Biosafety Manual

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Department of Applied Science and Environmental Technology

Algonquin College – Ottawa Campus

https://www.algonquincollege.com/safety-security-services/biosafety-and-laboratory-safety-at-algonquin-college/

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1.0 Introduction

The intent of the Department of Applied Science and Environmental Technology's (ASET) Biosafety Program and the purpose of this Biosafety Manual, is to guide personnel in how to work safely with biological material that can be hazardous to people and/or animals.

The ASET Department at Algonquin College maintains a Biosafety Program in order to:

- Identify biohazardous material;
- Reduce the risk of adverse effects from these materials for those working with them;
- Protect the community and the environment from harm by preventing the release of infectious materials or toxins;
- Promote and reinforce safe work practices, improve safety performance, and increase regulatory compliance through a combination of training, documentation, inspections, evaluation, review, and communications.

This Biosafety Manual describes the ASET Department's Biosafety Program in the context of the Government of Canada's guiding documents on biosafety. The WA130 Laboratory at Algonquin College, Ottawa Campus is a Containment Level 2 (CL2) Facility and is licenced by the Public Health Agency of Canada (PHAC). This licence authorizes the ASET Department to work with Risk Group 2 (RG2) human pathogens and toxins as well as RG2 terrestrial animal pathogens [excluding pathogens causing foreign animal diseases, emerging diseases and bee diseases] and toxins produced by animal pathogens. There are conditions to the licence; for example, work with prions and in-vivo work are not permitted.

This manual outlines how the ASET Department's Biosafety Program meets the requirements identified in the Canadian Biosafety Standard (CBS) and Handbook (CBH).

2.0 Definitions, Classifications and Key Terms

Several terms are often used interchangeably, such as "infectious material" and "pathogen". Laboratory personnel should be aware of the specific definitions of key terms.

2.1 Key Terms in Biosafety

Biosafety is defined as the containment principles, technologies, and practices that are implemented to prevent unintentional exposure to infectious material and toxins, or their accidental release.

Biological material is defined as any material containing genetic information and capable of reproducing itself or being reproduced in a biological system. This would include tissue, blood, urine, and other body fluids. Biological material could also refer to organic material that has come from a once-living organism. In the context of biosafety and biosecurity, biological material is defined as pathogenic and non-pathogenic microorganisms, proteins, nucleic acids, as well as any biological matter that may contain microorganisms, proteins, nucleic acids, or parts thereof.

Furthermore, biohazardous materials are material of biological origin that may be potentially harmful to humans, animals, plants, the economy or the environment. Biohazardous materials, also referred to as pathogens, include (but are not limited to):

- Pathogenic microorganisms such as certain bacteria, viruses, fungi, parasites, and bacteria;
- Biological toxins from microorganisms, plants and animals;
- Materials that may contain the above-mentioned agents (e.g. cell cultures; tissue, blood and body fluids from humans and animals; environmental samples);
- Certain proteins, nucleic acids (prions, siRNA, miRNA, DNA from pathogenic organisms, oncogenes);
- Genetically modified organisms (GMO) that may be hazardous to the environment if released.

A pathogen is any biological agent that causes a disease and is infectious. The definition is broad in order to encompass the wide variety of pathogens that exist in nature. Some of these are not even living organisms, in the strictest sense of the word. Regardless of their exact characteristics and classification, pathogens must be able to establish an infection in their host and spread. In the context of the CBS, any isolate of a pathogen or any biological material that contains human or animal pathogens is referred to as "infectious material".

2.2 Biological Toxin

Toxins are neither living, nor infectious. They are poisonous substances that are the natural product of the metabolic activities of certain microorganisms, plants, fungi and animal species. They can cause adverse health effects in humans, animals or plants.

On the other hand, toxicants are artificial products created by humans, for example industrial waste products and pesticides. These substances can also be poisonous and cause health effects.

2.3 Risk Groups

The Risk Group (RG), which defines the degree of hazard associated with a particular biological material, is assessed qualitatively by:

- How likely it is to cause disease in people;
- How serious that disease is likely to be;
- Whether or not effective treatment is available.

Biological material, in the context of biosafety and biosecurity, is classified into one of four Risk Groups based on how much potential hazard to health they pose, and how likely that hazard is to occur (see Table 2.3.1).

Table 2.3.1: Risk Groups of Biological Agents

Risk Group	Description	Usage at Algonquin
Risk Group 1 (RG1)	▪ A microorganism, nucleic acid, or protein that is either not capable of causing human/animal disease or capable but unlikely to do so ▪ Low individual risk ▪ Low community risk ▪ Not regulated by PHAC or CFIA due to the low risk to public health, livestock or poultry	Permitted in Lab A129 and A130 at Algonquin College
Risk Group 2 (RG2)	▪ A pathogen or toxin that is able to cause serious disease in a human or animal but unlikely to do so ▪ Pathogens and toxins that are prescribed or otherwise regulated by Public Health Agency of Canada or Canadian Food Inspection Agency as Risk Group 2 ▪ Low-moderate individual risk ▪ Low community risk ▪ Primary exposure hazards are through the ingestion, inoculation and mucous membrane routes; therefore, risk mitigation measures in the lab are designed to interrupt these routes ▪ Work to be conducted under a CL2 regulated biosafety/biosecurity permit	Permitted in Lab A130 at Algonquin College
Risk Group 3 (RG3)	▪ A pathogen or toxin that is likely to cause serious disease in a human or animal ▪ Pathogens and toxins that are prescribed or otherwise regulated by Public Health Agency of Canada or Canadian Food Inspection Agency as Risk Group 3 ▪ High individual risk ▪ Low community risk ▪ All work must be carried out in a Biological Safety Cabinet	Not permitted in labs at Algonquin College
Risk Group 4 (RG4)	▪ A pathogen or toxin that poses high risk to the health of individuals and a high risk to public health; likely to cause serious disease in a human or animal, which can often lead to death ▪ Pathogens and toxins that are prescribed or otherwise regulated by Public Health Agency of Canada or Canadian Food Inspection Agency as Risk Group 4 ▪ High individual risk ▪ High community risk	Not permitted in labs at Algonquin College
Security Sensitive Biological Agents (SSBAs)	▪ Subset of RG3 and 4 human pathogens and toxins which are prescribed by the Public Health Agency of Canada as SSBA ▪ A special license is required	Not permitted in labs at Algonquin College. Note: There is a subset of toxins that, when present in a quantity less than or equal to a certain quantity are not considered SSBAs (see Section 2.5, Table 2.5.1). Their use is subject to ASET Department Approval.

2.4 Containment Levels

A system of containment levels (CL) describes the minimum physical containment and operational practices required for the safe handling of biological materials in laboratories.

The system involves four containment levels, ranging from a basic laboratory (CL1) to the highest level of containment (CL4). The containment level and risk group of a pathogen are generally the same; however, containment levels may change when a pathogen has been modified or the original conditions of use have changed. The following factors are considered when determining the appropriate containment level:

- **Potential for aerosol generation** by equipment or procedures. Increased containment may be required if there is potential of exposure to infectious aerosols.
- **Quantity**: Large scale processes may have different containment requirements than laboratory scale work with the same pathogen.
- **Pathogen concentration** may vary with the work being done, e.g. diagnostic specimens may contain lower pathogen concentrations than pure cultures.
- **Nature of work**: (e.g. in vivo versus in vitro studies).

The ASET Department's licence allows for work with Risk Group 2 Human Pathogens and Toxins as well as Risk Group 2 Terrestrial Animal Pathogens at the CL2 level.

2.4.1 Containment Level 1 (CL1)

RG1 biological material poses a low risk to the health of individual humans and animals, and low or no risk to public health and animal populations. RG1 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.

2.4.2 Containment Level 2 (CL2)

CL2 builds upon the basic laboratory foundation established for CL1. Biosafety and biosecurity at CL2 are achieved through operational practices and a core subset of physical containment requirements that are proportional to the risks associated with the pathogens and toxins handled therein. Operational practices for CL2 include administrative controls (e.g. biosafety program management, training) and procedures (e.g. work practices, personal protective equipment [PPE] use, and decontamination) that mitigate the risks associated with the activities conducted within the zone. Physical containment features include facility design (e.g. location of laboratory, surface finishes, access control) and provision of biosafety equipment, such as primary containment devices (e.g. biological safety cabinets [BSCs]) for certain activities.

2.4.3 Containment Level 3 (CL3)

Biosafety and biosecurity at CL3 are achieved through comprehensive operational practices and physical containment requirements. CL3 requires stringent facility design and engineering controls (e.g. inward directional airflow [IDA], high efficiency particulate air [HEPA] filtration of exhaust air), as well as specialized biosafety equipment (e.g. BSCs, centrifuges with sealed rotors) to minimize the release of infectious material into the surrounding rooms inside or outside the containment zone, or the environment outside. Additional engineering controls, such as effluent decontamination systems, may be needed in some cases (e.g. Risk Group 3 [RG3] non-indigenous animal pathogens) to control the risks associated with pathogen release into the environment. Operational practices at CL3 build upon those required for CL2, taking into consideration the increased risks associated with the pathogen(s) and laboratory activities being carried out with RG3 pathogens.

2.4.4 Containment Level 4 (CL4)

CL4 is the highest level of containment available. CL4 requires a highly complex facility design that is a self-contained area within a building or, when necessary, a separate building. It includes enhanced engineering controls (e.g. HEPA filtration of exhaust and supply air), specialized biosafety equipment (e.g., BSC, effluent decontamination systems), and redundant biosafety features (e.g. two stages of HEPA filtration of exhaust air). CL4 requires the maximum level of operational practices (e.g., PPE use, work practices, medical surveillance) that build upon those required at CL3. CL4 zones necessitate the use of positive-pressure suits for personnel or, as an alternative, the use of a Class III BSC line in a laboratory work area that meets the necessary CL4 requirements.

2.5 Security Sensitive Biological Agents

Security Sensitive Biological Agents (SSBAs) are a subset of human pathogens and toxins that have been determined to pose an increased biosecurity risk due to their potential for use as a biological weapon. SSBAs are termed “prescribed human pathogens and toxins” in the Human Pathogens and Toxins Regulations (HPTR).

While there are various definitions of dual-use, the Public Health Agency of Canada (PHAC) defines dual-use potential as the qualities of a pathogen or toxin that allow it to be either used for legitimate scientific applications (for example: commercial, medical, or research purposes), or intentionally misused as a biological weapon to cause harm (such as bioterrorism).

The definition of dual-use potential also encompasses any asset related to a biological agent that could be used for nefarious purposes, including knowledge, technologies, or products that contribute to the weaponization of a pathogen or toxin. Examples include the creation of a high-risk pathogen or toxin, the development of a dispersal method, or the increase in risk of an existing pathogen or toxin. Another example is the knowledge gained through research on drug resistant microorganisms. While a better understanding of the resistance mechanisms could lead to improved treatment, the same information could also be used to develop organisms capable of evading drugs.

There are increased biosecurity requirements specified in the Canadian Biosafety Standard (CBS) for SSBAs. The ASET labs are not permitted to work with or develop SSBAs; however, according to the HPTR, certain toxins (see Table 2.5.1, column 1), are not prescribed toxins when present in the facility in a quantity that is less than or equal to the quantity set out in column 2 (also called the "trigger quantity"). Work with these toxins is subject to ASET Department approval.

Table 2.5.1: Toxins not prescribed in certain quantities (from HPTR)

Column 1 Toxin	Column 2 Quantity (mg)
Alpha toxin *Toxine Alpha*	5
Botulinum neurotoxin *Toxine botulique*	0.5
Cholera toxin *Toxine du choléra*	20
Clostridium botulinum C2 and C3 toxins *Toxines C2 et C3 de Clostridium botulinum*	5
Clostridium perfringens Epsilon toxin *Toxine Epsilon de Clostridium perfringens*	5
Hemolysin *Hemolysine*	10
Shiga-like toxin (verotoxin) *Toxine Shiga-like (vérotoxine)*	1
Shigatoxin *Shigatoxine*	1
Staphylococcal enterotoxins, Type B *Entérotoxine de staphylocoques, type B*	1
Staphylococcal enterotoxins, types other than Type B *Entérotoxine de staphylocoques, types autres que le B*	10
Staphylococcus aureus Toxic shock syndrome toxin *Toxine du syndrome du choc toxique de Staphylococcus aureus*	5

2.6 Laboratory Acquired Infection or Intoxication (LAI)

A laboratory acquired infection or intoxication (LAI) can result from exposure to infectious material, infected animals, or toxins that are handled or stored in the containment zone. Although laboratory acquired infections do occur, they often go unrecognized because of the generalized flu-like symptoms of many illnesses. Until recently there was no obligation to report an LAI so they often went unnoticed outside the lab or institution, unless they resulted in severe illness or death.

Now, the Human Pathogens and Toxins Act (HPTA), Section 13, requires that any exposure to human pathogens or toxins that may cause disease or any disease that may have been caused by an exposure to a human pathogen or toxin in the facility be reported to the PHAC without delay. This reporting allows the PHAC to assess the severity of the exposure incident and assist the facility in their response, if requested or necessary.

Reporting of LAIs is further explained in this manual (Chapter 9.0 – Medical Surveillance Program, Appendix 1- Emergency Response Plan and Appendix 4 – Medical Surveillance Program).

3.0 Government Safety Regulations and Policies on Biohazardous Material

People who work with biohazardous materials must know about and understand the laws and the regulations that direct what they may and may not do with those materials and how they are to work with them safely. Numerous agencies regulate activities involving human and animal pathogens and toxins including the Public Health Agency of Canada (PHAC) and the Canadian Food Inspection Agency (CFIA), in accordance with the *Human Pathogens and Toxins Act* (HPTA), Human Pathogens and Toxin *Human Pathogens and Toxins* Regulations (HPTR), *Health of Animals Act* (HAA) and *Health of Animals Regulations* (HAR).

This biosafety manual, along with the associated ASET guidelines, programs and plans (available in the appendices of this document) describe the requirements, tasks and procedures that are in place to ensure that the ASET Department at Algonquin College abides by the legislation.

3.1 Human Pathogens and Toxins Act (HPTA) and Regulations (HPTR) and Health of Animals Act (HAA and Health of Animals Regulations (HAR)

In Canada, the Public Health Agency of Canada (PHAC) and the Canadian Food Inspection Agency (CFIA), in accordance with the HPTA, the HPTR, the HAA and the HAR, regulate activities involving Risk group 2, 3 and 4 human and animal pathogens and toxins.

The HPTA was developed to protect the health and safety of the public from the risks posed by human pathogens and toxins and establishes basic biosafety requirements for handling human pathogens and toxins in Canada. The HPTR are the guidelines that dictate how the provisions of the act are applied. On December 1st, 2015, the Human Pathogens and Toxins Act came into full force. Administration and enforcement of the Act and Regulations are overseen by PHAC's Centre for Biosecurity.

The Health of Animals Regulations, under the authority of the Health of Animals Act, is intended to protect animals and animal health. They provide for the control of diseases and toxic substances that may affect terrestrial and aquatic animals or that may be transmitted by animals to persons.

Facilities where RG2, RG3, and RG4 pathogens are handled require licenses and permits from the PHAC and/or the CFIA. Risk Group 1 biological material is not regulated and as such, work with RG1 material does not require a licence.

The Public Health Agency of Canada has issued a Pathogen and Toxin Licence to Algonquin College's ASET Department. This licence gives the ASET Department permission to perform work with RG2 human pathogens and toxins as well as RG2 terrestrial animal pathogens [excluding pathogens causing foreign animal diseases, emerging diseases and bee diseases] and toxins produced by animal pathogens.

The licence requires that Algonquin College appoints an HPTA License Holder to comply with the HPTA. It is the license holder's responsibility to ensure that the College achieves and maintains compliance with the HPTA through implementation of ASET's Biosafety Program. Although the

HPTA and HPTR apply to all activities with Risk Groups 2, 3, and 4 human pathogens and microbial toxins, it should be noted that Algonquin College only works with Risk Groups 1 and 2 and only performs containment level 1 (WA129 and WA130 Laboratory) and containment level 2 work (WA130 laboratory).

3.2 Canadian Biosafety Standard (CBS)

The third edition of the *Canadian Biosafety Standard* (CBS), released in 2022 by the Public Health Agency of Canada (PHAC) and the Canadian Food Inspection Agency (CFIA), supports the HPTA, HPTR, HAA and HAR. The CBS is a harmonized national standard for Controlled Activities with human and terrestrial animal pathogens and toxins. The CBS also describes the physical containment and operational practice requirements for facilities that fall under the HPTA and HPTR, the HAA and HAR.

3.3 Canadian Biosafety Handbook (CBH)

The second edition of the *Canadian Biosafety Handbook* (CBH), released in 2016, is a companion document to the CBS and provides core information and guidance on how to achieve the physical containment and operational practice requirements outlined in the CBS.

3.4 Pathogen Safety Data Sheets and ePathogen Website

Pathogen Safety Data Sheets (PSDS) are technical documents that describe the hazardous properties of certain human pathogens and provide recommendations for work involving these agents in a laboratory setting. These documents have been produced by the Public Health Agency of Canada (PHAC) as educational and information resources for laboratory personnel working with infectious substances. These documents are publicly available here.

The Public Health Agency of Canada (PHAC) also has a database of pathogens that details the risk group, classification – human and/or animal, whether it is an SSBA (security sensitive biological agent) and whether it is regulated by the CFIA. This information is publicly available here.

4.0 Risk Assessment

Risk assessment (or risk analysis) is a mechanism that determines the likelihood of a hazardous agent or procedure to cause harm. Benefits of risk assessments include: ensuring risks are identified and mitigated, preventing the accidental release or contamination of research samples, demonstration of due diligence and compliance to regulatory requirements, identification of training and supervision needs, evaluation of procedural changes, evaluation of security controls, and evaluation of emergency planning, including spill response. Risk assessment is an essential component to a biosafety and lab safety program.

4.1 Risk Assessment in the ASET Labs

There are several types of risk assessments that take place in the Applied Science and Environmental Technology (ASET) labs, including local risk assessments (LRAs), pathogen and toxin risk assessments, biosecurity risk assessment, medical surveillance risk assessment, student lab activity risk assessments, regular lab inspections, and finally, an overarching risk assessment

(ORA). Each type of risk assessment aims to identify potential hazards and determine the associated risks with the goal of developing mitigation strategies.

The hierarchy of controls (see Figure 4.1) outlines the layers of controls used when considering hazard mitigation in the ASET labs. All five control methods (elimination, substitution, engineering, administrative and PPE) are effective; however, elimination of risk is the most effective form of control, while enforcing the use of PPE is the least effective method.

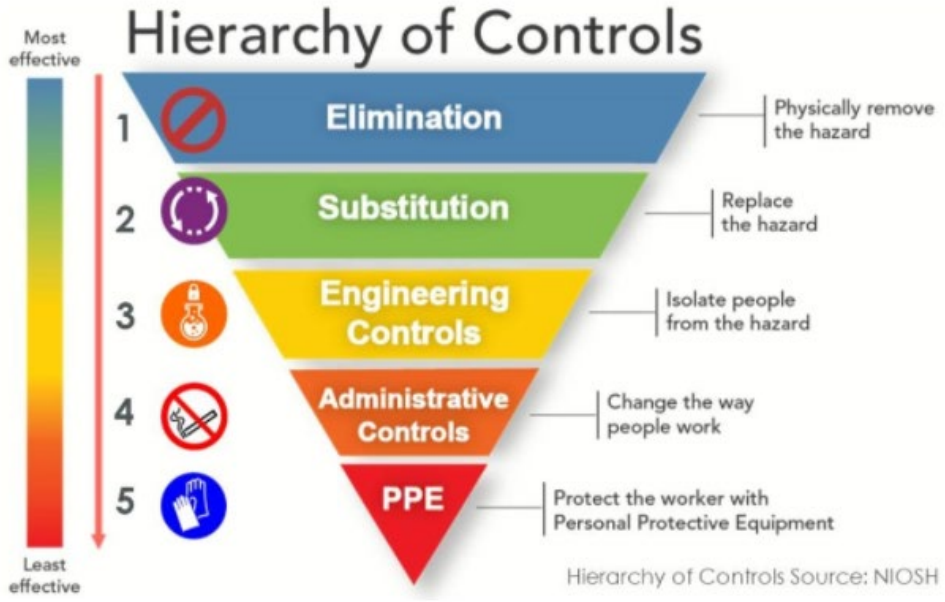


Figure 4.1: The Hierarchy of Controls

Reference: https://www.cdc.gov/niosh/topics/hierarchy/images/NIOSH_HOC_Main_508_photocredit.jpg

Events that can trigger a risk assessment can include:

1. A new procedure or process
2. Change, substitution or deletion of chemicals used in a procedure
3. Failure of any equipment used in the process
4. Unexpected test results – review how the new result impacts safety practices
5. If staff become ill, suspect exposure, detect a chemicals odour or suspect a failure of any safeguards
6. Change in PHAC risk group designation of an organism
7. A change in the physical environment where the work is being done
8. A potential risk or hazard that was not initially assessed is identified
9. An unintentional result is achieved that may present concerns
10. A laboratory incident occurs

4.2. ASET's Overarching Risk Assessment (ORA)

An overarching risk assessment (ORA) is a broad risk assessment that supports ASET's biosafety program as a whole and covers the WA130 containment zone at the Woodroffe campus. The ASET Department has completed an ORA, which includes the identification of

risks/hazards as well as mitigation strategies to control those hazards. The ORA is reviewed annually by the IBSC.

4.3 ASET's Medical Surveillance Risk Assessment (MSRA)

The ASET Department has completed a medical surveillance risk assessment (MSRA), which includes the identification of risks/hazards as well as mitigation strategies to control those hazards. Employees, students, researchers and contractors must complete medical surveillance, prior to working in the labs. The MSRA is reviewed annually by the IBSC. Refer to ASET's Medical Surveillance Program (Appendix 3) for more information.

4.4 ASET's Biosecurity Risk Assessment (BRA)

The ASET Department has completed a biosecurity risk assessment (BRA), which includes the identification of risks/hazards as well as mitigation strategies to control these hazards. The BRA is reviewed annually by the IBSC. Refer to ASET's Biosecurity Plan (Appendix 2) for more information.

4.5 Lab Inspections of the ASET Labs

An additional form of risk identification is the inspection of the working area. The workplace or safety inspection is one of the most important activities related to hazard recognition. Through the inspection process, hazardous conditions are brought forward to the attention of the Manager of ASET so that a response to remediate the hazardous conditions can be dealt with as soon as possible, where necessary.

When accomplished regularly, inspections can contribute significantly to ensuring hazardous conditions are identified and corrected before they cause an injury or illness. Lab inspections are reviewed by the ASET Manager and the BSOs on an ongoing basis and are also reviewed annually by the IBSC. Refer to ASET's Inspection Guidelines (Appendix 9) for more information.

4.6 ASET's Pathogen and Toxin Risk Assessment

The ASET Department conducts risk assessments when RG2 pathogens or toxins are considered for purchase. Generally, pathogens are acquired from companies who distribute ATCC (American Type Culture Collection) products. This means that these pathogens are well characterized and come with a safety data sheet (SDS) from ATCC (or other global biological resource centres and standards organizations). Since they are well characterized and the SDS is provided, risk assessments are generally quite simple. For other situations (e.g. growing samples from sewage, soil, transfer of samples from other labs, etc.), a more detailed risk assessment is required. Refer to ASET's Biological Safety Guidelines (Appendix 10) for more information.

4.7 Local Risk Assessment (LRA)

Local Risk Assessments (LRA) determine whether the existing physical containment and operational practices are sufficient to mitigate the risks to acceptable levels, or if additional measures are needed. In addition, since the CBS requirements are risk-based, the LRA is used to determine the way that many of the CBS requirements are implemented. For example, the CBS

requires that the appropriate dedicated PPE specific to each containment zone be donned in accordance with entry procedures; however, the PPE used and how and where it is donned and doffed is determined by an LRA.

The ASET Department has completed LRAs on the hazardous work that takes place in the ASET labs. Generally, the result of these LRAs is mitigation strategies that are included in "ASET Guidelines". For example, the pipetting of pathogens can create aerosols that can transfer into a human host and cause illness. The ASET Department has conducted an LRA for the task of pipetting, the result being risk mitigation strategies for pipetting that have been added into two guidelines: ASET's Biological Safety Guidelines (Appendix 10) and ASET's Equipment Safety Guidelines (Appendix 12). Information on safe pipetting techniques are outlined in both these documents; staff and students are trained to both of these guidelines.

If additional hazards are found in the ASET labs, LRAs are conducted with the results generally being placed into "ASET Guidelines".

4.8 ASET's Lab Activity Risk Assessment

Laboratory course protocols (i.e. teaching activities completed by students during regularly scheduled student lab courses) are risk assessed prior to the commencement of any work by students. Biological, chemical and physical hazards are all assessed by the risk assessment process. All lab protocols are reviewed by the BSO(s) every 5 years, or when significant changes occur. Any modifications to lab protocols must be approved by the BSOs, prior to students performing the lab activity. Refer to ASET's Risk Assessment Process (Appendix 8) for more information.

4.9 ASET's Research Project Risk Assessment (RPRA)

Generally, student research projects begin each September, and new activities may be created that support those projects. If the work/task that accompanies a new activity is not already included in an ASET guideline, a local risk assessment (LRA) must be completed prior to the activity proceeding. All research projects undergo initial and continual review by the students, faculty member(s), and BSO(s). Refer to ASET's Risk Assessment Process (Appendix 8) for more information.

4.10 Other Risk Assessments in the ASET Labs

All special projects, for example partnerships with external parties, must have a local risk assessment completed prior to activities taking place. These risk assessments occur on a case-by-case basis prior to the commencement of lab activities and continue for the duration of the project. Refer to ASET's Risk Assessment Process (Appendix 8) for more information.

5.0 Biosafety Program Governance and Administration

The Department of Applied Science and Environmental Technology at Algonquin College shall maintain and disseminate the Biosafety Program in accordance with the Human Pathogens and Toxins Act (HPTA), Health of Animals Act (HAA) and their associated regulations. Algonquin's Biosafety Program shall consist of the following components:

1. Senior Management Letter of Commitment
2. Overarching Risk Assessment
3. Algonquin's Plan for Administrative Oversight of Pathogens and Toxins
4. Biosafety Manual, including:
    - Emergency Response Plan;
    - Biosecurity Plan;
    - Medical Surveillance Plan;
    - Institutional Biosafety Committee (IBSC) Terms of Reference;
    - Risk Assessment Guidelines;
    - Inspection Guidelines;
    - Biological Safety Guidelines.
5. ASET Department Biosafety Training Program

These are governing documents that are approved by Algonquin College. Many of these documents are found on the Algonquin College Biosafety website and are updated continuously as changes are approved by the relevant institutional stakeholders.

5.1 Institutional Biosafety Committee (IBSC)

The College is responsible for establishing a Biosafety Committee to oversee the development and implementation of the Algonquin College Biosafety Program. The committee is empowered to advise the License Holder on matters pertaining to Biosafety policy, procedures and any other measures relevant to the administration of the Biosafety Program at Algonquin College. The Institutional Biosafety Committee (IBSC) will generally meet semi-annually or as needed to deal with safety issues, concerns, policy/protocol improvements or other matters that may be of a biological safety nature.

The IBSC reports to the College Risk Management Committee (CRMC) through the Manager Occupational Health and Safety and to the Senior Vice President-Academic through the Manager, ASET via the Dean, School of Advanced Technology. Biosafety Officer(s) at Algonquin College work within the Department of Applied Science and Environmental Technology (ASET) and report to the Manager, ASET. The BSO(s) also have a working relationship with the Manager of Occupational Health and Safety (OHS) who is a member of the IBSC. The OHS Manager is a member of the Joint Occupational Health and Safety Committee (JOHSC) at Algonquin College – Ottawa campus, a college-wide committee whose primary responsibilities are to inspect the physical condition of the workplace on a regular basis; monitor reporting functions of serious injuries; and make recommendations to the College regarding measures, procedures which serve to reduce hazards and enhance safety.

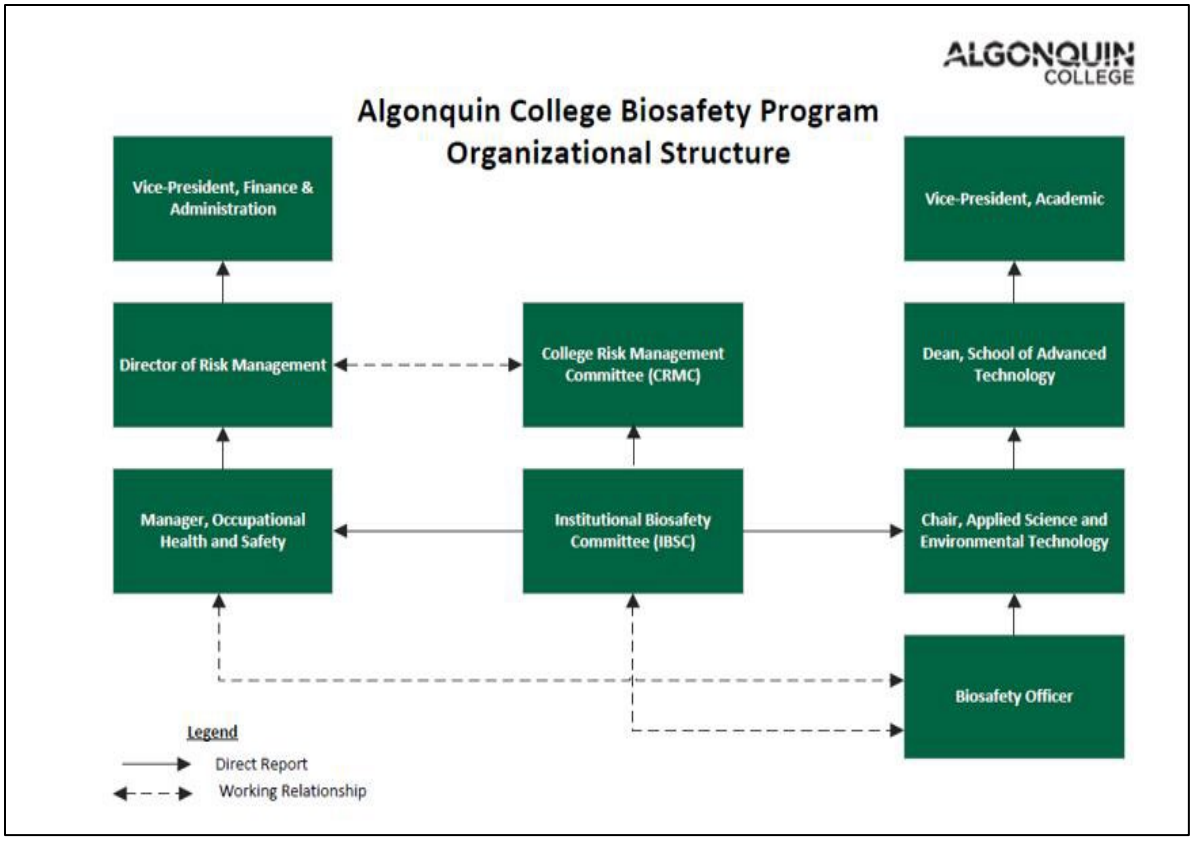


Figure 5.1.1: Algonquin College Biosafety Program Organization Structure

The IBSC is comprised of members of the College community with experience and training that enables them to advise on the containment principles, technologies, and operational practices to prevent unintentional exposure to pathogens or toxins. Members of the committee will be appointed by the Manager, ASET in consultation with the Manager, OHS.

Compulsory members of the IBSC include the following:

1. Co-Chair
    - Academic Chair (Manager), Department of Applied Science and Environmental Technology (ASET)
    - License Holder under the Human Pathogens and Toxins Act (HPTA)
    - Graduate degree in Biology/Biochemistry/Biotechnology or a closely related field
2. Co-Chair
    - Manager, Occupational Health and Safety (OHS)
    - Training in Industrial Hygiene
3. Biosafety Officer(s)
    - Diploma or degree in Biology/Biochemistry/Biotechnology or a closely related field
    - Biology and microbiology training

Additional members of the IBSC are appointed by the Co-Chairs of the IBSC and may include the following:

4. Laboratory Technologist(s)
5. Faculty Member(s)
    - Subject-matter expert(s) in Biology/Biochemistry/Biotechnology or a closely related field
    - Director of Applied Research, or designate.

The appointment of any additional members of the IBSC shall be reviewed annually by the IBSC Co-Chairs. Specific duties and details of the committee are outlined in the Biosafety Committee Terms of Reference document (Appendix 5).

5.2 Biosafety Officer(s) (BSOs)

According to the HPTA, the College is required to have a Biosafety Officer. The licence holder is responsible for appointing the Biological Safety Officer(s). The Biological Safety Officer(s) work within the Department of Applied Science and Environmental Technology and, on behalf of the License Holder, develop and implement the College Biosafety Program. The BSO(s) are responsible for the day-to-day operations of the Biosafety program including, but not limited to, the following:

1. To oversee biosafety practices, provide advice and guidance on biosafety program issues and act as the primary point of contact with the PHAC and the CFIA.
2. To oversee biosafety and biosecurity practices and develop and implement the biosafety program.
3. To assist the Licence Holder in developing policies and implementing effective procedures to ensure compliance with the CBS, PHAC, and CFIA standards and guidelines.
4. To monitor compliance by conducting risk assessments and internal inspections/audits.
5. To assist in the development and maintenance of the biosafety manual and standard operating procedures related to biosafety and biosecurity.
6. To develop, oversee, and document biosafety-related training.
7. To promote and monitor compliance with applicable legislation (HPTA, HPTR, HAA, HAR), conditions of the licence, the biosafety manual and standard operating procedures.
8. To assist with the internal investigations of incidents.
9. To notify the PHAC of any lab acquired infections, inadvertent possession of human toxins and pathogens not received as expected.
10. To inform the licence holder of any non-compliance by a person conducting activities under the licence.
11. To keep abreast of legislation concerning biohazardous materials and advise the IBSC about potential impacts on the College.

12. To determine the containment requirements and list any safety concerns of materials before purchasing/transferring biohazardous materials.
13. To assist the licence holder in investigations of any incidents related to accidents, injury, and/or noncompliance related to biosafety.
14. To compile and provide any reports/documentation as required by the regulatory agencies.
15. To verify the accuracy and completeness of license applications or renewals.
16. To work collaboratively with management, employees, students, and external agents as it relates to the continual improvement of the Biosafety program.

5.3 Algonquin College Department Heads and Senior Managers

Chair (Manager), Department of Applied Science and Environmental Technology

- Co-Chair, Institutional Biosafety Committee
- License holder under the Human Pathogens and Toxins Act (HPTA)
- Academic administrator responsible for operational elements of the Biosafety Program at Algonquin College
- Manager of Biosafety Officer(s) at Algonquin College
- Training/expertise: graduate degree in Biology/Biochemistry/Biotechnology or a closely related field of study

Manager, Occupational Health and Safety and Risk Management

- Co-Chair, Institutional Biosafety Committee
- Training/expertise: training in Industrial Hygiene

Director, Risk Management

- Responsible for college-wide risk assessment and monitoring
- Chair of the College Risk Management Committee (CRMC)
- CRMC is tasked with the development, implementation, review and revision of College risk management policies and procedures to identify, assess, control, monitor and measure College risk, maintain oversight on the development and implementation of specific College management initiatives such as emergency management

Vice-President Finance & Administration

- Executive sponsor of the College Risk Management Committee
- Signatory on the Senior Management Letter of Commitment regarding the Biosafety Program at Algonquin College

Senior Vice-President Academic

- Executive sponsor and senior manager responsible for all matters related to academic programming and activity at Algonquin College
- Signatory on the AC Senior Management Letter of Commitment regarding the Biosafety Program at Algonquin College

5.4 All College Personnel and Students Operating in ASET Laboratories

All college personnel and students, before operating in ASET laboratories, are responsible to:

- Read and be familiar with the contents of this Biosafety Manual and follow these rules and guidelines when working in the laboratories;
- Comply with all College- and Laboratory-specific relevant Guidelines, Processes and Plans released by the Department of Applied Science and Environmental Technology;
- Complete the lab orientation/training and biosafety training offered by the ASET Department as detailed in the Biosafety Training Program;
- Complete any other lab-specific training required by the ASET Department including, but not limited to, WHMIS training and OHSA training;
- Ensure that their training on Emergency Response Procedures is refreshed annually;
- Complete the ASET Department medical surveillance form annually and submit a copy to the Biosafety Officer(s) for filing;
- Ensure that if their health status changes, they promptly review the implications for the hazards with which they work and have the risk mitigation measures re-evaluated through their supervisor, the BSO, and their personal physician, if necessary;
- Promptly inform a Professor/supervisor and the Biosafety Officer(s) in the ASET Department of any exposure to hazardous materials or other accidents or significant “near misses” in the laboratory;
- Report any spills, release from containment, or stolen or missing Risk Group 2 material to their Professor/supervisor and the Biosafety Officer(s) in the ASET Department within 24 hours of the incident;
- Report to the BSO(s) and the Manager, ASET when an unauthorized human pathogen or is inadvertently produced or otherwise comes into your possession.

5.5 Laboratory Technologists, Faculty, and Researchers Operating in ASET Laboratories

All Faculty, Researchers, Laboratory Technologists and Laboratory Technicians operating in ASET Department laboratories are responsible to:

- Be familiar with the contents of this Biosafety Manual and ensure that it is followed in the laboratories;
- Take the centralized training required of persons under their supervision since, with this knowledge, the supervisor can better design lab specific training for the supervisee;
- In advance of their use in the ASET labs, submit proposed laboratory activities/protocols to the Biosafety Officer(s) for departmental inspection, review, and authorization;
- Utilize only laboratory activities/protocols authorized by the ASET Department;
- Work collaboratively with Biosafety Officer(s) and other colleagues regarding the implementation and continuous improvement of the departmental Biosafety Program;
- Ensure that all students under their supervision complete any and all required biosafety training before working in the laboratory, this includes training for all laboratory equipment, such as biosafety cabinet and centrifuges;

- Adequately supervise students and correct work errors or deficiencies in conditions that could pose a risk to employees, students and/or the environment or result in noncompliance with the regulations and guidelines pertaining to the lab activity/protocol;
- Report all exposure incidents or serious near misses involving biological or other hazards, in writing, to the Biosafety Officer(s) and the Licence Holder within 24 hours of the incident even if medical attention is not required;
- Report any spills, release from containment, or stolen or missing Risk Group 2 material to the Biosafety Officer(s) and the Licence Holder, in writing, within 24 hours of the incident;
- Report to the Biosafety Officer(s) and the Licence Holder, in writing, when an unauthorized human pathogen is inadvertently produced or otherwise comes into your possession.

5.6 Algonquin College Policies, Procedures and Safety Standards

Algonquin College and the ASET Department have programs, plans and guidelines in place to protect employees and students.

5.6.1 ASET Department Laboratory Guidelines, Programs and Plans

The ASET Department has established departmental guidelines, programs and plans which outline Algonquin's commitment to administratively manage and control biosafety and biosecurity risks in accordance with the applicable legislation, regulations and standards. These documents serve to protect members of the Algonquin community, the public, and the environment when biohazardous materials are used in education, applied research, or any other Algonquin activity. Most of these documents are available in the appendices of this manual.

Furthermore, the ASET Department has developed this Biosafety Manual that outlines ASET's laboratory practices and procedures which serve to reduce hazards and enhance safety. The official versions of these documents are found on the Algonquin College Biosafety website and are updated continuously as changes are approved by the ASET Department and the Department of Occupational Health and Safety.

5.7 Internal Inspections and Audit Guidelines

Routine lab inspection is an important component of a lab safety program and the ASET Department ensures that lab inspections take place on a regular basis. Generally, lab inspections take place once per month and the BSO(s) are responsible for conducting these inspections following the ASET Lab Inspection Guideline (Appendix 9). The BSO(s) will follow up with the Manager, ASET to discuss any non-compliance. Egregious deficiencies are reported to the IBSC for discussion and recommendations and the Manager, ASET is responsible for follow up with corrective actions until these deficiencies are resolved. If deemed necessary, the deficiencies are reported to the College Risk Management Committee for review.

6.0 Biosafety Training

The ASET Department at Algonquin College requires that all laboratory personnel have detailed training in the handling of biohazardous material. A training needs assessment matrix (Appendix

7) has been developed as part of the Biosafety Program training process. A series of training modules were developed by the ASET Department that provide both general, theoretical and site-specific hands-on knowledge and skills. This training is completed and documented on a regular basis within the ASET Department and it is the responsibility of the Manager, ASET, Biosafety Officer(s), Faculty, Researchers and Technologists (in their capacity as supervisor of a class, laboratory or college-sponsored activity) to ensure that they and all individuals involved with biohazardous materials receive the necessary biosafety training.

6.1. Student Biosafety Training

Students who work in the CL2 lab (WA130) must complete online biosafety training as part of their regular curriculum, either before entrance to the lab or during the first few weeks of the semester, dependent on program and activities performed. In addition, students receive in-person introductory lab training on their first day in the lab; this includes details related to biosafety, lab safety and emergency response. Records of training and the assessment of competency are documented.

6.2 Employee Biosafety Training

ASET Lab Employees who work in the in the CL2 lab (WA130) must complete both in-person lab familiarization and online biosafety training prior to working in the lab. This training is mandatory for all ASET employees and researchers (and in some circumstances for volunteers and visitors) who work directly with biohazardous materials. The training provides an overview of biosafety in order to promote awareness in research and teaching labs where biohazardous materials are handled or stored, in order to protect faculty, staff, researchers, students, the public and the environment from potential exposure to biohazardous materials. Records of training and the assessment of competency are documented.

Other staff members, for example custodial staff, receive biosafety training that is modified based on their role in the ASET labs.

6.3 Emergency Response Training

Training to emergency response procedures is delivered both in-person and online to students, staff, researchers and other lab users. Students receive both online and in-person ERP training during their 1st semester, and subsequently receive in-person training on a yearly basis, generally at the start of the fall semester. ASET Staff and researchers complete both online and in-person ERP training annually, generally at the start of the fall semester. Other staff members, such as custodial staff, receive modified ERP training, based on their role in the ASET labs.

6.4 Safe Use of Biosafety Laboratory Equipment

All ASET staff and students who work with biohazardous materials in Room WA130 (CL2) must be properly trained to operate biosafety-related equipment relevant to the work performed.

The ASET Department has conducted LRAs for specific tasks and equipment that are biosafety-related (e.g. use of equipment such as biosafety cabinets, autoclaves, centrifuges and pipetting of biohazardous materials), the result being risk mitigation strategies that have been added into

"ASET Guideline" (ASET's Biological Safety Guidelines (Appendix 10) and ASET's Equipment Safety Guidelines (Appendix 12)). ASET laboratory staff and students are trained to these guidelines.

7.0 Physical Containment Requirements and Engineering Controls

It is an important basic tenet of safety that engineering controls (lab design and containment equipment), including proper laboratory ventilation, should be used as a first line of defense against the exposure or release of biohazards and only then supplemented with personal protective equipment (PPE) and operational controls.

At Algonquin College, containment laboratories must meet the design requirements of the Canadian Biosafety Standards (CBS), 3rd Edition, 2022; and, where applicable, other requirements that might be imposed by the Public Health Agency of Canada (PHAC), the Canadian Food Inspection Agency (CFIA) or other regulatory authorities. It is the responsibility of the Manager, ASET to ensure that the required essential biosafety equipment (which is independent of the building infrastructure) is in place and used according to the manufacturer's recommendations. The BSO(s) are responsible for developing and maintaining the necessary equipment SOPs. The requirements for essential biosafety equipment such as biological safety cabinets may be discussed with members of the IBSC.

7.1 Lab Design

In building or renovating science laboratories under the portfolio of the ASET Department, the College's intention is to develop laboratories that are versatile and meet the changing needs of users over the service life of the facility. Any changes in lab design or location must be approved by the ASET Department Biosafety Officer(s) and final signoff approval must be obtained from the Manager, ASET Department as well as the Manager, Occupational Health and Safety.

It should be noted that a laboratory's HVAC system is not designed to control or exhaust biohazards or volatile or toxic chemicals; these must be handled in biological safety cabinets, chemical fume hoods or other containment enclosures. HVAC systems only dilute indoor air contaminants and maintain comfort parameters of temperature, humidity and air circulation.

7.1.1 ASET's Level 1 Containment Lab(s)

General Physical Design Features of Biosafety Level 1 Containment (Room A129) lab:

- Laboratory work areas are separated from public and administrative areas by a door;
- Whenever possible, dedicated paper/computer workstations are segregated from workstations where RG1 biological material (e.g., samples, specimens) are handled;
- Windows are kept closed at all times (i.e. there is no hardware to open the windows);
- Space is provided for the storage of PPE in use (note: students may leave lab coats on chairs when briefly exiting the lab; lab coats are to be placed into plastic bags (to prevent cross-contamination) and stored in students lockers);
- Floors, walls, benchtops and furniture are non-absorbent and resistant to scratches, moisture, and impact, to allow decontamination and cleaning, in accordance with function;

- Benchtops and other work surfaces do not have open seams, to allow for cleaning and decontamination;
- Backsplashes that are installed tight to a wall are sealed at the wall-bench junction, to allow cleaning and decontamination;
- Floors are slip-resistant, in accordance with function (i.e. slip-resistant wax is used);
- Sinks are provided for handwashing;
- Emergency eyewash and shower stations are provided;
- Have telephone or alternate emergency communication;
- Have emergency lighting;
- Have all appropriate door signage;
- Employ good microbiological laboratory practices when handling biological samples or biohazardous materials;
- Employ good general laboratory practices that include the use of appropriate personal protective equipment.

Note: detailed information regarding physical design for CL1 labs is available here.

7.1.2 ASET's Level 2 Containment Lab(s)

Biosafety level 2 containment involves enhanced practices to avoid splashes, the generation of aerosols and environmental contamination. For delineation of the current CL2 zone in the ASET labs, see Figure 7.1.2.1.

General Physical Design Features of Biosafety Level 2 Containment (Room A130) lab:

- Meet all the facility requirements described above for Biosafety Level 1 containment laboratories;
- Biohazard warning signage to be posted at points of entry to the containment zone;
- Biohazard warning signage to include:
    - International biohazard warning symbol;
    - Containment level;
    - Required PPE;
    - Entry requirements (i.e. Visitor's Policy) and
    - Emergency contact information.
- Doors must be kept closed at all times with access limited to authorized personnel only, and doors must be locked when the lab is not occupied;
- Where possible, it is recommended that all labs have directional air flow into the lab (i.e. lab under negative pressure relative to the corridor);
- Containment zones to be separated from public and administrative areas by a lockable door;
- Space to be provided inside the containment zone for dedicated PPE that has to be worn and may be reused;
- In accordance with function, surfaces and coatings, including floors, ceilings, walls, doors, frames, casework, benchtops and furniture to be:
    - Cleanable;
    - Non-absorbent;

  - Resistant to physical damage and resistant to damage caused by decontamination procedures and products.
- Surfaces that may come in contact with regulated materials to be continuous with adjacent and overlapping materials;
- Sinks to be provided to facilitate handwashing;
- Biological safety cabinets (or other primary containment devices) to be provided, depending on a risk assessment;
- Decontamination technologies to be provided within the containment zone (i.e. autoclave);
- Decontamination technologies to be equipped with monitoring devices and recording mechanisms that capture operating parameters;
- Mechanisms to be provided to prevent contamination of vacuum systems and the release of regulated materials;
- Adherence to standard operating procedures/guidelines related specifically to work conducted in a CL2 setting (e.g. proper use of Biosafety cabinet).

Note: detailed information regarding physical design for CL2 labs is available in the CBS.

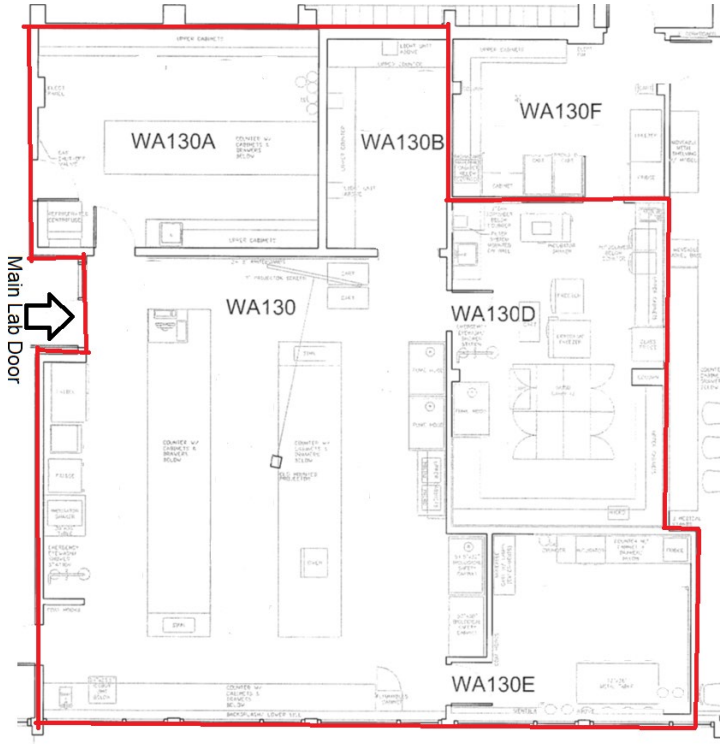


Figure 7.1.2.1: Containment Level 2 Zone (WA130 lab)

7.2 Containment Barriers and Access

A lab's containment barrier is what physically prevents unauthorized personnel from being able to enter facilities that use infectious or potentially infectious materials. The barrier is intended to prevent hazardous exposures and unauthorized use of pathogens.

Only authorized laboratory personnel are able to gain access to CL2 laboratory areas (Room A130). This is controlled through the use of electronic access cards. These cards are issued to each individual lab user (generally employees only) upon successful completion of Biosafety training as prescribed and delivered by the ASET Department. These electronic access cards are unique to each individual staff member and a record of each card's usage is logged in an electronic database under the management of Security Services at Algonquin College. Generally, laboratory visitors must be granted authorization by the Manager, ASET and must be supervised at all times in accordance with established laboratory safety standards and operating procedures. A visitor's policy notice is posted on the outside of all laboratory doors, indicating the requirements in order for visitors to access the labs.

7.3 Essential Biosafety Equipment and Supplies

Laboratory Equipment must be used correctly and must be properly maintained to provide the intended protection.

7.3.1 Biological Safety Cabinets

Biological safety cabinets (BSC) are designed to reduce the risk of infections by isolating the activities in the BSC from the laboratory environment. They are also used for maintaining an aseptic environment when working with infectious material or performing mammalian cell culture. BSCs provide effective primary containment for work with pathogens and toxins when properly maintained and used in combination with good microbiological practices (GMP).

Aerosols are fine droplets of liquid that can carry infectious organisms and stay suspended in the air for various periods of time depending on the size of the droplet. Aerosols are produced when force is applied to a liquid (e.g., pipetting, blending, stirring, sonicating, vortexing, centrifugation, pulling needles out of septums, filling a syringe, flaming loops or slides, opening snap cap tubes and pouring liquids). BSCs reduce the risk of airborne exposure to infectious material, by preventing the escape of aerosolized biohazardous agents into the laboratory environment. BSCs should be used for procedures that have the potential to produce infectious aerosols and for work involving high concentrations or large volumes of infectious material.

Detailed information regarding the use of BSCs is available in the Equipment Safety Guidelines (Appendix 12). The CBS dictates that the BSCs must be inspected annually.

7.3.1.1 HEPA filters

HEPA (High Efficiency Particulate Air) filters are essential components of BSCs, with particle removal efficiencies of 99.97% or better for 0.3 µm diameter particles. A particle size of 0.3µm is used as the basis for filter definition because it is the most difficult size to remove; particles that are larger or smaller are removed with greater efficiency.

A HEPA filter is comprised of a single sheet of fiber paper, which is pleated over rigid corrugated separators (to prevent the pleats from collapsing in the airstream) and glued onto a wood, metal or plastic frame. HEPA filters are easily damaged if mishandled; thus, biological safety cabinets must be tested and certified whenever they are moved.

Although HEPA filters effectively remove particulates from an airstream, they do not capture chemical gases or vapors. Thus, recirculating Class II BSCs must not be used with hazardous volatile or radioactive materials.

7.3.1.2 Classes of Biological Safety Cabinets

Not all BSCs are the same, although all of them protect personnel and the environment from contamination. There are three classes of BSCs, operating under the same basic principles. Personnel protection is provided by means of a continuous stream of inward air, which helps to prevent aerosols from escaping through the front opening. HEPA-filtered exhaust air provides environmental protection. In addition to protecting workers and the environment, some BSCs (Classes II and III) provide product protection from airborne contamination by sending HEPA-filtered air across the work surface.

Horizontal or laminar flow clean benches are not BSCs; they provide product protection but do not protect the ambient environment or the user from exposure to the materials being handled. Clean benches must never be used for handling infectious, toxic or sensitizing materials: they are appropriate for non-hazardous activities that require a clean environment, such as the assembly of sterile apparatus or electronic devices.

See Figures 7.3.1.2.1 and 7.3.1.2.2 for more details on BSCs.

SIDE-BY-SIDE COMPARISON OF BSC CLASS II TYPES

BSC	HEPA-Filtered Work Surface Air	Interior Design	Air Inflow Rate	Chemicals
II, A1	ALL is RECIRCULATED	May have contaminated air under POSITIVE pressure, so if plenum leaks, contaminants will escape into lab	75 linear feet per minute (lfpm)	Use with biologicals; Should NOT be used with chemicals
II, A2	MOST or ALL is RECIRCULATED	Contaminated air under/surrounded by NEGATIVE PRESSURE; if outside exhaust is present, uses flexible connection	100 lfpm	Use with biologicals; recommended for use with MINUTE amounts of volatile chemicals if some air is exhausted outside
II, B1	MOST is EXHAUSTED OUTSIDE	Contaminated air under/surrounded by NEGATIVE PRESSURE; outside exhaust must be hard-ducted	100 lfpm	Use with biologicals & MINUTE amounts of volatile or toxic chemicals
II, B2	ALL is EXHAUSTED OUTSIDE	Contaminated air is under/surrounded by NEGATIVE PRESSURE; outside exhaust must be hard-ducted	100 lfpm	Use with biologicals & SMALL amounts of volatile or toxic chemicals

Figure 7.3.1.2.1: Comparison of Class II Type Biological Safety Cabinets

Reference: https://www.ehss.vt.edu/programs/BIO_cabinets.php

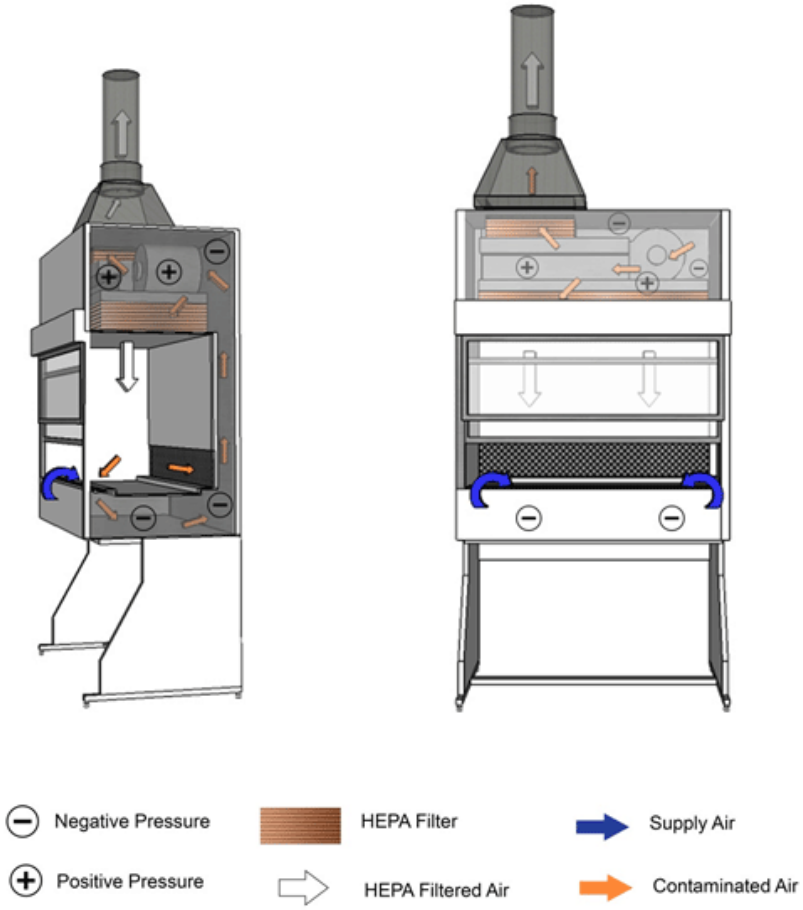


Figure 7.3.1.2.2: Illustration of a Class II Type A2 Biological Safety Cabinet (BSC)

Reference: https://www.canada.ca/en/public-health/services/canadian-biosafety-standards-guidelines/handbook-second-edition/chapter-11-15.html

7.3.1.3 Placement of Biological Safety Cabinets in the Laboratory

In order to ensure that the protective curtain of inward directional airflow is maintained, BSCs should be located away from interfering room air currents, such as those caused by:

- Pedestrian traffic;
- Room ventilation, e.g. overhead supply diffusers, fans, heating and air conditioning registers;
- Equipment that generates air currents, e.g. centrifuges, chemical fume hoods;
- Opening and closing of doors.

The ideal placement is in a "dead end" area of the lab, away from doors, throughways, windows, supply air diffusers, fume hoods and other equipment that could interfere with cabinet airflow. BSCs should not be located directly opposite seated work stations, other BSCs or fume hoods, and there should be adequate clearance on each side to allow access. Please contact the BSO(s) before relocating a BSC or installing a new one.

7.3.2 Fume Hoods

Fume hoods are NOT to be used for level 2 biohazard containment. Fume hoods are designed for collecting potentially harmful chemical gases, vapours, mists, aerosols and particulates generated during the manipulation of chemical substances. These harmful substances are usually directly exhausted to the outside of the building. A biological safety cabinet, not a fume hood, must be used to contain biohazardous aerosols from infectious cultures because this traps potentially infectious microorganisms in a HEPA filter, and does not release them to the environment.

When using a fume hood, be sure that:

- The sash is at the correct height
- You work well back in the fume hood
- The exhaust is not blocked by extraneous material (do not store things in the fume hood)
- Surfaces are protected to permit easy clean-up of spills

Detailed information regarding the use of fume hoods is available in the Equipment Safety Guidelines (Appendix 12).

7.3.4 Movement, Transportation and Shipping

The term "movement" is used when moving biohazardous materials within a laboratory or building, while "transportation" refers to transporting this material to another building or location in Canada or abroad. Transportation of infectious materials and toxins falls under the Transportation of Dangerous Goods Act (TDGA), the Transportation of Dangerous Goods Regulations (TDGR) and the Dangerous Goods Regulations issued by International Air Transport Association (IATA). Infectious material and toxins must be documented and packaged appropriately in order to protect against their release during movement or transport, and in accordance with TDGR, when applicable.

The transportation of infectious substances within Canada is administered through Transport Canada and regulated by the TDGA and TDGR. Infectious materials and toxins fall under *Class 6, Division 6.2 Infectious Substances* of the Regulations, which define the labelling, packaging and documentation requirements. Import, export, purchase, or transfer of biological materials at Algonquin requires strict adherence to the National Standard of Canada: Packaging of Category A and Category B infectious substances (Class 6.2) and clinical, (bio) medical or regulated medical waste (2016). International and national regulations stipulate that everyone involved in the transport (shipping, handling, transporting or receiving) of biohazardous materials must be trained, tested and certified. TDG training can be arranged by contacting the Manager, ASET.

Detailed instructions regarding movement, transportation and shipping of biohazardous materials can be found in Appendix 10.

7.3.5 Other Controls

Detailed instructions on centrifuges, autoclaves, etc. can be found in Appendix 10 and Appendix 12.

8.0 Operational Practice Requirements

This section describes the operational practices that are in place in the ASET labs. Operational practices are intended to mitigate risks associated with handling or storing pathogens, toxins, or other regulated infectious material by administrative procedures.

8.1 Good Microbiological Practices for Biohazard Laboratories (Level 1 and 2)

In addition to physical containment, good microbiological practices are important for reducing the risk of laboratory-acquired infections. Good microbiological practices include the use of PPE, hand washing, disinfecting work areas, the use of procedures that minimize the creation of aerosols, and proper decontamination and disposal of materials.

A detailed list of Good Microbiological Practices established for all ASET labs can be found within ASET's Biological Safety Guidelines" (Appendix 10).

8.2 Housekeeping

The containment zones (A129 and A130 labs) must be kept clean, free from obstructions and free from materials that are not required or cannot be easily decontaminated. A clean, uncluttered work environment minimizes slipping, tripping, falling and collision hazards that could potentially lead to exposure incidents or the spread of contamination. When work with biologicals is finished, the work surfaces must be properly decontaminated by trained lab personnel.

Custodial staff are responsible for ensuring that liquid hand soap and paper towels are stocked in the labs.

8.3 Containment Level 2 Operational Practices

Containment Level 2 (CL2) laboratories that are regulated under the HPTA must meet the operational practice requirements delineated in the CBS, Chapter 4. At CL2, the major addition to the good microbiological practices described above, is that a Biological Safety Cabinet (BSC) must be used for procedures that may produce significant infectious aerosols, or that involve high concentrations or large volumes of biohazardous material. The Biosafety Officer(s), with support from the ISBC, if necessary, perform local risk assessments to determine which procedures and what concentrations and volumes necessitate the use of a BSC or other primary containment device.

8.4 Operational Requirements for Specific Materials

Due to the risk of exposure to pathogens and toxins, there are specific operational requirements that must be adhered to when working in a CL1 and CL2 laboratory.

8.4.1 Microorganisms

Microorganisms including bacteria, viruses, fungi, and parasites and the materials that contain or may contain them are the focus of the Biosafety Program. Risk assessments of pure cultures of microorganisms may be quite straightforward because many have been characterized in detail. For some agents, the information is readily available as PHAC Pathogen Safety Data Sheets.

The Public Health Agency of Canada (PHAC) also has a database of pathogens that details the risk group, classification – human and/or animal, whether it is an SSBA (security sensitive biological agent) and whether it is regulated by the CFIA. This information is publicly available at: https://health.canada.ca/en/epathogen.

8.4.2 Biological Toxins

Biological toxins are non-replicating, non-infectious, poisonous substances produced by or derived from certain microorganisms, plants and animals. Many can cause adverse health effects in humans and/or animals at relatively low concentrations. An additional risk associated with working with toxins, includes the potential for buildup of static electricity and release of aerosolized toxin when handling dried/lyophilized toxins. Routes of exposure to biological toxins in the laboratory include: accidental inoculation, absorption through skin or mucous membranes, ingestion and inhalation of aerosols.

Human toxins are listed in Schedule 1 of the Human Pathogens and Toxins Act (HPTA) or in Part 1 of Schedule 5 of the HPTA. ASET's PHAC licence allows the use of controlled activities with CL1 and CL2 toxins only. This includes SSBAs (security sensitive biological agents) in amounts equal or below the trigger quantity. Trigger quantities are listed in Table 2.5.1. In all cases, any laboratory activity/protocol involving human toxins must be submitted to the Biosafety Officer(s) for inspection, review, and authorization in advance of usage in ASET labs. Any specific questions related to operational requirements for specific materials should be addressed to the BSO(s) for their advice and guidance.

8.4.3 Recombinant DNA: Genetically Modified Organisms and Viral Vectors

Natural or synthetic genetic material from more than one source can be combined to create new recombinant DNA (rDNA). The genetic material of microorganisms, animals and plants can be modified by the insertion or deletion of genes or gene segments to create a genetically modified organism (GMO). Viral vectors (e.g., lentivirus, retrovirus, adenovirus, herpesvirus vector systems) can be used to deliver genetic material into host cells for subsequent gene expression. Genetic manipulation may increase or decrease the risk group and containment level, depending on:

- The gene(s) being transferred
- Modification of genes (point mutations, deletions) already present in the organism
- Properties of the gene(s) expressed in the recombinant
- Risk Group of the host organism
- Interaction between the gene(s) being transferred and the host vector system(s)
- Viability of the host vector system

Work with recombinant DNA must include an assessment of the host, vector and insert; the work should be carried out at the highest containment level of any of the individual components. In general, when the source of the DNA being transferred, the vector and the host are all innocuous, the possibility of hazard is remote; however, approval must be sought from the BSO(s).

8.4.4 Cell Lines and Cell Culture

Cell cultures may contain unsuspected oncogenic, allergenic or infectious particles. Even well-characterized cell lines with no inherent risk have the potential to acquire pathogenic organisms, either naturally or through contamination by adventitious organisms, transformation or recombination. Cell lines that contain a known pathogen should be handled using the containment level appropriate for the agent.

Many commercially available eukaryotic cell lines of human or animal origin are classified as Risk Group 2 due to the presence of pathogenic viruses in the original cells or introduced during their immortalization. Since it is not feasible to test for all conceivable human pathogens, it is prudent to use CL2 facilities and operational practices when handling human or non-human primate sourced cell lines.

The potential hazards associated with human primary cell cultures include blood borne pathogens (e.g. HBV, HCV, and HIV) as well as agents such as Mycobacterium tuberculosis that may be present in lung tissue. All projects involving cell culture require approval from the BSO(s).

8.4.5 Environmental Samples

Environmental samples, such as water, sediment or soil may contain pathogens that present a hazard to people, animals or the environment, and should be collected using the appropriate PPE. In keeping with best biosafety practices, CL2 facilities and operational procedures are recommended when handling samples that contain unknown microbes/pathogens.

The HPTA states that a human pathogen or toxin that is in an environment in which it naturally occurs is excluded from the HPTA **as long as it has not been cultivated or intentionally collected or extracted.**

A PHAC licence is required if human pathogens are being produced, cultivated, cultured and/or grown. Therefore, if a possible RG2 organism is being subcultured, then the activity must be conducted in a CL2 lab.

In all cases, a risk assessment must be carried out with the BSO(s) to determine the risk group and containment level requirement for the environmental specimens.

8.4.6 Large-Scale

Activities involving volumes of 10 litres or more, whether in a single or in multiple vessels, are generally considered to be large-scale by PHAC and CFIA. Large-scale work may pose an increased risk to lab workers and the environment. Any large-scale project requires the BSO(s) to consult with PHAC and /or the CFIA to determine whether the work is considered laboratory or large-scale; therefore, all large-scale activities require approval of the BSO(s).

8.5 Personal Protective Equipment

The selection of appropriate personal protective equipment (PPE) for the specific work is important. PPE can provide a false sense of security, particularly if it is inappropriate or not properly maintained. The PPE required for a particular laboratory protocol must be described in

the laboratory activity/protocol so that all lab users (especially students) are aware of the PPE requirements for that activity.

Personal protective equipment required for use in a containment zone must be dedicated to that zone. Personal protective equipment must not be worn in public spaces and should be removed near the exit of the lab zone in such a way that contamination of skin and hair is minimized.

8.5.1 Eyes

Safety glasses, goggles and/or a face shield should be worn as required to protect from possible splashes, aerosols, or other relevant hazards. Safety glasses with side shields provide general eye protection but safety goggles offer superior eye protection from splashes. Note: It may be advisable in some cases to wear eye protection even when working at a biological safety cabinet to prevent individuals from touching their eyes with contaminated gloves.

Face shields are considered secondary protectors and only provide adequate eye protection when worn with safety glasses or goggles. Note: Face shields should be worn when removing tubes from liquid nitrogen due to the risk of tubes exploding if liquid nitrogen has leaked into them.

The wearing of contact lenses does not provide adequate protection against biological, chemical, or particulate hazards. The ASET Department strongly recommends that ASET lab users refrain from wearing contact lenses in the A129 and A130 labs. Inserting or removing contact lenses is not permitted in any laboratory.

8.5.2 Body

- Lab coats should be worn in all labs;
- Lab coats with snaps rather than buttons are recommended so that they can be removed quickly;
- Lab coats may not be worn in washrooms, lunchrooms, conference rooms, public elevators, offices or other areas where food or beverages are consumed;
- Generally, lab coats are to be folded so that the inside is not contaminated by the outside of the coat and then placed inside a bag (provided by the ASET Department) for storage;
- CL1 lab coats can be removed from the lab (and stored in student lockers, for example) while CL2 lab coats must remain in the lab until decontaminated prior to removal from the lab. Consult with the BSO(s) for the decontamination procedure;
- Any lab coats which are known or suspected to be contaminated with pathogens must be successfully decontaminated, by autoclaving or soaking in bleach (or other suitable disinfectant), before laundering.

8.5.3 Hands

Gloves of a suitable resistance material must be worn when handling materials in the lab. Generally, 100% nitrile gloves are worn in the ASET labs.

Recommended glove practices:

- Inspect gloves for cracks, tears and holes before wearing;
- When donning gloves, ensure that they fit so that no skin will be exposed;
- Gloves should be changed when visibly contaminated and as soon as possible after handling infectious agents;
- Change gloves often if wearing for a long period of time;
- Proper glove removal technique involves removing each glove without touching the outer contaminated surface (see Figure 1 (Appendix 10);
- Hands and wrists should be washed thoroughly, immediately after removing gloves;
- Double gloving should be considered for some agents or procedures where appropriate;
- Reusing disposable gloves is not recommended;
- Insulating gloves or mittens should be worn when handling high-temperature materials (e.g., recently autoclaved materials) or low-temperature materials (e.g. metal boxes from a -80^{o}C freezer or liquid nitrogen).

Even when gloves are worn, hands are to be washed before leaving the lab.

8.6 Hand Washing

Proper hand washing after removing gloves and before leaving the laboratory is one of the most important practices for preventing the spread of infectious agents. Proper hand washing is demonstrated in Figure 8.3.1.

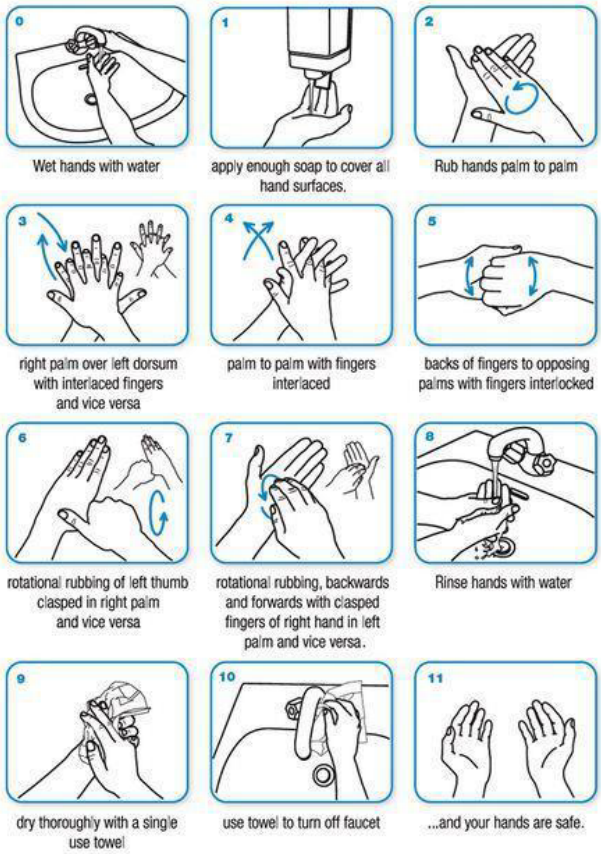


Figure 8.3.1: Good Handwashing Technique

Reference: https://microbeonline.com/handwashing-hygiene-wash-hands/

8.7 Proper Donning and Doffing of PPE

Refer to Section 5.8.4 of Appendix 10.

8.8 Decontamination and Waste Disposal

Decontamination is the process by which materials and surfaces are rendered safe to handle and are reasonably free of microorganisms or toxins. The primary objective of decontamination is to protect containment zone personnel and the community from exposure to pathogens that may cause disease. Depending on the situation, decontamination may require disinfection or sterilization.

8.8.1 Sterilization vs. Disinfection

Sterilization is a process that eliminates all living microorganisms, including bacterial spores. The probability of a microorganism surviving a sterilization process is considered to be less than one in one million (i.e. 10^{-6}), and is referred to as "sterility assurance".

Disinfection, a less lethal process than sterilization, eliminates most forms of living microorganisms. The effectiveness of the disinfection process is affected by several factors, including the nature and quantity of microorganisms, the amount of organic matter present, the type and state of items being disinfected, water hardness, and the temperature.

8.8.2 Decontamination Procedures in ASET Laboratories

It is good laboratory practice to decontaminate all biological waste generated, whether or not it is known to be infectious. Decontamination helps to prevent occupational exposure to, and/or the unintentional release of, infectious materials or toxins, and refers to procedures that render materials and surfaces safe to handle and relatively free of infectious microorganisms or toxins. In general, anything that is potentially contaminated is to be decontaminated using equipment or processes effective against the contaminating pathogen or toxin prior to cleaning, disposal, removal, or servicing.

Autoclaves are effective in decontaminating biohazardous waste. Chemical disinfection is also suitable for spill cleanup and the decontamination of substances, surfaces and equipment that cannot be autoclaved. Many chemical disinfectants are toxic; thus, it is important to read Safety Data Sheets (SDS), follow manufacturers' recommendations and wear the appropriate PPE when handling them. Refer to Chapter 15, Section 15.3.1 of the 2nd edition of the CBH for a summary of microorganism susceptibility to chemical disinfectants (Table 15.1), characteristics and contact times of chemical disinfectants (Table 15.2), and disadvantages of chemical disinfectants (Table 15.3).

The choice of decontamination method will depend on the nature of the material to be processed. Decontamination procedures should be included in all laboratory activities and SOPs. The BSO(s) are responsible for ensuring that the appropriate materials required for decontamination are readily available.

8.8.3 Autoclave Validation and Verification

Autoclave validation is more stringent than verification and is intended to test the efficacy of the decontamination process under more challenging conditions. Annual validation is required for each load type, using defined representative loads. The representative load consists of the maximum quantity of material of a particular load type, that would be decontaminated at any one time.

Autoclave verifications periodically test the decontamination process between annual validations to detect process or equipment failures. For verification, the biological (or chemical) indicator is placed within the autoclave chamber, outside of the load to avoid contact with infectious material. The verification load can be any quantity that does not exceed the maximum load quantity defined by the validation.

Detailed instructions on autoclave validation and verification can be found in Appendix 10.

9.0 Medical Surveillance Program

Individuals who work in areas where infectious material or toxins are handled and stored are at risk of exposure to these pathogens and toxins and the adverse consequences of an exposure event. Working with hazardous chemicals poses possible health hazards to individuals who work in areas where these chemicals are used and stored. Additionally, laboratory equipment has physical hazards, such as pinching, crushing, puncturing, etc.

The purpose of ASET's medical surveillance program is to help prevent and detect illness or disease related to exposure to infectious material or toxins. While the focus is on prevention, medical surveillance also provides a response mechanism through which a potential infection can be identified and treated before serious disease occurs.

ASET's Medical Surveillance Program can be found in Appendix 3.

10.0 Biosecurity Plan

While biosafety refers to the application of containment principles, technologies, and practices to prevent unintentional exposure to infectious material or toxins, biosecurity refers to measures taken to prevent the loss, theft, misuse, diversion or intentional release of these materials.

Potential consequences of a biosecurity lapse include:

- Infection, poisoning or death of humans or animals;
- Undesirable social, economic, or environmental impact;
- Negative impact on research due to the loss of material.

The biohazardous materials in use at Algonquin are generally quite common in the Canadian environment and are not cultured in large quantities, so they are extremely unlikely to represent a significant community-wide biosecurity risk. Nonetheless, biosecurity breeches, such as the intentional misuse or theft of biohazardous materials or toxins, can lead to serious undesirable consequences and a plan is in place at Algonquin to prevent such incidents.

The ASET Department has training and reporting mechanisms in place to promote, maintain, and reinforce biosecurity practices. Please refer to ASET's Biosecurity Plan (Appendix 2) for more information.

11.0 Emergency Response Plan (ERP)

Emergencies are generally unpredictable and occur with little or no warning. Prevention and mitigation measures must be developed, and emergency response procedures must be developed.

To ensure that personnel can respond immediately and effectively to emergencies, the CBS requires annual Emergency Response Plan (ERP) training for everyone who works in a CL2 (and higher) facility. ERP training related to general emergency procedures (listed on the Algonquin College Corporate Policies website and the Algonquin Risk Management website) is included in ASET's General Lab Safety and Orientation. Lab Employees are trained annually to ASET's Emergency Response Plan (Appendix 1).

12.0 Laboratory Visitors

All laboratory visitors must dress appropriately. They must wear the personal protective equipment required and must be accompanied by certified laboratory personnel. Please refer to ASET's Visitors' Policies (Appendix 6). Generally, laboratory visitors must be granted authorization by the Manager, ASET and must always be supervised in accordance with established laboratory safety standards and operating procedures.

The official visitor's policy is posted on the door to each laboratory (WA129 and WA130). All lab visitors must follow the rules and procedures of the laboratory. Anyone not complying with the above will not be allowed entry into the lab or will be asked to leave the lab.

Medical Surveillance is also in place for Visitors. Visitors must confirm that they are able to enter the ASET labs by reviewing the policy that is posted on the entrance door of each lab. Refer to Appendix 6 for more information regarding medical surveillance.

Lab personnel are required to challenge anyone unfamiliar who is not accompanied by a trained staff member. If not comfortable challenging them, then report to the BSO(s) and/or the Manager, ASET; if necessary, alert Campus Security at x5010.

12.1 Visitors (brief visit):

Refer to ASET's A129 or A130 Visitor's Policy (Appendix 6). Visitors on brief visits must be accompanied by trained employees.

12.2 Regular visitors:

Regular visitors are defined as individuals who do not fit into the category of student, employee, researcher, or brief visitor, such as custodial staff. These visitors are accessed by the ASET Manager and the BSO(s) on a case-by-case basis.

13.0 Service Animals in A130

Service Animals are not allowed in the CL2 Laboratory Environment (A130).

14.0 Algonquin College Contact Information

Ms. Pam Auchterlonie
Biosafety Officer and Laboratory Technologist
Tel: 613-727-4723 ext. 3433
Email: auchtep@algonquincollege.com

Mr. Vernon Mussgnug
Biosafety Officer and Laboratory Technologist
Tel: 613-727-4723 ext. 5906
Email: mussgnv@algonquincollege.com

Mr. Adam Shane
Chair (Manager), Department of Applied Science and Environmental Technology
PHAC Licence Holder
Tel: 613-727-4723 ext. 5400
Email: shanea@algonquincollege.com

Mr. Mike Benkie
Manager, Occupation Health and Safety and Risk Management
Tel: 613-727-4723 ext. 7142
Email: benkiem@algonquincollege.com

15.0 Useful Contact Information

The Centre for Biosecurity at the Public Health Agency of Canada
By email: phac.pathogens-pathogenes.phac@canada.ca
By phone: (613) 957-1779
By mail: 100 Colonnade Road, Ottawa, Ontario K1A 0K9
Website: https://www.canada.ca/en/services/health/biosafety-biosecurity.html

16.0 Acknowledgements

This Biosafety manual is modelled after Biosafety Manuals and materials from Thompson River's University, Queen's University, McMaster University, University of Toronto and the University of Manitoba, the Stoney Brook University Lab Safety Inspection Checklist and complies with PHAC and CBS guidelines. Particulars in this manual are also taken from: PHAC's *Spill Clean-Up Procedures, PHAC's Procedures to Minimize Aerosol Hazards,* the *Canadian Biosafety Standard*, 3rd edition, PHAC, November 2022, the *Canadian Biosafety Handbook 2nd edition*, PHAC, May 2016, the *Developing a Comprehensive Biosecurity Plan*, PHAC, June 2016 and the *Canadian Biosafety Guideline – Containment Level 1 Design and Operational Practices Document,* July 2017. This manual and appendices have been written by Pam Auchterlonie and the Manager, ASET.

17.0 Glossary of Terms/ Definitions

Accident: An unplanned event that results in injury, harm or damage.

Aerosol: A suspension of particulates or liquid droplets in a gaseous medium, such as air.

ASET Lab Personnel: All persons (Technologists, Faculty, Staff, Researchers, Technicians) who perform laboratory work in the ASET labs. Generally, Students are also considered ASET Lab Personnel.

Biohazardous material: material of biological origin that may be potentially harmful to humans, animals, plants, the economy or the environment. Biohazardous materials include:

Biological material: pathogenic and non-pathogenic microorganisms, proteins and nucleic acids, as well as any biological material that may contain them. Biological material that contains human or animal pathogens is referred to as "Infectious material".

Biological toxins: poisonous substances naturally produced by living organisms (microorganisms, plants and animals).

Biological safety cabinet (BSC): A primary containment device that provides protection for personnel, the environment, and depending on the BSC class, the product, when working with biological material.

Biological safety officer (BSO): A specific individual designated for overseeing facility biosafety and biosecurity practices.

Biosafety: The application of containment principles, technologies and practices to prevent unintentional exposure to infectious material or toxins, or their accidental release. See also: Microbial toxins.

Biosafety Manual: A facility-specific manual that describes the necessary core elements of a biosafety program (e.g. biosecurity plan, training, personal protective equipment).

Biosecurity: measures implemented to prevent the loss, theft, misuse, diversion or intentional release of infectious materials or toxins.

Biosecurity risk assessment (BRA): A risk assessment in which relevant pathogens, toxins, infectious material, and other related assets (e.g. equipment, animals, information) are identified and prioritized. Associated threats and risks of these materials are identified, and suitable mitigation strategies are determined to protect against any potential theft, misuse, diversion, or intentional release of these materials.

Containment: physical design parameters and operational practices that protect personnel, the immediate work environment and community from exposure to biological material.

Containment level (CL): The minimum required physical containment and operational practices for safely handling infectious material or toxins in laboratory, large scale production, and animal work environments. As defined by the CBS, there are four containment levels ranging from a basic laboratory (containment level 1 [CL1]) to the highest level of containment (containment level 4 [CL4]).

Containment system: Equipment dedicated to providing and maintaining containment. This includes, but is not limited to, primary containment devices (e.g. biological safety cabinets), decontamination apparatus (e.g. autoclaves), heating, ventilation and air conditioning (HVAC), and control systems.

Contamination: Unwanted infectious material/toxins within laboratory materials (e.g. laboratory samples, cell cultures) or laboratory surfaces (e.g. benchtop, hands, gloves).

Controlled activities: Any of the following activities referred to in Section 7(1) of the Human Pathogens and Toxins Act: possessing, handling or using a human pathogen or toxin; producing a human pathogen or toxin, storing a human pathogen or toxin; permitting any person access to a human pathogen or toxin; transferring a human pathogen or toxin; importing or exporting a human pathogen; releasing or otherwise abandoning a human pathogen or toxin; or disposing of a human pathogen or toxin.

Culture: The *in vitro* propagation of tissue cells, microorganisms, or other living matter under controlled conditions (e.g., temperature, humidity, nutrients).

Decontamination: process by which materials and surfaces are made reasonably free of microorganisms or toxins, and thus are safe to handle. Decontamination may be achieved through disinfection or sterilization.

Disease: A structural and/or functional disorder in a living human or animal, or one of its parts, resultant of infection or intoxication. Disease typically manifests via distinguishing signs and symptoms.

Disinfection: A process used to eliminate most forms of living microorganisms.

Emergency Response Plan (ERP): A document that outlines the procedures to be taken and the parties responsible in emergencies such as spills, exposure, release of infectious material or toxins, personnel injury or illness, power failure, fire, explosion or other emergency situations (e.g. severe weather, hurricane, armed intruder).

Exposure: Contact with, or close proximity to, infectious material or toxins that may result in infection or intoxication respectively. Routes of exposure include inhalation, ingestion, inoculation, and absorption.

Genetically Modified Organism (GMO): Genetically modified organisms (GMOs) can be defined as organisms (i.e. plants, animals or microorganisms) in which the genetic material (DNA) has

been altered in a way that does not occur naturally by mating and/or natural recombination (WHO, 2014).

Good Microbiological Laboratory Practices (GMLP or GLP): Basic laboratory practices applicable to all types of activities with biological material.

Handling or storing: "Handling or storing" pathogens, toxins, or infectious material includes possessing, handling, using, producing, storing, permitting access to, transferring, importing, exporting, releasing, disposing of, or abandoning such material. This includes all controlled activities involving human pathogens and toxins specific in Section 7(1) of the Human Pathogens and Toxins Act.

High concentration: Infectious material or toxins that are concentrated to a degree that increases the risks associated with manipulating the material (i.e., increases the likelihood or consequences of exposure).

High efficiency particulate air filter (HEPA): A device capable of filtering 99.97% of airborne particles 0.3µm in diameter, the most penetrating particle size. Due to the effects of impaction, diffusion, and interception, HEPA filters are even more efficient at trapping and retaining particles that are either smaller or larger than 0.3µm in diameter.

Incident: An event or occurrence with the potential of causing injury, harm, infection, intoxication, disease, or damage. Incidents can involve infectious material, infected animals, or toxins, including a spill exposure, release of infectious material or toxins, animal escape, personnel injury or illness, missing infectious material or toxins, unauthorized entry into the containment zone, power failure, fire, explosion, flood, or other crisis situation (e.g. earthquake, hurricane). Incidents include accidents and near misses.

Infectious material: Any isolate of a pathogen or any biological material that contains human or animal pathogens.

Injury: The occurrence of a sudden and unforeseen event, arising out of, or in the course of a College Sanctioned Activity, attributable to any factor that caused an injury or an occupational disease (an exposure to conditions or substances that resulted in a disease).

Inventory: A list of (biological) assets associated with a containment zone identifying pathogens, toxins, and other infectious material in storage both inside and outside the containment zone.

In vitro: Latin for "within glass"; describes experimentation involving components of a living organism within an artificial environment (e.g. manipulation of cells in a petri dish), including activities involving cell lines or eggs.

In vivo: Latin for "within the living"; describes experimentation conducted within the whole living organism (e.g. studying the effect of antibiotic treatment in animal models).

Laboratory: An area within a facility or the facility itself where biological material is handled for scientific or medical purposes.

Large scale: Activities generally involving volumes of toxins or the in vitro culture of infectious material on a scale of 10 litres or greater. This could be a single vessel with a volume of 10 litres or greater, or based on the processes and pathogen used, could be multiple vessels with a total volume of 10 litres or greater. It is determined in consultation with the Public Health Agency of Canada and/or the Canadian Food Inspection Agency on a case-by-case basis, whether or not particular activities conducted in a containment zone are required to follow the increased or unique requirements for large scale production areas.

Large volume: A volume of infectious material or toxins that is sufficiently large to increase the risk associated with the manipulation of the material (i.e., increases the likelihood or consequences of exposure or release).

Local Risk Assessment (LRA): Site-specific risk assessment that identifies hazards based on the infectious material or toxins in use and the procedures being performed.

Medical surveillance program: A program for prevention and detection of illness related to laboratory exposure to infectious material or toxins. The program emphasizes prevention, but also provides a process through which potential infections are identified and treated before disease occurs.

Microbial toxins: A subcategory of biological toxins. Microbial toxins are poisonous substances produced by microorganisms (bacteria, viruses, fungi).

Microorganism: A cellular or non-cellular microbiological entity, capable of replication or transferring genetic material and that cannot be reasonably detected by the naked human eye. Microorganisms include bacteria, fungi, viruses, and parasites, and may be pathogenic or non-pathogenic in nature.

Movement: The action of moving people, material or animals from one physical location to another in the same building. This can include movement within the same containment zone, to a difference containment zone, or to another location within the same building.

Near-Miss: The occurrence of event on College Property, arising out of, or in the course of a College Sanctioned Activity attributable to any factor that could have caused an injury or material damage.

Oncogene: A mutated gene that has the potential to cause cancer

Operational practice requirements: Administrative controls and procedures used in the laboratory to protect personnel, the environment and the community from biohazards.

Overarching risk assessment (ORA): A broad risk assessment that supports the biosafety program as a whole and may encompass multiple containment zones within an institution or

organization. Mitigation and management strategies reflect the type of biosafety program needed to protect personnel from exposure and to prevent the release of pathogens and toxins.

Pathogen: An agent (e.g., a microorganism, nucleic acid or protein) that can cause disease or infection in humans and/or animals.

Pathogen risk assessment: The determination of the risk group and appropriate physical containment and operational practice requirements needed to safely handle the infectious material or toxins in question.

Pathogenicity: The ability of a pathogen to cause disease in a human or animal host.

Parasites: An organism that lives in or on an organism of another species (its host) and benefits by deriving nutrients at the other's expense.

Personal protective equipment (PPE): Equipment and/or clothing worn by personnel to provide a barrier against infectious material or toxins, thereby minimizing the risk of exposure. PPE may include, but is not limited to, lab coats, gowns, full-body suits, gloves, protective footwear, safety glasses, safety goggles, masks, and respirators.

Physical containment requirements: Physical barriers, *i.e.* engineering controls and facility design that protect personnel, the environment and the community from biohazards.

Post-Exposure Prophylaxis: Is a short-term antiretroviral treatment aimed at reducing the likelihood of viral infection after potential exposure.

Primary containment: Protection of workers and laboratory from exposure to infectious material and toxins by provision of a physical barrier between the individual and/or the work environment and the biological material.

Primary containment device: Apparatus or equipment that is designed to prevent the release of infectious material or toxins and to provide primary containment (i.e., provide a physical barrier between the individual and/or the work environment and the biological material). Examples of primary containment devices include biological safety cabinets, isolators, and centrifuges with sealable cups, process equipment, fermenters, micro isolator cages, and ventilated cage racks.

Prion: Small proteinaceous infectious particle generally considered to be responsible for causing a group of neurodegenerative diseases in humans and animals known as transmissible spongiform encephalopathies.

Process equipment: Specific equipment used to carry out a manufacturing procedure involving biological material. This term is generally used to describe equipment used in large scale processes (e.g., industrial fermentation equipment).

Release: The discharge of infectious material or toxins from a containment system.

Restricted Access: Access that is strictly controlled to authorized personnel only by means of a physical barrier (i.e. a controlled access device or system, such as an electronic access card, access code, etc.).

Risk: The probability that a person will be harmed or experience an adverse health effect if exposed to a hazard.

Risk Group (RG): The classification of biological material based on its inherent characteristics, including pathogenicity, virulence, risk of spread, and availability of effective prophylactic or therapeutic treatments, that describes the risk to the health of individuals and the public as well as the health of animals and the animal population.

Scientific Research: As defined in Section 1 of the Human Pathogens and Toxins Regulation: the following types of systematic investigation or research that are carried out in a field of science or technology by means of controlled activities:

a) Basic research: when the controlled activities are conducted for the advancement of scientific knowledge without a specific practical application.

b) Applied research: when the controlled activities are conducted for the advancement of scientific knowledge with a specific practical application.

c) Experimental development: when the controlled activities are conducted to achieve scientific or technological advancement for the purpose of creating new – or improving existing – materials, products, processes, or devices.

Standard operating procedure (SOP): A document that identifies the hazards associated with a project and describes safe work practices and procedures to minimize or eliminate risk.

Sterilization: A process that eliminates (destroys) living microorganisms, including bacterial spores.

Terrestrial animal pathogen: An agent that causes disease in terrestrial animals, including avian and amphibian animals, but excluding invertebrates and aquatic animals.

Toxicant: Artificial products created by humans, for example industrial waste products and pesticides. These substances can also be poisonous and cause health effects.

Toxins:

- Biological Toxins: poisonous substances naturally produced by living organisms such as microorganisms, plants and animals.
- Microbial Toxins: a subcategory of biological toxins. Microbial toxins are poisonous substances produced by microorganisms (bacteria, viruses, fungi).

Transfer: A change in possession of pathogens, toxins, or other regulated infectious material between individuals from the same or different facilities (i.e., the movement from the place or places specified in the licence or animal pathogen import permit to any other place).

Transportation: Shipping of infectious material or toxins to another building or location, within Canada or abroad, in accordance with the *Transportation of Dangerous Goods Act* and *Regulations*.

Virulence: The degree or severity of a disease caused by a pathogen.

Waste: Any solid or liquid material generated by a facility for disposal.

Zoonoses: Diseases transmissible between animals and humans. This includes anthropozoonoses, which are diseases that are transmitted from animals to humans, and Zooanthroponoses ("reverse zoonoses"), which are transmitted from humans to animals.

18.0 Appendices

Appendix 1: ASET's Emergency Response Plan

ASET's Emergency Response Plan

1.0 Purpose

The purpose of the **Applied Science and Environmental Technology Department's (ASET) Emergency Response Plan (ERP)** is to outline the procedures relevant to the types of emergencies that can occur in the ASET labs, including those relevant to Containment Level 1 and 2 labs.

This Emergency Response Plan applies to ASET's containment level 1 (room WA129) and containment level 2 (room WA130) facilities at the Woodroffe Campus and must be adhered to by ASET lab personnel.

Based on an overarching risk assessment, this Emergency Response Plan builds on the existing Ottawa campus emergency procedures developed by Algonquin's Department of Risk Management.

2.0 Abbreviations and Acronyms

ASET: Applied Science and Environmental Technology
BSC: Biological Safety Cabinet
BSO: Biosafety Officer
ERP: Emergency Response Plan
HPTA: Human Pathogens and Toxins Act
HVAC: Heating, Ventilation, Air Conditioning
LAI: Laboratory Acquired Infection
PHAC: Public Health Agency of Canada
RG: Risk Group

3.0 Responsibilities

ASET Manager: Ensures that all ASET lab personnel are aware of "ASET's Emergency Response Plan" by delegating this duty to one or both of the Biosafety Officer(s).

Biosafety Officer(s): Ensure that all ASET lab personnel are aware of this plan by introducing during the "General Lab Safety and Orientation" training session, which all ASET lab personnel (Technologists, Faculty, Staff, Researchers, Technicians, and ASET Students) must complete.

ASET Lab Personnel: Must comply with the details in this document. Faculty are responsible for ensuring that students under their supervision follow the details outlined in this plan, whenever necessary. Supervisors are responsible for ensuring that personnel under their supervision follow the details outlined in this plan, whenever necessary.

4.0 ASET's Emergency Response Plan

ASET Lab Personnel must become familiar with, and follow College-wide procedures and policies, in addition to the ASET-specific emergency response procedures, outlined below.

As per Algonquin College's incident reporting procedures, members of the College Community are required to report all incidents/accidents/near-misses to their manager through an incident reporting form.

Members of the College community should be aware of how to respond in an emergency and contribute to the overall safety of our community by being conscientious about their own individual plans.

It is a good idea for all ASET lab users to become familiar with at least two routes out of the A building, Ottawa Campus.

Biohazardous spills, accidents involving biohazards, exposures to infectious materials and losses of containment must be reported immediately to the ASET Manager and to the BSO(s). Such incidents involving RG2 material must be reported to PHAC by the BSO(s).

Note: Emergencies may require the need to override existing access controls.

4.1 Medical Emergencies and Injury (Emergency)

Injuries and medical emergencies can occur on campus (in the ASET labs) or off campus (i.e. field course work).

4.1.1 In the event of a medical emergency or injury (emergency) on campus:

- Call Security at extension 5000 from a college phone (located in the laboratories) and describe the emergency and give the location;
- Stay on the phone as long as requested;
- Request assistance from bystanders;
- Make room around the sick/injured person(s);
- Apply first aid/CPR as necessary, while waiting for assistance to arrive;
- College security staff are trained in first aid and CPR and will initiate 911 services, as necessary;
- Complete an incident reporting form, as soon as possible, and submit to a BSO or the ASET manager.

4.1.2 In the event of an injury or medical emergency off campus (e.g. field course work):

- Call 911 and follow their instructions;
- Complete an incident reporting form, as soon as possible, and submit to a BSO or the ASET manager.

4.1.3 If an injury is not a medical emergency (e.g. minor injury):

- If necessary, assist with first aid (e.g. small cuts, burns, etc.);
- If necessary, contact your Supervisor;
- Security may also be reached at extension 5010 (non-emergency extension);
- Sometimes, only extra support is required – seek out the assistance of other laboratory staff who may be present in the lab or staff offices;
- Complete an incident reporting form, as soon as possible, and submit to a BSO or the ASET manager.

College Procedures and Policies related to injury and medical emergency:

- Algonquin College's Emergency Procedures
- Algonquin College Quick Reference Guide – Ottawa Campus
- Algonquin College's Emergency Services Site Plan
- Algonquin College's Incident Reporting Form

4.2 Near-Misses and Accidents (unrelated to injury)

A near-miss in an unplanned event that did not result in an injury, illness or damage but had the potential to do so. All accidents (unrelated to injury) and near-misses must be reported to the ASET Manager (via. an incident reporting form) and the Biosafety Officer(s) so the root cause can be determined and action can be taken to prevent recurrence. These events can include biological materials, biological toxins, chemicals and/or equipment.

4.3 Fire and Fire Alarm

Upon the discovery of fire or upon hearing the fire alarm sound, follow the details outlined below.

4.3.1 Discovery of fire in the ASET labs:

- Remain Calm (do not use elevators);
- Notify other lab personnel by assertively speaking the words "fire in the lab" or something similar to clearly notify others of the danger. Students should ensure that their Supervisor/Professor is made aware of the situation;
- Faculty in charge of students shall take control of the situation, whenever possible;
- In some situations, it may be possible to put out small fires:
    - Use a beaker, watch glass or other object that will cut off the source of oxygen to small fires;
    - Fire blankets are available in the lab;
    - Fire extinguishers are also available in the labs;
    - If located in the fume hood, close the sash.
- If possible, follow "Emergency Egress/Evacuation" (section 4.4 in this ERP document);

- Leave the lab immediately using the nearest safe exit;
- Faculty in charge of students shall ensure that students evacuate the lab;
- Ensure persons with disabilities are assisted, as required;
- Activate the nearest fire alarm pull station;
- Exit the building;
- Call Security Emergency at extension "5000" (preferably) or "911" and report the exact details of the fire;
- Persons with disabilities who are unable to leave the building shall proceed to the nearest collection point or nearest safe exit and wait for assistance from the Fire Department or emergency personnel;
- Do not enter or return to the building until approved by the Fire Department and notified to do so by emergency personnel.
- Complete an incident reporting form, as soon as possible, and submit to a BSO or the ASET manager.

4.3.2 If you hear the fire alarm sound while in the ASET labs:

- Remain Calm (do not use elevators);
- If possible, follow "Emergency Egress/Evacuation" (section 4.4 in this ERP document);
- Leave the lab immediately using the nearest safe exit;
- Faculty in charge of students shall ensure that students evacuate the lab;
- Ensure persons with disabilities are assisted, as required;
- Leave the building immediately using the nearest safe exit;
- Persons with disabilities who are unable to leave the building shall proceed to the nearest collection point or nearest safe exit and wait for assistance from the Fire Department or emergency personnel;
- Do not enter or return to the building until approved by the Fire Department and notified to do so by emergency personnel.

College Procedures and Policies related to fire emergencies:

- Algonquin College's Fire Safety Response Plan
- Algonquin College's Emergency Services Site Plan
- Algonquin College's Incident Reporting Form
- Algonquin College's Map of Woodroffe Campus' Collection Points

4.4 Emergency Egress/Evacuation

In situations where emergency egress/evacuation from the labs is necessary, complete the following (only if safely possible to do so):

- Turn off equipment and any direct sources of heat (e.g. Bunsen burners, hot plates, ovens, water baths);

- Close any open containers of biologicals and chemicals;
- Remove PPE and leave in the lab;
- Wash hands or use hand sanitizer before leaving the lab;
- If in use, turn off the main gas valve for the lab (only in A129 lab; A130 lab does not have functional gas valves);
- Close the lab door and leave the building;
- If the emergency is a result of a lab incident/accident, then complete an incident reporting form, as soon as possible, and submit to a BSO or the ASET manager.

When emergency evacuation is required, the most important thing is to evacuate the building. These steps (above) should only be completed if it is safety possible to do so.

College Procedures and Policies related to emergency egress/evacuation:

- Algonquin College's Emergency Procedures – Evacuation

4.5 Earthquakes

In the event of an earthquake:

- Follow the steps outlined in Algonquin College's Earthquake Emergency Procedure;
- If evacuation from the lab is necessary, refer to "Emergency Egress/Evacuation" (section 4.4 in this ERP document);
- Stop all laboratory work;
- During an earthquake, if possible:
    - Turn off equipment and any direct sources of heat (e.g. Bunsen burners, hot plates, ovens, water baths);
    - Close any open containers of biologicals and chemicals;
    - Move chemicals to appropriate storage locations;
    - Remove hazardous materials from fume hoods and biological safety cabinets (BSC) and secure in appropriate storage locations;
    - Close fume hoods and BSC sashes;
    - If in use, turn off the main gas valve for the lab (only in A129 lab; A130 lab does not have functional gas valves).
- If accidents/incidents occur or if damage to the lab or lab equipment occurs, then complete an incident reporting form, as soon as possible, and submit to a BSO or the ASET manager.

College Procedures and Policies related to earthquakes:

- Algonquin College's Emergency Procedures – Earthquake

4.6 Power Failure

In the event of a power failure/outage:

- Refer to Algonquin College's Power Outage Procedure;
- If evacuation is necessary, refer to "Emergency Egress/Evacuation" (section 4.4 in this ERP document);
- Cease work that requires engineered safety equipment, such as a chemical fume hood or a BSC
    - Close the sash and stop all work;
- Turn off equipment and any direct sources of heat (e.g. Bunsen burners, hot plates, ovens, water baths);
- If in use, turn off the main gas valve for the lab (only in A129 lab; A130 lab does not have functional gas valves);
- Do not open fridges and freezers;
- Laboratory work (i.e. with chemicals, biologicals and equipment) should be stopped, considering the Safety Data Sheet Computer must be functional for work to continue and because it is dangerous to perform lab work in low light conditions;
- If necessary, e.g. if class/lab must be cancelled, notify the ASET Manager.
- If accidents/incidents occur, then complete an incident reporting form, as soon as possible, and submit to a BSO or the ASET manager.

College Procedures and Policies related to power failure/outage:

- Algonquin College's Emergency Procedures – Power Outage

4.7 Failure of HVAC (heating, ventilation, air conditioning) System

The ASET labs have a negative pressure system; meaning that the air pressure in the labs is negative in relation to the corridors outside the labs. This allows chemical and biological aerosols to remain inside the lab and be filtered out through the laboratory ventilation system, rather than entering the hallways outside the lab.

Generally, the Facilities Team at Algonquin College will notify the Biosafety Officer(s) or the ASET Manager that the HVAC system has failed or of a scheduled shutdown. The individual who has been notified shall advise lab personnel, who will subsequently follow the steps below. Otherwise, if lab personnel notice that the HVAC system is not operational, then they shall follow these same steps, outlined below.

- All work with chemicals and biologicals must stop;
- If in use, turn off the main gas valve for the lab (only in A129 lab; A130 lab does not have functional gas valves);
- If evacuation is necessary, refer to "Emergency Egress/Evacuation" (section 4.4 in this ERP document);
- If necessary, e.g., if class/lab must be cancelled, notify the ASET Manager.

- If accidents/incidents occur, then complete an incident reporting form, as soon as possible, and submit to a BSO or the ASET manager.

4.8 Spills (Chemical and Biological)

In the event of a chemical or biological spill:

- If the spill is severe (often, this is a judgement call, depending on the chemical/biological involved, as well as the volume), evacuate the lab immediately and once in a safe location, call Security Emergency at extension "5000" (preferably) or "911" and follow their instructions;
- Note: Security (non-emergency) is also available at extension "5010";
- For a chemical spill, refer to ASET's Chemical Safety Guidelines;
- For a biological spill, refer to ASET's Biological Safety Guidelines;
- If necessary, refer to "Exposure/Potential Exposure to a Pathogen or Biological Toxin" (section 4.10 in this ERP document).

All lab employees who work with RG2 material must complete in-person biological spill training.

4.9 Breach of containment and/or failure of primary containment devices involving biohazardous materials

These details outline the steps to take in the event of the breach of containment or failure of primary containment devices. Users should also follow instructions in ASET's Equipment Safety Guidelines when operating equipment. Incident investigation is conducted for failure of containment systems involving pathogens and toxins, to determine root cause and mitigate future risks.

Records of any incidents involving pathogens, toxins, and other regulated infectious material or loss of containment must be kept on file for a minimum of 10 years.

These include: medical emergency, loss of containment of any kind, spills of infectious materials, (including spills inside and outside the lab as well as spills in the BSC), mechanical failure (including BSC and air handling), and accidental exposure (including near misses).

4.9.1 BSC Failure/Alarm

If the BSC failure is due to a temporary power failure, restart the cabinet when the power returns. Do not use the BSC until the power returns. Refer to ASET's Equipment Safety Guidelines. If accidents/incidents occur, then complete an incident reporting form, as soon as possible, and submit to a BSO or the ASET manager.

Signs of BSC failure include:

- Power failure - lights will go out and the blower motor will stop;
- No airflow;
- Alarm sounding or visible on cabinet;

- Unusual noises;
- Unusual smells.

In the event of a failure while working in a BSC:

- Stop all work in the BSC;
- Move slowly to prevent aerosols from spreading;
- Cap or cover vessels in the BSC;
- Remove gloves and discard in the BSC waste;
- Close the BSC sash (if it closes);
- Turn off the power to the cabinet;
- Wash hands;
- Attach a warning sign on the sash of the cabinet;
- Notify the Biosafety Officer(s) (BSO);
- If necessary, refer to "Exposure/Potential Exposure to a Pathogen or Biological Toxin" (section 4.10 in this ERP document).

4.9.2 Autoclave Failure

If accidents/incidents occur, then complete an incident reporting form, as soon as possible, and submit to a BSO or the ASET manager.

Signs of autoclave failure include:

- Power failure – alarm sounds or control panel displays incomplete cycle;
- Sterilization indicator indicates incomplete cycle.

In the event of the failure of an autoclave:

- If the autoclave failure is due to a temporary power failure, restart when the power returns;
- If the sterilization indicator indicates a failed autoclave validation test:
    - Ensure the issue was not caused by overloading the machine;
    - If repeating the cycle with a smaller load does not fix the issue, take the machine out of circulation.
- Notify the BSO(s);
- If necessary, refer to "Exposure/Potential Exposure to a Pathogen or Biological Toxin" (section 4.10 in this ERP document).

4.9.3 Centrifuge Containment Failure

If infectious material was placed in the centrifuge and the centrifuge has failed (indicated by the breakage of a sealable cup gasket and caps on tubes/containers leaking) then:

- Close the lid and clear the area of all personnel;

- Wait 30 minutes for aerosols to settle before attempting cleanup;
- Refer to PSDS, if available;
- Notify the BSO(s);
- Wear PPE during cleanup;
- Remove rotor and buckets to the BSC for cleanup;
- Thoroughly disinfect inside the centrifuge;
- Discard contaminated disposable materials using appropriate biohazardous waste disposal procedures;
- If necessary, refer to "Exposure/Potential Exposure to a Pathogen or Biological Toxin" (section 4.10 in this ERP document);
- Complete an incident reporting form, as soon as possible, and submit to a BSO or the ASET manager.

4.10 Exposure/Potential Exposure to a Pathogen or Biological Toxin

Exposure to a pathogen or toxin can occur via inhalation, ingestion, inoculation or absorption.

The Human Pathogens and Toxins Act (HPTA) requires that any exposure to human pathogens or toxins that may cause disease or any disease that may have been caused by an exposure to a human pathogen or toxin be reported to the Public Health Agency of Canada (PHAC) without delay. The BSO(s) and Licence Holder are responsible for reporting incidents to PHAC (refer to "Incident Reporting to PHAC", section 4.12 in this ERP document). Incident investigation is conducted for incidents involving pathogens and toxins, to determine root cause and mitigate future risks.

Possible exposure to a pathogen or toxin involves a detailed review by the by the ASET Manager, Biosafety Officer(s), Licence Holder and other relevant personnel. The review considers all relevant facts and circumstances to ultimately assess whether exposure has or may have occurred. Refer to Figure 1 (Appendix 1) for details regarding exposure incidents.

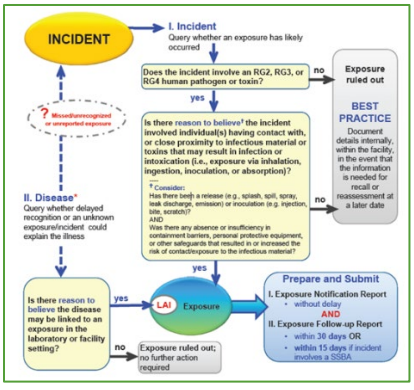


Figure 1 (Appendix 1): PHAC Decision Chart to Assist in the Assessment of an Exposure Incident

(Reference: Canadian Biosafety Handbook, Figure 18.2)

Records of any incidents involving pathogens, toxins, and other regulated infectious material or loss of containment must be kept on file for a minimum of 10 years.

4.10.1 In the event of an exposure to a pathogen or toxin:

- Follow the first aid/medical recommendations found in the Pathogen Safety Data Sheet (PSDS) for the organism, if available;
- Provide first aid, if necessary;
- If necessary, contact Algonquin College Security at extension 5000 and follow their instructions;
- Seek medical attention immediately (within 0-2 hours) and adhere to any course of treatment prescribed by a health care provider;
- Inform the ASET Manager (PHAC Licence Holder) of the incident as soon as possible. The Licence Holder will then report the incident to the BSO(s) who will then report the incident to PHAC;
- Complete an accident/incident reporting and submit to the ASET Manager, preferably as soon as possible (i.e., within 24 hours);
- Should the incident result in a laboratory acquired infection (LAI) then refer to "Suspected Laboratory Acquired Infection" (section 4.11 in this ERP document).

4.10.2 In the event of a possible exposure to a pathogen or toxin:

- Inform the ASET Manager (PHAC Licence Holder) of the incident as soon as possible. The Licence Holder will then report the incident to the BSO(s);
- A detailed review will determine if an exposure has indeed occurred;
- Complete an accident/incident reporting form and submit to the ASET Manager, preferably as soon as possible (i.e., within 24 hours);
- Should the incident result in a laboratory acquired infection (LAI) then refer to "Suspected Laboratory Acquired Infection" (section 4.11 in this ERP document).

4.11 Suspected Laboratory Acquired Infection/Intoxication (LAI)

Individuals who work in areas where infectious material or toxins are handled or stored are at risk of exposure to these pathogens and toxins and the adverse consequences of an exposure event. Laboratory acquired infections/intoxications (LAIs) are defined as diseases associated with workplace exposures to infectious material or toxins in a laboratory setting.

According to Section 13 of the HPTA, any incident resulting in an LAI or an exposure (i.e., probable inhalation, ingestion, inoculation, or absorption) involving a Risk Group 2 (RG2) must be reported to the PHAC without delay. Without delay means as soon as the situation is under control and sufficient information has been gathered to report the preliminary details of the incident. This information can be submitted to the PHAC electronically through the Biosecurity Portal, accessible through the PHAC website, in an exposure notification report. The Licence Holder and

the BSO(s) are responsible for submitting the report to PHAC. Incident investigation is conducted for incidents involving pathogens and toxins, in order to determine root cause and mitigate future risks.

The expectation is that all lab users monitor their health status on an ongoing basis and self-assess for symptoms that may be associated with occupational exposure to any infectious materials (see Appendix 3 and Appendix 4).

Records of any incidents involving pathogens, toxins, and other regulated infectious material or loss of containment must be kept on file for a minimum of 10 years.

4.11.1 If an LAI is suspected:

- Inform the ASET Manager (PHAC Licence Holder) of the incident as soon as possible;
- The Licence Holder will then report the incident to the BSO(s) and together they will determine the next steps;
- If not already completed, submit an incident reporting form to the ASET Manager.

4.11.2 If an LAI is confirmed:

- Inform the ASET Manager (PHAC Licence Holder) as soon as possible;
- The Licence Holder will then report the incident to the BSO(s) who will then report the LAI to PHAC;
- If not already completed, submit an incident reporting form to the ASET Manager;
- Seek medical attention and adhere to any course of treatment prescribed by a health care provider.

4.12 Incident Reporting to PHAC

The Licence Holder must inform the PHAC without delay if they have reason to believe an incident involving a human pathogen or toxin in the licence holder's possession has or may have caused disease in an individual. The licence holder may delegate this duty to the Biosafety Officer(s).

Reporting to the PHAC is not necessary in the case of an incident in a licensed containment zone wherein the incident investigation and local assessment of facts has determined that exposure (i.e. infection or intoxication) is unlikely to have occurred as a result of the event. Reporting to the PHAC is also not necessary in the case of a recognized disease that is determined not likely to have been caused by an exposure incident in the containment zone.

In addition, exposure incidents and LAIs that occur in containment zones or facilities that are exempt from the licence requirements (e.g., CL1 facility) under the HPTA and HPTR are not obligated to be reported to the PHAC but may still be reported on a voluntary basis.

Refer to Figure 2 (Appendix 1) for additional guidance in determining whether an exposure requiring notification of the PHAC has occurred.

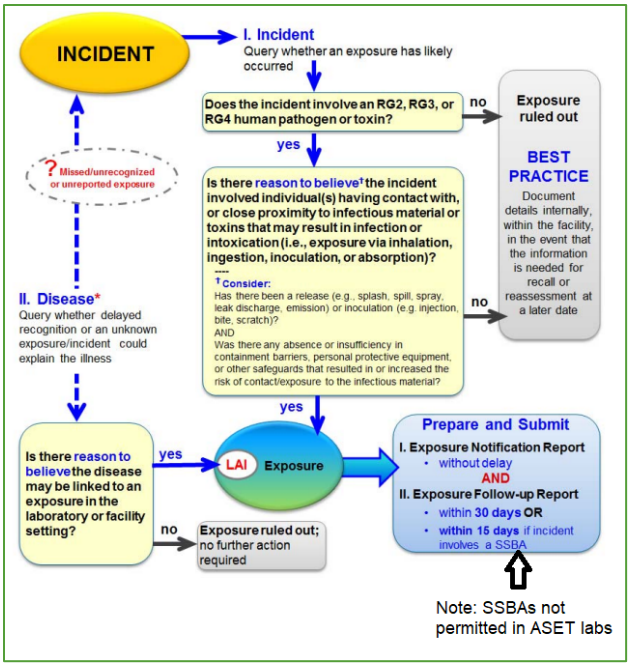


Figure 2 (Appendix 1): Decision Chart to Assist in the Assessment of an Incident
(Reference: Notification and Reporting Under the HPTA and HPTR, 2017)

In the event of an incident involving exposure to a human pathogen or toxin or an LAI, the following must occur:

1. An exposure notification report must be submitted without delay (i.e. as soon as reasonably possible) to PHAC; followed by
2. An exposure follow-up report, documenting the results of the investigation, must be submitted to PHAC within 30 days of the submission of the exposure notification report.

4.13 Theft/Loss of a Pathogen or Toxin

ASET's pathogen and toxin inventory control is fully described in ASET's Biosecurity Plan. Inventory control helps determine if loss or theft of pathogens or toxins has occurred.

In the event of a suspected theft/unauthorized removal/inventory discrepancy of a pathogen or toxin:

- The event must be reported immediately to the Biosafety Officer(s) and the ASET Manager who will determine the next steps.

4.14 Suspected Intentional Misuse of a Pathogen or Toxin

In the event of a suspected intentional misuse of a pathogen or toxin:

- The event must be reported immediately to the Biosafety Officer(s) and the ASET Manager who will determine the next steps.

4.15 Inadvertent Possession of a Human Pathogen or Toxin that is not permitted under ASET's PHAC Licence, whether produced or otherwise comes into possession

In the event of a suspected inadvertent possession of a pathogen:

- The event must be reported immediately to the Biosafety Officer(s) and the ASET Manager who will determine the next steps.

4.16 Theft or Loss of Chemicals or Equipment

In the event of a suspected theft/loss of chemicals or equipment:

- The event must be reported immediately to the ASET Manager who will determine the next steps.

4.17 Incident Reporting to the Public Health Agency of Canada

The functions of the BSO include communicating with the PHAC on behalf of the Licence Holder, which includes the required reporting of incidents. In accordance with the HPTA and HPTR, a Licence Holder is obligated to notify the PHAC without delay in the following scenarios:

- When a Licence Holder has reason to believe that a human pathogen or toxin has been released inadvertently from a facility;
- When a human pathogen or toxin that a person is not authorized to possess is inadvertently produced or otherwise comes into their possession;
- When a security sensitive biological agent (SSBA) is not received within 24 hours of the date and time when it was expected to be received;
- When there is reason to believe that a human pathogen or toxin has been stolen or is otherwise missing;
- When an incident involving a human pathogen or toxin has caused or may have caused disease in an individual;
- As specified by any additional licence condition set out on the licence itself that describes an incident scenario that requires notification of the PHAC.

5.0 Regulatory Standards

Human Pathogens and Toxins Act
Human Pathogens and Toxins Regulations
Canadian Biosafety Standard, 3rd edition
Canadian Biosafety Handbook, 2nd edition

6.0 Other College Resources

Algonquin College's Occupational Health & Safety Department's Website
Algonquin College's Health and Safety Policies
Algonquin College's Emergency Procedures
Algonquin College's Emergency Eyewash Program

ASET's Biosecurity Plan

1.0 Purpose

The handling and storing of human and animal pathogens or toxins pose risk to personnel, the community and the environment. All facilities that are licensed under the Human Pathogens and Toxins Act (HPTA) are required to develop a biosecurity plan. The purpose of a biosecurity plan is to prevent the loss, theft, misuse, diversion or intentional release of biological assets (i.e. pathogens, toxins and other regulated infectious material) and related facility assets.

The **Applied Science and Environmental Technology Department's (ASET) Biosecurity Plan** is based on a site-specific assessment of the biosecurity risks associated with pathogens, toxins and activities conducted in the Applied Science and Environmental Technology (ASET) labs.

This Biosecurity Plan applies to ASET's containment level 1 (room WA129) and containment level 2 (room WA130) facilities at the Woodroffe Campus and must be adhered to by all ASET lab personnel working in these areas.

2.0 Abbreviations and Acronyms

ASET: Applied Science and Environmental Technology
BSO: Biosafety Officer
CL: Containment Level
HAA: Health of Animals Act
HAR: Health of Animals Regulations
HPTA: Human Pathogens and Toxins Act
HPTR: Human Pathogens and Toxins Regulations
RG: Risk Group

3.0 Responsibilities

ASET Manager: Ensures that all ASET lab personnel are trained to "ASET's Biosecurity Plan" by delegating this duty to the Biosafety Officer(s).

Biosafety Officer(s): Ensure that all ASET lab personnel are aware of this plan by introducing during the "General Lab Safety and Orientation" training session, which all ASET lab personnel (Technologists, Faculty, Staff, Researchers, Technicians, and ASET Students) must complete.

ASET Lab Personnel: Must comply with the details in this document. Faculty are responsible for ensuring that students under their supervision follow the details outlined in this plan, whenever necessary. Supervisors are responsible for ensuring that personnel under their supervision follow the details outlined in this plan, whenever necessary.

4.0 ASET's Biosecurity Plan:

ASET lab personnel must be aware of and follow the details outlined below.

4.1 Physical Security:

Physical security refers to barriers or measures put in place to physically prevent unauthorized access to a facility, parts of a facility or assets.

ASET has the following measures in place to protect the physical security of the **WA130** laboratory:

- Doors that open to the outside of the Containment Level 2 (CL2) facility must remain closed and locked at all times and only authorized persons can access the CL2 lab (WA130);
- Electronic keycard access (with photo ID) for authorized lab personnel:
    - Keycards are programmed for individual employees only when training is up-to-date and lab access is required (as determined by the ASET Manager; note: this duty may be delegated to the Biosafety Officer(s) (BSO));
    - Access is logged in a database;
    - Keycard access is removed when ASET lab personnel no longer require lab access.
- Security camera in the WA130 main lab and security cameras in hallways outside of the WA130 main lab;
- Visitor Policies are in place and are posted on the doors of the lab. Lab personnel are trained to these policies;
- Bacteria stocks are stored in a locked -80 freezer in WA130;
- Lab personnel are required to challenge anyone unfamiliar who is not accompanied by a trained staff member; if not comfortable challenging them, then report to the BSO(s) as well as the Manager, ASET; if necessary alert Campus Security at x5010;
- The BSO(s) maintain an updated list of all persons authorized to access the WA130 lab;
- Unauthorized access is determined by monitoring the electronic card access system;
- Physical security requirements are reviewed annually by the ASET Department during an annual audit.

ASET has the following measures in place to protect the physical security of the **WA129** laboratory:

- Note:
    - Only Risk Group 1 (RG1) microorganisms and toxins are used in this lab space;
    - This lab space is shared with other College Departments that do not follow the same hiring process as ASET lab personnel since they do not work directly with the RG1 microorganisms and toxins;
    - Facilities (e.g. plumbers, electricians, etc.) have access to this lab space.

- Electronic keycard access (with photo ID) for authorized personnel:
    - For the ASET Department, keycards are programmed for individual employees only when training is up-to-date and lab access is required (as determined by the ASET Manager; note: this duty may be delegated to the Biosafety Officer(s));
    - Access is logged in a database;
    - Keycard access is removed when ASET lab personnel no longer require lab access.
- Security cameras in hallways outside of the WA129 main lab;
- Visitor Policies are in place for the ASET Department. ASET lab personnel are trained to these policies;
- Bacteria stocks (RG1 and 2) are stored in a locked -80 freezer in WA130;
- Unauthorized access is determined by monitoring the electronic card access system;
- Physical security requirements are reviewed annually by the ASET Department during an annual audit.

4.2 Personnel Suitability and Reliability:

Through the hiring process, ASET candidates are screened by the ASET Manager to confirm that they have the appropriate credentials, skills and personal traits to work with pathogens or toxins and that they are the best fit for the position prior to being offered a position and granted access to the CL2 laboratory. The ASET manager ensures that individuals have the appropriate training, experience, competency and personality traits to carry out the work.

Other individuals who work in the ASET labs, but do not work directly with pathogens or toxins, for example custodial staff and security staff, are hired by the managers who oversee those areas. Since these employees or contractors do not work directly with the pathogens or toxins and do not have access to these materials, their hiring process does not fall under the same scrutiny as the hiring of ASET lab personnel.

4.3 Pathogen and Toxin Accountability:

Accountability is a means of establishing ownership of pathogens and toxins and defining the responsibilities of each authorized individual for the oversight of pathogens and toxins within the facility. Under the HPTA, HPTR, HAA and HAR, all authorized individuals are accountable for their actions and decisions involving pathogens, toxins and other regulated infectious material.

In ASET's WA129 (CL1) lab, only work with RG1 microorganisms is permitted. In ASET's WA130 (CL2) lab, work with both RG1 and RG2 microorganisms is permitted. All ASET lab personnel are trained to the conditions of ASET's PHAC Licence.

ASET lab personnel working in both WA129 and WA130 labs are educated to the pathogen and toxin limitations of the laboratories during Module 1: General Lab Safety Orientation training and Module 3: Biosafety training. ASET lab personnel who work with pathogens and toxins must be trained to "ASET's Biological Safety Guidelines" (Appendix 10), which outlines acceptable work procedures in the ASET labs.

Transfer of RG1 microorganisms between the WA129 and WA130 labs is permitted and all ASET lab personnel who work with bacteria are trained to the proper transfer of microorganisms between these lab spaces. Also, transfer of RG1 microorganisms is permitted between the ASET labs and other College Programs at Algonquin College. Detailed information can be found in "ASET's Biological Safety Guidelines" (Appendix 10).

Only the Biosafety Officer(s) (BSO) can order and receive pathogens and toxins. Employees who would like to purchase a pathogen or toxin must consult with the BSO(s) first, to determine if a risk assessment must be conducted and if the agents are permitted in the facilities.

Risk assessments conducted on lab activities ensure that regulated pathogens and toxins will not be altered into those with dual-use potential. Any organisms with dual-use potential are not authorized for use at Algonquin College. The ASET labs are permitted, under the HPTA licence, to work with toxins, including security sensitive biological agents in amounts equal to or below the trigger quantity. However, the ASET Manager and BSO(s) must approve all work with toxins covered under the HPTA and generally, due to the risk involved, work with SSBA toxins will not be approved.

4.3.1 Inventory Control:

An inventory of pathogens, toxins and other regulated infectious material in long-term storage (i.e. greater than 30 days) within the containment zone must be kept up-to-date. For RG2 pathogens and toxins in long-term storage, the location and risk group must be kept on file.

A robust pathogen and toxin inventory is in place for long-term storage in the ASET labs. These measures include:

- The BSO(s) are responsible for the maintenance of the biological inventory;
- The BSO(s) and the ASET Manager are the only persons with access to the locked freezer that store the stocks of biological materials;
- The inventory is updated as materials are added and removed;
- All pathogens, toxins and other regulated infectious material in long-term storage are labeled appropriately;
- Loss or theft of biohazardous material (or other material from laboratories) must be reported immediately to the Biosafety Officer(s) and the ASET Manager.

4.4 Incident and Emergency Response:

An incident is an event that has the potential to cause harm to personnel, the community or the environment. ASET has an Emergency Response Plan (ERP), (Appendix 1) that includes response procedures should the following events occur:

- Exposure to a human pathogen or toxin;
- Disease that has been or may have been caused by a human pathogen or toxin;

- Inadvertent release of pathogens or toxins;
- Intentional release of pathogens or toxins;
- Inadvertent possession of a human pathogen or toxin that is not permitted under ASET's PHAC licence, whether produced or otherwise comes into possession;
- Theft or possible theft of a human pathogen or toxin;
- Natural disasters;
- Workplace violence;
- Bomb threats;
- Security breaches (unauthorized entry, unauthorized access to sensitive information);
- Emergencies (fire, medical emergency).

4.5 Information Management and Security:

ASET has a comprehensive biosafety program, which includes training, a biosafety manual, SOPs, inventory control and other important details that ensure the safety of employees, students and the community. The biological inventory is not sensitive information and the details are shared with ASET lab personnel, as are most of the specifics of the biosafety program.

Personal medical details of ASET lab personnel is protected information and is only shared with the ASET Manager, the PHAC Licence Holder and the BSOs. In some instances, these details may also be shared with members of the IBSC.

5.0 Regulatory Standards

Human Pathogens and Toxins Act
Human Pathogens and Toxins Regulations
Canadian Biosafety Standard, 3rd edition
Canadian Biosafety Handbook, 2nd edition

6.0 Other College Resources

AC's Health and Safety Policies
AC's Occupational Health & Safety Department's Website

ASET's Medical Surveillance Program

1.0 Purpose

The purpose of the **Applied Science and Environmental Technology Department's (ASET) Medical Surveillance Program** is to help prevent and detect illness or disease related to exposure to infectious material or toxins. As well, this program addresses the risks associated with the chemical and physical hazards that are present in the WA129 and WA130 labs and helps to prevent incidents related to those materials.

This Medical Surveillance Program applies to all ASET lab personnel who require access to Algonquin College's containment level 1 lab (room WA129) and containment level 2 lab (room WA129) at the Woodroffe campus.

This Medical Surveillance Program is based on ASET's Overarching Risk Assessment, as well as local risk assessments, and is reviewed annually by the Institutional Biosafety Committee (IBSC).

2.0 Abbreviations and Acronyms

ASET: Applied Science and Environmental Technology
BSO: Biosafety Officer
ERP: Emergency Response Plan
LAI: Laboratory Acquired Infection
PHAC: Public Health Agency of Canada

3.0 Responsibilities

ASET Manager: Ensures that all ASET lab personnel are aware of "ASET's Medical Surveillance Program" by delegating this duty to one or both of the Biosafety Officer(s).

Biosafety Officer(s): Ensure that all ASET lab personnel are aware of this program by introducing during the "General Lab Safety and Orientation" training session, which all ASET lab personnel (Technologists, Faculty, Staff, Researchers, Technicians, and ASET Students) must complete.

ASET Lab Personnel: Must comply with the details in this document. Faculty are responsible for ensuring that students under their supervision follow the details outlined in this program, whenever necessary. Supervisors are responsible for ensuring that personnel under their supervision follow the details outlined in this program, whenever necessary.

4.0 Medical Surveillance Program

ASET lab personnel must be aware of the information outlined below and must complete all required steps and documentation, also detailed below.

4.1 Emergency Response and Incident Investigation

Medical emergencies can result from accidents caused by a variety of hazards, such as biologicals, chemicals or equipment. Lab users must be aware of the steps to follow should an emergency occur, as detailed below.

4.1.1 Exposure/Possible exposure to infectious material or toxin:

Refer to ASET's Emergency Response Plan (ERP), (Appendix 1) for more information.

4.1.2 Exposure/Possible exposure to hazardous chemical:

Refer to ASET's Emergency Response Plan (ERP), (Appendix 1) for more information.

4.1.3 Injury from equipment/procedure:

Refer to ASET's Emergency Response Plan (ERP), (Appendix 1) for more information.

4.2 Emergency Medical Contact Card

All new pathogens for use in the ASET labs must be risk assessed prior to ordering/use. The Public Health Agency of Canada (PHAC) requires that an emergency medical contact card be issued to containment zone personnel who handle a pathogen that has been identified by a local risk assessment to require the issuing of a medical contact card. Currently, the ASET Department only uses well-characterized pathogens that do not require such a card. New pathogens must be risk assessed to determine if an emergency medical contact card is required.

4.3 Immunization

The ASET Department *recommends* that employees and students working in the ASET labs be up-to-date with the following immunizations:

- Tetanus
- Hepatitis A Virus (HAV)
- Hepatitis B Virus (HBV); note: College employees can discuss HS-14 with the ASET Manager.

Individuals must consult with their own medical service provider regarding requirements for immunization and proof of immunity. More information regarding immunization in Canada can be found here.

4.4 Medical Surveillance Evaluation

4.4.1 ASET Lab Personnel, excluding Students (i.e. Technologists, Faculty, Technicians and Researchers)

Lab personnel, excluding students, must complete the following steps to gain access to ASET's WA129 and/or WA130 lab(s):

1. Complete a Medical Surveillance Form (Appendix 4) and submit to the ASET manager or to the Biosafety Officer (BSO) in charge of employee training, at the start of employment/work and when there are changes in health status.
2. Must monitor their health status on an ongoing basis. Annual affirmation that self-monitoring is being carried out is documented in the medical surveillance form. This supports ongoing self-assessment for symptoms which may be associated with occupational exposure to any infectious materials, organisms or toxins handled in the ASET labs.
3. Have a discussion with the BSO(s) and/or the ASET Manager, if necessary.
4. Complete a Medical Clearance Form, if necessary, and discuss with the ASET Manager and the BSO(s). In some cases, the Institutional Biosafety Committee may also be included in the discussion.
5. Access will be granted once all training and documentation are completed, as deemed by the ASET Manager (or the BSO(s)). The ASET Manager (or the BSO(s)) will advise the individual of any precautions that must be followed when working in the lab(s). Access generally involves the BSOs programming an "employee" ID card, granting access for that individual to the lab(s).
6. Medical surveillance and clearance forms must be kept for 5 years after an individual has left the college.

4.4.2 Medical Surveillance Evaluation – Students

Students must complete the following steps to enter ASET's WA129 and/or WA130 lab(s):

1. Complete a Medical Surveillance Form (Appendix 4) and submit to the BSO in charge of student training, at the start of each fall semester and when there are any changes in health status. For off-cycle students, the form must be submitted at the start of the student's first semester and subsequently each fall semester thereafter and when there are any changes in health status. Note: generally, the first training session takes place during a regularly scheduled labs and the Professor will deliver the Medical Surveillance Form to the BSO, on behalf of the student.
2. Have a discussion with the BSO(s) and/or the ASET Manager, if necessary.
3. Complete a Medical Clearance Form, if necessary, and discuss with the ASET Manager and the BSO(s). In some cases, the Institutional Biosafety Committee may also be included in the discussion.
4. Students must monitor their health status on an ongoing basis. Annual affirmation that self-monitoring is being carried out by the individual is documented in the medical surveillance form. This supports ongoing self-assessment for symptoms

which may be associated with occupational exposure to any infectious materials, organisms or toxins handled in the ASET labs.

5. By default, students have access to the labs(s) when his/her/their scheduled labs take place. The BSO(s) and the ASET Manager will communicate with the student's Professor(s)/Instructor(s) if a student IS NOT allowed into the lab(s) due to incomplete documentation. Once proper documentation is received (as deemed by the ASET Manager or the BSO(s)), any concerns and special precautions necessary for the student to work safely in the lab(s) will be communicated to the student and the Professor(s)/Instructor(s) by the ASET Manager and/or the BSO(s).
6. Medical surveillance and clearance forms must be kept for 5 years after an individual has left the college.

4.4.3 Medical Surveillance Evaluation – Visitors

Visitors must confirm that they are able to enter the ASET labs by reviewing the policy (Appendix 6) that is posted on the entrance door of each lab. Refer to section 12.0 for more information regarding Visitors.

4.5 Ongoing Medical Surveillance

Infections that result from an exposure to pathogens or infectious material being handled in a containment zone are referred to as LAIs (Laboratory Acquired Infections). LAI also refers to a disease caused by exposure to a toxin being handled in a containment zone.

The expectation is that all lab users monitor their health status on an ongoing basis and self-assess for symptoms that may be associated with occupational exposure to any infectious materials, organisms or toxins that are stored and/or handled in the WA129 and/or WA130 labs. As well, self-monitoring is documented annually by completing a Medical Surveillance Form (Appendix 4).

In the event of onset of any symptoms associated with exposure to chemicals, infectious materials/organisms and toxins, employees must inform the ASET Manager immediately and follow the necessary steps (refer ASET's Emergency Response Plan (Appendix 1)).

4.6 Medical Clearance

Some individuals requiring access to the ASET labs may need to complete a medical clearance form. A clearance form is required when health status indicates that there could be a concern when working in the ASET labs, as indicated on a medical surveillance form.

4.7 Signs and Symptoms of Disease

Infections that result from an exposure to pathogens or infectious material being handled in a containment zone are referred to as LAIs. LAI also refers to a disease caused by exposure to a toxin being handled in containment zone.

Self-monitoring for symptoms that may be associated with occupational exposure to infectious materials or toxins is carried out by all lab personnel on an ongoing basis.

Signs and symptoms of disease may include fever, diarrhea, fatigue, muscle aches, rash and coughing. Each infectious disease has its own specific signs and symptoms. Pathogen Safety Data Sheets are technical documents that provide information regarding symptoms of disease for certain pathogens and can be referred to as required.

5.0 Regulatory Standards

Human Pathogens and Toxins Act
Human Pathogens and Toxins Regulations
Canadian Biosafety Standard, 3rd edition
Canadian Biosafety Handbook, 2nd edition

6.0 Other College Resources

Algonquin College's Health and Safety Policies
Algonquin College's Occupational Health & Safety Department's Website
Algonquin College's Hepatitis B Vaccine Policy

Appendix 4: ASET's Medical Surveillance Forms – Employee and Student

ALGONQUIN COLLEGE

Applied Science & Environmental Technology
Employee Medical Surveillance Form

In accordance with the *Canadian Biosafety Standard, 2nd edition*[1], Algonquin College's Applied Science and Environmental Technology Department (ASET) has developed a program designed to prevent and detect personnel illness related to exposure to infectious material or toxins. The focus of the program is primarily preventive, but provides a response mechanism through which a potential infection or intoxication can be identified and treated before serious injury or disease occurs. As well, this program addresses the risks associated with the chemical and physical hazards that are present in the WA129 and WA130 labs and helps to prevent incidents related to those materials. Employees must monitor their health status on an ongoing basis and self-assess for symptoms that may be associated with occupational exposure to chemicals, as well as infectious materials and toxins.

To ensure a safe work environment, employees are strongly encouraged to disclose any underlying medical conditions that may increase the risk of harm associated with working in the laboratories. Employees who **are immunocompromised (e.g. through radiation therapy or chemotherapy, pregnancy, diabetes or other conditions) may be particularly susceptible to infections, or experience more severe illness if they contract an infection following exposure to a pathogen.** The ASET labs also has physical hazards as well as various chemical hazards that may affect certain medical conditions; therefore disclosure of medical conditions is strongly recommended to ensure the well-being of employees.

Please check one of the following*:

☐ I am affected by one or more of the above mentioned conditions and I will consult with the Biosafety Officer(s) and/or the ASET Chair, prior to entering the WA129 and/or WA130 laboratories.
Please list relevant information here: _____

☐ I am **NOT** affected by any of the above mentioned medical conditions; **however, I do have a medical condition** that that I wish to disclose to ensure my safety when working in the ASET labs. I will consult with the Biosafety Officer(s) and/or the ASET Chair, prior to entering the WA129 and/or WA130 laboratories.
Please list relevant information here: _____

☐ I am **NOT** affected by any of the above mentioned medical conditions.

Employee Name (please print)	Signature	Date

***Throughout the academic year, it is incumbent upon all employees to disclose any changes in health status that could increase risk of exposure.**

1 of 2

ALGONQUIN COLLEGE

Applied Science & Environmental Technology
Employee Medical Surveillance Form

Ongoing Medical Surveillance:

Lab users must monitor their health status on an ongoing basis and self-assess for symptoms that may be associated with occupational exposure to any chemicals, infectious materials/organisms and/or toxins that are stored and/or handled in the WA129 and/or WA130 labs.

Infections that result from an exposure to pathogens or infectious material being handled in a containment zone are referred to as LAIs (Laboratory Acquired Infections). LAI also refers to a disease caused by exposure to a toxin being handled in a containment zone.

Self-monitoring is documented annually by completing a medical surveillance form to affirm that self-monitoring is being carried out by each individual as documentation of due diligence.

(Initial)	I understand that, on an ongoing basis, I am expected to self-monitor my health for symptoms associated with exposure to the chemicals, infectious materials/organisms and/or toxins that are stored and handled in the ASET labs.
(Initial)	I understand that I must inform the ASET Manager in the event of the onset of any symptoms associated with exposure to any of the chemicals, infectious materials/organisms and/or toxins that are stored and handled in the ASET labs.
(Initial)	In the event of an exposure to chemicals, infectious materials/organisms and/or toxins, I will refer to ASET's Emergency Response Plan.

2 of 2

ALGONQUIN COLLEGE

Applied Science & Environmental Technology
Student Medical Surveillance Form

In accordance with the *Canadian Biosafety Standard, 2nd edition*[1], Algonquin College's Applied Science and Environmental Technology Department (ASET) has developed a program designed to prevent and detect personnel illness related to exposure to infectious material or toxins. The focus of the program is primarily preventive, but provides a response mechanism through which a potential infection or intoxication can be identified and treated before serious injury or disease occurs. As well, this program addresses the risks associated with the chemical and physical hazards that are present in the WA129 and WA130 labs and helps to prevent incidents related to those materials. Students must monitor their health status on an ongoing basis and self-assess for symptoms that may be associated with occupational exposure to chemicals, as well as infectious materials and toxins.

To ensure a safe work environment, students are strongly encouraged to disclose any underlying medical conditions that may increase the risk of harm associated with working in the laboratories. Students who **are immunocompromised (e.g. through radiation therapy or chemotherapy, pregnancy, diabetes or other conditions) may be particularly susceptible to infections, or experience more severe illness if they contract an infection following exposure to a pathogen.** The ASET labs also has physical hazards as well as various chemical hazards that may affect certain medical conditions; therefore disclosure of medical conditions is strongly recommended to ensure the well-being of students.

Please check one of the following*:

☐ I am affected by one or more of the above mentioned conditions and I will consult with the Biosafety Officer(s) and/or the ASET Chair, prior to entering the WA129 and/or WA130 laboratories.
Please list relevant information here: _____

☐ I am **NOT** affected by any of the above mentioned medical conditions; **however, I do have a medical condition** that that I wish to disclose to ensure my safety when working in the ASET labs. I will consult with the Biosafety Officer(s) and/or the ASET Chair, prior to entering the WA129 and/or WA130 laboratories.
Please list relevant information here: _____

☐ I am **NOT** affected by any of the above mentioned medical conditions.

Student Name (please print)	Signature	Date

***Throughout the academic year, it is incumbent upon all students to disclose any changes in health status that could increase risk of exposure.**

1 of 2

ALGONQUIN COLLEGE

Applied Science & Environmental Technology
Student Medical Surveillance Form

Ongoing Medical Surveillance:

Lab users must monitor their health status on an ongoing basis and self-assess for symptoms that may be associated with occupational exposure to any chemicals, infectious materials/organisms and/or toxins that are stored and/or handled in the WA129 and/or WA130 labs.

Infections that result from an exposure to pathogens or infectious material being handled in a containment zone are referred to as LAIs (Laboratory Acquired Infections). LAI also refers to a disease caused by exposure to a toxin being handled in a containment zone.

Self-monitoring is documented annually by completing a medical surveillance form to affirm that self-monitoring is being carried out by each individual as documentation of due diligence.

(Initial)	I understand that, on an ongoing basis, I am expected to self-monitor my health for symptoms associated with exposure to the chemicals, infectious materials/organisms and/or toxins that are stored and handled in the ASET labs.
(Initial)	I understand that I must inform the ASET Manager in the event of the onset of any symptoms associated with exposure to any of the chemicals, infectious materials/organisms and/or toxins that are stored and handled in the ASET labs.
(Initial)	In the event of an exposure to chemicals, infectious materials/organisms and/or toxins, I will refer to ASET's Emergency Response Plan.

2 of 2

Institutional Biosafety Committee Terms of Reference

1.0 Purpose

The Department of Applied Science and Environmental Technology (ASET) at Algonquin College has established and shall maintain an Institutional Biosafety Committee (IBSC) comprising of members of the College community who are knowledgeable in the safe use of biohazardous materials. The IBSC is involved in the management of the Biosafety Program and is responsible for policy and process oversight to ensure all persons working with biohazardous materials comply with all applicable regulations, guidelines, standards and laws.

Activities in Canada involving human and animal pathogens and toxins are regulated by the Public Health Agency of Canada (PHAC) and the Canadian Food Inspection Agency (CFIA) in accordance with the Human Pathogens and Toxins Act (HPTA), Human Pathogens and Toxins Regulations (HPTR), Health of Animals Act (HAA), and Health of Animals Regulations (HAR). Guidance for the safe handling and storage of human and animal pathogens and toxins are found in the Canadian Biosafety Handbook (CBH) and the Canadian Biosafety Standard (CBS).

The IBSC is responsible for Containment Level 2 (CL2) biosafety and biosecurity oversight of the work conducted in the WA130 laboratory at Algonquin College. This lab is owned by the Department of Applied Science and Environmental Technology (ASET). Guidelines, Plans and Programs that apply to biosafety and biosecurity are detailed in the ASET Biosafety Manual. The official versions of these documents are found on the Algonquin College Biosafety website and are updated continuously as changes are approved by the relevant institutional stakeholders.

2.0 Abbreviations and Acronyms

ASET: Applied Science and Environmental Technology
BRA: Biosecurity Risk Assessment
BSO: Biosafety Officer
CBH: Canadian Biosafety Handbook
CBS: Canadian Biosafety Standard
CFIA: Canadian Food Inspection Agency
CL: Containment Level
CRMC: College Risk Management Committee
HAA: Health of Animals Act
HAR: Health of Animals Regulations
HPTA: Human Pathogens and Toxins Act
HPTR: Human Pathogens and Toxins Regulations
IBSC: Institutional Biosafety Committee

MSRA: Medical Surveillance Risk Assessment
OHS: Occupational Health and Safety
ORA: Overarching Risk Assessment
PAO: Plan for Administrative Oversight
PHAC: Public Health Agency of Canada

3.0 Guiding Principles

Algonquin College's ASET Biosafety Program consists of two constituent elements: (i) *biosafety*, namely the containment principles, technologies, and operational practices to prevent unintentional exposure to pathogens or toxins, and (ii) *biosecurity*, namely the security measures to mitigate loss, theft, or misuse of biohazardous materials. Sound management of the biosafety program necessarily requires participation of different organizational units and the implementation of the biosafety program is therefore a responsibility shared between those different organizational units.

4.0 Responsibilities of the IBSC

1. Formulate and recommend effective procedures governing the use of biohazardous materials/agents in the ASET Department at Algonquin College in accordance with CBS, CBH, PHAC, and CFIA standards and guidelines.
2. Advise on content and review ASET's Biosafety program every five (5) years or as regulatory requirements change.
3. Review and promote training programs that enhance ASET's Biosafety program.
4. Provide advice on the safe use of biohazardous agents and materials under the control of the ASET Department.
5. Provide advice and make itself available to the Biosafety Officers (BSOs) for issues regarding any biohazardous agents/materials, procedures, protocols or events. And respond to biosafety issues that require immediate consultation.
6. Review reports of all inspections, incidents, unusual occurrences and relevant materials presented by the BSOs. Make any recommendations deemed appropriate based on the information supplied in these reports.
7. Review all audits and reports regarding biosafety sent to the ASET Department by Federal, Provincial or Municipal authorities. Make any recommendations deemed appropriate based on the information supplied in these audits or reports.
8. Reviews the Overarching Risk Assessment (ORA), Medical Surveillance Risk Assessment (MSRA), Biosecurity Risk Assessment (BRA) and lab inspection reports on an annual basis.
9. Approve requests to commission/decommission laboratories in which biohazardous agents were or will be used.

5.0 Committee Membership

The IBSC shall be comprised of members of the College community with experience and training that enables them to advise on the containment principles, technologies, and operational practices to prevent unintentional exposure to pathogens or toxins. Members of the committee are appointed by the Manager, Department of Applied Science and Environmental Technology (ASET) in consultation with the Manager, Occupational Health and Safety (OHS).

1. Co-Chair
   - Academic Chair (Manager), Department of Applied Science and Environmental Technology (ASET)
   - License Holder under the Human Pathogens and Toxins Act (HPTA)
   - Graduate degree in Biology/Biochemistry/Biotechnology or a closely related field

2. Co-Chair
   - Manager, Occupational Health and Safety (OHS)
   - Training in Industrial Hygiene

3. Biosafety Officer(s)
   - Diploma or degree in Biology/Biochemistry/Biotechnology or a closely related field
   - Biology and Microbiology training

4. Laboratory Technologist(s)

5. Faculty Member(s)
   - Subject-matter expert(s) in Biology/Biochemistry/Biotechnology or a closely related field

6.0 Role of the Co-Chairs

The Manager of OHS and Chair (Manager) - ASET will act as co-chairs of the IBSC. Their responsibilities include the following:

1. To review previous minutes and materials prior to the meetings.
2. To prepare and arrange the IBSC meeting agenda.
3. To chair IBSC meetings.
4. To ensure the maintenance of an unbiased viewpoint.
5. To prepare meeting minutes and distribute to IBSC members.
6. To liaise with any other Algonquin College committees on issues related to the Biosafety program and report the issues to the committee for resolution.
7. To review recommendations by the IBSC and make final decisions on these recommendations; and plan, direct, and control operations related to the Biosafety program.

8. To prepare and submit an executive summary report once per year to Senior Managers and Executives at Algonquin College to provide a report on the continued management of biosafety and biosecurity risks at Algonquin College.
9. The Licence Holder is responsible for informing all persons who are conducting controlled activities authorized by the licence of its conditions.

7.0 Role of the Chair (Manager), ASET Department

The ASET Department is responsible for administering the ASET Biosafety Program. The Program is outlined in Algonquin College's Plan for Administrative Oversight (PAO) and the Manager, ASET Department is responsible for the following:

1. To develop policies and implement effective procedures for implementation of CBS, PHAC, and CFIA standards and guidelines.
2. To ensure compliance with regulations for the use of, or exposure to, biohazardous materials.
3. To ensure that training sessions regarding biosafety and biohazards are completed by all lab users.
4. To conduct investigations of any incidents related to accidents, injury, and/or noncompliance related to biosafety.
5. To authorize purchase requests for biohazardous materials.

8.0 Role of the Biosafety Officer(s)

Algonquin College employs one or more Biosafety Officers (BSOs) who play a key role in assisting scientific and technical staff in navigating the administrative and regulatory obligations associated with biosafety. The BSO(s) act as a liaison between Algonquin College and PHAC on regulatory issues. The BSO(s) are responsible for the day-to-day operations of the Biosafety program including, but not limited to, the following:

1. To assist the Manager, ASET in developing policies and implementing effective procedures for implementation of the CBS, PHAC, and CFIA standards and guidelines.
2. To monitor compliance by conducting risk assessments and internal inspections/audits.
3. To develop, oversee, and document biosafety-related training.
4. To notify the Manager, ASET (Licence Holder) of any lab acquired infections (LAIs), inadvertent possession of human toxins, pathogens not received as expected.
5. To inform the Manager, ASET (Licence Holder) of any non-compliance by a person conducting activities under the license.
6. To establish procedures for dealing with spills.
7. To keep abreast of legislation concerning biohazardous materials and advise the IBSC about potential impacts on the College.

8. To determine the containment requirements and perform risk assessments, when necessary, before purchasing biohazardous materials.
9. To assist the Manager, ASET in investigations of any incidents related to accidents, injury, and/or noncompliance related to biosafety.
10. To compile and provide any reports/documentation as required by the regulatory agencies and communicate with those agencies on behalf of the licence holder.
11. To inform regulatory agencies of any inadvertent possession of a pathogen or toxin.
12. To verify the accuracy and completeness of licence applications or renewals.
13. To work collaboratively with all management, faculty, staff, students, and external agents as it relates to the continual improvement of the Biosafety program.

9.0 IBSC Meetings

The Members will meet on a regular basis with a minimum of two meetings per year, the timing of which shall be determined by the Co-Chairs. Emergency or special meetings may be called at any time by either Co-chair at his/her/their discretion for the following reasons, but not limited to:

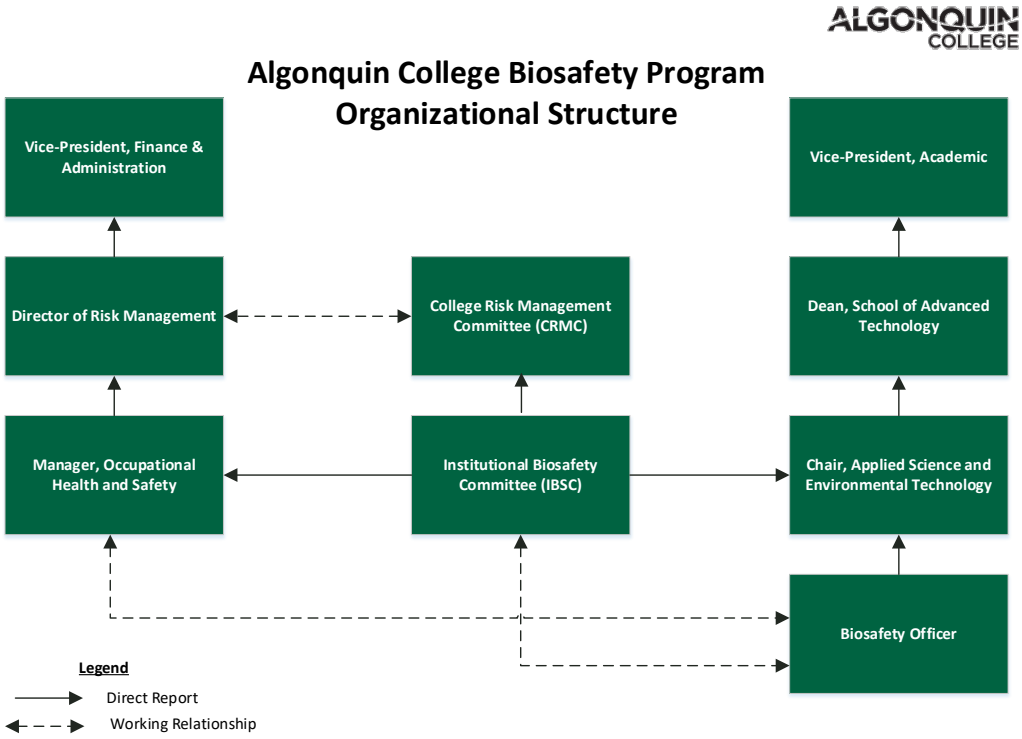
1. Accident investigations
2. Enforcement of conditions of the Biosafety license
3. Dangerous occurrences involving biohazardous agents or materials
4. Contamination/exposure incidents
5. Laboratory acquired infections
6. Resolution of conditions dangerous to health and safety regarding biohazardous agents or materials
7. Events or issues raised by members of the IBSC

The manner and conduct of the meetings of the Biosafety Committee shall be determined by either Co-Chair and may be held in person, by teleconference, by videoconference or by email as appropriate for the circumstances. Quorum shall be established by the mandatory attendance of the following members:

1. Co-Chair, Manager – OHS, or delegate
2. Co-Chair, Manager – ASET, or delegate
3. Biosafety Officer(s)

10.0 Reporting Responsibility

The ASET Institutional Biosafety Committee reports any identified risks or breaches to both the College Risk Management Committee (CRMC) through the Manager of OHS and to the Academic Area through the Manager-ASET.



11.0 Approval of Terms of Reference

The responsible authority, Manager-ASET, will have final approval of these Terms of Reference.

Visitor's Policy: ASET A130 Laboratory

Normally, a trained staff member must supervise visitors to the Applied Science and Environmental Technology (ASET) room WA130 laboratory. The supervising staff member must have signed off on all required safety documentation. It is the responsibility of the staff member in charge of the visitor(s) to ensure that the visitor(s) comply with all safety precautions. The staff member must advise the visitor(s) that they shall not touch any equipment and/or chemicals. Some visitor(s) may need to fill out a Medical Surveillance Form: please reach out to Adam Shane, Manager of ASET.

The trained staff member must advise visitors of the following:

Individuals with the following conditions should NOT enter the lab:

- **Allergic to any chemicals;**
- **Pregnant;**
- **Have an immune deficiency;**
- **Are taking immunosuppressive drugs;**
- **Have any other medical condition that may require special precautionary measures in a laboratory environment.**

Visitors are identified as individuals who have not received ASET training, i.e. Faculty/Staff, researchers and students who have completed ASET health and safety training are not considered visitors. Please note that students working in the laboratory must be supervised by a trained staff member at all times.

1

ALGONQUIN COLLEGE

Visitor's Policy: ASET A130 Laboratory

Proper Clothing and Footwear must be worn in this lab

Shoes should be comfortable, rubber soled, and cover the entire foot. Heels are not recommended. Since canvas shoes will absorb chemicals or infectious fluids, they are not recommended. Leather or a synthetic, fluid-impermeable material are recommended. Skin (top of foot, ankles and legs) must be covered – this offers protection should any chemicals or infectious materials spill. PPE (personal protective equipment) including lab coat, safety glasses or goggles and nitrile gloves may be required upon entry – consult with the Professor or the Lab Technologist(s).

Examples of Footwear that are Permitted and are NOT Permitted:

2

ALGONQUIN COLLEGE

Visitor's Policy: ASET A129 Laboratory

Normally, a trained staff member must supervise visitors to the Applied Science and Environmental Technology (ASET) room WA129 laboratory. The supervising staff member must have signed off on all required safety documentation. It is the responsibility of the staff member in charge of the visitor(s) to ensure that the visitor(s) comply with all safety precautions. The staff member must advise the visitor(s) that they shall not touch any equipment and/or chemicals. Some visitor(s) may need to fill out a Medical Surveillance Form: please reach out to Adam Shane, Manager of ASET.

Visitors are identified as individuals who <u>have not</u> received ASET training, i.e. Employees, researchers and students who have completed ASET health and safety training are not considered visitors. Please note that students working in the laboratory must be supervised by a trained staff member at all times.

Before entry, please ensure that you have been trained or are being accompanied by a trained staff member.

1

ALGONQUIN COLLEGE

Visitor's Policy: ASET A129 Laboratory

Proper Clothing and Footwear must be worn in this lab

Shoes should be comfortable, rubber soled, and cover the entire foot. Heels are not recommended. Since canvas shoes will absorb chemicals or infectious fluids, they are not recommended. Leather or a synthetic, fluid-impermeable material are recommended. Skin (top of foot, ankles and legs) must be covered – this offers protection should any chemicals or infectious materials spill. PPE (personal protective equipment) including lab coat, safety glasses or goggles and nitrile gloves may be required upon entry – consult with the Professor or the Lab Technologist(s).

Examples of Footwear that are Permitted are and NOT Permitted:

2

Appendix 7: TNAM

All ASET lab personnel are provided with their annual Training Needs Assessment Matrix (TNAM) when they first start working in the ASET labs and again annually, see Figure 1 (Appendix 7).

ASET Training Needs Assessment Matrix for Employees Designation: NEW Professor - WA129 and WA130 labs (Full Access*) Required Completion Date: 31-Dec-23			
Training Sessions:		**Requirements**	**Notes**
Module 1	General Lab Safety and Orientation: Introduction to the A129 and A130 Labs	In Development	In-person session. Completed every 5 years.
Module 1m	Modified General Lab Safety and Orientation (e.g. Field Course Staff)	In Development	Completed every 5 years.
Module 1a	Annual Emergency Response Training	**Required**	Completed annually.
Modulel 2	Intensive WHMIS	In Development	Completed every 5 years.
Module 2m	Modified WHMIS (e.g. Field Course Staff)	In Development	Completed every 5 years.
Module 3	Biosafety, including Biological Safety Guidelines	**Required**	Completed every 5 years.
Module 4	Chemical Safety, including Chemical Safety Guidelines and Equipment Guidelines	In Development	Completed every 5 years.
As needed basis (lab specific, e.g. equipment):			
None		**N/A**	
Other:			
First Aid		Recommended	Consult with ASET Manager regarding opportunities.
TDG		Not Required	
Algonquin College Training:			
Algonquin College Legislated and Mandated Training for Employees - Click here for link to training		**Required**	Consult with ASET Manager regarding completion.
PHAC Modules (Log into PHAC to complete these courses - Click here for more information):			
Biological Safety Cabinets - when complete, upload to assignment link on Brightspace		**Required**	Completed every 5 years.
Laboratory Acquired Infections - when complete, upload to assignment link on Brightspace		**Required**	Completed every 5 years.
Biosafety in the Classroom: Post-Secondary Laboratories Course- NEW		**Required**	Completed every 5 years.
* WA129 and WA130 Full Access is defined as access to A129, A129a,b,c and A130, A130a,b,c,d,e,f; also includes access to biologicals, all chemicals and equipment (note: Module 1 and 1m training informs all individuals that they are not to use chemicals or equipment unless training on specific chemicals and equipment has been completed and documented).			

Figure 1 (Appendix 7): TNAM for ASET Employee

ASET's Risk Assessment Process

1.0 Purpose

These guidelines provide the general instructions to follow when new student lab protocols/activities are developed and risk assessed for the ASET (Applied Science and Environmental Technology) Department (WA129 and WA130 labs).

2.0 Abbreviations and Acronyms

ASET: Applied Science and Environmental Technology
BSC: Biological Safety Cabinet
BSO: Biosafety Officer
CL: Containment Level
HPTA: Human Pathogens and Toxins Act
PHAC: Public Health Agency of Canada
PPE: Personal Protective Equipment
RA: Risk Assessment
RAT: Risk Assessment Table
RRF: Reagent Request Form
SOP: Standard Operating Procedure
TNAM: Training Needs Assessment Matrix
WHMIS: Workplace Hazardous Materials Information System

3.0 Responsibilities

ASET Manager: Ensures that all ASET lab personnel (excluding students) are aware of "ASET's Risk Assessment Process" by delegating this duty to one or both of the Biosafety Officer(s). The ASET Manager also reminds faculty member(s) of these processes when assigning lab development.

Biosafety Officer(s): Ensure that all ASET lab personnel (Technologists, Faculty, Staff, Researchers, Technicians), excluding students, are aware of this process by introducing during the General Lab Safety and Orientation training session, which all ASET lab personnel must complete. The Biosafety Officers (BSOs) are also responsible for conducting risk assessments.

ASET Lab Personnel (excluding students): Must comply with the details outlined in this document.

4.0 Lab Activity Risk Assessment Guidelines

All student lab activities must be risk assessed before delivery to students and completion by students. The ASET Manager is responsible for assigning the development of student lab

activities/protocols to Faculty members. The Biosafety Officer(s) (BSO) are responsible for conducting the risk assessment. Faculty are responsible for providing risk-assessed protocols and activities to students.

Ordering/obtaining biological material, including pathogens and toxins, is covered in ASET's Biological Safety Guidelines (Appendix 10).

4.1 Risk Assessment Procedure and Lab Repository

- The Faculty member assigned to lab development obtains the two required templates (Experiment Template and Reagent Request Form [RRF] template) from the Microsoft Teams site.
    - Once lab development is completed, the faculty member submits both documents in a timely manner (as determined by ASET Manager) to the designated BSO for review by saving them in the Microsoft Teams site and alerts the BSO (via. email) that the documents are available for review and with a link to the documents.
- The BSO reviews the documents to assess for hazards/risks and ensures that the ASET Department is following applicable legislation, such as the Human Pathogens and Toxins Act (HPTA).
    - If the documents submitted to the BSO are incomplete or if there are errors/inconsistencies, the BSO will email the faculty member, indicating the errors/inconsistencies or what is missing. Conversations may take place to discuss what clarification is required and what the next steps will be.
    - The BSO ensures that the activities align with the ASET Department's Public Health Agency of Canada (PHAC) Licence and other applicable legislation.
    - The BSO reviews for potential hazards and risks, such as specific jobs, activities, chemicals and biologicals used, etc. Some jobs might need to be broken down into a sequence of steps to better understand the hazard and determine risk mitigation.
    - The BSO documents these risks and mitigation strategies/preventative measures in a risk assessment table (RAT) (Addendum A of this guideline), which also lists examples that the BSO may use when completing the risk assessment.
    - Occasionally, the BSO might need to converse with the faculty member to determine substitution, elimination, etc. mitigation strategies.
    - Once the primary BSO completes the risk assessment, a second review (brief) may be completed by the second BSO.
    - The final documents, including the lab protocol, accompanying RRF and RA Table, are saved in in the Microsoft Teams site by the primary BSO.
    - **Only the final document (in PDF format) shall be provided to the students and used for regular student lab activities.**

- Generally, if edits to these documents are required, the RA process must begin again. For more information, contact the BSO(s).

4.2 Resources Available for Risk Assessment (Completed by BSO)

- Workplace Hazardous Materials Information System (WHMIS)
- ASET Lab Safety Manual
- ASET Biosafety Manual
- ASET Guidelines
- Safety Data Sheets
- Pathogen Safety Data Sheets
- Epathogens website
- Other biosafety websites
- Canadian Biosafety Standard
- Canadian Biosafety Handbook
- Canadian Biosafety Guideline - Dual-Use in Life Science Research
- HPTA and HPTR
- HAA and HAR
- PHAC and CFIA contacts
- Ontario H&S Act and Guide
- Canada Health and Safety Regulations
- Scientific journals
- Published safety manuals
- Manufacturer's bulletins and equipment manuals
- Lab records (incidents/accidents, equipment maintenance, inspections)
- Other online sources
- Etc.

4.3 Examples of Hazards and Risks to be Considered (Completed by BSO)

- **Biological Hazard**
  - Engineering controls, administrative controls, PPE
  - Risk Group level - appropriate containment measures and controls (consider method of infection, e.g. inhalation, etc.)
    Consider:
    - Quantities and concentration
    - Form or state (eg. Liquid, solid, powder)
    - Who is performing the activity (experienced, junior tech, students)
    - How pathogen gains entry into host
    - Host range
    - Stability of pathogen outside of host

- Genetically modified organisms, viral vectors and synthetic biological devices and systems. Although the risk group and containment level may have been determined for a particular pathogen, modifications to a pathogen that increase risks posed by the pathogen may result in changes to the physical containment or operational practice requirements.
  Consider:
  - Does the modification alter pathogenicity or virulence or decrease the effectiveness of anti-infective agents?
  - Does the modification alter pharmacological activity (e.g. Resistance to antibiotics)?
  - Does the modification delete genetic material or introduce m=novel genetic material with potentially adverse effects (e. g. Insertion of an oncogene)?
  - Does the inserted gene encode a toxin or a relatively uncharacterized toxin?
  - Does the modification produce attenuated strains of recombinant pathogens that have lost virulence factors?
  - Does the modification produce host bacterial or viral vectors with limited ability to survive outside the laboratory?
  - Is the genetically modified organism (GMO) replication competent?
  - Can the modification alter the host range or cell tropism?
  - Can there be novel hazards of the GMO that may not be well characterized?
  - Are potentially pathogenic factors associated with the donor nucleic acid segment?
  - What are the properties of the donor nucleic acid segment?
  - If the modification has resulted in a form of attenuation, how extensively has this strain been utilized without incident and/or has the attenuation been proven in animal models?
  - Does the modification have an effect of increasing or decreasing the efficacy of available treatment or prophylaxis?
- Dual-use potential: See Figure 1 (Appendix 8).

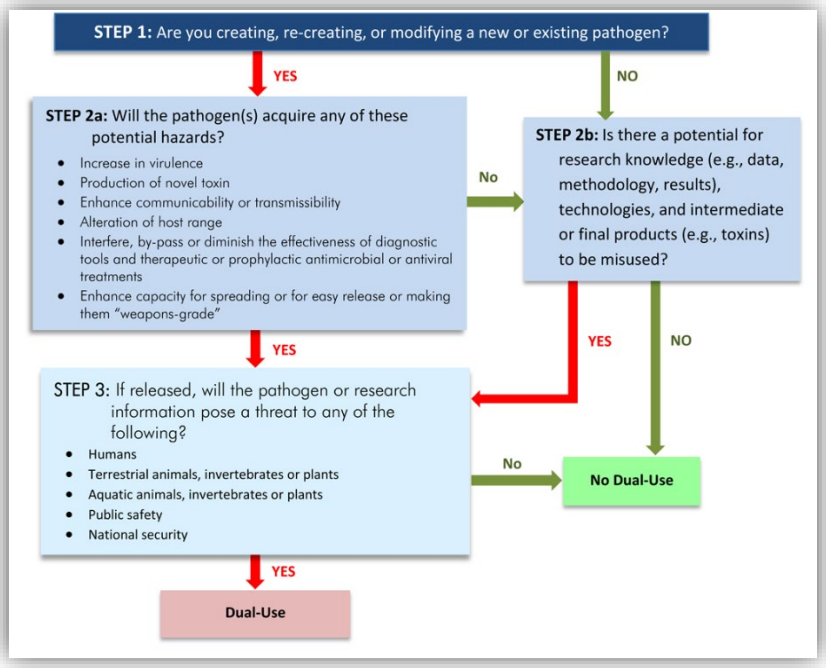


Figure 1 (Appendix 8): Decision Tree to Identify Research with Dual-Use Potential
(Canadian Biosafety Handbook, Figure 18.2)

- Cell lines: Many cell lines do not inherently pose a risk to the individuals manipulating them; however, cell lines can harbour infectious materials. A pathogen risk assessment should be performed for every new cell line that is manipulated in a laboratory in order to determine the appropriate level of precautions to be taken.
  Consider:
  - Source of cell line: provides an indication of possible contaminants and latent viruses. For example, tumor cells may have oncoviruses; some pathogens are predominantly found in their target tissue.
  - Source tissue: provides an indication of possible contaminants and latent viruses. For example tumor cells may have oncoviruses; some pathogens are predominatly found in their target tissue
  - Type: may provide indication of potential risks. For example, primary cultures are not well characterized and may harbour pathogens from an infected donor; continuous cell lines have undergone a transformation to become immortal; intensively characterized, established cell lines may be less likely to contain infectious material;
  - Source population: The particular breeding group or colony of the specimen from which the cell line was derived can provide some indication of the likelihood a given pathogen is present. For example,

cell from a "specific pathogen free" primate colony are much less likely to harbour simian B virus than cell from "wild caught" primates. This does not take into account the possibility of contamination from other cell lines that may have been handled simultaneouly.

- (Bio) aerosols (activities with potential of aerosol generation)
  - Pipetting (blowing out pipettes)
  - Cell sorters
  - Shaking or vortexing, stirring
  - Sonicating homogenizing, blending, grinding, cell disruption
  - Opening lyophilized culture, opening snap top tubes, breakage of culture containers
  - Centrifugation steps – filling tubes, removing plugs or caps after centrifugation, removing supernatant, resuspending pellets, breakage during centrifugation, centrifugation itself
  - Flaming loops or slides
  - Pulling needles out of septums, filling a syringe
  - Pouring liquids
  - Etc.
- Risk of splashes
- In vivo work (NOT permitted)
- Standard Operating Procedures (SOPs) in existence or required?
- Physical Containment, e.g. use biosafety cabinet (BSC)
- Movement of infectious materials
- Waste disposal requirements
- Biological toxins – PHAC regulated?
- Etc.

- **Chemical Hazard**
  - Engineering controls, administrative controls, PPE
  - Strong acids or bases (corrosive)
  - Dangerous chemicals, e.g. DCM
  - Mutagen, Carcinogen, Teratogen, Toxicity, etc.
  - Volumes
  - Concentrations
  - Flammability
  - Reactivity
  - Inhalation – dusts, mists, fumes, vapours, etc.
  - Risk of splashes
  - Access to chemicals
  - Liquid Nitrogen
  - SOPs in existence or required?

- Designated substances (occupational exposure limits)
- Peroxide forming
- Physical containment e.g. Use fume hood
- Movement of chemicals
- Compressed gases
- Waste disposal requirements
- Etc.

- **Physical Hazard**
  - Engineering controls, administrative controls, PPE
  - Equipment:
    - Centrifuge
    - Autoclave
    - Alcohol burner
    - Bacticinerator
    - Hotplate
    - Vortex
    - Sonicator
    - Etc.
  - SOPs in existence or required?
  - Pressure – high or low
  - Electrical
  - Fire hazard
  - Compressed gases
  - Explosive or hazardous reaction
  - Impact hazard
  - Temperature – high or low
  - Sharps
  - Noise or vibration
  - Physical strain
  - Pinching or crushing
  - Etc.
- **Other:**
  - Radiation Hazard
  - Waste Generation and Disposal
  - Health Hazard
  - Slip, trip, fall
  - Etc.

4.4 Risk Mitigation Strategy Examples (Completed by BSO)

- Contain the hazard, revise work procedures, reduce the exposure (e.g. work in fume hood or BSC)
- Isolation (e.g. physical containment)
- Engineering controls (e.g. lab design)
- Elimination

- Substitution (e.g. substitute hazardous chemical for a less hazardous alternative)
- Administrative Controls
    - Signage
    - SOPs
    - Selection and use of PPE (e.g. glove type, face shield, etc.)
    - Training
    - Vaccination
- Operational Requirements
    - Containment equipment and supplies (e.g. closed, screw-capped tubes)
    - Centrifuge cups with aerosol resistant lids with o-rings
    - Appropriate PPE
    - Decontamination and disposal methods
    - Medical surveillance
- Training requirements
- Refer to ASET guidelines, TNAM, etc.
- Substitute CL2 organisms for CL1, whenever possible
- Substitute hazardous chemical for a less hazardous alternative
- Work with small volumes or reduce the quantity to lessen the intensity of any hazardous condition, e.g. work with a few grams or a fraction of a gram.
- Purchase and use dilute solutions instead of concentrated solutions
- Replace equipment requiring 120 volts AC with equipment that will run on 24 volts AC
- Reduce buildup of static charge by grounding the containers or apparatus involved
- Use lower temperature instead of higher temperatures
- Filter tips
- Reverse pipetting
- Use vacuum line traps to protect vacuum systems from aerosols
- Etc.

4.5 Final Documentation

4.5.1 Lab Protocol

The BSO saves the final protocol in the Microsoft Teams site, and in the format: “Name of Lab Protocol.date.LP” (LP for Lab Protocol and the date is in the form DD-Mmm-YY [e.g. 01-Jan-22]). This naming format allows for document control.

4.5.2 Reagent Request Form (RRF)

The BSO saves the final RRF in the Microsoft Teams site, and in the format: “Name of Lab Protocol.date.RRF” (RRF stands for Reagent Request Form and the date is in the form DD-Mmm-YY [e.g. 01-Jan-22]). This naming format allows for document control. Note that some lab courses may have an RRF that covers an entire semester; therefore, each lab

protocol will not have an individual RRF document. In those cases, the title of the RRF may be in the format "Name of **Lab Course**.date.RRF", with the date being the final date that the RRF was updated.

4.5.3 Risk Assessment Table (RAT)

The BSO saves the final RA Table in the Microsoft Teams site, and in the format: "Name of Lab Protocol.date.RAT" (RAT stands for Risk Assessment Table and the date is in the form DD-Mmm-YY [e.g. 01-Jan-22]). This naming format allows for document control.

4.5.4 PSDS and SDS

BSO(s) ensure that SDS and PSDS are available in the appropriate (i.e. depending on program – Biotechnology, WWT, EMA, Food Science, SAT Foundations) Microsoft Teams Folder as well as the SDS computers in the A129 and A130 lab. Faculty ensure students have access to the SDS and PSDS by posting on their course Brightspace. For consistency, all lab Brightspace pages must have a module called SDS and PSDS.

4.6 Post RA Procedures

- **Only the risk assessed lab and associated documents shall be used for student activities.**
- Once a lab activity is risk assessed, it does not have to be risk assessed again unless there is a change in the activity, a new or different risk is identified, or the activity becomes non-compliant. If any incidents (e.g. injuries, accidents, etc.) have occurred since implementation, then a review is required.
- **Faculty and Technologists must review the RA documents prior to the labs running.** The risk assessment table (RAT) table is a document that communicates the hazards, risks and mitigation strategies to both the Technologist, who is supporting the laboratory, and the faculty member, who is delivering the activity to the students. It is important that all users are aware of the risks and the strategies that are used to ensure the safety of all individuals in the lab. Faculty and Lab Technologists should refer to the RAT document regularly to ensure that mitigation procedures are being followed while the lab activity/protocol is taking place.

5.0 Regulatory Standards

Human Pathogens and Toxins Act
Human Pathogens and Toxins Regulations
Canadian Biosafety Standard, 3rd edition
Canadian Biosafety Handbook, 2nd edition

6.0 Other College Resources

AC's Health and Safety Policies
AC's Occupational Health & Safety Department's Website

Risk Assessment Table (RAT)

Name of Laboratory:	
Primary Risk Assessor/BSO:	
Secondary Risk Assessor/BSO:	
Final Approval Date:	

Hazard (What can cause harm) Identification and Characterization	**Risk (chance that harm will happen)** Identification and Assessment **May need to break the job down into a sequence of steps. (consider: likelihood, consequences and severity)**	**Mitigation Strategies/Protective Measures in Place** emergency equipment/procedures in place **(note: more oversight and mitigation controls may be required for students)**	**Outcome** • Is risk acceptable? • Are mitigation measures acceptable? • Are proper measures in place? • If not, send back to activity lead requesting modification.
Biological Materials Assessment			
• Bacteria or fungi (RG1), already in ASET inventory • Bacteria or fungi (RG2 pathogen, NOT infectious via. aerosol route), already in ASET inventory • Bacteria or fungi (RG2 pathogen, infectious via. aerosol route), already in ASET inventory	• Aerosols - exposure from pipetting, centrifuging, sonicating, breakage, etc. • Large volumes – exposure from spills • How is it being used, i.e. specific technique – is there a risk of splash, etc. • Investigate any other potential risks	• Refer to ASET's "Biological Safety Guidelines" • Indicate PPE required • Work on benchtop using regular pipetting technique • Must work in the BSC – this must be documented in the lab protocol – in reagent table and body of protocol • Refer to PSDS • Small volumes used • Disposal and decontamination steps include…. • Indicate training required (student, employee, etc.) – including emergency response plan	

		• Whenever possible, use plastic containers to avoid breakage. • Etc.	
Bacteria or fungi not in ASET inventory	• Is it RG1 or RG2? • Is it a pathogen that is infectious via the aerosol route?	• Follow "ASET's Biological Safety Guidelines, Appendix A: ASET's Risk Assessment Tool for Acquisition of Biological Materials and Toxins" (to ensure it is approved for purchase.	
Work with toxin (biological or other)		• Follow "ASET's Biological Safety Guidelines, Appendix A: ASET's Risk Assessment Tool for Acquisition of Biological Materials and Toxins" (to ensure it is approved for purchase.	
Products of Biotechnology SSBA (dual use) – see decision tree, Figure 4.1, recombinant DNA			
Human fluids (e.g. blood, urine), etc.	Work denied – not allowed in ASET labs		
Human cell lines (e.g. HeLa)			
Animal cell lines			
Aquatic animals, aquatic animal tissues, fluids, cells or other samples.			
Terrestrial animals, Terrestrial animal tissues, fluids (e.g. blood), cells or other samples			

Environmental Samples – Soil, water and waste water	• If it contains infectious material, lab personnel could become ill		
Plants, plant tissues, fluids, cells or other samples			
Microorganisms, protozoa, pests or parasites, algae, viruses or viral vectors			
Prions	Work denied – not allowed in ASET labs		
In vivo work	Work denied – not allowed in ASET labs		
Other biological samples/specimens	• If it contains infectious material, lab personnel could become ill		
Etc.			
Chemical Assessment			
• Risk of fire or explosion • Risk of splash • Dust/powders • Combustible • Volatile • Etc.		• Work in fume hood • Training • PPE – details (e.g. faceshield required) • Refer to SDS • Proper disposal	
Toxic, Mutagens, carcinogens, etc.			
Liquid nitrogen			
Acid bases, caustic chemicals			
Organic Solvents			
Etc.			

Physical/Procedural Assessment			
Risk of fire			
Dangerous equipment: centrifuge, autoclave, etc.			
-80 freezer			
Heating equipment – hot plates, heating blocks, Bunsen burner, alcohol burner, ovens, etc.			
Apparatus under high vacuum (pressure), distillations, etc.			
Etc.			

File Name for RA Table Document:
Name of Protocol.date as DD-Mmm-YY.RAT

File Name for Associated lab protocol:
Name of Protocol.date as DD-Mmm-YY.LP

ASET's Lab Inspection Guidelines

1.0 Purpose

This document outlines the lab inspection process that takes place in the ASET (Applied Science and Environmental Technology) Labs (WA129 and WA130). Routine lab inspection is an important component of a lab safety program and the ASET Department ensures that lab inspections take place on a regular basis (generally, monthly).

2.0 Abbreviations and Acronyms

ASET: Applied Science and Environmental Technology
BSO: Biosafety Officer
IBSC: Institutional Biosafety Committee

3.0 Responsibilities

ASET Manager: Ensures that all ASET lab personnel are aware of "ASET's Lab Inspection Guidelines" procedures by delegating this duty to one or both of the Biosafety Officer(s).

Biosafety Officer(s): Ensure that all ASET lab personnel are aware of these guidelines by introducing during the "General Lab Safety and Orientation" training session, which all ASET lab personnel (Technologists, Faculty, Staff, Researchers, Technicians and ASET students), must complete.

ASET Lab Personnel: Ensure that they are familiar with the details of these guidelines.

4.0 Rules, Processes and Procedures

The Biosafety Officer(s) (BSO) are responsible for conducting regular lab inspections. Generally, lab inspections take place once per month, using the Laboratory Inspection Form (Addendum A of this guideline). The BSO(s) will follow up with the ASET Manager to discuss any non-compliance. Laboratory Inspection Forms may also be reviewed at subsequent IBSC meetings.

5.0 Regulatory Standards

Human Pathogens and Toxins Act
Human Pathogens and Toxins Regulations
Canadian Biosafety Standard, 3rd edition
Canadian Biosafety Handbook, 2nd edition

6.0 Other College Resources

AC's Health and Safety Policies
AC's Occupational Health & Safety Department's Website

ASET's Laboratory Safety Inspection Form

Room#:	Inspector:	Date:	Time:

General Safety		Yes	No	N/A
1	Doors are locked when no one is in lab.			
2	Exit doors are not blocked and are easily accessible (4 exit doors in A130, 3 in A129).			
3	Eyewash and safety showers are unobstructed and easily accessible (2 in each lab).			
4	Fire extinguishers are unobstructed and easily accessible (2 in each lab).			
5	First aid kits contain sterile waterproof bandaids and hard copies of incident reporting forms.			
6	Hand-washing sink (WA130) is freely available.			
7	Lab is free of slip and trip hazards.			
8	Lab is clean, neat and orderly.			
9	Minimal glassware is stored on carts, near sinks, etc.			
10	Lab sinks are clean and free of clutter.			
11	Benches and floors are kept free of chemicals, biologicals and equipment not in use.			
12	Fume hoods are free of clutter and unnecessary chemicals.			
13	Hoses or cords are not inserted through the face of fume hoods; instead, they must run underneath the airfoil so the sash can close completely.			
14	Emergency contact information is posted in the lab.			
15	Extension cords are not "daisy-chained".			
16	Hazardous laboratory equipment is regularly inspected, maintained and serviced.			
17	No food or drinks in lab.			
18	Proper PPE in use (lab coats, gloves, safety glasses/goggles etc.).			
19	Loose clothing, long hair, dangling accessories, jewellery, or other similar items are tied, covered, or otherwise secured to prevent a hazard.			
20	Appropriate clothing is worn by all (no shorts, sandals, etc.).			
21	Is there any evidence of non-compliance with safety rules?			
Biological Safety				
22	WA130 Main lab door is kept closed and is not blocked open.			
23	Effective disinfectants are on hand and are not expired.			
24	BSCs are free of clutter and stored items. Biological waste stored in the BSC is disposed of in a timely manner.			

25	BSC has been tested and certified with the past 12 months.			
26	Biological spill kit is in proper location (under BSC in lab).			
27	Biological material is used in appropriate location (e.g. RG2 that is infectious via inhalation is used in BSC only).			
28	Separated paperwork stations are used when pathogens are in use.			
29	Infectious material is stored and handled properly.			
30	Proper PPE is worn by all persons handling infectious material.			
31	Lab users understand the proper disposal of the pathogens in use.			
32	Autoclave is tested regularly.			
33	Biohazardous waste is contained in closed containers and autoclaved in a timely manner.			
34	Is there any evidence of non-compliance with safety rules?			
Chemical Safety				
35	Proper WHMIS labels are found on all WHMIS controlled products.			
36	Chemical spill kit is in proper location.			
37	SDS computers are operational.			
38	All compressed gas cylinders are securely anchored to prevent them from falling or tipping.			
39	All compressed gas cylinders are capped when not in use.			
40	Lab users understand the proper disposal of the chemicals in use.			
41	Is there any evidence of non-compliance with safety rules?			

Notes:

ASET's Biological Safety Guidelines

1.0 Purpose

These guidelines outline the procedures to follow when working with biological materials and biological toxins in the ASET (Applied Science and Environmental Technology) Labs (WA129 and WA130).

In the context of biosafety and biosecurity, biological material is defined as pathogenic and non-pathogenic microorganisms, proteins, and nucleic acids, as well as any biological matter that may contain microorganisms, proteins, nucleic acids or parts thereof. Biological toxins are poisonous substances that are produced by living organisms.

2.0 Abbreviations and Acronyms

ASET: Applied Science and Environmental Technology
BSC: Biological Safety Cabinet
BSO: Biosafety Officer
CL: Containment Level
HPTA: Human Pathogens and Toxins Act
HAA: Health of Animals Act
IBSC: Institutional Biosafety Committee
PHAC: Public Health Agency of Canada
PPE: Personal Protective Equipment
PSDS: Pathogen Safety Data Sheet
RG: Risk Group
TDG: Transportation of Dangerous Goods

3.0 Responsibilities

ASET Manager: Ensures that all ASET lab personnel are aware of "ASET's Biological Safety Guidelines" by delegating this duty to one or both of the Biosafety Officer(s).

Biosafety Officer(s): Ensure that all ASET lab personnel are aware of these guidelines by introducing during the "General Lab Safety and Orientation" training session, which all ASET lab personnel (Technologists, Faculty, Staff, Researchers, Technicians, and ASET Students) must complete.

ASET Lab Personnel: Must comply with the details in this document. Faculty are responsible for ensuring that students under their supervision follow these guidelines, whenever necessary. Supervisors are responsible for ensuring that personnel under their supervision follow these guidelines, whenever necessary.

4.0 Algonquin College's Commitment Regarding Biohazardous Materials

Algonquin College is committed to administratively manage and control biosafety and biosecurity and the associated risks in accordance with the applicable legislation, regulations and standards. These guidelines serve to protect members of the Algonquin community, the public, and the environment when biohazardous materials are used in education, applied research, or any other ASET activity occurring at Algonquin College in the WA129 and WA130 laboratories.

1. Algonquin is committed to managing and controlling biosafety and biosecurity risks to ensure the protection of students, employees, and visitors in all Algonquin facilities.
2. The ASET Department shall maintain and disseminate a Biosafety Program in accordance with the Human Pathogens and Toxins Act (HPTA), Health of Animals Act (HAA) and their associated regulations. **Algonquin's Biosafety Program shall consist of the following components:**
    - Senior Management Letter of Commitment
    - Overarching Risk Assessment
    - Algonquin's Plan for Administrative Oversight of Pathogens and Toxins
    - Biosafety Manual, including:
        - Biosecurity Plan
        - Medical Surveillance Program
        - Emergency Response Plan
        - ASET Biological Safety Guidelines
        - Institutional Biosafety Committee (IBSC) Terms of Reference
    - ASET Department Biosafety Training Program
3. Roles and responsibilities within the Biosafety Program are outlined in ASET's Biosafety Manual and Terms of Reference for the Institutional Biosafety Committee.
4. The Biosafety Manual shall be readily available to Algonquin personnel.
5. The ASET Department shall maintain internal accountability through biosafety and biosecurity risk assessments, an internal permitting system, internal compliance checks/audits, and maintenance of a biohazardous materials inventory.

5.0 Rules, Processes and Procedures

Biological materials and biological toxins pose a risk to lab personnel and to the college community. ASET has procedures in place for purchasing/acquiring and working with biological materials and biological toxins. As a general rule, lab users should treat all microorganisms as potential pathogens.

5.1 Acquisition of Biological Materials and Toxins

The acquisition of all biological material and biological toxins must first be approved by the Biosafety Officer(s) (BSOs). The BSO(s) are responsible for completing a risk assessment using ASET's Risk Assessment for Biological Materials and Biological Toxins (Addendum A of this Appendix). The BSO(s) will determine if the acquisition is permitted under ASET's Public Health Agency of Canada (PHAC) Licence and what precautions and procedures are required for working safely with the biological material or toxin.

5.2 Shipping and Receiving of Biological Materials and Toxins

The BSO(s) are responsible for the shipping and receiving of all biological materials and biological toxins. All lab personnel are required to contact the BSO(s) before shipping or receiving any biological materials.

5.3 Inventories

The BSO(s) are responsible for maintaining the inventory of all biological materials and biological toxins.

5.4 Environmental Samples

Culturing of environmental samples does not require a PHAC (Public Health Agency of Canada) licence; however, knowingly culturing or isolating an RG2 (risk group 2) pathogen from an environmental sample does require a licence and must only be performed in a facility that meets the applicable requirements specified in the Canadian Biosafety Standard.

The use, culturing and ordering/obtaining of environmental samples must first be approved by the BSO(s). Often, a risk assessment must take place, using PHAC's Risk Assessment Tool and/or by following ASET's Risk Assessment Process (Appendix 8 of ASET's Biosafety Manual) and/or by using ASET's Risk Assessment Tool for the Acquisition of Biological Materials and Biological Toxins (Addendum A of this Appendix). The BSO(s) will determine what precautions and procedures are required for working safely with environmental samples.

5.5 Movement of Biological Materials and Toxins

Best Practices:

- PPE must be worn when handling biological material and toxins;
- Biological materials and toxins must be adequately protected from being dropped, tipped or spilled;
- Closed containers (primary containment) that are leak-proof and impact resistant containers are recommended;
- Generally, petri plates should be carried in racks with handles or in plastic bins;
- When working with liquid cultures, work with small volumes of liquid material and carry aliquots in racks;
- Whenever possible, screw top containers should be used rather than snap-cap tubes;
- When carts are required, shelves should have a minimum of 2-inch edges on all sides, to prevent items from falling off the cart;
- Care should be taken when moving biological materials and toxins within a lab space – individuals should move slowly and with caution;

5.5.1 Movement within the containment zone (WA130)

Follow the best practices indicated above.

5.5.2 Movement between CL1 and CL2 lab (WA129 and WA130)

Follow the best practices indicated above. Only RG1 material can be used/transported to the WA129 (Containment Level 1 [CL1]) laboratory. Containers must be closed, labelled, leak-proof, (preferably) impact-resistant and placed inside secondary containers. Once inoculated in the CL1 lab, culturing of these materials then, generally, takes place in the CL2 laboratory (i.e. due to space restrictions, incubators are in the CL2 lab). Care must be taken to ensure that RG1 cultures are not incubated in proximity to RG2 cultures. After incubation, the cultures are usually stored in a fridge in the CL2 lab and brought over to CL1 lab on the day that they are required. Biosafety level 2 materials must not leave Room WA130. Consult with the BSO(s) to determine which RG1 materials can be used in WA129.

5.5.3 Movement between CL1 or CL2 and other locations on campus

Follow the best practices indicated above. Ensure that all biologicals are secured in closed, labelled, leak-proof, (preferably) impact-resistant containers and placed inside secondary containers. Note: only RG1 material can be used/transported to other areas on campus (e.g. Vet Tech). Ensure that Pathogen Safety Data Sheets (PSDS) are provided to the recipient. RG2 materials must not leave Room A130.

5.5.4 Movement from Shipping to CL1 or CL2 lab (WA129 and WA130)

Personnel working in Algonquin College's Central Shipping and Receiving are trained to the Transportation of Dangerous Goods (TDG). RG2 items received from suppliers will be transported from Central Shipping and Receiving (in the original supplier containers/vessels/boxes) directly to the CL2 A130 laboratory for the BSO(s) to receive.

5.6 Paperwork Stations

Whenever possible, paperwork stations should be used when working with RG2 materials on the lab bench. Please check with the BSO(s) for more information.

5.7 Entry and Exit Procedures for Lab Personnel

Only authorized personnel may access the ASET Labs.

5.7.1 Entry to A129 Lab

- Doors to this lab should be kept closed at all times and access limited to authorized personnel only;
- Proper Clothing, Footwear and PPE must be worn in this lab (see ASET's Biological Safety Guidelines, Section 5.10);
- Backpacks, jackets and other items are to be left in lockers and offices. Only items pertinent to the work (lab protocols, writing implements, calculators, etc.) should come to the lab.
- Visitors should be accompanied by a trained staff member (see Biosafety Manual, Section 12.0);
- Upon entry, don PPE (ASET's Biological Safety Guidelines, Section 5.10.4).

- Then clean lab benches with the available disinfectant/cleaner, prior to putting items down on the benches (use the lab chairs, if necessary) and commencing work.

5.7.2 Exit from A129 Lab

- Ensure that lab benches and other equipment are disinfected with the available disinfectant/cleaner;
- After the proper removal of PPE (see ASET's Biological Safety Guidelines, Section 5.10), exit the lab;
- Personnel in charge of the lab must ensure that all lab occupants under their supervision have left the lab (e.g. Faculty in charge of students);
- Lab personnel that were last in charge of the lab must ensure that the lab is clean and secure and that all lab doors are closed and locked when the lab is not occupied.

5.7.3 Entry to A130 Lab

- Doors to this lab **must** be kept closed at all times (e.g. not left propped open while labs are in session) and access limited to authorized personnel only;
- Proper Clothing, Footwear and PPE must be worn in this lab (see ASET's Biological Safety Guidelines, Section 5.10);
- Backpacks, jackets and other items are to be left in lockers and offices. Only items pertinent to the work (lab protocols, writing implements, calculators, etc.) should come to the lab.
- Visitors should be accompanied by a trained staff member (see Biosafety Manual, Section 12.0);
- Upon entry, don PPE (ASET's biological Safety Guidelines, Section 5.10.4);
- Then clean lab benches with the available disinfectant, prior to putting items down on the benches (use the lab chairs, if necessary) and commencing work.

5.7.4 Exit from A130 Lab

- Ensure that lab benches and other equipment are disinfected with the available disinfectant;
- After the proper removal of PPE (see ASET's Biological Safety Guidelines, Section 5.10), exit the lab;
- Personnel in charge of the lab must ensure that all lab occupants under their supervision have left the lab (e.g. Faculty in charge of students);
- Lab personnel that were last in charge of the lab must ensure that the lab is clean and secure and that all lab doors are closed and locked when the lab is not occupied.

5.8 Personal Protective Equipment (PPE)

Protective laboratory clothing must not be worn in non-laboratory areas. Laboratory clothing must not be stored in contact with street clothing. Personal belongings (e.g. purses, bags) and street clothing (e.g., coats, boots) must be stored separately from PPE and from work stations where biological material is handled. Staff and students must leave personal belongings in lockers

or staff offices. PPE should be removed in a manner that minimizes the spread of contamination to the skin and hair. Student lab protocols have been risk assessed, prior to students completing labs. These lab protocols have a "reagent table" that indicates the proper PPE to wear during that lab activity.

5.8.1 Gloves

Generally, nitrile gloves are used for all procedures that involve biological materials and toxins. Gloves are to be removed when leaving the laboratory or use a one-glove-technique if transporting hazardous material. Disposable gloves should be discarded after use. Disposal of used gloves involves proper decontamination with other solid laboratory waste.

5.8.2 Laboratory Attire

Protective lab coat, properly fastened, must be worn by all lab personnel, including visitors, trainees and others entering or working in the laboratory. The lab coat must be long sleeved, knee length, have snap closures for quick removal and be fastened. Generally, it should be put on immediately upon entering lab. Suitable footwear with closed toes and heels must be worn as well as long pants or skirt that cover the entire leg. Shoes should be comfortable, rubber soled, and cover the entire foot. Heels are not recommended. Since canvas shoes will absorb chemicals or infectious fluids, they are not recommended. Leather or a synthetic, fluid-impermeable material are recommended. Skin (top of foot, ankles and legs) must be covered – this offers protection should any chemicals or infectious materials spill.

5.8.3 Eye and Face Protection

Where there is a known or potential risk of exposure to splashes or flying objects, whether during routine operations or under unusual circumstances (e.g. accidents), eye and/or face protection must be used. Careful consideration should be given to the identification of procedures requiring eye and face protection, and selection should be appropriate to the hazard. Generally, safety glasses are worn in the ASET labs; however, the risk assessments that are completed for regular student lab protocols will indicate if goggles and face shields are required.

5.8.4 Donning and Doffing PPE

Proper removal of PPE is an essential step in preventing the spread of infectious materials. The proper way to put on (donning) and removal (doffing) of PPE is described below. Note that the wearing of masks is required when the college dictates the use (e.g. during a pandemic) or when a risk assessment of a chemical or biological requires the use.

<u>Donning</u>

1. Ensure hands are clean – wash if necessary.
2. Put on protective eyewear.

3. Put on lab coat and close all snaps/buttons. Avoid touching the outside of the lab coat.
4. If necessary (i.e. dependent on chemicals used and/or college requirements) put on face mask/N95 respirator. Note: when wearing a mask for health concerns, such as during a pandemic, some people may come into the lab wearing a mask. This is fine; however, the ASET Department requires that they be disposable masks and recommends that the masks be disposed when exiting the lab.
5. Put on gloves.

<u>Doffing:</u>

1. Remove gloves (follow procedure in Figure 1 (Appendix 10)).
2. Remove lab coat. Avoid touching the outside of the lab coat. Fold the lab coat with the inside on the outside. In the WA130 laboratory, lab coats must be placed in plastic bags prior to placing in lab drawers. Lab coats cannot be removed from the WA130 lab unless they have been autoclaved (i.e. decontaminated). There are some areas in the lab where lab coats can be hung, but they should be hung so they are not touching adjacent lab coats. In the WA129 laboratory, lab coats must be placed in plastic bags prior to leaving the lab.
3. Wash hands.
4. Remove Mask/N95 Respirator.
5. Remove eye protection.

Figure 1 (Appendix 10): Doffing Gloves

Reference: https://www.technicleanproducts.com/blog/how-to-remove-disposable-gloves

5.9 Aerosols

All work with biological material and toxins should be performed to minimize the creation of splashes and/or aerosols. Whenever possible, manipulate infectious materials in a biological safety cabinet (BSC).

For detailed equipment procedures, refer to ASET's Equipment Safety Guidelines.

All work with RG2 material that is infectious via the inhalation route must be completed in the BSC. Consult with the BSO(s) for more information and a list of RG2 material that fall into this category.

5.9.1 Examples of aerosol-producing activities and prevention techniques

- **Culturing Samples**
  - Grow organisms on sold media (e.g. agar) rather than liquid (e.g. broth) whenever possible, to prevent spills and the formation of aerosols.
  - Tape the cover of inoculated agar plates to the base of the petri plate to prevent accidental opening. Make observations through the closed cover.
  - Incubate petri dishes upside down to prevent condensation from dripping onto the cultures.
- **Opening Tubes containing microorganisms**
  - Whenever possible, open tubes in a biological safety cabinet (BSC).
  - Use a vortex mixer instead of inverting tubes and wait 5 minutes before opening.
  - After centrifuging, wait 5 minutes before opening.
  - Upon opening, unscrew the cap slightly and wait a few seconds before removal.
  - Use tubes with outside screw-on closures, since screw-in or push-in closures can release the film of liquid trapped between the tube and closure, releasing aerosols.
- **Flaming loops or slides:**
  - To reduce the risk of aerosol generation, avoid sterilizing inoculation loops in open flames; instead, use a micro-incinerator (bacti-cinerator) or disposable loop. If flaming the loop is required, allow the loop to cool after sterilization and before spreading culture. The sizzling that you hear when the hot loop touches the plate is creating an aerosol.
  - To minimize the creation of aerosols, loops should be enclosed and well formed (to avoid shedding their load). Loops that are bent or encrusted with material should be replaced.
  - To avoid aerosol production, perform streaking on smooth rather than rough media plates
  - Alcohol burners are used with the spreaders or "hockey sticks". Hold the spreader at an angle to prevent the alcohol and flame from travelling down the spreader to the gloved hand. To avoid aerosols, allow the spreader to cool before touching the agar plate and first touch an area of the plate that does not have culture.
- **Pipetting microorganisms:**

- Do not pipette by mouth.
- Use “to deliver” pipettes calibrated to retain the last drop.
- Use pipettes with plugs.
- Discharge pipettes close to the fluid level and let the contents run down the wall of the container.
- Carefully eject disposable tips to minimize aerosol formation.
- Never forcefully expel infectious materials from the pipette.
- Expel pipette tips into a container containing disinfectant.
- Whenever possible, use reverse pipetting when working on the lab bench.
- Whenever possible, work in a BSC.

> **Centrifugation of microorganisms**:
  - Whenever possible, use sealed centrifuge buckets with o-rings (safety caps). **This is a requirement for the centrifugation of RG2 material that is infectious via. the inhalation route.**
  - Aerosol containment devices should be removed from the centrifuge and opened in a BSC. If a BSC is unavailable, a minimum of 5 minutes settling time should be allowed before opening.
  - Always cap tubes before centrifugation.
  - Check tubes for cracks/degradation before centrifuging.
  - Regularly decontaminate the outside surface of safety cups and rotors.
  - Maintain the centrifuge to ensure that it is clean and the gaskets and O-rings are not compromised.
  - Do not overfill centrifuge tubes. Generally, ¾ full is the maximum. Wipe the outside of the tubes with disinfectant after they are filled and sealed.
  - Ensure the rotor is balanced.

> **Sonicating, homogenizing, mixing, blending, grinding, cell disruption (of microorganisms):**
  - Whenever possible, operate and open equipment in a BSC. **This is a requirement for RG2 material that is infectious via. the inhalation route.**
  - Place a towel moistened with disinfectant over the top of the blender, grinder, sonicator, etc.
  - Ensure lab blenders have a lid with gasket and leak proof bearings.
  - Wait 5 minutes before opening.
  - For detailed procedures, refer to ASET’s Equipment Safety Guidelines.

> **Vortexing microorganisms:**
  - Vortex infectious materials within a biological safety cabinet (BSC). **This is a requirement for RG2 material that is infectious via. the inhalation route.**
  - Whenever possible, open vortexed containers inside a BSC after vortexing on the benchtop.
  - Allow 5 minutes for aerosols to settle before opening vortexed containers.
  - When opening the tubes, cover the cap with a tissue and open slowly.

- Use plastic tubes with screwcaps if working with more than 1.0mL of biohazardous materials. For 1mL and under, micro-centrifuge tubes are acceptable.
- Avoid vortexing glass containers where possible.
- Use a vortex, instead of inverting the cultures.
- Start vortexing at low speed and increase as needed.

> **Breakage:**
  - Avoid the use of glassware where possible.
  - Use plastic tubes, flasks and bottles.

> **Pouring Infectious Materials:**
  - Perform work over plastic-backed absorbent material or work in a BSC. **This is required for RG2 material that is infectious via. the inhalation route.**
  - Wipe the rim of the tube with disinfectant-soaked absorbent paper to remove potential contamination on the outside of the tube.
  - Pour waste materials into containers located in a BSC (since aerosols form when pouring).

> **Syringes/Needles use with Microorganisms:**
  - Withdraw needles from bottles using disinfectant-soaked absorbent pads wrapped around the bottle cap.
  - Do not recap needles or remove needles from syringes by hand.
  - Use locking syringes.
  - Strictly limit the use. If they must be used by students, direct supervision is required.

> **General:**
  - Whenever possible, use screw-capped tubes and bottles rather than plugs or snap caps.
  - Work over absorbent material, whenever possible.

5.10 Spills and Exposures

Biohazardous spills, accidents involving biohazards and exposures to infectious materials and losses of containment must be reported immediately to the ASET Manager and to the BSO(s). Such incidents involving RG2 material must be reported to PHAC by the BSO(s). PSDS are available for reference.

After any risk of injury has been controlled, the following steps are recommended to contain a spill of infectious material and decontaminate the area affected by a spill. If the spill is severe (often, this is a judgement call, depending on the chemical involved as well as the volume), call Security Emergency at extension 5000 and follow their instructions.

1. Remove any contaminated or potentially contaminated clothing and PPE. Wash hands and any other potentially contaminated parts of the body.
2. If the spill is significant and has created aerosols, notify everyone in the area and evacuate the lab immediately.

3. Ensure the laboratory doors are closed and call for assistance, as needed. Biosafety Officer(s) and Laboratory Technologists are usually available to assist with clean-up.
4. Evaluate the degree of risk involved and proceed only if comfortable with your ability to clean the spill. Call Security at extension 5000 (emergency), if necessary.
5. Exposed persons should seek medical attention, if necessary. Refer to ASET's Emergency Response Plan (Appendix 1).
6. If aerosols have been generated, wait approximately 30 minutes to allow settling to occur before cleanup.
7. If the spill is in the BSC, leave the BSC blower on and leave the sash open. Follow the clean-up procedure described below, while keeping head outside the BSC at all times. Clean-up of the BSC also involves cleaning the catch tray. Generally, the BSO(s) should be called upon to assist with cleaning the BSC. Allow the BSC to run for a minimum of 10 minutes before resuming work or shutting down the BSC. Refer to the manufacturer's manual for additional instructions.
8. If the spill in inside a centrifuge, switch the unit off and leave it closed for approximately 30 minutes to allow aerosols to settle. Follow the clean-up procedure described below (5.8.9). Broken tubes, glass fragments, buckets, trunnions and the rotor should be placed in disinfectant. Place unbroken sealed safety cups in disinfectant and carry to a BSC to be unloaded. The centrifuge bowl should be swabbed with disinfectant, swabbed again, washed with water and dried. Refer to the manufacturer's manual for additional instructions.
9. Commence cleanup by first obtaining the biosafety spill kit. Contents of the kit include:
    - Heavy-duty utility gloves
    - Nitrile gloves
    - Safety glasses/goggles
    - Paper towels
    - Autoclave bags (2)
    - Forceps (for picking up sharps and broken glass)
    - Stiff cardboard (to move broken glass)
    - Heavy-duty plastic bags to dispose contaminated items
    - Squeeze bottle of sodium hypochlorite (bleach). The appropriate concentration of sodium hypochlorite for disinfecting 5000 ppm, approximately 0.5%. Household bleach is 5 - 6 % sodium hypochlorite; therefore, a 1:10 (v/v) dilution of bleach to water. The solution must be prepared fresh.
    - Puncture-resistant container for broken glass/sharps
10. Don appropriate PPE, which includes: laboratory coat, nitrile gloves, utility gloves (if deemed necessary) and safety glasses/goggles.
11. Remove contents of the spill kit and place in an uncontaminated area nearby.
12. Cover the spill with several layers of paper towel; this will help contain the spill.

13. Pour the bleach disinfectant over the spill, starting at the outer margin of the spill area and concentrically working toward the center, over the paper towel and the immediately surrounding area.
14. After 20 minutes of contact time, clear away the towels and debris by placing in the autoclave bag. If there is broken glass, use the cardboard to collect and place the material into the puncture-resistant container (which must be autoclaved before disposal). Use the forceps to handle broken glass and sharps; place in puncture-resistant container (these must also be autoclaved or disinfected before disposal).
15. Clean and disinfect the area again. If necessary, repeat the previous steps.
16. Place contaminated materials into the autoclave bag for autoclaving and disposal, including contaminated PPE.
17. Wash hands.
18. Once spill clean-up is complete, inform the BSO(s), the ASET Manager and complete an incident report.

5.11 Decontamination of Lab Waste

All items that come into contact with infectious biological material, including liquid or solid wastes, must be decontaminated before disposal or reuse. Contaminated materials and equipment leaving the laboratory for servicing or disposal must be appropriately decontaminated and labelled or tagged-out as such. Acceptable methods of decontamination are summarized below. Generally, in the ASET labs the decontamination of RG1 biological material follows the same procedures as for RG2.

5.11.1 Procedures for liquid waste

- The collection of biohazardous liquid waste should generally take place so that aerosols are not generated. Ideally, a vessel to hold the waste is placed in the biosafety cabinet and liquid waste is poured into this waste container. For example, students that need to dispose of liquid waste in small tubes after an experiment. The biosafety cabinet will contain any aerosols produced by the pouring procedure.
- Liquid waste can be decontaminated using the autoclave or with bleach;
- If autoclaving, the autoclave must reach and maintain a temperature of 121° C for at least 30 minutes by using saturated steam under at least 15 psi of pressure. Increased cycle time may be necessary depending upon the make-up and volume of the load. Ensure that the autoclave is being efficacy tested regularly;
- For detailed procedures on autoclaving, refer to ASET's Equipment Safety Guidelines;
- If bleaching, the liquid samples must sit for 20-30 minutes in a 0.5% sodium hypochlorite solution. The appropriate concentration of sodium hypochlorite for disinfecting general liquid biological waste is 5000 ppm, approximately 0.5%. Household bleach is 5 - 6 % sodium hypochlorite; therefore, a 1:10 (v/v) dilution of bleach to liquid biological waste is appropriate. (e.g. 1part bleach into 9 parts liquid biohazardous waste). For surface

disinfection, a contact time of 1 minute is required. Bleach solutions must be prepared fresh daily.

5.11.2 Procedures for solid waste

- All biohazards solid waste must be collected in containers equipped with a lid and labelled with the universal biohazard symbol, and lined with an autoclave-safe bag. Bags with waste must then be autoclaved using validated autoclave settings and procedures. Once autoclaved, the bag with contents can then be placed in the regular trash for disposal. The biohazard symbol must not be visible on the bag (e.g. defaced) when placed into the regular trash. An alternative is to purchase autoclave-safe bags that do not have the biohazard symbol.
- The autoclave must reach and maintain a temperature of 121° C for at least 30 minutes by using saturated steam under at least 15 psi of pressure. Increased cycle time may be necessary depending upon the make-up and volume of the load. Ensure that the autoclave is being efficacy tested regularly (see 5.11.3 and 5.11.4).
- Waste left in a BSC must be labelled and disposed of daily or as soon as possible (i.e. by the next day). If left in the BSC overnight, then the hepa filter must be left on.

5.11.3 Autoclave Validation

In the ASET labs, autoclaves are the main method of decontaminating biological waste before final disposal. Autoclave validation is intended to test the efficacy of the decontamination process under more challenging conditions. Annual validation is required for defined representative loads using the procedure described below. These records must be kept on file for a minimum of 5 years.

Procedure for Autoclave Validation of a Full Bag of Petri Plates in the Sanyo Autoclave (D2):
Note: This procedure must be completed by a Biosafety Officer and must only be completed in the D2 autoclave (i.e. the autoclave with functional printer).

1. Ensure sufficient water is in the chamber and exhaust tank.
2. Ensure the autoclave printer is operational and sufficient tape is installed.
3. Place the steel waste bin into the autoclave.
4. Place a large autoclave bag with a full load of Petri dishes (i.e. Petri plates with solidified agar and RG1 bacteria) into the waste bin, level to the top of the steel waste bin).
5. Tape a new biological indicator (“Test Sample”, labelled “TS” with a sharpie) to the 3mL mark on a 10mL glass pipette and place the pipette into (approximately) the middle of the load in the autoclave.
6. Ensure the autoclave gasket is in place and close the lid.
7. Select “Liquid Sterilization” (121^{o}C for 30 minutes) and start the cycle.
8. Once the cycle is complete and has cooled to optimal opening temperature, open the lid and remove the glass pipette with the attached test sample.

9. Remove the test sample from the pipette and depress the cap on the test sample to break the inner glass vial (this allows for the media to come in contact with the disc).
10. Depress the cap on a second biological indicator from the same lot# as the test sample. This second indicator has not been autoclaved and acts as a control.
11. Place both biological indicators into a 55^{o}C incubator for 18-24 hours.
12. Observe results:
    a. **Successful autoclave validation result**: The test sample has no colour change (i.e. remains purple/grey) and the control biological indicator is yellow.
    b. **Failed autoclave validation result**: Both the test sample and the control biological indicator change colour to yellow (this means that the bacteria in the test sample has not been decontaminated and its growth has resulted in acid production, changing the test media to yellow).
13. **After a successful validation procedure**, autoclave the biological indicators for 30 minutes at 121^{o}C and dispose in regular garbage.
14. **If the validation has failed**, unplug the autoclave and place a warning sign on the autoclave, indicating that it is "out of service until further notice". Store the biological indicators in a safe location until a successful autoclave validation result is obtained and the indicators can be successfully decontaminated.
15. Log the procedure in the ASET autoclave log book and place the printer log in the autoclave log book envelope.

Procedure for Autoclave Validation for Mixed Load in Sanyo Autoclave (D2):
Note: This procedure must be completed by a Biosafety Officer and must only be completed in the D2 autoclave (i.e. the autoclave with functional printer).

1. Ensure sufficient water is in the chamber and exhaust tank.
2. Ensure the autoclave printer is operational and sufficient tape is installed.
3. Place the steel waste bin into the autoclave.
4. Place a large autoclave bag with a full load of used nitrile gloves and Petri dishes (i.e. Petri plates with solidified agar and RG1 bacteria) into the waste bin, level to the top of the steel waste bin).
5. Tape a new biological indicator ("Test Sample", labelled "TS" with a sharpie) to the 3mL mark on a 10mL glass pipette and place the pipette into (approximately) the middle of the load in the autoclave.
6. Ensure the autoclave gasket is in place and close the lid.
7. Select "Liquid Sterilization" (121^{o}C for 30 minutes) and start the cycle.
8. Once the cycle is complete and has cooled to optimal opening temperature, open the lid and remove the glass pipette with the attached test sample.
9. Remove the test sample from the pipette and depress the cap on the test sample to break the inner glass vial (this allows for the media to come in contact with the disc).
10. Depress the cap on a second biological indicator from the same lot# as the test sample. This second indicator has not been autoclaved and acts as a control.
11. Place both biological indicators into a 55^{o}C incubator for 18-24 hours.
12. Observe results:

a. **Successful autoclave validation result**: The test sample has no colour change (i.e. remains purple/grey) and the control biological indicator is yellow.
b. **Failed autoclave validation result**: Both the test sample and the control biological indicator change colour to yellow (this means that the bacteria in the test sample has not been decontaminated and its growth has resulted in acid production, changing the test media to yellow).

13. **After a successful validation procedure**, autoclave the biological indicators for 30 minutes at 121^{o}C and dispose in regular garbage.
14. **If the validation has failed**, unplug the autoclave and place a warning sign on the autoclave, indicating that it is "out of service until further notice". Store the biological indicators in a safe location until a successful autoclave validation result is obtained and the indicators can be successfully decontaminated.
16. Log the procedure in the ASET autoclave log book and place the printer log in the autoclave log book envelope.

5.11.4 Autoclave Verification

Autoclave verification periodically tests the decontamination process between annual validations to detect process or equipment failures. In the ASET Labs, autoclaves are generally verified monthly. These records must be kept on file for a minimum of 5 years.

Autoclave Verification Procedure:

1. Ensure sufficient water is in the chamber and exhaust tank.
2. Ensure the autoclave printer is operational and sufficient tape is installed.
3. Place the steel waste bin into the autoclave.
4. Place a large autoclave bag with a load that does not exceed the maximum load quantity (check with Biosafety Officer prior to continuing with the verification procedure).
5. Place a biological indicator (test sample) outside of the load to avoid contact with infectious materials.
6. Ensure the autoclave gasket is in place and close the lid.
7. Select "Liquid Sterilization" (121^{o}C for 30 minutes) and start the cycle.
8. Once the cycle is complete and has cooled to optimal opening temperature, open the lid and remove the biological indicator.
9. Remove the biological indicator, label "TS", i.e. test sample, and depress the cap to break the inner glass vial (this allows for the media to come in contact with the disc).
10. Depress the cap on a second biological indicator from the same lot# as the test sample. This second indicator has not been autoclaved and acts as a control.
11. Place both biological indicators into a 55^{o}C incubator for 18-24 hours.
12. Observe results:
    a. **Successful autoclave verification**: The test sample has no colour change (i.e. remains purple/grey) and the control biological indicator is yellow.

b. **Failed autoclave verification**: Both the test sample and the control biological indicator change colour to yellow (this means that the bacteria in the test sample has not been decontaminated and its growth has resulted in acid production, changing the test media to yellow).

13. **After a successful verification procedure**, autoclave the biological indicators for 30 minutes at 121^{o}C and dispose in regular garbage.
14. **If the verification has failed**, unplug the autoclave and place a warning sign on the autoclave, indicating that it is "out of service until further notice". Store the biological indicators in a safe location until a successful autoclave validation result is obtained and the indicators can be successfully decontaminated. Inform the BSO(s).

17. Log the procedure in the ASET autoclave log book and place the printer log (if available) in the autoclave log book envelope.

5.12 Handwashing

Handwashing is required after removing gloves, before leaving the lab, and after working with chemicals, toxins or biologicals. Hand washing sinks are located in the WA130 (CL2) laboratory. Refer to section 8.3 of the ASET Biosafety Manual for more information and proper technique.

5.13 Clean-up

Laboratories are to be kept clean and tidy to avoid cross-contamination and to facilitate cleaning and disinfection. Storage of materials that are not pertinent to the work and cannot be easily disinfected (e.g., journals, books, correspondence) should be minimized; paperwork and report writing should be kept separate from biohazardous materials work areas.

Normal clean-up procedures include:

- Sterilizing equipment and materials.
- Disinfecting work areas before and after use, using an appropriate disinfectant.
- Washing hands.

5.14 Good Microbiological Practice in the ASET Labs – Additional Guidelines

> Follow aseptic techniques (e.g. organize the workspace with a clean to dirty work flow and have the required materials close at hand to avoid reaching over the work area);
> Oral pipetting of any substance is prohibited;
> Open wounds, cuts, scratches and grazes must be covered with waterproof dressings;
> Avoid hand to mouth or hand to eye contact;
> No food or drink is permitted in the laboratory (except that which is required for laboratory purposes and not for consumption);
> The application of cosmetics or lip balm is not permitted in the laboratory;
> Chewing of gum or candy is not permitted in the laboratory;
> The handling of contact lenses or taking of medication is not permitted in the laboratory;
> The use of contact lenses is NOT RECOMMENDED while working in the ASET labs;

- Long hair is to be tied back, restrained, or covered, so that it cannot come into contact with hands, specimens, containers or equipment;
- Jewelry that may come into contact with biological material being handled (e.g. long necklaces, large watches, etc.) or rings that may puncture protective gloves are not to be worn;
- Generally, the use of personal electronic devices (including cell phones) is not permitted in the ASET labs as they may become contaminated by material used in the lab. Exception: on occasion, the A129 lab permits use of personal computers (Students will be notified if this is the case).
- Ear buds are not to be worn in the labs, since they might be contaminated if touched by gloves; also, they prevent lab users from hearing important warnings, such as the sound of the fire alarm;
- Store all biohazardous materials securely in clearly labeled, sealed containers;
- Do not give biohazardous material to anyone who is not authorized (if unsure, contact the BSO(s));
- Do give keys/electronic security devices to unauthorized individuals;
- Doors to laboratories must not be left open (this does not apply to an open area within a laboratory);
- Access to laboratory and support areas is limited to authorized personnel - consult the BSO(s) for assistance with visitors;
- If a known or suspected exposure occurs, contaminated clothing must be decontaminated before laundering;
- Generally, needles are not used for biological materials and toxins in the ASET labs - consult the BSO(s) for more information, if required;
- Personal belongings (e.g. purses, jackets, bags) should not be stored in the lab.

5.14 Records and Documentation

Records and documentation regarding biohazardous materials and toxins must be kept on file for a minimum of:

- 5 years for licence activities with human pathogens and toxins;
- 2 years following the date of disposal, complete transfer, or inactivation of the imported material in accordance with terrestrial animal pathogen import permit requirements for terrestrial animal pathogens or part of one;
- 5 years for performance and verification test records or until repeat testing is conducted, whichever is longer.

Records of any incidents involving pathogens, toxins, and other regulated infectious material or loss of containment must be kept on file for a minimum of 10 years. These include:

- Medical emergency;
- Loss of containment of any kind;
- Spills of infectious materials, (including spills inside and outside the lab as well as spills in the BSC);

- Mechanical failure (including BSC and air handling);
- Accidental exposure (including near misses).

6.0 Regulatory Standards

Human Pathogens and Toxins Act
Human Pathogens and Toxins Regulations
Canadian Biosafety Standard, 3rd edition
Canadian Biosafety Handbook, 2nd edition

7.0 Other College Resources

AC's Health and Safety Policies
AC's Occupational Health & Safety Department's Website

Addendum A (Appendix 10):

ASET's Risk Assessment Tool for the Acquisition of Biological Materials and Biological Toxins

This document is to be completed by the Biosafety Officer(s) whenever new biological material or a biological toxin is *acquired** for use in the ASET labs. This document is to be completed in full before the material arrives on campus.

*Note: generally, samples that will come from sources other than typical vendors/academia/government (e.g. environmental) will need to be risk assessed using the PHAC Risk Assessment Tool.

Details Required for Risk Assessment
Name of Material or Toxin:

List information here

Vendor/Source:

List information here

List all relevant information (e.g. catalog number, name of individual obtained from, etc.):

List information here

Risk Assessment (to be completed by BSO)

1. Is a PSDS available? ☐ Yes ☐ No ☐ Unknown
   If no or unknown, then further investigation is required and details to be provided.
2. Is the material or toxin permitted under the conditions of the ASET PHAC Licence?

List information here

☐ Yes ☐ No ☐ Unknown

- If "no" then the acquisition of the material/toxin is DENIED.

- If “unknown” then further investigation is required PRIOR to purchase/acquisition.

List information here

3. If the transfer/purchase is approved, then indicate the risk level.

   Human ☐RG1 ☐RG2

   Animal ☐RG1 ☐RG2

4. If the material is approved for transfer/purchase by the BSO and special conditions are required (e.g. must be used in BSC), then indicate here:

Special Conditions Required:

Approval/Denial

☐ Approved for Purchase/Transfer

☐ Denied

Performed by:
Date completed:
Notes: (e.g. Special Conditions)

Note: this document must be filed in Microsoft Teams (ASET Labs → Biosafety Files → Bacteria Inventory → Risk Assessments for New Materials)

Appendix 11: ASET's Chemical Safety Guidelines

The Chemical Safety Guidelines document is available in ASET's Laboratory Safety Manual

Appendix 12: ASET's Equipment Safety Guidelines

The Equipment Safety Guidelines document is available in ASET's Laboratory Safety Manual