protocols (e.g., human testing) through dedicated departmental resources. If you are unsure of how to safely and properly complete a task, ask for assistance.

In CBS, WHMIS, Biosafety and Laboratory Safety training is mandatory for anyone involved in laboratory and/or other research. WHMIS training is required for any additional personnel whose work may involve handling hazardous materials.

Additional courses may be mandatory due to the nature of the research being performed. All personnel working with radioactive materials or devices are required to complete the training program delivered by the Radiation Safety Officer. Anyone conducting animal experiments is required to complete the training modules set out by the Animal Care Committee.

5. Standard Operating Procedures

CBS has developed a catalogue of Standard Operating Procedures (SOPs). These are documents that lay out specific directions on what to do in certain emergency situations, or instruction on the use of common lab equipment.

Standard Operating Procedures for the College of Biological Science are available on the CBS Health & Safety Website, under 'CBS Safety Handbook, Procedures & Forms' (www.uoguelph.ca/cbs/safety).

Also be aware of departmental procedures that apply to your work; for example the code of conduct requirements applicable to the human anatomy laboratories.

6. Emergency Procedures

Knowing what to do in an emergency could save your life.

6.1. Evacuation

When you hear the evacuation alarm, **immediately:**

- Extinguish any open flames and close any open gas valves.
- Close the sash on fume hoods and biosafety cabinets (BSCs).
- Exit the lab, and close the door behind you.
- Move quickly and calmly to the nearest safe exit or stairwell. Do not attempt to use the elevator.
- **Once outside, move well away from the building.**
- Pass any relevant information on to fire wardens.
- Reentry to the building may proceed once the alarm bells have stopped ringing unless instructed otherwise by emergency response personnel.

Anyone requiring assisted evacuation must be moved to the landing of the nearest safe stairwell. Ensure a fire warden or colleague notifies the emergency authorities of the person's location.

6.2. Fire

In the event of a fire, getting out safely is the top priority.

- Assess the fire – if it is small and controllable, you may use a portable extinguisher to put out the fire using the method described below. For fires that are not controllable, evacuate right away.
- Notify others in the lab and move quickly to the nearest safe exit.
- Activate the alarm pull station on your way out.
- If you are last to leave an area, close doors behind you.
- Use the nearest safe stairwell/exit.
- **Once outside, move well away from the building.**
- Pass any relevant information on to fire wardens and be available if the emergency authorities need to speak with you.
- Reentry to the building may proceed once the alarm bells have stopped ringing unless instructed otherwise by emergency response personnel.

If you need assistance to evacuate, move to the nearest safe stairwell and have a colleague or fire warden notify the emergency authorities of your location.

To operate an extinguisher, remember **P-A-S-S**:

P - Pull the pin.

A - Aim the nozzle at the base of the fire.

S - Squeeze the trigger.

S - Sweep side to side.

The Fire Prevention Office has created a video to demonstrate proper use of a fire extinguisher – it is available at this URL: http://www.fire.uoguelph.ca/fire_extinguisher.html.

In all CBS buildings, we have people who voluntarily serve as Fire Wardens; please follow their instructions and be respectful. Evacuation is mandatory and the Fire Prevention Officer may take disciplinary action against anyone refusing to leave.

6.3. Chemical Spill

The critical factor in chemical spill emergencies is knowing when you need to evacuate and get help. If you are ever in doubt of your ability to handle and clean a chemical spill, evacuate the lab and dial 2000 for assistance.

Refer to the CBS SOP at: http://www.uoguelph.ca/cbs/safety/cbs_ehs_procedures.html for detailed instructions on how to manage a chemical spill.

Spills can be classed as major (i.e. you need help) or minor (i.e. you can handle it yourself).

Evacuate the lab and get help if you have a spill that:

- You are not comfortable cleaning yourself.
- Is greater than 4L and is a flammable, combustible or other organic liquid.
- Poses a risk of fire or explosion.
- Creates a respiratory hazard (e.g., corrosive vapours, highly toxic chemicals).
- Involves unknown chemicals.
- Involves >1L of a concentrated strongly oxidizing acid (e.g., nitric, perchloric or chromic acid).

Following a spill, do a 'self-check'. If you have been splashed with a hazardous chemical, flush the area immediately. Remove all contaminated clothing and continue to flush the area; caustic or corrosive chemicals trapped against your skin can cause severe burns.

There are certain chemicals (e.g., hydrofluoric acid, mercury, and formaldehyde) that require specific neutralizers or absorbents not commonly found in lab spill kits. If these materials are used in your lab, make sure the spill kit has the supplemental items recommended in the SOP.

6.4. Biohazard Spill

Review the CBS SOP at: http://www.uoguelph.ca/cbs/safety/cbs_ehs_procedures.html for further details.

The important principles when managing a biohazard spill are to know the hazards of what you are working with, to avoid aerosol exposure or contact with contaminants, and to use the right disinfectant in the right way.

The first consideration is your safety. If biohazardous material has spilled on you, remove contaminated clothing and thoroughly wash the affected areas. If material gets in your eye, flush at the eyewash for 15 minutes. If it is a spill that that creates a hazard for others in the area (e.g. aerosolized pathogen), notify everyone in the lab and have them evacuate.

You want to avoid inhalation of pathogens. If the spill is in the lab and there is concern of airborne exposure, evacuate the room and allow 30 minutes for aerosols to settle. If the spill occurs in a biosafety cabinet, lower the sash and ensure the fan is running for at least 10 minutes. If a tube of pathogenic material breaks in a centrifuge, put a sign on the equipment and leave the centrifuge closed for 30 minutes for droplets to settle before you attempt to clean the spill.

Specific directions are provided in the SOP. The basic technique is to cover the spill with absorbent material, soak with a suitable chemical disinfectant, allow enough contact time for the disinfectant to work, then bag all waste and send for autoclaving. It is also important to notify your supervisor of the spill and complete an Incident Report.

6.5. Medical Emergency

- Obtain first aid assistance. The names and contact numbers of departmental first aiders are posted in every lab. In addition the University's first aid stations are:
    - Student Health Services, JT Powell Building
    - Occupational Health and Wellness (OHW), Alexander Hall
    - Campus Police/Fire Prevention, mobile service
- Students may obtain further medical treatment from Student Health Services. Employees can seek medical treatment or advice through Occupational Health and Wellness.
- **For emergencies, dial 2000 and request emergency assistance.**
- In an emergency, do not attempt to transport the casualty to the hospital yourself. Dial 2000 and request an ambulance.
- Severe injuries require **immediate** notification of EHS. If an injury meets the regulated definition of 'critical', the Ministry of Labour must be notified and the scene preserved.
    - A critical injury is one that:
        - Is potentially life threatening.
        - Causes loss of sight in an eye.
        - A burn to major portions of the body.
        - Produces unconsciousness.
        - Causes substantial loss of blood.
        - Causes fracture of arm or leg, or amputation of arm, hand, leg or foot.
- For non-critical injuries, notify your supervisor as soon as possible and ensure an Incident Report is submitted to OHW (Fax: (519) 780-1796) within 24 hours. Incident Report Forms are available through the EHS website at: http://www.uoguelph.ca/ehs/forms_by_alphabetically

Specific Incidents:

- **Cuts –** if someone suffers a severe cut, place pressure on the wound, and if possible elevate the wound above the heart.
- **Punctures –** if the object is still lodged in the person's body, do not remove it. Call 2000 immediately and request medical assistance.
- **Fainting –** if someone is about to faint, have them sit or lie down. If they have fainted in a seated position, steady them and put their head between their knees. If they have fallen to the ground, roll them to their back and elevate the legs 20-30 cm. If someone sustained an injury during the fall, begins convulsing, or does not recover within two minutes, dial 2000 and request emergency medical assistance.
- **Needle sticks** – Rinse the wound for 15 minutes. Determine whether it is a 'clean' or potentially 'dirty' needle. If the needle was potentially contaminated with an infectious substance, advise the victim to immediately contact Occupational Health and Wellness (x52647) or Student Health Services (x52131) and seek medical treatment. Outside of regular hours, advise the victim to seek immediate medical treatment (i.e. Emergency Room). Prophylaxis for hepatitis and HIV must be started as soon as possible following exposure.
- **Seizures –** help the person to the floor and clear away nearby objects. Try to prevent the person from striking objects in the area and harming themselves during the seizure. Do not attempt to restrain the victim or force anything into their mouth. Placing any object in the mouth of a seizure victim only increases the likelihood of choking. Dial 2000 immediately and request medical assistance; be sure to inform them if the victim is having trouble breathing or any other relevant details.

- **Choking –** call for help. If the airway is only partially obstructed and there is air exchange, encourage the victim to continue coughing. If the airway is fully obstructed administer the Heimlich maneuver.
- **Cardiac emergency** - if someone is showing symptoms of a heart attack (sudden pain in arm, chest, neck or back; pale skin), call 2000 and request an ambulance be sent to your location. Get the person to a sitting position and remove any constrictive clothing. Monitor their pulse and provide reassurance. If the victim goes into cardiac arrest and you are trained, administer CPR until emergency authorities arrive.

6.6. Active Threat

If you become aware of a violent situation, such as an armed person on campus:

- If possible, lock yourself in the nearest safe room and stay out of sight.
- If safe to do so, dial 2000 and request help.
- If you are certain you can get to an exit safely, move quickly and evacuate the building.

6.7. Power outage

Many of the areas occupied by the College of Biological Science are supplied with back-up power by generator, either from a stand-alone system or via the university's essential service grid. The time required for back-up power to come on-line is typically about 30 seconds, so if the power does go out, stay where you are for a moment to see if it comes back on. If it doesn't, check to see if the rest of the building is out as well. If it is a problem in only a portion of the building, have one person contact the Physical Resources work order desk at x53854.

Fume hoods and biosafety cabinets must be closed in a power outage to prevent migration of hazardous aerosols or vapours into the lab. Keep away from the hoods to prevent introducing air currents and minimize exposure to any accumulated vapours or aerosols.

If it is a widespread outage and back-up power has not come on-line, before leaving the lab for any length of time, shut off any open gas valves, compressed air/vacuum valves, light switches, fans, and any other equipment. One person from the department should call Physical Resources to notify them of the outage. Also ensure the rest of the department is notified by informing the chair's office.

6.8. Flood

If you discover a flooded area and it is safe to do so, try to cut off the source of the water. If there is an electrocution hazard (e.g., the water has risen to the level of electrical outlets, submerged electrical cords), evacuate everyone from the area and contact Physical Resources at x53854. Outside of regular hours, notify Campus Police at x52245 or x2000.

7. Hazard & Incident Reporting

7.1. Reporting of Hazardous Conditions

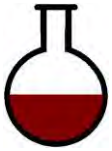
Under OHS law, every worker has a duty to report unchecked hazards. With the nature of our work across the college, there are many hazards; but with proper planning and precautions the risk can be controlled to an acceptable level. If you have concern about a hazard in your work area, start by discussing it with your supervisor or advisor. If the scope of the problem is too large or if there is question on what should be done, the issue can be raised to the department chair, the local safety committee and/or EHS.

Remember that as workers in Ontario, you have a legal right to refuse work that you legitimately feel would put you in danger. Refer to section 43 of the OHSA for more details (http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90o01_e.htm#s43s1 .

7.2. Incident Reporting

If you are injured at work, get appropriate first aid and notify your supervisor as soon as possible. An Incident Report Form must be filled out, signed by the supervisor, provided to the department head and employee group and submitted to EHS within 24 hours – but if an injury is serious and potentially life threatening, after getting help for the victim, call EHS (x53282) to report the incident as soon as possible. Allow Campus Police to notify the next of kin to avoid miscommunication and confusion.

Near misses (i.e., accidents that were narrowly avoided) should be reported using the Incident Report Form. The Incident Report Form is available through the EHS website.



8. Laboratory Safety

8.1. General Laboratory Safety

The goal of the safety program is not to have you memorize an arbitrary set of rules – it is much better if you try to understand the rationale behind the rules. In a lab, we need to do three fundamental things:

1) **protect ourselves from exposure to the hazards present**
2) **prevent the migration of contaminants out of the lab**
3) **put systems in place to mitigate the impact of a serious incident (e.g., fire, spill)**

Key points:

- Report all potential hazards or safety issues to lab supervisor/advisor.
- Familiarize yourself with the emergency response procedures.

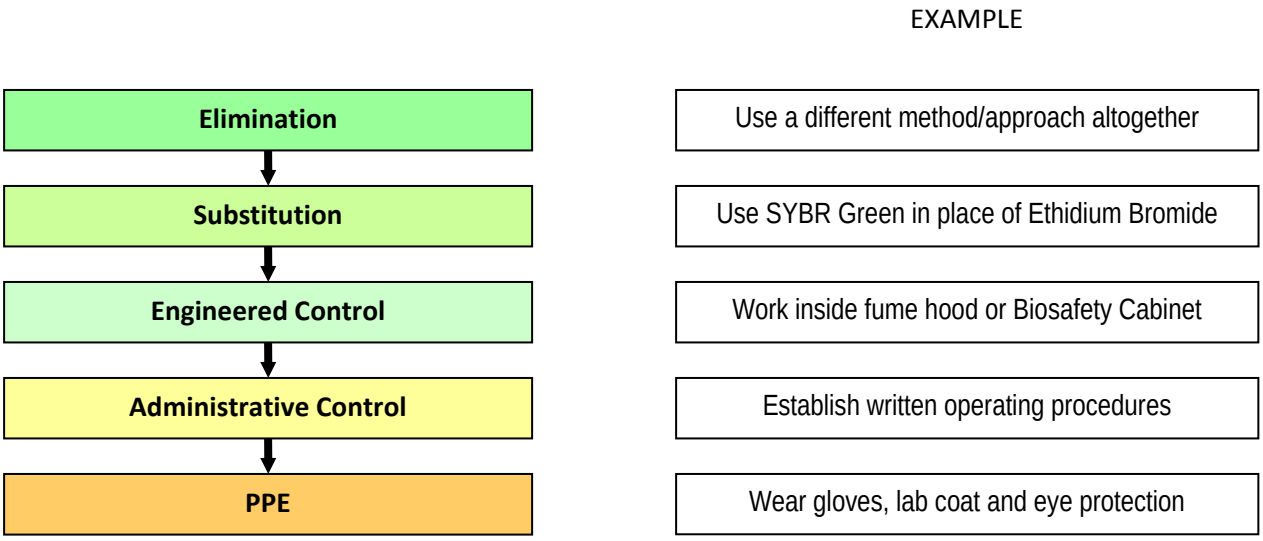
- Know evacuation routes from your lab and the location of emergency equipment such as fire extinguishers, spill kits, emergency showers/eyewashes, first aid kits, phones and emergency call boxes.
- Do not bring food, drinks, tobacco products or cosmetics into the lab.
- Always wear suitable clothing, closed-toed/heeled shoes, and required personal protective equipment (PPE) when working with potentially hazardous materials.
- Dispense hazardous materials inside a fume hood.
- Never allow gloved hands to touch surfaces outside of the lab, or 'clean' surfaces in the lab such as door knobs, phone receivers, or computer keyboards.
- Do not wear lab coats in common areas or stairwells.
- Keep personal items separated from hazardous materials.
- Never leave lab doors propped open.
- All materials dispensed from their original containers must be labeled.
- Place a sign on any unattended experiments, and provide contact information so you can be reached if something goes awry.
- Avoid use of personal music players when doing lab work – you need to be able to hear if equipment is functioning properly and it's important to be aware of the location of people around you.
- Keep incompatible chemicals separate (no acids with bases, no flammables with oxidizers) – look at the labels and/or MSDSs if you aren't sure.
- Practice good housekeeping and good hygiene.

Safety rules and regulations in a laboratory environment are unavoidable - it is an environment where fires, explosions, injuries, and exposures to chemical/biological/radiological/physical threats are a very real possibility. We have had serious incidents in CBS in the past that we do not want to repeat, so please take lab safety seriously.

To demonstrate the type of precautions needed to protect oneself, consider the simple task of decanting strong acid into a beaker for dilution. To do this properly one would:

- plan ahead, ensuring there was a clear space to work in the fume hood (a work practice control that reduces the likelihood of a spill/accidental exposure)
- be wearing close-toed shoes, long pants, a lab coat, acid-resistant gloves, and goggles (personal protective equipment to protect the skin and eyes in the event of small spills and splashes)
- perform all tasks inside a fume hood, with the sash in a low position (an engineered control that keeps corrosive fumes from entering the breathing zone)
- slowly pour the acid into a beaker partially filled with water (a work practice control that reduces the amount of undiluted acid splashing up)

The above emphasizes the use of engineered controls, safe work practices, and personal protective equipment to maintain exposures at a safe level: It is a demonstration in the hierarchy of controls, which is a model for the evaluation of protective measures. The schematic below depicts the order in which alternatives should be ranked; the more reliable and effective preventative measures are given preference. In practice, usually a combination of controls are used together to reduce exposure to a hazard.



Keep these concepts in mind when critically evaluating the work that you do in your lab.

Some key points about preventing contamination:

- Always assume gloves are contaminated. You put on gloves to prevent one thing or another from touching your skin. The logical conclusion is that whatever it was you didn't want on your skin is now on the exterior of the glove. Change gloves frequently and never allow a gloved hand to touch a common surface (like a door knob, phone receiver, etc.).
- Lab coats protect you, and the clothes that you own, from becoming contaminated. It is a requirement that lab coats be worn in all labs for any work involving hazardous materials. Lab coats can not be worn outside of the research wings in CBS. If you will need a lab coat at your destination on another floor, simply place your coat in a plastic bag and carry it with you.
- A clean work area goes a long way to reducing cross-contamination. When working with radioisotopes, we have the benefit of being able to detect contamination with a survey meter; with biological and chemical contaminants, we aren't so lucky. For any hazardous agent it is important to consider how the inevitable small spills, droplets and splashes can be controlled. Working over disposable bench paper is an easy way to control contamination, alternatively you can work over a low tray that has cleanable surfaces. Regardless of the method you use, be sure to clean your work area when finished, and if there are any small spills, clean them up using an appropriate method as soon as possible (refer to CBS SOPs on spills for more details).
- Another area with high potential for spreading chemical/biological or radiological contamination is the transport of materials through hallways. Make use of carts, trays and bottle carriers when moving materials around the building.
- Another factor to consider is the storage of your personal belongings; as much as possible, you should keep personal items out of the lab. If you do have items you need in the lab, keep them well separated from potentially contaminated areas.

There are additional aspects of contamination control that pertain to the design of equipment and the laboratory itself, but the list above covers most of the basic responsibilities.

Finally, to manage the potential impact of emergencies, the general responsibilities of lab personnel include:

- Familiarizing yourself with evacuation routes, emergency procedures, as well as the locations of phones, call boxes, and emergency equipment in your work area.
- Notifying others of incidents such as spills or fires; verbally for minor incidents, or by activating an alarm pull station for more serious situations.
- Keeping aisle and exit routes clear.
- Ensuring that the access to eyewash stations, showers, and fire extinguishers is unobstructed, and that extinguishers have adequate charge (needle on pressure gauge is in green zone).
- Ensuring spill kits and first aid kits are readily accessible and appropriately stocked.

Further information can be found in the University's Laboratory Safety manual located on the EHS website at: http://www.uoguelph.ca/ehs/programs/lab-safety/

8.2. Workplace Hazardous Materials Information System (WHMIS)

The Workplace Hazardous Materials Information System, or WHMIS, is a very important component of the hazard communication scheme in a university laboratory. WHMIS regulations set out requirements for the training of personnel, the labeling of hazardous materials, and the provision of Material Safety Data Sheets (MSDSs).

Anyone working in a laboratory environment must receive WHMIS training.

All hazardous materials decanted from their original container must be labeled. Containers that will not leave the laboratory require only a product identifier (i.e. the name of the product written on the exterior). If a decanted hazardous material will be moved out of the lab, it requires a workplace label, which needs to include a product identifier, directions for safe handling, and a reference to the MSDS.

Historically, each lab was required to keep a binder of printed Material Safety Data Sheets, which are only valid for 3 years. To eliminate this labour intensive inventory and updating requirement, the University has implemented an electronic MSDS system. It is still advised that each lab keep a hardcopy of the 20 most used solvents or chemicals on hand, but for the majority of chemicals, access to MSDSs can be through the internet via a computer terminal. MSDSs can be accessed from the University of Guelph network at: http://hq.msdsonline.com/uoguelph/Search/Default.aspx

8.3. Monthly Laboratory Self-inspections

Key Points:

- Activate eyewash stations weekly to flush out contaminants, discourage microbial growth and ensure the flow is adequate.
- Ensure the access to the emergency eyewash/shower is not obstructed.
- Check the fire extinguisher – it should be easy to access (i.e. unobstructed), and the pressure indicator should be in the green area of the gauge.
- Check the spill kit – it should contain neutralizers (usually 3 – acid, base, and organic solvent suppressant), absorbent materials, gloves, goggles, a dustpan/scraper or dustpan/broom and bags for waste material.
- Check first aid boxes – the kit should contain gloves, tweezers, scissors, adhesive bandages, tape, gauze, and pads or compress bandages.
- Visually inspect chemical storage areas to ensure there is no leakage and incompatibles are separated each month.
- Look for issues with unsecured gas cylinders, poor housekeeping, electrical hazards, and access to exits.
- Report any issues to your supervisor.

It is important that laboratory inspections be completed regularly to monitor and maintain the safety of each work area. In any given lab there can be a combination of physical, chemical, biological and radiological hazards - diligence is required to control these hazards and keep the work environment safe.

8.4. Fume Hoods

Key Points:

- Keep sash closed when not in use.
- Ensure that the fume hood is on prior to use.
- Work with sash as low as possible (less than 18”/50cm).
- Keep all work at least 6”/15cm back from front edge.
- Do not obstruct air vents at rear of hood.
- Do not allow hoods to become cluttered or to be used as extra storage.
- Uncap containers inside the hood, recap them as soon as you are finished.
- Do not use a fume hood if the alarm indicates low flow.
- Any solution of perchloric acid above 70% being heated must be handled in a specially designed hood with wash-down features.
- Completely close the sash if you are working in a hood when the fire alarm goes off.

Further instructions on the proper use of fume hoods are provided in the CBS SOP at: http://www.uoguelph.ca/cbs/safety/cbs_ehs_procedures.html.

When a hood is not in use, keep the sash fully closed. This is a simple thing that can conserve a lot of energy - fume hoods exhaust a large volume of air when they are open, and it requires a great deal of energy to heat or cool the replacement air.

When you are working in a hood, keep the sash as low as you reasonably can. This improves ability of the hood to keep airborne contaminants out of your breathing space, offers some protection to your face should there be a splash or spill, and conserves energy.

Fume hoods on campus are equipped with a warning device that will alarm when the airflow is inadequate for the hood to function as designed. The alarm will go off if the airflow falls below a preset threshold (face velocity of 80 feet per minute). Do not attempt to use the hood if the alarm is going off and stop any experiments taking place inside the hood if the alarm persists. Close the sash fully to prevent hazardous vapours from migrating into the lab.

To determine if low flow may be resulting from a disruption of airflow, remove items that may be obstructing the movement of air through the vents at the back of the hood. Also, lower the sash and reset the alarm if possible. Sash position will affect the face velocity, which is an important factor in effective capture of airborne contaminants. Baffles should not be adjusted by users.

Large disruptions in the air around a hood (e.g., the opening/closing of a door) may temporarily affect the airflow through the hood; if this is suspected as the cause of the problem, try resetting the alarm if possible. If the above changes do not rectify the issue, label the hood as 'out of order' and notify Physical Resources (x53854) or the appropriate departmental contact for equipment problems.

8.5. Biosafety Cabinets (BSCs)

Key Points:

- Any time your work requires use of the BSC, you should wear a lab coat and gloves to protect you skin and your clothing from contamination. As well, long hair should be tied back, as required by the Laboratory Biosafety Guidelines.
- Plan your work and minimize movement in and out of the hood.
- Chemically disinfect before and after use
- Allow time for air currents to stabilize before starting work in the cabinet

Review the CBS SOP at: http://www.uoguelph.ca/cbs/safety/cbs_ehs_procedures.html for additional details on the use and care of this equipment.

8.6. Liquid Nitrogen

Key Points:

- Always wear gloves and eye protection when handling liquid nitrogen

- Follow the operational practices outlined in the CBS SOP at: http://www.uoguelph.ca/cbs/safety/cbs_ehs_procedures.html
- Keep the door open when dispensing from bulk storage dewars.
- If you have a spill, the only thing you can do is evacuate immediately. Make sure everyone gets out of the immediate area, and wait 30 minutes for the air to clear. If a spill is >4L, call EHS, as air testing may be required to verify the oxygen level has returned to normal.

Some storage areas for dewars are equipped with an oxygen monitor. When the alarm sounds, close any open valves immediately and leave the room.

8.7. Chemical Safety

Key Points:

- Know the hazards of the materials with which you are working. Review the MSDS prior to handling a new chemical.
- Don't accumulate unnecessary inventory - check to see if your lab already has the chemical, and order only as much as you need.
- Never store incompatible materials together. Acids cannot be stored with bases, flammables cannot be stored with oxidizers.
- Never put flammable solvents in a fridge unless the fridge is specifically designed to accommodate flammables. There are far too many recorded cases of fridges and freezers exploding in laboratories as a result of improper storage of flammable materials.

8.8. Compressed Gas Cylinders

Key points:

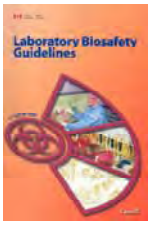
- When moving a tank – ensure the safety cap is completely screwed on and the tank is chained or strapped to a cylinder cart.
- Always secure tanks vertically using a strap or chain whether in storage or in use.
- Tanks in use must be secured in an upright position with a regulator attached.
- Do not attempt to change a tank unless you have been trained to do so.
- Never store tanks of incompatible materials together (e.g., flammable gases beside oxygen).

Compressed gas cylinders are under high pressure, and contain a lot of potential energy. The principle hazards are that a failure in the tank or the valve will cause a rapid release of pressure (i.e. an explosion), and a release of the contents (leaking or open valve) that could be hazardous.

Even non-toxic gases such as nitrogen are potentially harmful, as the leaking gas can displace oxygen and lead to asphyxiation. A leak of a toxic gas can rapidly reach a hazardous level. Similarly a leaking cylinder of flammable gas could potentially lead to a fire or explosion.

To prevent leaks, always use the right type of regulator, fittings, and hoses for your application. Inspect all components prior to assembling to ensure they are clean, dry, and functioning properly. When

appropriate, check all connections by brushing on a soapy solution to ensure there is no errant gas escaping. In some applications a gas detector may be required.



8.9. Biosafety

Risk Groups and Containment Levels

Biological materials are classified into 'Risk Groups' on the basis of their ability to cause disease in humans and/or animals.

Risk Group 1 – low individual and community risk

Risk Group 2 – moderate individual risk, limited community risk

Risk Group 3 – high individual risk, low community risk

Risk Group 4 – high individual risk, high community risk

The Risk Group indicates the relative level of risk to workers and to public health, but the more relevant classification from an operational perspective is the **Containment Level**. The Containment Level defines the nature of the engineering and procedural controls required for handling different organisms. For common organisms, the Containment Level can be obtained from the MSDS posted on the Public Health Agency of Canada website, at this URL: http://www.phac-aspc.gc.ca/msds-ftss/index.html

If you are unable to find information on an organism of interest, contact the University of Guelph Biosafety Officer for assistance.

The containment level for recombinant DNA and genetic manipulation is not something that can feasibly be defined in advance. It will depend on a risk assessment that takes into account the pathogenicity of the donor/source organism and the recipient organism, as well as the properties of the recombinant organism with respect to protein expression and replication. For assistance in determining the proper containment level, you may contact the Office of Laboratory Safety in Ottawa at (613) 957-1779.

Cell lines may be biohazardous as a result of the organism's inherent pathogenicity, or due to contamination with other agents such as viruses, fungi, bacteria or prions. At the University of Guelph, the policy is to work with cell lines/cell cultures under Containment Level 2. In cases where there is a high potential for laboratory-acquired infection (e.g., cell lines derived from macaques that may be contaminated with *Herpesvirus simiae*) Containment Level 3 will be required; conversely in cases where the risk is assessed and deemed to be low, work with cell lines may be downgraded to Containment Level 1.

Anyone performing work with human pathogens must familiarize themselves with the Laboratory Biosafety Guidelines issued by Health Canada. If you are doing work with animal pathogens, you must review the Canadian Food Inspection Agency's Containment Standards for Veterinary Facilities. The

general safety precautions for handling pathogenic biological agents are discussed in the section on operational requirements below.

Permits

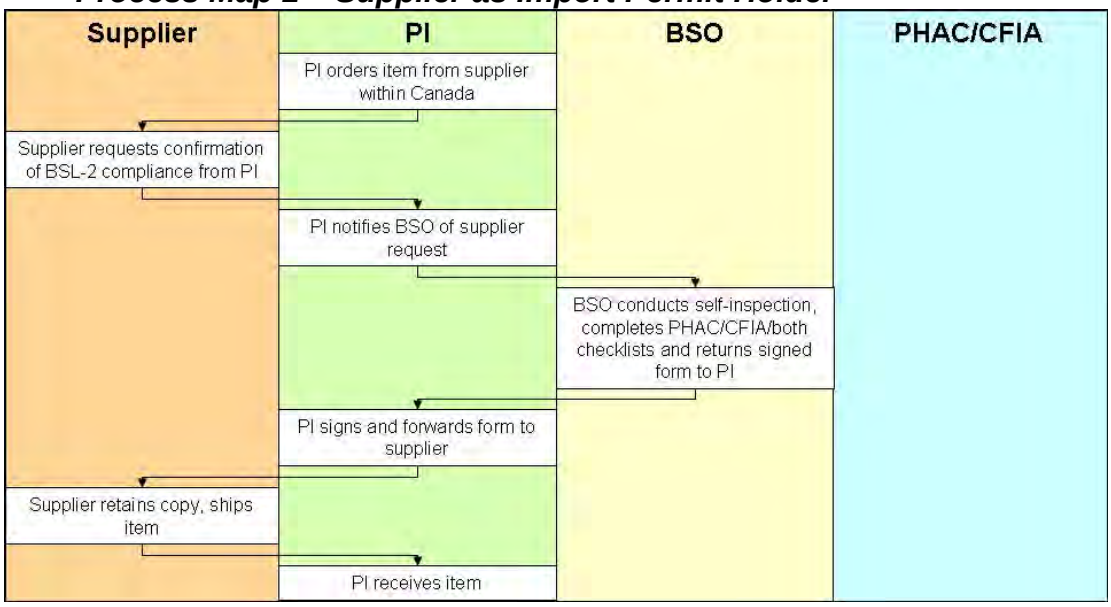
A valid biosafety permit, issued by the University of Guelph Biosafety Committee, must be obtained for all activities involving use or storage of biohazardous materials. For more details, please refer to the information provided on: http://www.uoguelph.ca/ehs/programs/biosafety/.

Additional resources are available on the CBS Health & Safety website to assist in preparing biosafety permit applications.

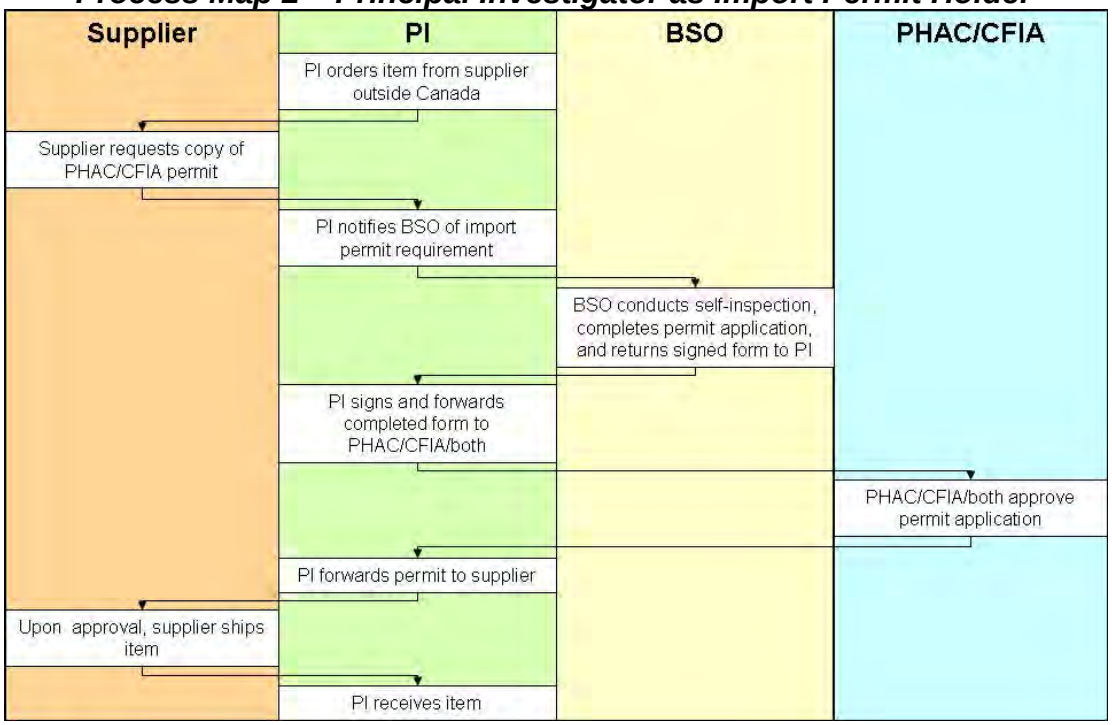
Import of Pathogens

In order to bring pathogenic agents into Canada, one of, or both, the Public Health Agency of Canada (PHAC) and the Canadian Food Inspection Agency (CFIA) must approve the importation. In some cases we must obtain the permits ourselves, in other cases we import under the permit of a supplier or distributor. The flowcharts below depict the process for importation of risk group 2 materials for circumstances where the supplier is the permit holder, and for situations where the PI applies for the import permit.

Process Map 1 – Supplier as Import Permit Holder



Process Map 2 – Principal Investigator as Import Permit Holder



The PHAC and CFIA operate as separate entities, so at present, documentation may be required by both. Each agency provides a checklist to help users confirm whether they comply with all the requirements of the relevant guidelines - the checklists are available at the following URLs:

http://www.phac-aspc.gc.ca/ols-bsl/containment/pdf/cl2-checklist_e.doc

http://www.inspection.gc.ca/english/sci/bio/anima/path/animae.shtml

Material Transfer

Before we release biohazardous materials to another individual, organization or institution, it is incumbent on us take reasonable steps to ensure that the material will be handled properly.

For materials that fall into Risk Group 2 (or higher), we must ensure the destination facility fulfills all requirements of a Containment Level 2 laboratory, as described in the PHAC and/or CFIA guidelines. As well, shipments of risk group 2 or higher materials may fall under the Transportation of Dangerous Goods (TDG); refer to the CBS SOP on Transport of Dangerous Goods for further details at: http://www.uoguelph.ca/cbs/safety/cbs_ehs_procedures.html.

Another consideration is the protection of intellectual property of the university; the Business Development Office in the Office of Research has a Material Transfer Agreement form which is available online: http://bdo.uoguelph.ca/assets/Material_Transfer_Agreement.pdf

Biosecurity

In recent years the level of concern over the security of pathogenic materials has grown. From the perspective of the end user, the key points surround access and inventory control.

Access control is an important aspect of biosecurity. Never prop open doors or tamper with locking mechanisms, and please report any suspicious activities or behaviour. Generally speaking, doors can be unlocked during the day when the lab is occupied, but after hours lab doors must be securely closed and locked.

To facilitate proper inventory control, make sure you keep your materials well organized, properly labeled, and accounted for using the inventory system in your lab. If freezers or storage rooms are kept locked, be sure to relock them when you are finished using them. Dispose of biological wastes properly so that pathogens are effectively destroyed.

Operational Requirements

The requirements for the various Biosafety Containment Levels are defined in detail in the Health Canada and CFIA guideline documents, and reiterated in the reference materials that support the biosafety program. Take time to review the Health Canada Laboratory Biosafety Guidelines prior to starting any work with biological organisms.

As discussed in the section on lab safety, the purpose of the various requirements are to keep you, as a worker, from being exposed; to prevent contamination from being carried out of the lab and spread to other parts of our facilities; and to put plans in place to deal with emergencies that may arise.

A few of the essential operational requirements for Containment Level 2 (many of which are applicable in all labs) are listed below:

- All personnel must wear fastened lab coats when working in the lab. Lab coats are not to be worn in stairwells or common areas of the building. Contaminated lab coats should be autoclaved or chemically disinfected prior to laundering (unless laundry has been proven to effectively decontaminate lab coats).
- Eye or face protection is required whenever there is a risk of splashes, aerosols or flying objects.
- Closed toed shoes are required when working in all laboratories, including Containment Level 2 areas.
- Gloves must be worn whenever there is a potential for skin contact with a biohazard, and removed prior to leaving the work area. Any cuts or scrapes must remain covered at all times with a waterproof dressing. Hands should be washed whenever gloves are removed, and prior to leaving the laboratory.
- To prevent accidental contamination, long hair must be tied back and lab coats must be worn by all personnel when working in the lab. Jewelry is not recommended.
- To reduce the probability of ingestion, food, drink and cosmetics are not permitted in the lab, and oral pipetting is prohibited.

- Routine chemical disinfection of work surfaces is necessary to prevent the spread of potentially pathogenic material, and non-essential items and personal belongings must be kept away from areas where biohazards are handled. Benchkote should be changed on a regular basis and following any minor spills.
- All biohazardous waste materials must be decontaminated (i.e. autoclaved) prior to disposal or collected by a disposal company specializing in the handling of biohazardous waste.

8.10. Radiation Safety

Permits

All radioactive materials must be ordered through the Radiation Safety Officer and may only be handled by laboratories that have a permit granted by the campus Radiation Safety Committee.

At the University of Guelph, we have Basic Level Laboratories (BLL) and Intermediate Level Laboratories (ILL). The open quantity of a radioisotope in a BLL is limited to less than 5 times the Annual Limit on Intake. An ILL may be used to handle radioactive material with activity up to 50 times the Annual Limit on Intake.

In addition to quantity limitations within permitted labs, there are extensive requirements for inventory tracking, use of shielding devices and exposure controls, monitoring of exposure and contamination, and management of waste. These topics are covered in detail as part of the Radiation Safety Training, and documented in the Radiation Safety Operational Guidance (RSOG) documents. More information is available on the EHS website at: http://www.uoguelph.ca/ehs/programs/radiation/

Requirements

Prior to any work with radioactive materials, staff and students must successfully complete Radiation Safety Training. The core set of RSOG documents are available to users in permitted labs, and treated as the primary reference for operational guidance (along with the specific protocols followed in your individual lab).

During experiments, in most circumstances it will be appropriate to have a survey meter on hand to periodically sweep the work area, verifying that contamination has been effectively controlled. As well, post-experiment wipe-testing must be performed to confirm the work area is adequately free from radioactive material. The wipe test protocol for the shared Intermediate Level Laboratories in the Science Complex is available online, and can be used as a template for setting up a protocol in your lab.

8.11. Human Testing

The use of human subjects for research has obvious ethical and safety implications. Any research projects that will involve human subjects must be approved by the University of Guelph Research Ethics Board. Further details are available online at: http://www.uoguelph.ca/research/services-divisions/ethics . In addition researchers involved in human clinical trials involving human fluid and/or

tissue require hands-on clinical training provided by Human Health and Nutritional Sciences. Please contact x53493 for more information.

8.12. Animal Care

The use of animals in biological research is under the oversight of the Animal Care Committee. Prior to initiating any study involving animals, an Animal Utilization Protocol (AUP) must be approved by the committee, and participants must successfully complete training as animal users. Further details are available online at:

http://www.uoguelph.ca/research/animals-in-research-teaching

8.13. Laboratory Wastes

Across the college we generate many different types of waste. The proper segregation of waste is an important issue; placing hazardous waste in the normal garbage can put the safety of the custodial staff at risk, and lead to serious fines and penalties to the University. The pouring of chemicals down the drain is incredibly irresponsible, damaging to the environment, and is prohibited by law.

If you are unsure of how a certain chemical or material might be classified as a waste, hang on to it and ask for clarification from your supervisor, or the Laboratory Safety Officer in the EHS department.

The table below itemizes the types of waste we routinely have in the college, and what should be done with each.

Hazardous Waste tags, like the one shown below are available from the Stockroom or from the EHS Department. You may call x53282 and ask the Administrative Assistant to send you a supply of tags through interoffice mail. Affix a tag to the waste container when you begin collecting waste.

Waste	Examples	Disposal Procedure
Regular, non-hazardous garbage	Paper towel, gloves,	Place in garbage container (black bag).
Recyclable materials (not contaminated with hazardous materials)	Fine paper, newspaper	Place in blue bin (clear bag)
Aqueous solutions	Phosphate buffer Tris buffer	Aqueous solutions that contain any hazardous materials (metals, dyes, stains) must be collected and disposed of as hazardous waste. If a solution is a mixture of aqueous and organic solvents, treat as either halogenated or non-halogenated solvent. NOTE – if solutions are strongly acidic or basic, label and separate. Do not mix acids and bases in waste jugs.
Halogenated organic solvent waste	Chloroform, methylene chloride	Collect in either a safety can or an empty 4L bottle. Safety cans will be returned within a week of pick-up. If using a safety can, label to indicate the type of waste. Keep lid closed except when filling, and store in flammable storage cabinet. If using a 4L bottle, ensure it either contained a compatible chemical or has been cleaned of any residue. The original label must be defaced or removed, and the bottle must be labeled indicating the type of waste it contains. Store in the flammable storage cabinet.
Non-halogenated organic solvent waste	Acetone, ethanol, isopropanol	Collect in either a safety can or an empty 4L bottle. If using a safety can, label to indicate the type of waste. Keep lid closed except when filling, and store in flammable storage cabinet. If using a 4L bottle, ensure it either contained a compatible chemical or has been cleaned of any residue. The original label must be defaced or removed, and the bottle must be labeled to indicate the type of waste. Store in the flammable storage cabinet.
Biohazardous Waste	Used culture plates/tubes/flasks, disposable pipettes	Collect in an autoclavable bag (typically orange or red). Regularly (e.g. daily) close the top of the bag and use a cart to take it to the waste autoclave. Do not pack waste in tightly; penetration of the steam is imperative for effective decontamination. Note – in departments/areas where suitable autoclaves are not available, a specialized waste contractor can be contracted to regularly pick up collected biohazard waste. Contact EHS to initiate this type of agreement with a contractor in this area.

Biohazardous sharps	Syringes, blades, contaminated broken glass or other sharp object potentially contaminated with a biohazardous material	Biohazardous sharps can be disposed of in one of two ways. In both cases, sharps must be collected in a puncture-resistant container designed for sharps collection. When the bin has reached the fill line, the lid must be secured shut. Some departments autoclave the sharps container, and then submit a requisition to EHS to have the autoclaved waste removed. Alternatively, a waste company that specializes in biohazardous waste, can be contracted to pick up the secured containers without autoclaving. In this case, the sharps are classified as biohazardous waste.
Clean Glass Waste	Clean glassware, glass pipettes	Clean/sterilized glass, including broken glassware and pipettes, can be placed in the containers marked as 'Glass' (white pail, yellow bag). Ensure any glass going into this waste stream is clean.
Radioactive waste	C14, P32	There are 2 methods that may be applied for disposal of radioactive wastes, depending on the circumstances. The most common is to arrange for a radioactive waste pickup. Waste is collected in designated bins (separated by isotope). Complete the Request for Radioactive Waste Disposal and submit to EHS. Solutions with very low activity that contain no other hazardous ingredients can be discharged to drain, in accordance with the license issued to the University. The amount discharged must be less than the waste activity concentration listed on the permit issued to your lab, and this practice must be approved by the RSO, through submission of the RSOF100 Form.
Expired/Unneeded chemicals	Expired dry or liquid chemicals, chemicals that are no longer used	Do not remove from original container. Place in a safe area of the lab, affix a waste tag and submit requisition to EHS.
Compressed gas tanks	Empty N2 cylinder	In most cases, tanks can be return to the supplier. If you are left with a tank that can not be returned, affix a waste tag and submit requisition to EHS for disposal.
Formaldehyde	Formalin preservative	Formaldehyde is an irritant and a human carcinogen, and must be treated as a hazardous waste. Collect in a suitable container, and when full affix tag and submit requisition to EHS.

Ethidium bromide waste	Stock solutions	Stained gels and contaminated solid wastes (weigh paper/tray, benchkote) should be collected in a sealable container (e.g, 20L pail w/lid, lined with heavy gauge plastic bag & labeled as HAZARDOUS - EtBr WASTE). To dispose of container contents, submit requisition to EHS. Stock solutions should be collected in a labeled bottle and stored in a safe location. When necessary, submit requisition to EHS for disposal. Staining solutions can be treated in the same manner as stock solutions, or detoxified by chemical reaction or specialized filtration. By-products of the filtration method must be treated as hazardous waste.
Acrylamide	Stock solutions, polymerized gels	Acrylamide monomer (i.e. powder or in solution) must be treated as a hazardous waste. Uncontaminated polymerized gels can be discarded in the regular garbage.

9. Field Safety

9.1. Overview

Across CBS we have many different researchers coordinating many different projects. There is no standard list of precautions that is going to be applicable in all circumstances – but what is universally critical is to **plan ahead**. If the project requires collection of plant material from the forest canopy, then proper training and climbing equipment are going to be important; if it involves research on the diet of bears, than some form of protection from local predators, such as pepper spray or firearms, is a top priority.

When considering the training, equipment and safety precautions a field team will need, consider all the things which could go wrong – engineers call this type of approach 'failure mode and effects analysis'; we don't need to be so technical, but in concept we are trying to accomplish the same goal – to determine up front the problems that could arise.

Prior to starting a project involving field work:

- Principal Investigators must complete a Field Research (or Field Trip) Safety Plan Form (available on-line) and have it approved by the department Chair.
- Prior to the start date, all participants must have received all the training or certifications indicated in the Field Research Safety Plan.
- Anyone intending to use a University Vehicle, must submit a Driver Information Profile Form (available online) to the Insurance Manager.

9.2. Field Research Safety Plans

A Field Research Safety Plan must be completed by the Principal Investigator and approved by the department chair.

The University Policy on Field Work contains detailed information on various hazards and is available on the EHS website.

9.3. Remote Locations

Any time you are working away from developed areas, it becomes important that you are prepared to deal with any situation which may occur.

A reliable means of communication is critical. You need to be able to call for help if you find yourself in circumstances that you are not equipped to handle. Cell phones, satellite phones, access to a local phone, radios or locator beacons may be appropriate. It is important to check in regularly – if a schedule is established for calling in, make sure you keep to it.

Emergency assistance may not be readily available, so it's important to have a plan. You must have a first aid kit and a trained first aider on the expedition to deal with minor injuries. You also must have a plan for getting help in the event of a serious injury requiring medical evacuation – know the location of the nearest hospital or medical centre and how to contact them.

Anyone who will be working in the field and taking a medication for pre-existing conditions is strongly encouraged to bring an adequate supply, and preferably extra in case circumstances change. If you would like to consult confidentially with a medical professional on this subject, please contact Occupational Health and Wellness of Student Health Services as appropriate.

For expeditions to very remote locations, contact the emergency search and rescue authority in advance of your trip to let them know the details of when and where your research will be conducted. For example, in Northern Ontario the Ministry of Natural Resources coordinates search and rescue; please contact them if you will be doing field work in highly remote areas.

9.4. Disease

Contact the local public health unit for information on travel advisories and vaccines or prophylactic treatments you may need. For insect-borne diseases, controls such as mosquito netting and repellents may also be advisable.

9.5. Sun Safety

Almost everyone enjoys working out in the sun on a nice day, but overexposure to ultraviolet rays can have serious long term consequences. As well, exposure to direct sunlight increases the risk of dehydration and heatstroke.

When on university business, use typical sun protection measures such as sun glasses, wide-brimmed hats and a broad spectrum sunscreen, reapplied every 2 hours. Take frequent breaks in the shade and drink plenty of water to stay hydrated. Pay attention to the Environment Canada UV Index and adjust your work schedule accordingly when possible. Where possible, try to minimize prolonged, direct exposure to sunlight during the hours when UV rays are most intense (10am to 4pm).

9.6. Wildlife

Being knowledgeable about the wildlife in the region is a crucial factor in keeping safe when conducting field research. Thoroughly research an area when establishing your field research safety plan and, where necessary, make use of local experts.

In high-hazard circumstances, you may need to obtain anti-venom or antidotes and carry them with you on your trip. In some instances, firearms may be necessary for protection. In order to lawfully carry a

firearm in Canada you must have successfully passed the Canadian Firearms Safety Course and hold a valid Possession & Acquisition Licence (PAL) from the Canadian Firearms Centre (see www.cfc-cafc.gc.ca)

9.7. Working at Height

If the nature of your research requires any work more than 3 metres off the ground, you must have appropriate training and equipment.

Equipment for working at height can come in several forms – make sure you are fully trained on the equipment you will be using, and that all equipment is inspected pre-use and kept in good condition. The type of safety gear required will depend on the type of work being done.

Do not work at height alone. It is imperative there be someone present to get help if you do fall and injure yourself.

9.8. Security

Traveling abroad for research can be a rewarding experience, but it is important to be familiar with the political and socioeconomic conditions of your destination. Make use of local contacts to gain an understanding of the potential issues that may arise. The University of Guelph's Centre for International Programs provides a great deal of information to ensure safe international travel. See their website at: http://www.uoguelph.ca/cip/page.cfm?id=246 for more information. Travel advisories issued by Foreign Affairs and International Trade Canada can be viewed directly at: www.voyage.gc.ca).

9.9. Water Hazards

Boats

Any use of watercraft for University activity must be in accordance with the laws and regulations of the applicable region. For use of powered small water craft in Ontario, the operator must have (at least) a valid Pleasure Craft Operator Card (see http://www.tc.gc.ca/eng/marinesafety/debs-obs-menu-1362.htm)

Basic safety equipment on a boat includes life jackets for all occupants, a bailing bucket, a flashlight or flares, a whistle or air horn, and a fire extinguisher. You should also have oars in case you lose power, an anchor and anchor line, and buoyant rope in case you need to throw a line to another vessel or a person in the water. Depending on the size of your boat, you may also need a radio and navigation equipment. Vessels less than 6m without a motor (such as canoes and rowboats) do not require a Pleasure Craft Operator Card, but do require lifejackets for all occupants, a bailing bucket (or pump), a whistle or horn, as well as 15m of buoyant line and an oar or an anchor. If the craft will be used after dark, navigation lights are required.

The University has limited facilities for the storage of unused gas and fuel tanks. If you have gasoline left over at the end of the field season, you can transfer the gas into the fuel tank of another vehicle. If you are transferring between two metal containers, be sure to ground and bond the containers to reduce the probability of static discharge.

Marine/Aquatic

In Ontario there are regulations that specifically pertain to diving operations. If doing any work underwater in Ontario involving more than a snorkel, the dive will be subject to Ontario Regulation 629/94. Under the Diving Operations regulation, you must file a notice with the Ministry of Labour and conduct the dive in accordance with the applicable sections of the regulation. Diving outside Ontario must be conducted in accordance with the relevant standards and regulations in that jurisdiction. Contact EHS for more information.

If you are working in a marine environment, avoid snorkeling, swimming or diving around piers as you could be seriously injured if you were struck against a pier or pylon. Similarly, one of the major hazards of working in and around streams and rivers is the current. Never wade into water flowing quickly enough to sweep you downstream, and if you have doubts as to whether you can safely walk or stand in the water, don't go in!

If you are using hip-waders, keep the belt cinched at your midsection. Loose waders can increase the risk of drowning if they get swamped with water. It is not recommended to wear hip waders in a boat – if you fall in, they can fill with water and increase the risk of drowning. Be very cautious when wading into any body of water and ensure you know the depth and have good footing.

Electroshocking

The use of electroshocking/electrofishing equipment requires precautions to prevent accidental electrocution of the user. There is a risk of severe electrical shocks and cardiac fibrillation when using this equipment, so never use electrofishing equipment when alone, and ensure at least one member of the team has a valid CPR certification.

Inspect the electroshocking unit, waders and gloves prior to sampling each day in the field. Waders or gloves that fail a leak test must be replaced or repaired before use. If a leak is detected at any point, stop sampling and replace/repair the equipment immediately. No member of the team should contact the water with unprotected skin at any time during sample collection.

Review the manufacturer's instructions for the equipment and familiarize yourself with all necessary safety precautions before using this type of equipment.

Ice

Be wary of ice conditions, particularly during milder periods in fall and spring. The Canadian Red Cross recommends a thickness of 15 cm of clear, solid ice before walking alone on an ice sheet. Snowmobiles require a thickness of 25 cm, and cars and light trucks should not be moved onto ice until it is at least 30 cm thick.

In determining whether it is safe to venture onto the ice, consider more than just ice thickness and consult with local experts. White/opaque ice is only about half as strong as clear/blue ice, and the age of the ice, freeze/thaw cycles, and recent climatic conditions like temperature, sunlight and snow cover can all impact the strength of the ice. The common sense rule is that if you aren't sure it's safe, don't go out on the ice!

9.10. Vehicles

Use of personal vehicles for university business is not recommended. Whenever possible, make use of university-owned vehicles for field work and field trips. Personal vehicles are not covered under the University's insurance, so if you do intend to use a personal vehicle it is your responsibility to ensure you have appropriate coverage.

Prior to using a University vehicle, submit a Driver Profile Form, authorized by the department chair, to the Insurance Manager.

If your research requires the transport of dangerous goods, refer to the SOP for further details.

If you must use an all-terrain vehicle, tractor, snowmobile or other form of transport, you must obtain training prior to use in the field.

9.11. Transportation of Dangerous Goods (TDG)

Anyone who ships, carries or receives dangerous goods must have a valid training certificate. Anyone requiring TDG training should contact EHS at x53282.

Review the CBS SOP at: http://www.uoguelph.ca/cbs/safety/cbs_ehs_procedures.html on Transportation of Dangerous Goods for detailed instructions on training requirement, packaging design, labeling, and documentation.

10. Standard Operating Procedures, Forms and Other Resources

This handbook provides an introduction to the basic hazards we face within CBS, and a rudimentary discussion of the types of safety measures that we need to consider. More detailed information on specific procedures and equipment is presented in the university policies and the college SOPs, available from http://www.uoguelph.ca/cbs/safety/cbs_ehs_procedures.html.

Commonly used forms are also posted at this URL. The table below explains the purpose of the various forms

Form	***When do you need this form?***
Incident Report Form	You are required to complete an incident report following any injury or spill. It must be signed off by the department head and sent to EHS within 24 hours of the incident. You can also use this form to report a near miss of a hazardous condition.
Chemical/Sharps Disposal Request Form	Submit this requisition for chemical or sharps waste pickup to EHS when you have materials ready for disposal.
Radioactive Waste Disposal Request Form	Submit the radioactive waste disposal requisition to EHS to arrange for in-lab pickup.
Field Research Safety Form	The field research safety plan form must be completed and submitted to the department chair for approval prior to any new field work project
CBS Safety Orientation Record	The orientation training of new personnel is documented on this form.
CBS Ongoing Safety Training Record	This record is to be generated and updated on a continuous basis as new training is provided.