Guideline
Biosafety Manual and Emergency Response Plan for Level 1 Permits

Scope and Purpose

This document is a guideline on how to create your lab's permit-specific biosafety manual, it does not constitute your manual.

This guideline is based on the biosafety standards developed by the Public Health Agency of Canada (PHAC) and the Canadian Food Inspection Agency (CFIA) as discussed in the *Canadian Biosafety Guideline – Containment Level 1: Physical Design and Operational Practices (2017)* (CBG) and the *Canadian Biosafety Handbook* (CBH) 2nd edition, 2015. Its goal is to provide guidance on how to mitigate the risks of working with Risk Group 1 (RG1) biological material.

The University of Toronto's Institutional Biosafety Committee has mandated that the operational practices outlined in the CBG must be followed by Level 1 permits.

The CBG (Canadian Biosafety Guideline – Containment Level 1: Physical Design and Operational Practices) can be referenced here (have this link in your manual):

https://www.canada.ca/en/public-health/services/canadian-biosafety-standards-guidelines/guidance/containment-level-1-physical-design-operational-practices.html#a1

The CBS (*Canadian Biosafety Standard*) can be referenced here (have this link in your manual):

http://canadianbiosafetystandards.collaboration.gc.ca/cbs-ncb/index-eng.php

The CBH (*Canadian Biosafety Handbook*) can be referenced here (have this link in your manual):

http://canadianbiosafetystandards.collaboration.gc.ca/cbh-gcb/index-eng.php

More information can be found on the University of Toronto's Biosafety webpage (have this link in your manual): http://ehs.utoronto.ca/our-services/biosafety/

Introduction

Risk Group 1 Biological Material

Biological material refers to microorganisms, proteins, and nucleic acids, as well as other biological matter (e.g., cells, tissues, other specimens) that may contain microorganisms, proteins, and nucleic acids, or parts thereof, regardless of whether or not they are infectious or toxic. RG1 biological material

is defined as a microorganism, nucleic acid, or protein that is either a) not capable of causing human or animal disease; or b) capable of causing human disease or animal disease, but is unlikely to do so.

RG1 pathogens pose a low risk to the health of individual humans and animals, and low or no risk to public health and animal populations. RG1 pathogens may pose harm to immunocompromised or immunosuppressed individuals (e.g., through medical therapy, pregnancy, diabetes, or other conditions). The Human Pathogens and Toxins Act (HPTA) and Human Pathogens and Toxins Regulations (HPTR) do not cover RG1 organisms, due to their low risk; therefore, laboratories and other facilities conducting activities with RG1 biological material are not regulated by the Public Health Agency of Canada (PHAC). Nevertheless, reasonable precautions should be taken (e.g., good microbiological laboratory practices) when handling these materials.

If RG1 biological material is modified resulting in an increased risk to personnel or the environment (i.e., increased virulence or pathogenicity, communicability, resistance to a preventive or therapeutic treatment, or toxicity of a toxin), work with the material is to be stopped and the material must be transferred to a facility of an appropriate containment level. Contact the biosafety office if there is a possibility that your biological's risk factors have changed.

Regulations

Though RG1 biological material is not covered under the HPTA or HPTR, the federal regulators, PHAC and CFIA, published a guideline (CBG) for working with this material. They recommend that RG1 material be handled safely, using safe work practices and in a laboratory that incorporates basic laboratory design. This guideline (see link above) along with the recommendations found in the CBH provide institutions and researchers with guidance on how to work safely with RG1 material. Our institutional biosafety committee has agreed that the operational practices recommended in the CBG must be followed at UofT.

The federal authority, Environment and Climate Change Canada (ECCC), has the New Substance Notification Regulations (Organisms) (NSNR (Organisms), which mandates that genetically modified organisms must not be released into the environment. Therefore, RG1 organisms must be pre-treated and made non-viable prior to disposal (see Waste section below for further information).

There are further regulations, both provincial and federal, which do not allow any non-native organisms to be released into the environment.

Biosafety Manual Overview

All biosafety permit holders are responsible for the development of their permit-specific Biosafety Manual which contains institutional policies and programs, a training program, an emergency response plan as well as work-specific Standard Operating Procedures (SOPs). These SOPs should also outline the good microbiological laboratory practices that are to be followed in their labs. The term "good microbiological laboratory practices" describes a basic set of safe work practices and techniques established in microbiology laboratories. Personnel can apply these in any work area where similar

laboratory-related activities are performed involving RG1 biological material to prevent the exposure or injury of personnel and to prevent the contamination of samples and the environment.

The permit-specific biosafety manual will act as an effective tool with which to educate personnel on hazards, risks, mitigation strategies, emergency response and safe work practices and which personnel can consult as the need arises to review updates or refresh their memories.

Your manual must contain:

1. The University of Toronto's Institutional Biosafety Manual
2. Training program which includes the required Environmental Health & Safety (EHS) courses, in-house training requirements, training needs assessment procedures, and documentation requirements
3. Biosecurity plan that includes physical security, accountability for biological material (i.e.no release to the environment, requirements for acquiring new biologicals), and incident reporting
4. Housekeeping program which includes routine cleaning/decontamination of laboratory, storage of laboratory supplies
5. Facility and equipment maintenance
6. Standard Operating Procedures (SOPs) for laboratory procedures including safe work practices specific to the containment zone (lab)
7. Emergency Response Plan that is detailed and specific to the bioagents/materials/chemicals used in your containment zones, the lab procedures/processes carried out by your personnel and the equipment used

Your lab's manual should be in digital format. A digital format will allow links to information to be available and make updating the information easier. The information must be organized in a clear manner, and in such a way that your personnel can easily find what they are looking for (i.e. include an index; active links to different sections of your manual).

All lab workers must be familiar with the information contained in your manual and have it available for review. If the manual is in digital format, place the file in a shared directory or instruct all lab workers to have it bookmarked on their computer while associated with the lab. They must be able to reference the manual in a quick and easy fashion.

If planning to use cloud-based storage for your documents, it is recommended that Canadian servers be used.

SOPs should be reviewed and amended whenever there are changes to equipment or procedures. Personnel need to be advised of any changed or updated SOP.

Components of Level 1 Biosafety Manuals CBG 3.2.2, CBS 4.1.10

1. University of Toronto's Biosafety Policies and Procedures Manual

https://ehs.utoronto.ca/our-services/biosafety/biosafety-manual/

This link to the University of Toronto's institutional manual must be included in your lab's manual. It contains information on many biosafety issues including:

- Biosafety program at UofT
- Relevant physical operation and design of the containment zones and systems
- Correct use and operation of laboratory equipment, including primary containment devices
- Incident reporting and follow-up

2. Training Program CBG 3.2.6, CBS 4.3, CBH Chapter 8

Your biosafety manual should state your training program objectives and goals and clearly identify the desired behaviour or skill to be learned in training. Training on the contents of your Biosafety Manual and SOPs will familiarize your personnel with the requirements for work in your lab such as required Personal Protective Equipment (PPE) and your emergency response plan. With training your personnel will be able to safely handle the biological agents and chemicals they will encounter in the workplace and respond accordingly in an emergency situation.

Online Environmental Health & Safety (EHS) training

Before working with any biologicals, personnel must first take the required Environmental Health & Safety (EHS) courses. The training matrix for laboratory personnel (list of available online courses) can be found here: https://ehs.utoronto.ca/training/laboratory-personnel/

Required online training for all personnel working with biologicals:

- EHS 601 Laboratory Biosafety: all personnel attached to a biosafety permit must complete this course prior to starting work in the laboratory.
- EHS 602 Biosafety Refresher: must be taken annually starting one year after completing EHS 601.
- EHS 101 WHMIS and Lab Safety: all personnel attached to a biosafety permit must complete this course prior to starting work in the laboratory.
- EHS 112 WHMIS Refresher: must be taken annually starting one year after completing EHS 101.

Training requirements for Permit Holders:

- EHS 601 Laboratory Biosafety: please note that EHS 601 and the no longer available EHS 014 (PI online biosafety quiz) are equivalent and if you have taken EHS 014 in the past you do not have to take EHS 601.
- EHS 621 PI Biosafety Refresher: must be taken annually starting one year after completing EHS 601.
- EHS 101 WHMIS and Lab Safety.
- EHS 112 WHMIS Refresher: must be taken every 3 years after completing EHS 101.

Example of other training available (for full list see training matrix):

- EHS 113 Compressed Gas Safety for Lab Users: labs that use compressed gas can have their personnel take this course in tandem with their lab's in-house training. This course will not be tracked by EHS (will not show up on their EHS training record) but a certificate is available to personnel that complete the course.

Any personnel that have not fully completed all required training (trainees) must be directly supervised by trained personnel when working in the lab until they have completed their training (CBG 3.2.6, CBS 4.3.8).

If anyone has any questions regarding EHS training, they can check our Training FAQ page at: https://ehs.utoronto.ca/training-faq/ or contact our course coordinator at ehs.courses@utoronto.ca

Personnel may check their EHS training history by logging into the EHS portal here:

https://ehs.utoronto.ca/training/my-ehs-training/

In-House Lab-Specific Training

Personnel must know and understand the potential hazards of their work, and follow all operational practices and procedures. The fundamentals of safe biological work are discussed in the Laboratory Biosafety course (EHS601). Supervisors must also ensure that all personnel, have successfully completed in-house training on their lab's SOPs including equipment use, waste procedures and emergency response. Personnel must show understanding and competence in those procedures prior to working in the lab. This requirement is applicable to both new and experienced personnel. All in-house training must be documented, dated and signed by both the trainee and trainer, and available for review upon request by EHS personnel and external regulators. Documentation of all in-house training should be kept by the supervisor for a minimum of 5 years after the personnel has left the lab.

In-house training must include the following:

- Relevant components of the permit-specific Biosafety Manual and SOPs as determined by a training needs assessment.
- Potential hazards associated with the work involved, including the necessary precautions to prevent exposure to, or release of, biological agents or toxins. This should include safe work practices for each task involving RG1 material and physical control measures such as decontamination, waste management, and the correct use of PPE.
- Relevant (to their activities) physical design and operation of the containment zone and containment systems and on the correct use and operation of laboratory equipment. This should include how to determine if the equipment is functioning properly and how to protect against a release, or injury (i.e. safe sharps use). A review of any secondary containment systems should also be included. Some examples of equipment and systems are Biological

Safety Cabinets (BSCs), autoclaves, centrifuges, incubators, fume hoods and any other laboratory equipment/apparatus used when handling biologicals or toxins.

- Personnel working with animals to be trained in restraint and handling techniques (CBG 3.4.1, CBS 4.3.5)

Training Needs Assessments

Training needs assessments should be undertaken by supervisors on a regular basis at minimum annually, or more often if there is a change in program intent, new research protocols/practices or following any incidents that may have occurred in the lab to determine if all personnel are up to date on their required in-house and EHS training. Retraining or training reviews may have to be undertaken when SOPs are amended with changes to equipment, projects or procedures, remember to also update your emergency response plan when changes are made. Any in-house retraining must also be documented.

Biosafety Memorandum of Understanding and Agreement (MOU)

It is the permit holder's responsibility to have on file signed MOU forms for everyone listed on their permit. These forms must be kept for at least 5 years from the last date of the personnel's appointment. The MOU file must be available for review upon request by EHS personnel. The biosafety MOU can be found here:

https://ehs.utoronto.ca/wp-content/uploads/2016/10/Memorandum-of-Agreement.pdf

3. Biosecurity

Lab Access/Security CBG 3.1.7, 3.1.8, CBS 4.5.1, 4.5.2

No unauthorized personnel are to have access to the lab (authorized means attached to your permit and fully trained). Visitors must be accompanied at all times.

Containment (lab) doors must be kept shut. Any unoccupied labs must be locked. Unlocked and unoccupied labs are considered a serious biosecurity concern. Not only is there a possibility of biological agents or hazardous chemicals being removed from the lab but personal items and lab equipment could be stolen.

No Release of Biologicals from Facilities:

A Local Risk Assessment (LRA) should be performed to assess what procedures/training is required to ensure that no viable biologicals will be released into the environment from your facilities (labs). These risk assessments must also consider the containment of any genetic material (i.e. eggs, pollen, spores etc.) from genetically modified or non-native species. This may take the form of having additional equipment in your spill kit (i.e. spill containment dikes or drain closures) to block any biological spills

from going down floor drains, moving equipment containing larger volumes (i.e. shakers) away from drains, regularly checking process equipment for leaks, correct labelling/dating of waste containers, physical containment requirements (i.e. screens or secondary containment) and additional training of personnel.

4. Housekeeping, Laboratory Storage

Housekeeping is the responsibility of laboratory personnel and/or other specifically trained staff.

The containment zone (including floors) must be kept clean and free from clutter or obstructions. Excess or extraneous materials are to be stored outside of the work area, and use of materials that are difficult to decontaminate must be avoided. (CBG 3.1.6, CBS 4.6.35)

A clean, uncluttered work environment allows appropriate decontamination of the containment zone. It also minimizes slipping, tripping, fall, and collision hazards that could potentially lead to exposure incidents. injury or the spread of contamination. Storing excess materials outside the containment zone also protects this material from becoming contaminated.

Do not store any items that are difficult to decontaminate on or near the floor i.e. cardboard or Styrofoam, place these items up off the floor or in plastic storage containers. Glass bottles should not be stored on the floor where they are a dangerous trip hazard. If they must be stored on the floor, then place them in secondary containment (i.e. a pail or other plastic container).

If using bench coat/bench protector paper, regular change-outs should occur as part of housekeeping and if spills occur. The covering of work surfaces with bench coat must not interfere with the required decontamination procedures. Work surfaces where biologicals are handled must be decontaminated prior to starting work, when work is finished, after any spills, or more often based on your lab's Local Risk Assessment (LRA). (CBG 3.1.11, 3.1.12, CBS 4.6.11)

Housekeeping should also include items like ensuring liquid hand soap and paper towels are always available at your hand washing sink, and waterproof bandages and other First Aid supplies are checked and replaced when needed.

Do not have electric power bars or other electrical connections on the floor in labs. Having electrical connections on the floor may lead to possible electrical hazards or damage to sensitive equipment if a flood or spill were to occur.

5. Facility and Equipment Maintenance

Lab equipment also requires regular cleaning, decontamination and other maintenance. Your lab's housekeeping schedule/plan should also contain instructions on required equipment maintenance. As with the operation of any equipment, the manufacturer's instructions on safe use and required maintenance should be followed.

Equipment maintenance schedules (examples)

- Vacuum Line Systems: have a maintenance schedule that includes in-line filter replacement and vacuum line trap maintenance in your biosafety manual. See the information and diagram available in the UofT Institutional Biosafety Manual on how to set up vacuum line systems.
- Weekly flushing of emergency eyewashes must be done in all labs and this flushing needs to be documented. See the UofT Safety Eyewash and Shower Standard for further information and testing advice: https://ehs.utoronto.ca/wp-content/uploads/2015/10/Emergency-Eyewash-and-Shower-Std.pdf
- Biological Safety Cabinets (BSCs) and other equipment that have come into contact with biological material must be decontaminated prior to service or certification by authorized personnel and before removal from labs or disposal (CBG 3.3.3, 3.3.4; CBS 4.8.8)

Visual inspections of work area (lab): (CBG 3.2.8, 3.2.9, 3.2.10)

In-house lab inspections must be conducted on a regular basis at minimum annually (once per term or every 4 months is recommended), and corrective actions are to be taken if any damage, faults or deterioration (e.g. chipped benchtops, faulty equipment and lighting) is found. Records of all inspections and corrective actions taken are to be kept for at least 5 years.

If working with large volumes (10L or more) all process equipment, closed systems and containment devices to be inspected for leaks on a regular basis.

A general lab checklist can be downloaded here, add items for checking that are consistent with your work and permit requirements:

https://ehs.utoronto.ca/wp-content/uploads/2016/12/Laboratory-PI-inspection-checklist-Oct-2016-ver-1.02.pd-Updated.pdf

6. Standard Operating Procedures (SOPs) for Safe Work Practices CBG 3.2.2

The safe work practices required in your lab should be based on the hazards that have been identified by your lab's LRAs. These safe work practices would include any safety precautions deemed necessary by the biosafety permit holder and should include written instructions concerning, e.g. extra PPE (i.e. eye protection) requirements, aerosol reduction, sharps use, risks associated with work, how to use lab equipment etc. These practices provide a foundation for the development of your lab's work-specific, safety-focused SOPs.

Local Risk Assessments (LRAs) CBS 4.1.8, CBH 4.4.1

Permit holders/Principal Investigators are responsible for their site-specific LRAs. These assessments should identify hazards based on the biological material, or toxin in use and the activities to be performed in their laboratories. They should identify not only the potential biological hazards but any other hazards such as chemical, radiological, or physical risks and outline measures to be used to reduce

the risk of injury. This risk assessment can then be used to create their work-specific, safety-focused SOPs.

For more details on LRAs see CBH 4.4.1 and PHAC's LRA Guideline: https://www.canada.ca/en/public-health/services/canadian-biosafety-standards-guidelines/guidance/canadian-biosafety-guidelines.html

Standard Operating Procedures (SOP) CBS 4.1.15, CBH 5.3.5

A Standard Operating Procedure (SOP) is a detailed step-by-step procedural document on how to safely perform the activities and procedures done in your lab. It should contain precise, practical instructions on how to use instruments, handle bioagents, perform experiments and all the safety measures that should be followed including PPE requirements. It should also include maintenance and documentation requirements, waste and decontamination instructions, emergency procedures and accident reporting instructions.

Principal Investigators are responsible for reviewing and approving all SOPs relevant to their laboratory operations. SOPs should be introduced to personnel during training and must be reviewed, understood and followed by all laboratory users. The SOPs should be included in your lab-specific biosafety manual and be available for review by all users. SOPs should be reviewed and amended whenever there are changes to equipment or procedures. Personnel need to be advised of any changed or updated SOP.

For more information on SOPs see CBH 5.3.5

SOPs should contain the following (if applicable) and any other instructions needed to perform lab activities safely based on your LRA:

- safety considerations/potential hazards/risks based on risk assessment, any special handling procedures
- PPE requirements
- entry/exit procedures
- use of primary containment devices
- instructions on where the work is to be carried out, e.g. BSC, clean bench, fume hood
- animal work considerations
- decontamination, cleaning procedures and waste (disposal) procedures for both liquid and solid waste
- safe and secure movement/transportation of biological materials and storage requirements (CBG 3.2.3)
- any procedure/task involving RG1 material as determined by an LRA
- spills, accident procedures and exposure response (must be included in your emergency response plan)

Information to Assist in the Writing of SOPs:

Included below is some general information and reference links on PPE, decontamination procedures and waste protocols to assist labs in the creation of their work-specific SOPs.

Safe Work Practices Documents:

Your SOPs must be specific to the work carried out in your lab but we do have a number of general "safe work practices" documents available on our biosafety webpage https://ehs.utoronto.ca/our-services/biosafety/ for example:

Safe Work Practices - Safe Sharps Use:

https://ehs.utoronto.ca/wp-content/uploads/2020/09/Safe-Work-Practices-Safe-Sharps-Use.pdf

Safe Work Practices – Centrifuge Use:

https://ehs.utoronto.ca/wp-content/uploads/2020/10/Safe-Work-Practices-Centrifuge-Use.pdf

Personal Protective Equipment (PPE) CBG 3.1.9, CBS 4.4, CBH Chapter 9

The PPE to be worn when working in any lab should be in accordance with the highest risk or possible hazard for the equipment, biological agents, material or chemical used in the procedure. The supervisor should advise what PPE is required based on a LRA to identify potential risks in any lab procedure. PPE must be worn at all times when working with biological agents. Check the Safety Data Sheet(s) (SDSs) for the chemicals that will be used in the procedure, to ascertain if any additional PPE is required. PPE must be stored within the containment zone (lab).

- Lab coats must be long sleeved and knee length
- Long pants or skirt (the entirety of the legs must be covered)
- Shoes are to be closed toe and heel, low heeled (or no heeled) and have non slip soles
- Gloves. Specific glove types may have to be specified for different procedures (based on you LRA). Some examples include, nitrile/latex laboratory gloves for handling specimens, and insulated utility gloves for handling freezing materials. Ensure gloves are compatible with possible hazards
- Safety goggles and/or face shield if there is a possibility of ocular splash, or flying debris
- Personnel to remove PPE carefully to minimize possible contamination of their skin, hair or clothing when leaving the containment zone (lab) (CBG 3.1.15)
- Potentially contaminated clothing articles and PPE should be decontaminated prior to washing (CBG 3.1.14): https://ehs.utoronto.ca/wp-content/uploads/2015/10/Lab-Coat-Washing-Guidelines.pdf

Additional information and resources on PPE are provided below:

General Laboratory PPE Assessment tool: https://ehs.utoronto.ca/wp-content/uploads/2016/06/Laboratory-PPE-Assessment-Tool.pd-Updated.pdf

General information on PPE: https://ehs.utoronto.ca/resources/personal-protective-equipment-ppe/

Lab coat Guidelines: https://ehs.utoronto.ca/wp-content/uploads/2017/04/Lab-Coat-Guidelines.pdf

Protective Glove Standard: https://ehs.utoronto.ca/wp-content/uploads/2015/10/Hand-Protection-Gloves.pdf

Protective Eye and Face wear Standard: https://ehs.utoronto.ca/wp-content/uploads/2015/10/Eye-Protection-Standard.pdf

Respiratory Protection Program: https://ehs.utoronto.ca/wp-content/uploads/2015/10/Respiratory-Protection-Program.pdf

Waterproof Dressings

Any breach of the skin (scratch, cut, wound) needs to be protected from contact with biological material. Waterproof dressings (adhesive bandages) must be available to people working with biologicals (CBG 3.1.5). The type that seal all around the circumference are recommended.

Instructions on the requirement to cover cuts or scrapes on hands with waterproof dressings before work with biological agents should be included in the relevant SOPs as part of the PPE section of your permit-specific biosafety manual.

Hand Washing

Must be done after removing gloves, before leaving the lab, after working with animals, toxins, chemicals or biologicals (CBG 3.1.13). Ensure that liquid hand soap and paper towels are always available at the hand washing sink in your lab (include in your lab maintenance schedule).

Decontamination Procedures CBG 3.1.11, 3.1.12, CBH Chapter 15

Your manual must detail the decontamination procedures followed in your lab i.e. what disinfectant should be used and at what final concentration for all biologicals handled; required disinfectant contact time to be indicated; describe what equipment needs to be disinfected and how often; work areas are to be disinfected before and after each experiment, and after any spill. If your lab uses a BSC, it must be disinfected for certification personnel. Procedures are to be performed in a manner that minimizes the risk of producing splashes or aerosols (CBG 3.1.11).

Some quick facts about Bleach:

- Active ingredient is sodium hypochlorite.
- Bleach stocks come in a variety of different concentrations of sodium hypochlorite, from as low as 3% up to 12% for some industry brands.
- Lab members MUST know the concentration in their stock to be able to calculate the final dilution of sodium hypochlorite. For example, if your bleach stock is 6% then 100 ml. of bleach

stock can be added to 500 ml. of fluid to result in 600 ml. of 1% sodium hypochlorite (dilution often used for spills). Lab SOPs should state the final dilution of sodium hypochlorite required for disinfection NOT the % of bleach (since bleach stocks are so variable).

- Diluted bleach breaks down very quickly and must be remade fresh every 24 hours.
- Bleach is very corrosive, if using 0.5% or higher of sodium hypochlorite to disinfect surfaces then be sure to rinse them with water after the required contact time (usually 20 – 30 minutes depending on organism).
- Bleach must never be autoclaved as this can cause chlorine gas to be released.

Waste Management Protocols CBG 3.1.12, CBH Chapter 16

All RG1 biologicals (solid and liquid waste) must be pre-treated (made non-viable) before disposal in the regular garbage stream. The pre-treatment and disposal SOPs for your biological waste both solid and liquid must be written, available to all users and in your permit-specific biosafety manual. Your waste procedures must also be available for review by EHS personnel. If you have any questions regarding waste, contact the Environmental Protection Services (EPS) at 416-946-3473/416-978-7000. See the Hazardous Waste Manual for further contact information.

For a summary of waste procedures to be followed in bio labs:

https://ehs.utoronto.ca/wp-content/uploads/2019/04/Waste-Information-and-Procedures-for-Bio-Labs_v3.1-09-14-2020.pdf

Include the link for the university's hazardous waste manual:

http://ehs.utoronto.ca/laboratory-hazardous-waste-management-and-disposal-manual/

Movement of Biological Material CBG 3.2.3, CBH Chapter 20

For movement within the containment zone (lab), ensure that all precautions are taken to avoid spills and the release of biologicals. Biological agents should be moved in closed containers (primary containment) which are leak-proof and impact-resistant. Screw top containers should be used rather than snap-cap tubes.

For movement outside of the containment zone (lab) but still within the same building, ensure that all biologicals are secured in labelled, closed and leak-proof secondary containers. Movement of biologicals out of the containment zone should only be done when transporting to a decontamination area, another appropriate containment zone or storage area. Use a cart with raised edges and guard rails when moving heavy containers or a large number of samples. Avoid using passenger elevators, where possible use freight elevators instead.

7. Emergency Response Plan (ERP) CBG 3.2.5, CBS 4.1.16, 4.9.1, CBH Chapter 17

An Emergency Response Plan based on overarching risk assessments and LRAs must be developed, implemented and kept up to date. It must be available to all personnel.

Your ERP must include the name and telephone number of emergency contacts and describe emergency procedures in the work area for the following:

Accidents/Incidents

An incident is an event with the potential to cause injury, harm, or damage. Incidents include accidents, as well as near misses and other dangerous occurrences. The term "incident" refers to all possible occurrences, including accidents, exposures, laboratory acquired infections/intoxications (LAIs), containment failures (spills), environmental releases (e.g., improperly treated waste or spills sent to the sewer system), and biosecurity breaches (e.g., theft or intentional misuse of an biological material or toxin).

All incidents involving RG1 material, infected animals or involving failure of containment/control systems or release to the environment to be reported immediately to your Principal Investigator/Permit Holder.

For a more detailed explanation and examples see CBH Chapter 18.

The Senior Biosafety Officer (sBSO) must be notified immediately by the Permit Holder of any release of genetically modified organisms or their products (i.e. spores, seeds, eggs etc.) into the environment and any laboratory acquired infections. Reports of release into the environment should include the material involved, amount, location and any remedial action taken.

Incident investigation should be conducted and documented in order to determine the cause(s). Records of any incidents must be kept on file for a minimum of 10 years.

Medical Emergencies/Injuries

Call 911 or campus police and inform them if biologicals are involved.

Personnel must immediately inform their supervisor of any accident causing injury. Within 24 hours, the supervisor will have to file a report via the University of Toronto EHS website (https://ehs.utoronto.ca/report-an-incident/). Appropriate medical evaluation, surveillance, and treatment must be sought and provided if needed.

Medical emergency contacts: https://ehs.utoronto.ca/report-an-incident/emergency-procedures/medical-emergencyfirst-aid/

Fire

For UofT fire prevention information including laboratory fire safety and fire emergency procedures:

https://ehs.utoronto.ca/report-an-incident/emergency-procedures/fire/

http://www.fs.utoronto.ca/main-property-management/fire-prevention/

http://www.fs.utoronto.ca/main-property-management/fire-prevention/lab/

Emergency Egress/Evacuation

Ensure that lab personnel are familiar with at least 2 routes out of your building for the purpose of emergency evacuation. Remind them that when the fire alarm sounds, they must leave the building.

Post emergency evacuation instructions at the exits from your lab. The following basic lab evacuation may be modified by the permit holder:

Basic Emergency Lab evacuation

Always assume you may not be able to return to lab for some time.

1. Turn off any direct sources of heat (i.e. Bunsen burners, hot plates, ovens, water baths)

2. Close any open containers of biologicals and chemicals.

3. Remove any PPE and Take your personal belongings (including any outerwear i.e. winter coat).

4. Leave the building – Shut the lab door behind you. Ensure the lab door is locked.

People should wash their hands or use hand sanitizer (if effective against biologicals in use) before leaving the lab, but this depends on the severity of the emergency and what they were working with.

Chemical/Biological Spills

Chemical Spills

Check the information on the chemical's SDS (Safety Data Sheet) for spill procedures/PPE requirements. The SDS for all chemicals in the lab must be available to your personnel. Ensure that all personnel are familiar on how to access this information.

Chemical spill Procedures

Place a copy in a waterproof sleeve in your Chemical Spill kit and post a copy near your fume hood or area where chemicals are handled.

https://ehs.utoronto.ca/report-an-incident/emergency-procedures/chemical-spill-procedures/

Chemical Spill Response Training

For a short online course on how to handle small chemical laboratory spills see the information about EHS 820:

https://ehs.utoronto.ca/our-services/environmental-protection-services/eps-training-presentations/

Chemical spills on body (including ocular exposure)

https://ehs.utoronto.ca/report-an-incident/emergency-procedures/chemical-spills-on-body/

Mercury Spill Procedures (if applicable)

https://ehs.utoronto.ca/report-an-incident/emergency-procedures/mercury-spill-procedures/

Guide for Chemical Spill kits

These kits can be purchased or assembled, all personnel should be aware of the location of your spill kit.

https://ehs.utoronto.ca/laboratory-hazardous-waste-management-and-disposal-manual/guide-for-general-laboratory-spill-kit-contents/

For more information about Chemical and Lab Safety and more spill procedures, please see the following webpage for a list of available SOPs/standards/documents:

https://ehs.utoronto.ca/our-services/chemical-and-lab-safety/

If you have any questions about chemical storage/safety, please contact our Chemical and Lab Safety specialist Geoff Shirtliff-Hinds at: geoff.shirtliff.hinds@utoronto.ca

Biological Spills (Spill procedures specific to your biologicals are required)

Biological spill Procedures (ensure that your people know what disinfectant to use and at what final concentration):http://ehs.utoronto.ca/our-services/biosafety/biological-spills/

Instructions on what items to have in your biological spill kit can be accessed here https://ehs.utoronto.ca/our-services/biosafety/biological-spill-kit-2/

Spill on lab coat https://ehs.utoronto.ca/wp-content/uploads/2015/10/Lab-Coat-Washing-Guidelines.pdf

The Canadian Biosafety Handbook has a chapter outlining spill procedures (Chapter 17.3) which can be accessed here https://www.canada.ca/en/public-health/services/canadian-biosafety-standards-guidelines/handbook-second-edition/chapter-16-20.html#s173

If assistance with spills is necessary, contact the Environmental Protection Service (EPS) or contact Campus Police after hours. All spills must be reported to the permit holder.

EPS contact numbers – 416-946-3473/416-978-7000

Animal Escape (if applicable)

Animal facilities have procedures and contact information available. If working with animals from these facilities, have this information in your manual. If working with animals that are not from campus animal facilities (e.g. invertebrates), then you will have to write instructions for needed procedures to ensure no inadvertent release into the environment, and provide emergency contacts.

Emergency Contacts/Notification of Key Personnel

Have a list of emergency contacts posted in your lab (ensure personnel know where this list is located).

For an overview of emergency response preparedness for labs, including emergency contacts at UofT (police, fire, medical, spills etc.): https://ehs.utoronto.ca/emergency-response-overview-u-t-labs/

Incident Reporting and Follow-up

List appropriate internal authority and contact information. All accidents or near-miss incidents are to be reported to the permit holder.

For incidents involving biologicals, the permit holder may contact the Senior Biosafety Officer, Ayoob Ghalami (ayoob.ghalami@utoronto.ca) for assistance in investigating and for recommendations to mitigate future risk.

The permit holder to contact the Senior Biosafety Officer if the following incidents occur:

a). Inadvertent release to the environment of biological material or toxin.

b). When a biological agent has caused an illness or may have caused an illness in laboratory personnel.

c). If any RG1 biological material in their possession has been modified in such a way that it's risk factors have changed (i.e., increased virulence or pathogenicity, communicability, resistance to a preventive or therapeutic treatment, or toxicity of a toxin).

d). If permit holder has in their possession or Inadvertently produces a biological agent not listed on their permit.

e). When a biological agent may have been stolen or is otherwise missing.

For incidents involving chemicals or general lab safety, the Chemical & Lab Safety Specialist, Geoff Shirtliff-Hinds (geoff.shirtliff.hinds@utoronto.ca) can be contacted.

Other information to have in your manual (if applicable)

- Containment and disposal SOPs for genetically modified and non-native organisms (including plants and invertebrates)
- SDS for any toxins, written SOP for toxin disposal.
- Aerosol reduction techniques: http://ehs.utoronto.ca/our-services/biosafety/techniques-for-minimizing-aerosols/ and https://ehs.utoronto.ca/wp-content/uploads/2020/09/Safe-Work-Practices-Aerosol-Risk-Reduction-RG2-Biological-Agents.pdf
- If working with aquatic animal pathogens, your manual must contain the CFIA's "Containment Standards for Facilities Handling Aquatic Animal Pathogens" http://www.inspection.gc.ca/animals/aquatic-animals/imports/pathogens/facilities/eng/1377962925061/1377963021283
- If working with plant pests, your manual must contain the CFIA's "Containment Standards for Facilities Handling Plant Pests"

http://www.inspection.gc.ca/plants/plant-pests-invasive-species/biocontainment/containment-standards/eng/1412353866032/1412354048442

Operational Practices in effect for Level 1 – A Overview:

- Oral pipetting is prohibited; therefore, mechanical devices must be used. (CBG 3.1.1)
- Do not touch face or mucus membranes – no eating, drinking, storing of food or utensils, applying cosmetics, handling contact lenses, inserting ear buds, chewing gum in labs etc. (CBG 3.1.2)
- Long hair (may include beards) should be tied back, restrained or covered (to prevent contact with specimens, containers, or equipment) while working. (CBG 3.1.3)
- Jewellery that may come in contact with biologicals (rings, long necklaces) or that may puncture gloves should not be worn. (CBG 3.1.4)
- Open wounds, cuts, scratches and grazes should be covered with waterproof dressings before starting work. Labs must have waterproof dressings available. (CBG 3.1.5)
- Hands should be washed after handling biological material, after removing gloves and before leaving the lab. (CBG 3.1.13)
- Footwear must be closed-toe, closed-heel, with no or low heels. Preferably non-slip soles. (CBG 3.1.9)
- Suitable PPE to be worn when working with RG1 material (i.e. lab coats, gloves etc.). PPE exclusively worn and stored inside of lab. (CBG 3.1.9)
- Gloves should be worn when handling any biologicals. Discard single-use gloves after use. (CBG 3.1.9)
- Eye protection (e. g. goggles) should be worn when there is a risk of splashing; and full face protection (e.g. face shield) when there is a risk of flying debris/objects. (CBG 3.1.9)
- Personal belongings (e.g. purses, backpacks, personal electronic devices) and street clothing (e.g. coats, scarves) should be stored separately from PPE and away from work stations. (CBG 3.1.10)
- All clothing and PPE should be decontaminated when a known or suspected exposure/contamination has occurred before sending out for laundering. (CBG 3.1.14)
- Personnel to remove PPE in a manner that minimizes contamination of skin and hair. (CBG 3.1.15)
- Lab doors must be kept shut. Labs are to be locked if unoccupied. (CBG 3.1.7, 3.1.8)
- Access to lab restricted to authorized personnel and authorized visitors only. (CBG 3.1.8)
- Labs (including floors) should be kept clean and free of clutter and obstructions. Excess or extraneous materials should be stored outside of work areas and materials that are difficult to decontaminate (i.e. cardboard, Styrofoam) should be avoided. (CBG 3.1.6)
- Work stations (benchtops) should be kept clean and uncluttered to allow for cleaning/disinfecting. Work stations to be disinfected prior to and after work with biological material and after any spills. (CBG 3.1.6, 3.1.11, 3.1.12)

- Laboratory procedures are performed in a manner that minimizes the risk of producing splashes or aerosols. (CBG 3.1.11)
- An effective pest control program must be in place; if pests i.e. insects are seen in your lab report to your facility administrator. (CBG 3.2.7)
- SOPs for safe work practices must be developed and strictly followed. (CBG 3.1.16, 3.2.2)
- Precautions to be developed (e.g. use of cart, closed containers) to prevent a leak, drop, spill or similar event during the movement of biological material within the lab or to other parts of the building. (CBG 3.2.3)
- On demand open flames in a BSC to be avoided, sustained open flames are prohibited. (CBG 3.1. introduction)
- Use of needles, syringes, and other sharp objects to be strictly limited and avoided when suitable alternatives are available. Safe work practices for the handling and disposal of sharps are to be developed and strictly followed. (CBG 3.1.16)
- An Emergency Response Plan (ERP) specific to the material handled to be developed and kept up to date. The ERP must be available to all personnel. (CBG 3.2.5)
- A training program must be developed to educate personnel on all aspects relevant to the safe handling of biological material in lab, and procedures to be carried out. Personnel must fulfill all of the required training prior to independent work with biological material. (CBG 3.2.6)
- Lab personnel should conduct and document regular visual inspections of work areas to identify any damage or deterioration (e.g. chipped benchtops, faulty equipment and lighting). Corrective actions should be taken when found. Records of inspections and corrective actions should be kept on file for at least 5 years. (CBG 3.2.8, 3.2.9)
- Equipment used for large scale activities (process equipment, closed systems and other containment devices) are inspected for leaks regularly. (CBG 3.2.10)
- Disinfectants or neutralizing chemicals effective against the RG1 material present are available, used in work area and routinely verified. (CBG 3.3.2)
- Gross contamination is removed prior to decontamination of surfaces and equipment, and disposed of in accordance with SOPs. Organic material such as bedding, feed, excrement, blood and tissues are examples of gross contamination that can be removed by physical methods, such as scraping, brushing and wiping. (CBG 3.3.1)
- Equipment that has come in contact with RG1 biological material is decontaminated prior to maintenance and repair. (CBG 3.3.3)
- Solid and liquid waste, equipment, and other items that have come in contact with RG1 material is decontaminated prior to disposal or removal from work area, or placed in closed, labelled and leak-proof containers that have been surface decontaminated for movement or transport to another area for decontamination. (CBG 3.3.4)
- See the CBG Section 3.4 for additional operational requirements for work involving animals.