Biosafety Reference Manual

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University of the Fraser Valley Biosafety Manual 2019

1.0 Introduction

The intent of the Biosafety Program at UFV, and the purpose of the UFV's Biosafety Manual (BSM), is to inform UFV faculty, staff, and students how to safely manage biological agents that can be hazardous to people, animals, and the environment. Its goal is to provide information to safeguard UFV personnel from any accidental exposure and to explain how to reduce the risks of such exposure. This manual has been edited by the Office of Safety & Security, the UFV Institutional Biosafety Officer (IBO) and the UFV Institutional Biosafety Committee (IBC). UFV is committed to adhere to the most current version of the Canadian Biosafety Standards and Guidelines. UFV adopts the UFV Biosafety Manual as its policy and procedures for biosafety on all campuses.

The UFV BSM will guide you in how to fulfill the legislative requirements as outlined in the Canadian Biosafety Standard (CBS) 2nd Edition, 2015, the Canadian Biosafety Handbook (CBH) 2nd Edition, 2016 , the Public Health Agency of Canada (PHAC), the Canadian Food Inspection Agency (CFIA), the BC Occupational Health and Safety Regulations (OH&S Regulations), the Human Pathogen and Toxin Act (HPTA) and the Human Pathogen and Toxin Regulations (HPTR). Much of the information presented in the UFV BSM has been reproduced directly from CBS or the CBH and is summarized for your convenience. To be fully aware of all aspects of Biosafety, it is recommended that you review CBS and the CBH.

UFV defines biohazardous agents as biological material that poses a potential health risk to people or animals or is a potential threat to the environment. Biohazardous agents may include but are not limited to; bacterial pathogens and their toxins, viruses, mammalian blood, blood products and other mammalian body fluids contaminated with infectious agents, fungus, cell lines, prions, animal carcasses and body parts, mycoplasma, and parasites. In addition, materials such as DNA or RNA used to produce genetically altered organisms, or other genetic manipulations are considered potentially biohazardous.

Principal investigators, faculty, staff, or students working with any biohazardous material as defined above are required to contact the UFV Biosafety Officer (IBO) or the Institutional Biosafety Committee (IBC) to obtain a biosafety permit. The commencement of any work with biohazardous material is not permitted without a valid biosafety permit.

1.1 Roles and Responsibilities

1.1.1 Human Pathogen and Toxin Act (HPTA) License Holder

The HPTA requires all facilities working with biohazardous agents to appoint a license holder. At UFV, the Director of Safety and Security acts as the license holder on behalf of the university. It is the license holder's responsibility to ensure that implementation of UFV's Biosafety Policies and Procedures are following the HPTA and is accountable for any activities conducted with the pathogens and toxins in a licensed facility.

1.1.2 Institutional Biosafety Officer (IBO)

The IBO is part of UFVs Safety and Security Office and is the Manager Environmental Health & Safety. The IBO is the license holder's representative and is responsible to develop and implement UFVs Biosafety Policies and Procedures and is charged with the oversight of all biosafety and biosecurity practices, including the overall management of UFVs biosafety program. As outline in the CBG the IBO primary responsibilities include, but are not limited to:

- Consult with the Institutional Biosafety Committee (IBC) to develop and implement specific policies and procedures that promote compliance with the applicable legislation and requirements of the PHAC and CFIA
- Provide any reports or documentation as required by the regulatory agencies of Canada
- Develop, maintain and update UFVs Biosafety Manual
- Provide support and advice on safe work practices within UFV facilities managing biohazardous agents
- Advise researchers and faculty on the regulations and guidelines found within UFVs Biosafety manual
- Review applications for biosafety permits, verifying the accuracy and completeness of license applications or renewals and conducting local risk assessments
- Oversee and document biosafety-related training as required
- Conduct facility site visits and promote compliance of all regulations found within UFVs biosafety manual
- Function as the contact person for any incidents involving biosafety or biosecurity

1.1.3 Institutional Biosafety Committee (IBC)

The IBC is responsible for overseeing the UFVs Biosafety Program and Procedures, providing policy direction, recommend changes and any other measures relevant to the administration of this program. Members of the committee may hold positions of Biosafety administration in their faculty departments. IBC members are appointed by senior management, and jointly with the IBO, act in an advisory role reporting to the license holder on matters pertaining to biosafety and biosecurity. The primary responsibilities of the IBC include but are not limited to:

- To develop and implement specific policies and procedures that promote compliance with the applicable legislation and requirements of the PHAC and CFIA
- Meet on a regular basis to review updates on biosafety and biosecurity issues
- In instances of non-compliance advise and recommend corrective measures

1.1.4 Principal Investigator or Laboratory Supervisor

The PI or laboratory instructors are the supervisory individuals working most closely with any biohazardous agents in their area. As such, they shoulder a heavy responsibility to protect all UFV personnel and prevent damage to the environment. Their duties include, but are not limited to:

- Be familiar with the contents of the UFV BSM and ensure that it is followed in their work area
- Identify any biohazardous agents and keep an inventory of all such material stored or used within their work area.
- Obtain and maintain a valid Biosafety Permit
- Maintain and keep up to date any required biosafety training
- Ensure personnel under their supervision are adequately trained to the required level. This will include an online Biosafety Quiz, and any other training deemed appropriate in the local risk assessment (LRA)
- Maintain documentation of training for any personnel under their supervision
- Ensure that all individuals under their supervision receive any necessary immunizations and any other medical surveillance that may be required

- Ensure that UFV's Emergency Procedures are in place, posted in a visible area and that personnel know the location
- Report all exposure incidents to the IBO as soon as possible (within 24 hours).
- Report any spills, release from containment, or stolen or missing RG2 biohazardous agents to the IBO as soon as possible (within 24 hours)

1.1.5 UFV Personnel and Students Working with Biosafety Permit Holder

All UFV personnel and students have an obligation to keep themselves, others around them, and the environment safe from accidental exposure to biohazardous agents. Working in a restricted area requires diligent observance of all safety related procedures and regulations. Failure to do so may have serious health implications for lab personnel or the public and as such anyone not adhering to all biosafety guidelines may be removed from the containment zone. In general, personnel and students under the authority of a UFV biosafety permit are required to:

- Take the UFV biosafety training appropriate to the containment zone and the type of infectious material they are working with which includes taking an online Biosafety quiz and any other training material deemed necessary by the IBO.
- Strictly follow all work area specific SOPs identified within the Biosafety permit
- Know UFV's Emergency Response procedures for their work area
- Inform the PI or lab supervisor if they may be immunocompromised so that any mitigation strategies can be reviewed.
- Inform the PI or lab supervisor if their health status changes and may require a reassessment of any working conditions
- Immediately inform the PI or lab supervisor of any exposure to biohazardous agents
- Report any spills or release of containment of any biohazardous materials

UFV adheres to the most current version of the Canadian Biosafety Standards and Guidelines. For further information on Biosafety, contact the UFV Institutional Biosafety Officer (IBO@ufv.ca)

2.0 Requirements for Working with Biohazardous Material at UFV

You must have a valid Biosafety permit to manage or work with any biohazardous material at UFV. The process of obtaining a valid biosafety permit will involve the following.

- Contacting the UFV biosafety officer (IBO) (IBO@ufv.ca)
- Completing a local risk assessment (LRA) (UFV BSM 3.1)
- Establishing standard operating procedures (SOPs) for the safe handling of all biohazardous materials (UFV BSM 4.3) in the work area
- Implementing an effective training program for all personnel (UFV BSM 5.1)
- Ensuring all biohazardous material is safely stored and inventoried (UFV BSM 5.2.1)
- Employing the appropriate decontamination and waste disposal protocols (UFV BSM 6.0)
- Ensuring proper signage is in place (UFV BSM 4.7)
- Ensuring Biosafety measures are in place (UFV BSM 5.2)
- Applying UFV's Emergency Response Plan if necessary (UFV BSM 4.8)

2.1 Biosafety Permit Applications

All UFV faculty, staff and students working with any biohazardous agents or biomedical material are required to be under the administration of an approved biosafety permit. Commencement of any research, laboratory teaching, medical practice training or student projects may not start without the written approval of the UFV Institutional Biosafety Officer (IBO), their designate or the Institutional Biosafety Committee (IBC). Note: Depending on the project, you may also require permits from the Human Research Ethics Board (HREB) or the Animal Care Committee (ACC).

2.1.1 When to Apply

A biosafety permit must receive written approval from the UFV Institutional Biosafety Officer (IBO), their designate or the Institutional Biosafety Committee (IBC) prior to the start of any work involving biohazardous material. It is the role of the IBO, or their designate, to review and approve biosafety permits. There are numerous requirements necessary to obtain a valid permit, therefore, it is strongly recommended that you apply as early as possible.

2.1.2 Who Can Apply

Program Coordinators, Department Heads, Principal Investigators, Faculty members and Laboratory Instructors may apply. Students may not apply. Student projects require the oversight of a principal investigator or faculty member who may apply for them.

Researchers from institutions other than UFV, but who are working in conjunction with UFV personnel, may be included as co-researchers on a UFV biosafety permit providing the research is conducted at UFV. A joint research project conducted at both UFV, and another institution requires biosafety approval from both institutions. Projects involving UFV members working in collaboration with co-researchers from other institutions, and where the research is exclusively conducted at another institution, will require a copy of the other institution's biosafety permit. A UFV biosafety permit is not required.

2.1.3 Application Process and Permit Duration

Once an application has been completed, it should be submitted electronically to the UFV IBO or the co-chair of the IBC where it will be quickly reviewed for completeness. Incomplete applications will be returned to the applicant which may delay approval. Applications will be reviewed by the IBO and co-chair of the IBC. Approved permits will be signed, and a copy sent to the applicant.

Permit expiry dates can be found on the signed permit approval document. Unless noted on the permit, biosafety permits for course-based applications are valid for 3 years providing no changes have been made. Permits for research applications are valid for one year after the approval date. The IBO must be immediately informed if any changes or additions are made to the original application. The IBO or their designate will determine if a new biosafety application is needed.

2.1.4 After Submission

After a review of the application, either by the IBO or the IBC, a local risk assessment (LRA) must be completed. The IBO, or their designate, will contact the applicant to arrange an LRA. In general, the LRA will assess the following:

- the risk group (RG) of any pathogens or potential infectious agents
- is the workspace suitable for the level of containment required
- is proper signage in place

- have all workers been trained on the appropriate SOPs
- are all biohazardous materials securely stored and inventoried
- have biosecurity measures been considered and put into place
- is the waste management plan appropriate for the biohazardous materials being used

For more detailed information on the LRA see BSM 3.0

3.0 Risk Assessment

Risk assessment is the cornerstone of a Biosafety program. Risk, as an element of biosafety, is the chance that an unwanted event will happen, and risk assessment evaluates the likelihood and consequences of such an event. As much as possible, a risk assessment tries to predict risks and then mitigate those risks through safe working conditions. An overarching risk assessment is multi-faceted and evaluates several factors such as:

- Identification of biohazardous agents and reducing the risk of adverse effects from these materials
- Protecting workers, the environment, and animal resources from harm
- Preventing the release of infectious materials or toxins
- Promoting safe work practices and improving safety performance
- Maintaining regulatory compliance through a combination of training, documentation, inspections, evaluations, and communication
- Evaluating Biosecurity requirements

Biosafety and Biosecurity risk assessments aim to identify potential hazards to determine the associated risks with the goal of mitigating the identified risks. Risk assessments also determine whether existing mitigation measures are appropriate and meet the requirements of the Canadian Biosafety Standards (CBS).

3.1 Local Risk Assessment (LRA)

The first step of your LRA is to contact the IBO. After an initial consultation you will be asked to submit a biosafety permit application (UFV BSM Appendix 1). Information on how to apply, and what is required, can be found in section 2.0 of the UFV BSM.

The IBO, or their designate, will help you evaluate the degree of risk associated with your activities and help you determine the appropriate containment level required (see BSM 4.2). In addition, the IBO will help establish a suitable training program for all individuals involved and will help with other components of biosafety such as biosecurity measures, selection or development of SOPs, evaluation of any medical surveillance requirements, and identification of proper waste management practices. In general, your LRA should assess the following:

- the risk group (RG) of any pathogens or potential infectious agents
- is the workspace suitable for the level of containment required
- is proper signage in place
- have all workers been trained on the appropriate SOPs
- are all biohazardous materials securely stored and inventoried
- have biosecurity measures been considered and put into place
- is the waste management plan appropriate for the biohazardous materials being used
- is a medical surveillance program necessary

There is a systematic approach to conducting risk assessments, regardless of the type of risk. A good risk assessments strategy follows a plan that allows for continual improvement of processes to improve the risk assessment and to evaluate any incidents that have occurred since the implementation of the risk mitigation strategies. Additionally, it is essential that the mitigation strategies implemented have not introduced new hazards.

Various types of risk assessment are used to evaluate the risk associated with the handling and storing of infectious materials and toxins, including the risks related to the pathogen, to the specific work activities or tasks, to biosecurity and to the scientific program as a whole. The key concepts and approaches to risk assessment and risk management can be universally applied to each type of risk assessment.

The IBO, or their designate, will perform a LRA based on the information provided in the application and will evaluate the different categories of risk as outlined below. Depending on

the nature of the activities, the IBO may consult with the IBC co-chair, members of the IBC, or local UFV experts to determine the appropriate containment level. For applications considered as CL1, the IBO and the IBC co-chair will undertake the LRA. For applications deemed CL2, the IBO, IBC co-chair and a departmental biosafety representative will conduct the LRA.

3.1.1 What to expect during an LRA

Your LRA can vary dramatically depending on the information provided in the application. For example, a LRA for a student teaching lab that has received prior biosafety approval, but now is relocating to a different lab space, will be less time consuming compared to a newly proposed research program. The former will already have in place approved pathogen risk assessments, developed SOPs, waste management protocols, and biosecurity measures. As such, the LRA will focus more on the new facilities to ensure they are appropriate to the biosafety work and then modify the existing protocols as deemed necessary. On the other hand, a new research program may need to freshly develop all protocols and documentation associated with their biosafety work. Below are some key considerations of an LRA.

Step 1: Development and Implementation of Standard Operating Procedures (SOPs)

First, identified and characterized the activity-specific hazards. If possible, break down the activities into steps, which can reduce the amount of work needed for each LRA. If a step is ever modified, only that step needs to be reassessed, not the entire procedure. An analysis of the hazardous materials and activities performed will allow the PI to develop standard operating procedures (SOPs) appropriate to the work being conducted (see UFV BSM 4.3). To aid in SOP development the following should be considered:

- What is the quantity and concentration of infectious material or toxin managed or stored?
- What is the potential of aerosol generation by equipment or activities?
- What is the form or state of the infectious material or toxin (e.g., liquid, solid, powder)?
- Does the work involve animals?
- Are sharps or glassware used? Are sharps managed and disposed of properly?
- Who will be performing the activity? (e.g., experienced investigator, junior technician, or student).

While the pathogen's risk group and the containment level at which it must be managed or stored will be determined by the pathogen risk assessment, certain pathogen-specific characteristics may need to be considered in the LRA, such as:

- How the pathogen enters hosts (i.e., ingestion, inhalation, inoculation, contact with skin or mucous membranes, or genitourinary)
- The host range; and
- The stability of the pathogen outside the host. That is, the environmental conditions in which it can survive and for how long.

Step 2: Assess Risk

Assess the potential risks associated with each activity-specific hazard. When assessing risk, for each step in the procedure, the likelihood of exposure to, or release or loss of the pathogen or toxin, and the severity of the consequences (e.g., infection, illness, outbreak etc.) in the event of an exposure, should be considered. During this process each hazard that poses an unacceptable risk will be evaluated to see if mitigations steps are available. Guides from the BC Worker's Compensation Board and the BC Municipal Safety Association may prove useful in developing a numerical approach to assigning risk.

The LRA will consider all potential risks that could occur at each step or task in an activity. By assessing the potential risks of each task, the circumstances and the likelihood of an incident leading to exposure, release, or loss of infectious material or toxins will be identified.

Those performing the activity may also need to be considered. The likelihood of an incident occurring can depend on the individual performing the activity. For example, the likelihood of an incident occurring when a student is performing a laboratory activity for the first time is much higher than when an experienced technician is performing the same activity. More oversight and mitigation controls may be required for the student.

Step 3: Develop and Implement Risk Mitigation Strategies

After the risks associated with each step or task have been assessed, mitigation strategies that address any unacceptable risk (i.e., over the risk tolerance threshold) can be implemented. It may be found that existing mitigation measures reduce the identified risks to acceptable levels and that no additional measures are needed. On the other hand, if mitigation strategies cannot reduce the risk to acceptable levels, the activity will have to be modified, or the work terminated.

Whenever possible, it is best to implement controls to prevent the incident from occurring altogether. However, having a mechanism in place to contain biohazardous materials to prevent exposure (e.g., PPE, sealed secondary container, biological safety cabinet) will reduce the consequences of the incident, should it occur.

For example, a student lab exercise requiring students to streak a culture plate with a bacterial sample should have the following mitigation strategies in place

- Bench top surfaces should be cleaned with disinfectant at the start of the lab period and again at the end.
- To prevent exposure to the student, PPE such as a lab coat and disposable gloves must be worn
- To prevent aerosol formation, single use disposable loops should be used
- To prevent contamination of the working environment, containers containing an appropriate chemical disinfectant should be at hand to immediately collect contaminated disposable loops and biohazard bags should be readily available to collect contaminated gloves.
- To aid in waste removal, leak proof containers should be available to transport any contaminated waste to site of decontamination (e.g., central autoclave)

3.1.2 Pathogen Risk Assessment

A pathogen risk assessment characterizes the risks associated with a pathogen based on the inherent characteristics of the pathogen that contribute to the risk it poses to humans and animals. It is used to determine how likely a pathogen is to cause negative health effects and the severity of those health effects. The pathogen risk assessment process will determine the pathogen's risk group, and the appropriate containment level needed for the safe and secure handling of the pathogen.

The Human Pathogens and Toxins Act (HPTA) website maintains a Pathogen Safety Data Sheet (PSDS) data base assigning risk group levels to many human and animal pathogens. This resource is a good starting place for information helpful in developing a pathogen risk assessment profile for a specific pathogen.

The pathogen risk assessment characterizes the risks associated with a pathogen based on the close examination of the following risk factors, which are the inherent characteristics of a pathogen that contribute to the risk it poses to humans and different animal species.

- **Pathogenicity and Virulence**: Is the pathogen able to infect and cause disease in humans or animals (i.e., pathogenicity)? What is the severity of disease in individuals or in different animal species (i.e., virulence; the degree of disease)?
- **Route of Infection**: How does the pathogen enter hosts (i.e., ingestion, inhalation, inoculation, contact with skin or mucous membranes, or genitourinary)?
- **Mode of Transmission**: How does the pathogen travel to hosts? Is the pathogen transmissible by direct contact (e.g., close intimate contact or casual contact) or indirect contact (e.g., fomites, aerosolized droplets, or airborne transmission)? Can the pathogen be transmitted by vectors or zoonosis?
- **Survival in the Environment**: How stable is the pathogen outside the host? Under which environmental conditions can it survive and for how long?
- **Infectious Dose**: What amount of pathogen is required to cause an infection in the host (measured in number of organisms)?
- **Availability of Effective Preventive and Therapeutic Treatments**: Are effective preventive measures available (e.g., vaccines)? Are effective treatments available (e.g., antibiotics, antivirals)?
- **Host Range:** What is the primary, intermediate, and dead-end hosts? Does the pathogen cause infection in a wide range of species, or is the host range more restricted?
- **Natural Distribution**: Is the pathogen present in Canada or is it exotic to Canada (i.e., non-indigenous)? Is it prevalent in a particular location, region, or human or animal population?
- **Impact of Introduction and/or Release into the Environment or the Canadian Public**: If the pathogen were introduced into the human or animal population or released into the environment (within Canada), what would be the economic, clinical, and biosecurity impact?

While most infectious material will clearly fall into one of the four risk groups (see BSM 3.1), in some cases the level of risk associated with the different risk factors can vary dramatically within a risk assessment. As a result, certain risk factors may be considered more important when determining the final risk group category. For example, if a pathogen is unlikely to cause disease in humans or animals, it may be irrelevant that it can survive in the environment for a long period of time.

3.1.3 Biosecurity Risk Assessment

A biosecurity risk assessment is used to identify, prioritize, and mitigate the biosecurity risks associated with biological and other related assets in a facility. It is an evaluation of the probability of the loss of a biological asset (e.g., pathogen, toxin, infectious material, equipment, animals, information) or of an intentional event, such as the theft, misuse, diversion, or unauthorized release of biological and related assets (e.g., personnel, equipment, non-infectious material, and animals), and the consequences of that event (e.g., community health impact resulting from unauthorized release of a pathogen, theft of proprietary information). The biosecurity risk assessment differs from biosafety risk assessments (i.e., overarching, pathogen, and toxin, and LRAs), in that the individuals or groups that may have malicious interest in the asset (i.e., threats) also need to be considered.

In addition, a biosecurity risk assessment needs to consider the increased security requirements of assets with dual-use potential (i.e., assets that can be used for legitimate scientific applications, but also pose an increased biosecurity risk due to an inherent potential for development and use as a biological weapon). Assets with dual-use potential not only include security sensitive biological agents (SSBAs) but can also include assets related to their handling and storing (e.g., equipment, information).

3.2 Definition of Biohazardous Agents

3.2.1 Bacteria

Bacteria are single-celled prokaryotic organisms lacking a nucleus and other membrane-enclosed organelles. There are microscopic in size and appear as spherical (cocci) or appear as rods (bacilli) that may be straight, curved, spiraled, or tightly coiled. Some bacteria can induce an extreme immune response, secrete exotoxins, produce surface-associated endotoxins, or form spores that enhance survival and transmission outside the host for extended periods of time.

Bacteria that can infect and cause disease in humans and/or animals are referred to as pathogenic bacteria. Many pathogenic bacteria that colonize the body do not cause disease unless a disruption occurs in the host's immune system or natural barriers to infection, or the host is exposed to an excessively high dose of the pathogen, as may occur through activities conducted in a laboratory or an animal facility. Infections with certain pathogenic bacteria always result in illness. Examples of pathogenic bacteria include Bacillus anthracis, certain strains of Escherichia coli, Mycobacterium tuberculosis, and Salmonella species (spp.).

3.2.2 Viruses

Viruses are the smallest of replicating organisms. Their small size (20-300 nm) allows them to pass through filters that typically capture the smallest bacteria. Viruses have no metabolism of their own and, once inside a host cell, they redirect existing host machinery and metabolic functions to replicate. Structurally, the simplest viruses consist of nucleic acid enclosed in a protein capsid (nucleocapsid). Enveloped viruses have a more complex structure in which the nucleocapsid is enclosed inside a lipid bilayer membrane. This membrane facilitates the virus's interaction with the host cells but also increases susceptibility to decontamination.

There are many families of viruses that are able to infect human and animal hosts. Some are species-specific while others infect a wide range of host species. Some viruses are able to produce a persistent infection (i.e., host cell remains alive and continues to produce virus over a long period of time) or a latent infection (i.e., there is a delay of months or years between viral infection of the host and the appearance of symptoms), or they may be carcinogenic (e.g., integration of an oncogene-carrying retrovirus into host genome). Examples of pathogenic viruses include influenza viruses, HIV, herpes viruses, rabies virus, and Ebola virus.

3.2.3 Human Blood, Blood Products, and other Human Body Fluids

Primary specimens are samples taken directly from a person. The HPTA and HPTR do not apply to human pathogens and toxins that are in an environment in which they naturally occur.
However, human body fluids can contain infectious pathogens that are classified as RG2 or higher. Most of these pathogens cause diseases with visible symptoms, but not always. Often individuals in an early stage of an infection or those who are asymptomatic carriers, will not exhibit any visible signs. These individuals can be highly contagious capable of transmitting disease to those around them through their body fluids

3.2.4 Fungi

Fungi are eukaryotic microorganisms that can be easily distinguished from bacteria and other prokaryotes by their greater size and the presence of organelles. Of the 1.5 million estimated fungal species, 300 are known to cause disease in human and/or animal hosts. Several species of yeast, which normally grow as single cells, and of molds, which grow in branching chains, are known to be pathogenic to animals and humans. Differences in the virulence of these fungal species are used to categorize them into two main categories: frank pathogens, which can cause disease in healthy hosts, and opportunistic pathogens, which can cause disease in immunocompromised hosts.

The main risk associated with fungi is the exposure to spores that can be transmitted via the airborne route, inoculation, or casual contact, depending on the species. In addition, some fungal species may produce and disperse mycotoxins, which can be toxic. In general, human, and animal tissue and blood samples are not considered a risk for the airborne dispersal of fungal spores. Examples of pathogenic fungi include Aspergillus Niger, Candida albicans, and Histoplasma capsulatum.

3.2.5 Prions

Prions are small, proteinaceous infectious particles that are accepted to be the cause of a group of progressive neurodegenerative diseases in humans and animals known as Transmissible Spongiform Encephalopathies (TSEs). When an infectious prion enters a healthy host, it induces the normally folded prion protein to convert to the disease-associated, misfolded prion isoforms. The pathogenic isoform acts as a template that guides the misfolding of more prion proteins, which eventually leads to an accumulation of large amounts of the extremely stable, misfolded protein in infected tissue, causing tissue damage and cell death.
There are no treatments and no vaccines available for TSEs.

The route of transmission to personnel handling infectious prions is through accidental inoculation or ingestion of infected tissues. Appropriate procedures and the use of PPE to avoid cuts and punctures are the best approaches for protecting personnel. Although there is insufficient information to completely assess the risk associated with TSE disease- causing prions transmitted by inhalation, it is prudent to mitigate personnel exposure when aerosol- or splash-generating procedures are being conducted. The short-and long-term consequences of gross contamination of mucosa in the nasal, olfactory, and oral cavities, as well as ingestion, are not known.

3.2.6 Toxins

Biological toxins are poisonous substances that are a natural product of the metabolic activities of certain microorganisms, plants, and animal species. Toxins can cause adverse health effects, severe incapacitation, or death in a human or animal. Toxins can often cause severe health effects even when present at low levels in host tissues. Some toxins can be artificially produced by chemical synthesis or by genetic engineering and rDNA technology. Toxins are classified according to the organism from which the toxin is derived (e.g., bacterial, fungal, plant, animal), although toxins are typically associated with bacterial disease.

Two types of bacterial toxins exist: exotoxins and endotoxins. Exotoxins are often heat-labile proteins and polypeptides that are produced and secreted or released by a variety of species, including both Gram-negative and Gram-positive bacteria. Bacterial exotoxins can be classified in five main groups based on their effect on the host, as follows: damage to cell membranes, inhibition of protein synthesis, inhibition of release of neurotransmitters, activation of secondary messenger pathways, or activation of host immune responses. Examples of exotoxins include tetanus toxin, produced by the Gram-positive bacterium Clostridium tetani, and cholera toxin, produced by the Gram-negative bacterium Vibrio cholerae. Additionally, a family of heat-stable exotoxins exists, called enterotoxins, which exert their primary effects on the digestive tract. They include Staphylococcus Enterotoxin Type B produced by Staphylococcus aureus, heat-stable enterotoxins produced by enterotoxigenic Escherichia coli (ETEC), and ceruleite produced by Bacillus cereus.

Endotoxins are structural molecules that are embedded in the outer layer of the cell wall of certain Gram-negative bacteria, such as Escherichia coli and Shigella dysenteries. They are less toxic than exotoxins and are heat stable. When compared to microbiological pathogens, it is easy to control the spread of toxins. Toxins do not replicate, are not infectious, and are not transmitted from person to person. The route of transmission to personnel handling toxins is through accidental inoculation or by the exposure of mucous membranes to aerosols.

Note: There is no specific research being conducted on toxins within UFV, however, the production of a toxin (exotoxin) or the presence of endotoxins is possible from bacteria used in a student laboratory.

3.2.7 Recombinant DNA

Genetic material from more than one source, either natural or synthetic, can be combined to construct novel recombinant DNA (rDNA). rDNA technologies are widely used in modem-day research and have many applications, including the production of transgenic animals, the cloning of microbial toxin genes or other genes in expression vectors, and the production of full-length infectious viral clones.

3.2.8 Cell Lines

Cell lines (or cell cultures) are commonly used in diagnostic, research, and industrial microbiology laboratories. Many cell lines do not inherently pose a risk to the individuals manipulating them in the laboratory; however, they have the potential to contain pathogenic

organisms such as bacteria, fungi, mycoplasmas, viruses, prions, or recombinant virions. This can occur either naturally or through contamination by adventitious organisms, transformation, or recombination. Cell lines that are known or potentially contaminated should be manipulated at the containment level appropriate for the contaminating organism of the highest risk.

Bacterial and fungal contamination in cell lines can be readily identified; however, viruses are not as easily identified and can pose a significant hazard. Growth conditions (e.g., pH, temperature, medium supplements) may cause altered expression of oncogenes, expression of latent viruses, interactions between recombinant genomic segments, or altered expression of cell surface proteins. One of the primary hazards of manipulating any cell line relates to the expression of latent viruses. Endogenous viral sequences have been found in a variety of cell lines derived from mammalian species, including humans.

3.3 Risk Groups

Biohazardous agents are assigned to specific risk groups. This statement is not as simple as it sounds as new uncharacterized pathogens are constantly being discovered and because microorganisms are adept at evolving and changing their characteristics. However, most infectious material can be categorized into one of four risk groups. The Human Pathogens and Toxins Act (HPTA) website maintains a Pathogen Safety Data Sheet (PSDS) resource assigning risk group levels to many human and animal pathogens**. Note:** working with biohazardous agents requiring containment level 3 or higher is prohibited at UFV. UFV has no laboratories compliant with CL3 regulations.

3.3.1 Risk Group 1 (low individual and community risk)

A microorganism, nucleic acid, or protein that is either a) not capable of causing human or animal disease; or b) capable of causing human or animal disease, but unlikely to do so. Those capable of causing disease are considered pathogens that pose a low risk to the health of individuals or animals, and a low risk to public health or animal population. RG1 pathogens can be opportunistic and may pose a threat to immunocompromised individuals resulting in serious health issues. Therefore, due care should be exercised when managing these materials.

Because there is a low risk to public health and animal population associated with RG1 material, CBS has no mandatory physical or operational requirements for handling CL1 biohazardous agents. However, the PHAC has recently publish a companion guide of recommendations for CL1 physical design and operational practices and highly recommends the use of Good Microbiological Laboratory Practices for all activities involving RG1 pathogens and toxins. In

addition, the waste from some RG1 biohazardous material is classified as biomedical waste (waste from human blood or other body fluids) and must be decontaminated prior to disposal. Non-decontaminated biomedical waste cannot be disposed of in a normal waste disposal system (see BSM 6.3.1).

Due to the potential serious health issues of exposure to opportunistic pathogens and the nature of biomedical waste, the UFV IBC requires all UFV personnel and students managing CL1 biohazardous material to be under the authority of a valid CL1 biosafety permit.

3.3.2 Risk Group 2 (moderate individual risk, low community risk)

A pathogen or toxin that poses a moderate risk to the health of individuals or animals, and a low risk to public health and the animal population. These pathogens can cause serious disease in a human or animal but are unlikely to do so. Effective treatment and preventive measures are available and the risk of spreading diseases caused by these pathogens is low.

3.3.3 Containment Areas

Once the risk group has been determined by a LRA, there are several key factors to determine the appropriate level of containment at which the identified pathogen or toxin can be safely managed. Well-characterized pathogens that have had a pathogen risk assessment completed by the PHAC or the CFIA have already been assigned an appropriate risk group and containment level. In general, the containment level and risk group of the pathogen are the same (e.g., RG2 pathogens are managed at CL2); however, there are some exceptions. If the pathogen has been modified, the containment requirements may need to be revised accordingly. These containment level changes reflect the risk mitigation strategies to address the specific modification of the pathogen.

The following factors are considered when conducting a containment assessment (i.e., determining the specific physical containment requirements, operational practice requirements, and performance and verification testing requirements) for a pathogen:

- Aerosol Generation: Are equipment or procedures that may generate aerosols (e.g., pipetting, centrifugation, homogenization) being used? Personnel can be exposed to infectious aerosols or aerosolized toxin by direct inhalation of aerosolized droplets or by ingestion of droplets that settle on surfaces or hands.
- Quantity: What quantity of pathogen is being manipulated, and in what format (e.g., one large vessel, multiple small vessels)? Large scale processes may have different containment requirements than laboratory scale work using the same pathogen.

- Concentration of the Pathogen: The concentration of the pathogen may vary depending on the work being performed (e.g., diagnostic specimens may contain a lower concentration of pathogen than pure cultures).
- Type of Proposed Work: What is the nature of the work (e.g., diagnostic activities, scientific research, in vitro, in vivo, large scale)? For example, for in vivo work, the type of animal (e.g., host versus non-host species) and the inherent risks associated with that animal need to be considered when determining the appropriate containment level.
- Shedding (specific to animals): The shedding of pathogens should be considered when working with infected animals. Pathogens may be present in the saliva, urine, or feces, and may also be exhaled by the animal. Due to the nature of zoonotic pathogens, additional precautions may need to be implemented whenever known or potentially infected animals are managed.

Some factors considered when determining the risk group may also be evaluated in the context of the containment assessment. For example, the concentration of the pathogen being managed may have less importance if the infectious dose is extremely high. On the other hand, aerosol generation becomes more important for pathogens transmitted via the inhalation route.

4.0 Biosafety Practices and Procedures

4.1 General UFV Biosafety Practices Overview

I. The UFV Institutional Biosafety Committee has adopted the UFV BSM, the CBS, the CBH, and the UFV Biosafety Standard Operating Procedures (SOP's) as its policy and procedures governing all aspects of activities, either research (faculty or student based), teaching laboratories, or medical training programs that are managing biohazardous materials.

II. It is the responsibility of the Principal Investigator or Laboratory Instructor to identify potential biohazards and to specify safe practices and procedures. All laboratory personnel must be informed of the potential hazards and trained in safe handling techniques as defined within the UFV BSM. Service personnel and cleaning staff that enter the facility must be informed of the hazards that might be encountered.

III. Prior to the commencement of any biosafety work involving infectious materials, all UFV employees and students managing RG1 biohazardous material must be trained in SOP UFV BS01. Employees or students managing RG2 biohazardous materials must be trained on SOP UFV BS03. In addition, personnel must be trained according to requirements identified during the LRA review.

IV. Issues of non-compliance will be reported to the IBO and an incident report form will be generated (see BSM Appendix 6). The IBO and the IBC review all incident report forms. An offending laboratory may be shut down according to CBS compliance requirements.

V. All students enrolled in a UFV Biology laboratory handling microorganisms must be trained and evaluated to ensure that they are competent to safely work with infectious materials. Under the direction of the IBO, training is the responsibility of the PI or the laboratory supervisor. Testing will be accomplished using a biosafety quiz and a record of the testing results must be maintained.

VI. The recommendations for containment levels assume a population of immunocompetent individuals. Individuals with altered immunocompetence may be at increased risk for the hazards associated with manipulating a particular pathogen or combinations of pathogens in the laboratory environment. The IBO must take immunocompetence into consideration in individual cases when containment levels are being determined. All students involved in a student laboratory involving biological material are requested to inform their instructor, supervisor, or IBO if they consider themselves to be immunocompromised. Reasons for a student to be immunocompromised include, but are not limited to certain illnesses, pregnancy, malnutrition, or drug use.

4.2 Containment Levels

Classification of organisms according to risk group may not be entirely appropriate for the handling of biological hazards in the laboratory setting. For example, the risk group system does not consider the procedures that are to be employed during the manipulation of a particular organism. Containment levels are more appropriate and give the end-user an indication of the containment required for managing the organism safely. A LRA is required to assign an appropriate containment level for the safe handling of the biohazardous material in use. The LRA will evaluate all aspects of the work involved; the inherent nature of the pathogen or toxin; the types of manipulations and procedures used; the engineering and physical attributes of the working area. In some instances, this may mean a CL2 facility is required when working with an RG1 pathogen. Likewise, an LRA may determine that potential RG2 material (e.g., human body fluids) that undergo clinical diagnostic procedures may only require a CL1 biosafety permit.

The containment level required for work with a particular agent is based on the manipulations associated with laboratory-scale research and clinical procedures. If a particular procedure, such as the preliminary identification of an infectious agent, poses a lower hazard than manipulating a live culture, then a lower containment level may be appropriate.

Both physical containment and good laboratory practices are important for reducing the risk of laboratory acquired infections. Note that laboratory technique can significantly alter the risk of exposure to biohazards. 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.

4.2.1 Requirements When Working with CLI Biohazardous Material

CLI requires no special design features beyond those suitable for a well-designed and functional laboratory. Biological safety cabinets are not required. Work may be done on an open bench top, and containment is achieved using practices normally employed in a basic microbiology laboratory.

In general, manipulating RG1 biological material requires a CL1 working area. RG1 biological or biomedical material is unlikely to cause human or animal disease, and as such, is not considered pathogenic. Nevertheless, RG1 material can be harmful to individuals under certain conditions. Many RG1 infectious agents are opportunistic pathogens capable of harming

immunocompromised or immunosuppressed individuals. While many individuals susceptible to these pathogens are aware of their condition (e.g., diabetics or other chronic medical conditions) others may not be (e.g., early pregnancy or in an early stage of infectious disorders such as mononucleosis). Therefore, as recommended in the CBS, the UFV IBC require the manipulation of CL1 biohazardous agents be carried out in a laboratory or area that incorporates basic laboratory design using CL1 safe operational practices (see SOP UFV BS01) and that all UFV personnel and students handling CL1 biohazardous material be under the jurisdiction of a valid CL1 biosafety permit.

Both physical containment and safe laboratory practices are important for reducing the risk of laboratory acquired infections. PI and lab supervisors should consider that laboratory technique can significantly alter the risk of exposure to biohazards. If possible, techniques that are likely to increase the risk of aerosols or increase the chances of direct skin contact should be avoided. If this is not possible, informing students of the potential risk when using these procedures should be emphasized. In addition, the use of mitigation strategies such as wearing PPE, hand washing, disinfecting work areas, should be closely monitored.

4.2.2 Requirements When Working with CL2 Biohazardous Material

This level applies to the laboratory handling agents requiring containment level 2. The primary exposure hazards associated with organisms requiring CL2 are through the ingestion, inoculation, and mucous membrane route. Agents requiring CL2 facilities at UFV are not transmitted by the airborne route, but care must be taken to avoid the generation of aerosols (aerosols can settle on bench tops and become an ingestion hazard by contamination of the hands) or splashes. CL2 requirements are achieved through standard operational practices and through a set of containment requirements listed below. Required operational practices include, but are not limited to:

- Biosafety program management
- Implementation of SOP UFV BS03
- The use of PPE (gloves, lab coat, protective eye wear)
- Hand washing
- Disinfection of work areas
- Collection and disposal of contaminated waste
- UFV's Emergency Response Plan posted and in place

Due to the potential serious health issues of exposure and the nature of biomedical waste, the UFV IBC requires all UFV personnel and students managing RG2 biohazardous material to be under the authority of a valid CL2 biosafety permit.

4.2.3 Requirements when Working with Human Tissues, Cell Lines and Body Fluids

Primary specimens are samples taken directly from a person. The HPTA and HPTR do not apply to human pathogens and toxins that are in an environment in which they naturally occur. However, human body fluids can contain infectious pathogens that are classified as RG2 or higher. Most of these pathogens cause diseases with visible symptoms, but not always. Often individuals in an early stage of an infection or those who are asymptomatic carriers, will not exhibit any visible signs. These individuals can be highly contagious, capable of transmitting disease to those around them through their body fluids. A small sampling of contagious human pathogens found in body fluids that potentially exist in the UFV population or in individuals from the Fraser Valley population are listed below.

- RG2 Influenza virus
- RG2 Epstein Barr Virus
- RG2 Hepatitis A or B
- RG3 Mycobacterium tuberculosis
- RG2 Parvo Virus
- RG2 Norwalk Virus
- RG3 Human Immunodeficiency Virus
- RG2 Enter invasive Escherichia coli
- RG2 Rubeola Virus
- RG2 Cytomegalovirus (CMV)

The dichotomous nature of human body fluids (free of infectious agents versus potentially pathogenic) poses unique challenges for the PI, lab supervisor and IBO. During an LRA, the IBO (in consultation with stakeholders) will carefully exam all procedures involving the collection or manipulation of primary human biohazardous materials to develop the appropriate mitigation strategies.

At UFV and most Canadian universities, human tissues, cell lines, blood, and body fluids are classified as RG2 biohazardous materials and require CL2 level facilities and practices. The UFV IBC requires that a Biosafety permit be obtained prior to the commencement of any work involving human tissues, human cell lines, blood, or body fluids. Laboratory practices should assume that human materials are potentially infectious.

Diagnostic activities involving primary specimens that do not involve propagating, concentrating, or purifying the pathogen (e.g., enzyme-linked immunosorbent assay [ELISA], extraction of genetic material, fixation of tissue samples for histology) are regularly conducted in hospitals, public health laboratories, and veterinary diagnostic laboratories. In most cases,

the risks associated with this type of work are considered lower than propagation and in vivo work. Based on the risks associated with the pathogen suspected of being within the primary specimen and the laboratory procedures, the physical containment, and operational requirements for activities with primary specimens may sometimes be lower than the requirements for managing pure cultures.

Due to the diverse nature of the programs offered at UFV, personnel from the Health Sciences might be more familiar with, and may have received infection control training, using the safety practices referred to as "Universal Precautions and Routine Practices." Routine practices and good microbiological laboratory practices are similar in scope, and both are suitable training methods. During the LRA the IBO will review all pertinent SOPs to ensure the Biosafety permit holder and any workers under their supervision have been adequately trained regardless of their educational program.

During the LRA the IBO will evaluate the likelihood of risk by assessing the following factors:

- The nature of the sample population. Is the population healthy or likely to be infected?
- Is the sample population screened for transmittable infections (e.g., HIV, Hepatitis) and are infected samples excluded?
- The means of sample collection (e.g., saliva in a microfuge tube, sharps such as a retractable lancet or a needle and syringe) and the volume collected (e.g., microliters or milliliters)

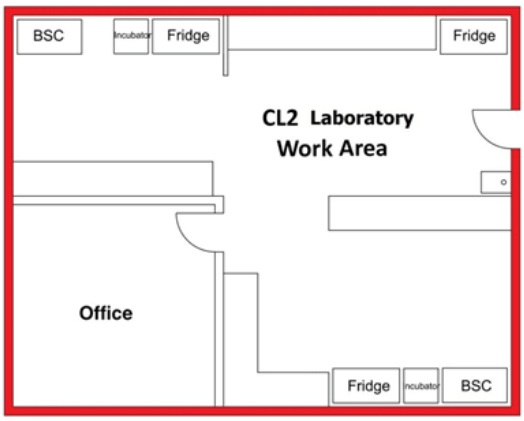
The collection and manipulation of samples should follow the general safe work practices listed below:

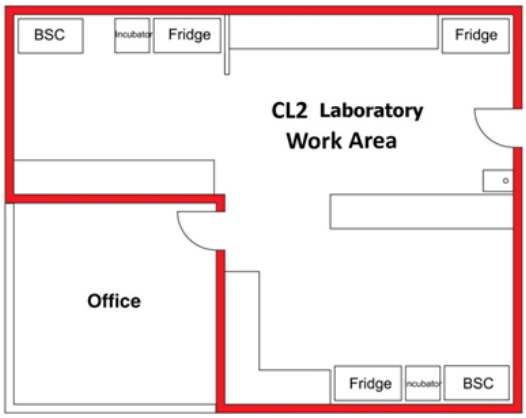
- Training on the appropriate SOP
- Wearing the appropriate PPE such as lab coats, gloves, appropriate footwear, long pants/skirts, and protective eyewear when there is a risk of exposure to splashes
- Waste to be disposed of in biohazardous waste bags
- Waste requiring transport to the waste disposal site (e.g., autoclave) should be double bagged and transported in a leak proof container
- Wastes to decontaminated either through autoclaving, chemical disinfection or other means deemed appropriate through the LRA
- After removing gloves, hands should be washed

- Appropriate vaccinations as deemed appropriate
- Are appropriate sharp containers needed and readily accessible

4.3 CL 2 Working Area

A CL2 laboratory work area includes physical containment features within a containment zone as shown below. Prior to setting up a containment zone, special considerations should be given to the placement of office space. Office space within the containment zone cannot be used to store personal items (e.g., street clothes, lunches etc.). On the other hand, lab personnel must remove their lab coats and wash their hands prior to entering office space located outside of the containment zone.





CL2 laboratory designs include features such as:

- Location of the lab work area, support areas and offices
- Restricted access (lockable doors) into and out of the lab work area
- Doors to separate containment versus non-containment areas
- Impermeable washable bench tops and floors
- Biohazardous signage
- Storage for user lab coats to remain within the containment zone
- Primary containment devices
    - Biological safety cabinet

- centrifuges with sealed rotors or safety cups

CBS lists in matrix 3 and 4 the requirements for CL2 work areas (reproduced below for your convenience).

CBS Identifier	CL2 Requirement
3.1.1	Containment zones to be separated from public and administrative areas by a door
3.1.2	Dedicated paper/computer workstations within the containment zone to be segregated from laboratory workstations, animal rooms, animal cubicles, and postmortem rooms (PM rooms).
3.3.1	Doors to the containment zone to be lockable
3.3.2	Biohazard warning signage (including the international biohazard warning symbol, containment level, name and telephone number[s] of contact person, and entry requirements) to be posted at the containment zone point(s) of entry.
3.3.3	Where unique hazards exist, project-specific signage to be posted at the animal room, animal cubicle, and postmortem room (PM room) point(s) of entry
3.3.9	Space to be provided for the storage of PPE in use.
3.4.1	Surfaces and interior coatings, including, but not limited to, floors, ceilings, walls, doors, frames, casework, bench tops, and furniture, to be cleanable, non-absorbent, and resistant to scratches, stains, moisture, chemicals, heat, impact, repeated decontamination, and high pressure washing, in accordance with function.
3.4.5	Floors to be slip-resistant in accordance with function.
3.6.4	Sinks to be provided and located to facilitate hand washing upon exit from the containment zone
3.6.6	Emergency eyewash and shower equipment to be provided in accordance with containment zone activities.

3.7.1	Certified BSCs and other primary containment devices to be provided, based on work activities
3.7.3	Class II B2 BSCs, where present, to be installed and set-up in a manner to eliminate reversal of airflow from the face of the BSC (i.e., puff-back) during a failure of the heating, ventilation, and air conditioning (HVAC) system or the BSC exhaust fan; where elimination of puff-back cannot be achieved, the risk associated with puff-back to be mitigated through physical and operational means.
3.7.4	Process equipment, closed systems, and other primary containment devices to be designed to prevent the release of infectious material or toxins
3.7.6	BSCs, where present, to be located as far as possible from high traffic areas, doors, openable windows, and air supply/exhaust diffusers
3.7.11	Decontamination technologies for the decontamination of materials to be provided within the containment zone, or standard operating procedures (SOPs) to be in place to safely and securely move or transport waste out of the containment zone to a designated decontamination area
3.7.14	Decontamination technologies to be provided with monitoring and recording devices that capture operational parameters.
3.7.15	An autoclave, where present, to be capable of operating at the appropriate temperature for decontamination, as determined by validation
3.7.17	Vacuum systems to be equipped with a mechanism that prevents internal contamination
3.7.18	Two-way communication system(s) to be provided inside the containment barrier that allows communication between inside the containment barrier to outside the containment zone, in accordance with function.

4.4 Standard Operating Procedures (SOPs)

SOPs are detailed, step-by-step procedures that are introduced during training, and are read prior to performing the procedure for the first time, for re-familiarization with procedures that

are performed infrequently, and whenever the SOP is amended. They provide documentation that can be reviewed by internal or external auditors and can facilitate evaluation of compliance with program requirements. Safe work practices and SOPs specific to the containment zone (e.g., personal protective equipment [PPE], entry and exit procedures, and waste management) are developed to address specific biosafety issues for the containment zone and added to the Biosafety Manual so that they are documented and accessible for all containment zone personnel.

While each biosafety protocol is likely to have unique requirements, there are some standard procedures common to all biosafety work. The standardization of common SOPs makes it easier for all end-user to be consistent in the application of safe working practices and the development of training modules. The SOPs listed in table 4.3.A were developed by the IBC, the UFV Biology Department Biosafety Committee, and the UFV Kinesiology Physical Education Department Biosafety Committee and have been made available for use by UFV faculty, staff, and students. As these are standardized SOPs, changes may not be made without the approval of the UFV IBO or IBC.

Table 4.3.A UFV Standardized SOPs

SOP Identifier	Title
UFV-BS01	Safe Operational Practices for CL1 Facilities
UFV-BS03	Good Microbiological Laboratory Practices for CL2 Facilities
UFV-BS05	Biosafety Training for CL1, CL2 facilities
UFV-BS07	Pathogen Risk Group Assessment
UFV BS011	Operation and Monitoring of Autoclaves
UFV-BS013	Clean Up of Risk Group 2 Biohazardous Spills
UFV-BS015	Decontamination of RG2 Biohazardous Laboratory Waste
UFV-BS017	Operational Practices and Certification of Biological Safety Cabinets
UFV-BS019	Transport of Biohazardous Materials between Containment Zones
UFV-BS021	Operational Practices for Handheld Portable Lactate Analyzers

UFV BS23	Operational Practices for Saliva Collection and Handling
UFV BS25	Operational Practices for Human Urine Collection and Handling
UFV BS27	Operational Practices for Measuring Maximal Aerobic Capacity Using a Metabolic Cart

4.5 Personal Protective Equipment (PPE)

PPE acts as a barrier between the worker and exposure to biohazardous material and is designed to reduce the risks of transmitting infectious agents to the worker and the public. PPEs provide an additional layer of protection in the event of a failure in administrative or engineering controls. The necessity of PPE is determined by the IBO as part of the Biosafety permit application process and the LRA.

At a minimum, all personnel working within CL1 or CL2 facilities must wear full shoes with neither low heel, long pants or a garment covering the legs and must don a lab coat when entering the facility. This level of protection is intended to prevent splashes from directly contacting the skin. Within CL2 facilities, lab coats must be stored within the facility and may not be removed from the premises without prior decontamination. Personal belongings, such as coats, bags, and backpacks should be stored in an area outside of the containment area.

Additional PPE can include, but is not limited to:

- Gloves: Gloves protect the hands from direct contact with biohazardous materials and reduce the chances of a laboratory acquired infection (LAI) associated with ingestion of infectious agents or toxins.
- Eye and Face Protection: There are many different types of eyes and face protection that can be used to shield the eyes, nose, or mouth from flying objects or splashes from infectious liquids or toxins. The type of eye and face protection selected will depend on the degree of coverage needed for the specific task at hand. Safety glasses protect the eyes from injuries associated with larger objects, including chips, fragments, sand, and dirt, as well as minor splashes. Safety goggles provide a higher level of protection due to the snug fit over and around the eyes, which creates a barrier to liquid hazards. Face shields provide coverage of the nose, mouth, and skin, in addition to the eyes. Depending on the type of protective eye and face equipment selected, prescription eyeglasses may be worn underneath; safety glasses can also have prescription lenses.

- Respiratory Protection: At UFV respirators are not normally used in CL1 or CL2 facilities. Instead, a biological safety cabinet (see BSM 4.6) is used to mitigate exposures to aerosols. If the IBO deems that respirators are necessary, a fit tested respirator such as N95 disposable respirator or a half face respirator with P100 cartridges may be recommended. Annual fit tests are required if using a respirator.

4.6 Containment Equipment

Some containment equipment is common in lab settings, not specifically managing biohazardous material. The CBH reviews and addresses potential biosafety concerns when using this equipment with infectious agents or toxins. The material from the CBH has been reproduced here for your convenience.

4.6.1 Biological Safety Cabinets

Biological safety cabinets (BSC) provide effective primary containment for work with biohazardous materials and should be used in conjunction with good microbiology laboratory practices (see SOP UFV BS03). CL2 laboratories at UFV contain class II type A BSCs.

- All personnel using BSCs, whether working with biohazardous material or not, must receive training on SOP UFV BS17
- BSCs in CL2 laboratories must be inspected and certified annually or whenever they are moved
- When used correctly, airflow is directed inward through HEPA filters protecting workers and the environment from exposure to biohazardous material.
- BSCs are designed to have only one person working in them at a time
- BSC must be properly located away from areas of high traffic, air vents and opening doors to prevent disrupting normal airflow.
- During the LRA the IBO will determine if the use of a BSC to contain Risk Group 2 biohazardous aerosols is required. The decision about whether or not a BSC is required is based on the actual material being used, the concentration and volume of pathogen in use, whether or not the procedures generate significant aerosols, and the qualifications and experience of personnel

4.6.2 Centrifuges

There is a risk of infectious aerosol generation when a centrifuge is used (e.g., tube breakage, improper use of safety cups or rotors, or lack of proper maintenance). The following points highlight some requirements and recommendations for centrifuge use when working with infectious material or toxins:

- The outside surface of cups and rotors should be decontaminated, as required.
- Equipment should be used in accordance with the manufacturer's instructions, which include the balancing of rotors to prevent rotor damage or explosion.
- Plastic tubes that are suitable for centrifugation should be used (e.g., thick wall external thread plastic tubes with screw caps).
- Sealed centrifuge cups or rotors are to be used to prevent the release of aerosols during centrifugation, and the integrity of the cup or rotor seal regularly inspected.
- Cups and rotors with samples of infectious material or toxins are to be unloaded inside a biological safety cabinet (BSC) to protect against the release of infectious aerosols or aerosolized toxins
- Sufficient time for aerosols to settle should be allowed prior to opening cups and rotors.
- The use of centrifuges inside a Class II BSC will disrupt the airflows and compromise the protection provided by the BSC and should be avoided.

4.6.3 Microtomes

Microtome work with infectious material or toxins that may not have been inactivated by fixation should be performed in a low traffic dedicated area (e.g., taped off) to prevent tracking of wax shavings within or out of the containment zone. Care should be taken as the floors in histopathology areas tend to be quite slippery from the wax. Disposable shoe covers, dedicated to this area, should be worn; slip-resistant shoe covers are recommended for such areas. Respiratory protection should also be worn if deemed necessary by an LRA. Troughs may be installed on the edge of the work bench to contain excess shavings. Care should be taken when installing or removing microtome blades; non-disposable blades can be cleaned with an instrument, rather than by hand, to prevent contact with the blade. When manipulating tissue potentially infected with pathogens or prions, additional personal protective equipment (PPE) such as cut-resistant gloves can be worn to reduce the risk of exposure or injury.

4.6.4 Blenders, Sonicators, Homogenizers, Shaking Incubators, and Mixers

The operation of blenders, Sonicators, homogenizers, mixers, shaking incubators, and other similar equipment can generate aerosols. The following points highlight some requirements and recommendations when using these types of equipment:

- Laboratory equipment and associated accessories specially designed to contain infectious aerosols can be used for manipulations of pathogens and toxins. For example, cup horn Sonicators allow sonication of samples within a contained vessel without direct contact with the material being processed.
- When equipment designed to contain infectious aerosols is not available, equipment should be operated in a BSC (only if the equipment does not disrupt airflow patterns) or another primary containment device.
- Time for aerosols to settle should be allowed before opening or removing the covers.

4.6.5 Bunsen Burners

Bunsen burners are commonly used for heating (e.g., fixing cells onto slides) and sterilization (e.g., inoculation loops). Aerosolization of infectious material can occur when inoculation loops are sterilized in the open flame of a Bunsen burner; micro incinerators or disposable loops are recommended as alternatives. Sustained open flames are prohibited from use inside a BSC as they will disrupt the airflow patterns, decrease the user protection provided by the air curtain, and have the potential to damage the filters. When suitable non-flame alternatives are not available, touch-plate micro burners that provide a flame on demand may be used.

4.6.6 Micro incinerators

Micro incinerators can be used as an alternative to Bunsen burners, especially for use in a BSC. They are often equipped with shields to minimize the dispersal of infectious aerosols. When used in a BSC, the micro incinerator should be placed at the rear of the working area inside the cabinet to help minimize disruption of the air curtain at the front of the cabinet.

4.6.7 Disposable Loops

Single-use disposable loops are sterile and can be used in a BSC as an alternative to reusable loops that require sterilization with a burner or micro incinerator; however, they will add to the amount of waste requiring decontamination. Disposable loops should be placed in a leak-proof, puncture-resistant waste container immediately after use.

4.6.8 Pipetting Aids

Pipetting aids minimize the risk of aerosol generation when used properly; they also eliminate the risk of ingestion of infectious material through oral pipetting, which is prohibited at all containment levels. Discharging liquid from a pipette and the aspirate/expel action used to mix cultures can create aerosols. The following points highlight some requirements and recommendations for the safe use of pipetting aids:

- use a BSC when pipetting infectious material or toxins.
- work over plastic-backed absorbent material; the droplets will be absorbed rather than "splash."
- use pipettes calibrated "to deliver," which reduces the risk of creating aerosols by retaining the last drop in the tip.
- use plastic pipettes instead of glass pipettes whenever possible.
- use filtered serological pipettes with pipette aids and filtered pipette tips with micro pipettors, as these will prevent contamination of the pipetting device.
- use appropriate decontamination procedures for pipette aids and micro pipettors when non-filtered tips are used or when the pore size of the pipette filter is insufficient for filtering the pathogen(s) or toxin(s) in use.
- do not mix liquids by bubbling air from a pipette through the fluid or by alternate suction and forceful expulsion through the pipette.
- discharge liquids as close as possible to the wall of the tubes or to the surface of media.
- avoid forcefully aspirating or expelling liquids from the pipette.
- pipet tips can be ejected directly into a container (e.g., bottle, beaker) for subsequent decontamination or bag for autoclaving; and,
- pipettes should be decontaminated with a suitable disinfectant immediately after use.
    - Serological pipettes can be laid horizontally in a pan and completely immersed in a disinfectant (care should be taken when moving the pan to avoid a spill hazard); or
    - Serological pipettes can be filled with disinfectant and left to drain by gravity into an oversized waxed cup in an autoclave bag (the bag can be closed over the pipettes, and this can be autoclaved as a whole in an upright position before reuse).

4.6.9 Vacuum Pumps and Systems

Vacuum systems are used to create a void in filtration units and to aspirate liquids. The most common laboratory vacuum systems are centralized vacuum (void) systems, vacuum pumps, or a faucet aspirator vacuum pump attached to the water supply. The primary concern with vacuum pumps is that the process of aspiration can cause the aerosolization of infectious material or toxins, and subsequent contamination of the vacuum line and pump or system. A device (e.g., in-line high efficiency particulate air [HEPA] filter or 0.2 µm filter with disinfectant traps) is used to protect the vacuum system from internal contamination. A maintenance program for the regular inspection and replacement of in-line filters will help prevent a breach in filter integrity and containment. For high containment zones, the use of portable vacuum systems instead of centralized vacuum systems will minimize the risk of a containment breach.

4.6.10 Chemical Fume Hoods

Chemical fume hoods are designed for the manipulation of chemical substances, particularly volatile substances. Materials exhausted from chemical fume hoods are filtered with recirculation of the remaining air stream or exhausted directly to the outside atmosphere. If required, filters are selected according to the type of contaminant to be removed, the efficiency required to meet occupational and environmental exposure limits, and the required residence time. Locating filters upstream of the exhaust fan, and in such a way as to allow replacement without contaminating the surrounding area, keeps contaminated ducts under negative pressure and prevents the release of chemical substances. Testing and replacement should be more frequent for filters used to trap chemicals that are capable of degrading the filter. It is the responsibility of the facility to determine the compatibility of specific chemicals with various filters, and to determine the appropriate replacement frequency. The inclusion of exhaust air treatment devices (e.g., activated carbon filters) is to be consistent with applicable local regulations.

Chemical fume hoods are not designed for the manipulation of infectious material or toxins, and consideration should be given to minimizing the placement of chemical fume hoods in high containment zones; instead, Class II B2 BSCs, which are designed to handle infectious material or toxins as well as volatile chemicals and radionuclides, should be considered. Fume hoods that are located in high containment zones are to comply with the requirements for HEPA filtration of exhaust (CBS Matrix 3.5). Chemical fume hoods should not be located directly opposite or in close proximity to BSCs in order to prevent disruption of the protective air curtain. The installation of a HEPA filter upstream of the charcoal filter is recommended as a measure to protect the charcoal filter from contamination with infectious material and toxins.

4.6.11 Cell Sorters

Cell sorters are used to physically separate a defined subpopulation of cells from a heterogeneous cell population. The risk associated with cell sorters can be attributed to both the nature of the sample (i.e., the presence and type of the infectious material or toxins in the sample), and to the equipment itself (e.g., the use of droplet-based cell sorting, which uses jet-in-air technology that can produce aerosolized droplets). Droplet-based cell sorting involves the injection of a liquid stream carrying the cells through a narrow nozzle that vibrates at a high frequency. High-speed cell sorters with jet-in-air technology use even higher pressures and nozzle vibration frequencies and consequently produce a large amount of aerosolized material. An LRA can be conducted to determine the physical containment and operational practices necessary to safely work with infectious material or toxins in a cell sorter. A cell sorter may need to be housed inside a ventilated enclosure that is custom-built by the same manufacturer for use with pathogens and toxins if it is not able to be housed inside a BSC.

4.6.12 Additional Equipment Considerations for Prions

The following are additional equipment considerations for containment zones dedicated to prion work:

- dedicated laboratory work areas and equipment should be used, where possible.
- disposable equipment and laboratory supplies should be used when managing material known to contain prions.
- blunt cannulas can be used in place of needles; the use of needles, syringes, and other sharp objects are to be limited.
- plasticware can be used in place of glassware; and
- instruments should be kept moist until decontamination.

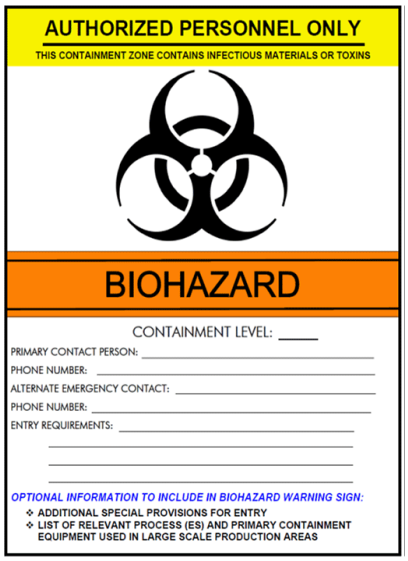
4.6.13 Additional Equipment Considerations for Toxins

The following are additional equipment considerations for toxin work:

- plasticware should be used in place of glassware.
- thin-walled glassware should be avoided; and
- glass chromatography columns should be enclosed in a secondary container.

4.7 Signage

All level 1 and level 2 facilities must display a biohazard warning sign at the points of entry into the containment zone. An example of a standard biohazard sign used at UFV is shown below.



Properly displayed Biohazard warning signage must include the international biohazard warning symbol, containment level, name and telephone numbers of a contact person, and entry requirements. In addition, anyplace where biohazardous materials are stored (e.g., refrigerators, freezers, cupboards) must also prominently display a biohazard warning sign.

4.8 Emergency Response Plan

An emergency response plan (ERP) outlines the necessary steps to be taken in the event of a biohazardous event or incident. The ERP plan is essential to protect lives and safeguard the environment. UFV's Risk and Safety office has developed an overarching ERP for facilities at UFV that addresses response measures relevant to any foreseeable situations such as: accidents, medical emergencies, fires, spills, power failure, animal escape, or natural disasters. In addition, UFV's SOPs BS11 Operation and Monitoring of Autoclaves, BS13 Control of Biohazardous Spills, BS15 Decontamination of Infectious Materials, and BS17 Biological Safety Cabinet: Certification and Use are available for review in case of a biological spill or failure of the biological safety cabinet.

Matrix 4.9 of the CBS specifies the minimal requirements and has been reproduced here for your convenience.

CBS Identifier	CL2 Requirements
4.9.1	The ERP is to describe emergency procedures applicable to the containment zone for: • accidents/incidents. • medical emergencies. • fires. • chemical/biological spills (small/large; inside/outside BSC and centrifuge). • power failure. • animal escape (if applicable). • failure of primary containment devices. • puff-back from class II B2 BSCs, where present. • loss of containment. • emergency egress. • notification of key personnel and relevant federal regulatory agency (or agencies). • natural disasters. • incident follow-up and recommendations to mitigate future risks
4.9.2	ERP to include procedures for any infectious material or toxins stored outside the containment zone
4.9.7	Incidents involving pathogens, toxins, other regulated infectious material, infected animals, or involving failure of containment systems or control systems to be reported immediately to the appropriate internal authority

4.9.8	Incident investigation to be conducted and documented for any incident involving pathogens, toxins, other regulated infectious material, infected animals, or failure of containment systems or control systems, in order to determine the root cause(s).
4.9.9	The Public Health Agency of Canada (PHAC) to be informed without delay via the submission of an exposure notification report following: • an exposure to a human pathogen or toxin; or • recognition of a disease that has or may have been caused by an exposure to a human pathogen or toxin.
4.9.10	An exposure follow-up report documenting the completed investigation, to be submitted to the PHAC within: 15 days of the submission of an exposure notification report involving a security sensitive biological agent (SSBA); or 30 days of the submission of an exposure notification report involving a human pathogen or toxin other than an SSBA.

Emergency response procedures must be in place for any incidents that might occur while managing biohazardous materials. Each facility's Emergency Response Plan should contain SOPs to address those items listed in CBS section 4.1.10 and section 4.9. UFV SOP BS13 describes procedures to follow in the event of a biohazardous material spill and an incident report form can be found in BSM Appendix 6.

CBS recommends annual emergency response training for existing personnel and immediate training for any new personnel. The Emergency Response Plan, for a specific containment zone, must be posted and clearly visible. All personnel must be familiar with the contents of the protocol and know where it is posted.

If you are not able to, or if is unsafe for you to clean up the spill, evacuate the lab, post a "Do Not Enter" sign on the door and immediately contact UFV security at 1-855-239-7654 (local 7654).

4.8.1 Spill Response Procedures

Spills are the incidents that require an emergency response. The nature of the spill will determine the appropriate response. For example, spills have the potential to expose personnel to pathogens or their toxins, contaminate surfaces or equipment or to produce aerosols. Each CL2 facility is required to have a biological spill kit (BSK) to facilitate an effective spill response, and all personnel are to be adequately trained to follow the spill response procedures.

4.8.2. General Spill Clean-Up Procedure

After the 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:

1. Remove any contaminated or potentially contaminated clothing and personal protective equipment (PPE).
2. Contaminated personnel doff their outer layer of PPE and any contaminated or potentially contaminated clothing and follow normal exit procedure, including hand washing. In the case of a large spill, personnel remove the outer layer of protection in proximity to the spill. Depending on a local risk assessment (LRA) and SOPs, personnel may proceed to a change room to remove the inner layer of PPE, which is placed into an autoclave bag for decontamination. Personnel proceed to wash any other potentially contaminated parts of their body.
3. Notify all staff in the immediate vicinity that a spill has occurred and to leave the area.
4. Exposed persons should be referred for medical attention. The laboratory supervisor or responsible authority should be informed without delay and Security contacted for large spills.
5. Allow aerosols to settle (e.g., for 30 minutes) before re-entering the area. If the laboratory does not have a central air exhaust, entry should be delayed (e.g., for 24 hours) to allow sufficient air exchanges to exhaust any aerosols and to allow heavier particles to settle. Signs should be posted indicating that entry is forbidden.
6. Don fresh PPE appropriate to the risk, which may include gloves, protective clothing, face and eye protection, and a respirator.

7. Assemble required clean-up materials (e.g., biological spill kit) and bring them to the site of the spill.
8. Cover the spill with cloth or paper towels to contain it.
9. Pour an appropriate disinfectant (i.e., sufficient concentration, effective against the pathogen(s) spilled, freshly prepared) starting at the outer margin of the spill area, and concentrically working toward the center, over the cloth or paper towels and the immediately surrounding area.
10. After the appropriate contact time (i.e., for the pathogen and disinfectant), clear away the towels and debris. If there is broken glass or other sharps involved, use a dustpan or pieces of stiff cardboard to collect and deposit the material into a puncture-resistant container for disposal. Glass fragments should be managed with forceps. Dustpans can be autoclaved or placed in an effective disinfectant.
11. Clean and disinfect the area of the spillage. If necessary, repeat the previous steps.
12. Dispose of contaminated materials in a leak-proof, puncture-resistant waste disposal container.
13. Once the spill clean-up is complete, as per the general spill clean-up procedure, personnel doff contaminated PPE and don clean PPE prior to returning to work in the laboratory.
14. After disinfection, inform the appropriate internal authority (e.g., containment zone supervisor, IBO) that the site has been decontaminated.
15. Depending on the nature and size of the spill, complete room decontamination may be warranted.

4.8.3 Spill Inside a Biological Safety Cabinet

The size of the spill is determined by how far it spreads, and less by its volume. When a small spill occurs inside a BSC, the worker is not considered contaminated unless a splash or spillage has escaped the BSC; however, the gloves and sleeves may be contaminated. A large spill in a BSC may result in material escaping the BSC and the worker becoming contaminated. In this case, the outer layer of PPE is considered potentially contaminated and should be removed at the BSC. The following general procedure is recommended for spills inside a BSC:

1. Remove gloves and discard within the BSC. If two pairs are worn, discard the outermost layer. If sleeves are potentially contaminated, the lab coat or gown should also be removed. Fresh gloves should be donned and if necessary, also a fresh lab coat or gown.
2. Leave the BSC blower on and the sash at the appropriate level.

3. Follow the instructions outlined in for general spill clean-up, keeping head outside the BSC at all times.
4. Surface disinfect all objects before removing them from the BSC or place them into bags for autoclaving. Remove contaminated gloves and dispose of them inside the cabinet.
5. Place PPE into bags for autoclaving.
6. If material has spilled through the grill of the BSC, pour disinfectant through the grill to flood the catch tray underneath.
7. Wipe all inside surfaces with disinfectant.
8. Raise the work surface, clean the catch tray, and then replace the work surface.
9. Allow BSC to run for at least 10 minutes before resuming work or shutting down.

4.8.4 Spill inside a Centrifuge

If a breakage occurs or is suspected while a centrifuge is running, the motor should be switched off and the centrifuge left closed (e.g., for 30 minutes) to allow aerosols to settle. Should a breakage be discovered only after the centrifuge has been opened, the lid should be replaced immediately and left closed (e.g., for 30 minutes).

1. Inform the appropriate internal authority (e.g., containment zone supervisor, IBO).
2. Follow the instructions outlined in for general spill clean-up.
3. If possible, use a non-corrosive disinfectant known to be effective against the pathogen concerned. Whenever possible, consult the centrifuge manufacturer's specifications on the unit to confirm the chemical compatibilities.
4. All broken tubes, glass fragments, buckets, trunnions, and the rotor should be placed in a non-corrosive disinfectant (forceps are to be used to manage and retrieve glass and other sharps debris). Unbroken sealed safety cups may be placed in disinfectant and carried to a BSC to be unloaded.
5. The centrifuge bowl should be swabbed with the same disinfectant, at the appropriate dilution, and then swabbed again, washed with water, and dried.

4.8.5 Spill Clean Up Kit

To facilitate a quick response to spills of biohazardous materials, each CL2 facility must contain a spill clean-up kit containing the following:

- Disposable gloves

- Disposable gown
- Respirator N95
- Effective disinfecting agent (Clinicide or 5% bleach)
- Paper towels
- Dustpan and broom
- Tongs
- Biohazardous autoclave bags
- Waterproof copy of spill cleanup SOP UFV BS13

4.8.6 Medical Emergencies

Procedures for workplace emergencies are listed under UFV Safety & Security and are found within the UFV Emergency Procedures Guide (EPG). The EPG states the following for any Chemical, Biohazard, or Radiation Spill:

Any uncontrolled release of hazardous materials is considered a spill, and these procedures must be followed:

- Evacuate immediate area. If able, shut down equipment.
- Isolate area and notify others in the area to prevent re-entry.
- Stay calm and evacuate in a quick and orderly manner.
- Close doors on your way out, but ONLY DO SO IF IT IS SAFE.
- Upon exiting the building, proceed directly to an area that is at a safe distance outside the main entrance of the building and wait for emergency personnel. Provide emergency personnel with information on hazardous materials involved (e.g., Safety Data Sheets (SDS)).
- Call 911
    - State your name.
    - Give the address where the spill is and the nearest intersection.
    - Provide information about the spill:
        - Injuries
        - Chemical Name

    - Quantity
    - Hazards (Information on SDS)
- Call Security at 1.855.282.7770 (Emergency)
- Inform Supervisor or Department Head.
- DO NOT RE-ENTER THE BUILDING until the Fire Department gives permission to do so

4.8.7 Accidental Contact with Biohazardous Material

- Immediately inform Supervisor or Lab instructor who will contact UFV Security
- Rinse for 15 minutes with water at the emergency wash station
- Remove contaminated clothing or lab coats for autoclaving
- Have your supervisor complete a UFV incident report form

4.8.8 Accidental Needle sticks or cuts involving Biohazardous Material

- Immediately inform Supervisor or Lab instructor who will contact UFV Security
- Wash with soap and water
- Apply a bandage if necessary
- Have your supervisor complete a UFV incident report form

4.8.9 Animal Emergencies

The health and welfare of animals used in research or for teaching purposes falls under the guidance of the UFV Animal Care Committee (ACC). The ACC maintains an external contract with a local Veterinarian. For more information contact Animal Care at acc@ufv.ca or 604-557-4011

4.9 Medical Surveillance Program

The purpose of a medical surveillance program (MSP) is to help prevent and detect illnesses due to the exposure of personnel to biohazardous materials. An MSP identifies the biohazardous material managed or stored in the containment zone and identifies any risks. The MSP complements UFV's medical emergency procedures and is part of UFV's emergency response plan.

Personnel who work in areas where biohazardous materials are used have an increased risk of contracting a Laboratory Acquired Infection (LAI). The MSP needs to be appropriate to the

agents in use, and as such, it is reviewed by the IBO as part of the local risk assessment which is performed as part of the Biohazard Permit Application process. The LRA will determine if a specific MSP is required for each biosafety application. If required, the program may include: a medical examination; serum screening; immunizations; testing and/or storage; and other tests as determined by the risk assessment process. The requirements for an MSP are specified in the CBS matrix 4.2 and are reproduced here for your convenience.

CBS Identifier	CL2 Requirement
4.2.2	Containment zone personnel to immediately inform appropriate internal personnel or authority of any: • Incident that may have resulted in an exposure of an individual to a human pathogen or toxin in a facility; or disease that may have been caused by an exposure to a human pathogen or toxin in a facility.
4.2.4	Emergency medical contact card to be issued to containment zone personnel handling non-human primates or a pathogen identified by a local risk assessment (LRA).

The risks to lab personnel should be reviewed in order that they each gain an understanding of the biological hazards as they relate to personal immune system susceptibility and medical conditions. Appropriate risk mitigation methods must then be employed.

4.10 Incident Reporting at UFV

All incidents involving infectious material, infected animals, or toxins, such as a containment systems failure, an exposure to a human pathogen or toxin, or release of an animal pathogen, must be reported immediately to the Principal Investigator (PI) or laboratory supervisor. The PI or lab supervisor will report to the UFV IBO and complete an incident report (UFV BSM appendix 6). The IBO, or designate, will make an initial assessment, and may conclude that reporting to senior management and the PHAC is required. As stated in the CBS, all persons collaborating with the authority of a license are legally obligated to notify the appropriate facility personnel if they have reason to believe that an incident has occurred involving inadvertent

release, inadvertent production, disease (i.e., any exposure incident), or a missing human pathogen or toxin.

Incident reports help to protect the health and safety of students and university employees and are a key to assessing the most important areas for additional training at the university. Therefore, reporting any lab incidents in a timely manner is a critical part of the safety process.

4.10.1 Incident Report Procedure

Note: Extremely small spills, e.g., from a culture tube onto a laboratory bench of not more than 10 mLs, do not require to be reported to the IBO. However, the supervisor or member of faculty present must be notified of the spill. If in doubt, contact the IBO immediately.

General Procedure

- Immediately contact the PI or Lab supervisor
- If required, contact 911 for emergency help and/or UFV first aid (1-855-282-7770 or local 7770 from any UFV phone) and/ or UFV security (1-855-239-7654)
- PI, lab instructors, or lab technicians should fill out an Incident report form (UFV BSM appendix 6) and contact the UFV IBO as soon as possible (within 24 hours) after the incident
- Laboratory instructors, laboratory technicians, or principal investigators can submit an incident report.
- Types of incidents that are reportable include, but are not limited to:
    - Spill or accident involving infectious substance
    - Spill or accident with material that may have become infectious through storage (i.e., potential media for microorganisms allowing for their growth)
    - Personal exposure such as a spill or splash to the eyes, nose, or mouth of infectious substance
    - Personal injury such as a needle stick injury, exposure of a cut to infectious substance, or potential inhalation of a biohazardous substance
    - Breach of containment or failure of a primary containment device (e.g., BSC)
    - When a human pathogen or toxin has caused, or may have caused, a LAI

- When there is reason to believe that a human pathogen or toxin has been stolen or is otherwise missing

A UFV Incident Report form can be found in BSM Appendix 6.

4.11 Moving and Transporting Biohazardous Materials

Movement of biohazardous materials can take different forms. For example, pathogens can be moved from one area within a containment zone to another (e.g., bench top to centrifuge) or from one containment zone to another zone in the same building (e.g., from a student lab in one zone to an autoclave for disposal in another zone). However, movement of biohazardous material from one building to other falls under the Transportation of Dangerous Goods Regulations (TDGR) which must be followed (BSM 4.11.3) if transported on a public roadway.

4.11.1 Moving Biohazardous Materials within the Same Containment Zone

When moving infectious material or toxins within a containment zone the infectious material or toxins should be adequately protected from being dropped, tipped, or spilled. The precautions taken by personnel to prevent mishaps should correlate with the inherent risk associated with the infectious material or toxins (i.e., the greater the risk associated with the material, the greater the care that should be taken when moving it).

Closed containers provide primary containment for the movement of infectious material and toxins. Moving infectious material or toxins within a containment zone using closed containers, in conjunction with a cart, when necessary (e.g., for large number of specimens, large volumes, or heavier items), will help reduce the likelihood and extent of a drop, spill, or leak. Labelled containers will promote timely and appropriate spill response and post-exposure follow-up in the event of a spill or leak. Leak-proof, impact-resistant containers are recommended, and specially designed containers equipped with lid clamps are commercially available. Externally threaded tubes with screw caps should be used instead of snap-cap tubes or internally threaded tubes with screw caps to prevent leaking and minimize contamination of the lid surface. With higher risk agents and multiple samples, carts with rails or raised edges should be used and absorbent material placed on each cart shelf; cart pans may also be used. Samples should be loaded in a manner that will prevent them from being tipped or spilled if a collision occurs. Individuals should move slowly and with caution whenever carrying infectious material or toxins. Following established directional traffic and workflow patterns within the containment zone, based on a local risk assessment (LRA), will help facilitate the movement of

personnel and materials from "clean" areas (i.e., areas of lower contamination) to "dirty" areas (i.e., areas of higher contamination) in a manner that minimizes the spread of contamination. A biological spill kit available inside the containment zone allows for a prompt, appropriate clean-up in the event of a spill.

4.11.2 Moving Biohazardous Materials between Containment Zones Within the same Building

Using leak-proof and impact-resistant containers to move infectious material and toxins between containment zones in the same building will help prevent a spill or leak if a container is dropped. In the event that an incident occurs, such as the container is dropped, breaks, or its contents are spilled, the use of appropriate labels on the container to identify the contents and the hazards will assist with the appropriate response. Surface decontamination of containers performed prior to removal from the containment zone helps prevent the spread of infectious materials and toxins. This includes the movement of waste to a centralized decontamination area within the building, but outside the containment zone. Large or heavy items should be transported on carts and loaded in a manner that will prevent them from tipping. A cart designed with guard rails or raised edges can be considered to protect the items from falling off the cart during relocation. An emergency response plan (ERP) for infectious material or toxins stored outside the containment zone, and spill kits available outside the containment zone, will allow for a prompt, appropriate response in the event of a spill. Wet or dry ice used to keep specimens or samples cold during transit should always be used in accordance with the current requirements of the Workplace Hazardous Materials Information System (WHMIS). To prevent gas build-up, dry ice should never be placed inside an airtight secondary container.

4.11.3 Moving Biohazardous Materials between Containment Zones in Different Buildings or on Different Campuses

UFV is a multi-campus university and as such transporting biohazardous material between campuses can occur. In addition, research projects may collect primary samples from off campus locations which require transportation to containment zones within the university.

Under these circumstances, transportation of biohazardous materials requires documentation and should be packaged in labelled containers that are sealed, leak-proof, and impact-resistant (in accordance with the TDGR). Additionally, pathogen and toxin accountability measures (e.g.,

inventory) need to be considered when biohazardous materials are being transported and relocated between different locations.

5.0 Risk Control

5.1 Training

UFV's SOP BS05 lists the different personnel training groups and the associated training requirements for each group. All biosafety training programs at UFV share a common goal irrespective of the biohazardous material being managed. That goal is to educate and train UFV personnel about the potential biohazards present in their environment, and to establish mitigating practices that can protect them from these hazards. Due to the wide range of activities encountered by the various end-user groups, different training levels, containing different content, are necessary.

Regardless of the biohazardous material managed, biosafety training is not a one size fits all. Many activities may require one training module for one group (i.e., experienced faculty teaching a new lab) and a different module for inexperienced personnel. For example, students new to a lab activity are much more likely to expose themselves or others to an infectious agent compared to an experienced lab technician. During the LRA, the IBO or their designate will consider the training needs as part of the LRA. The IBO will help the PI or laboratory instructor develop an appropriate training program suitable for all personnel working under a specific biohazard permit.

A training program encompasses two related but quite different instructional activities. The first is education which provides personnel with general information and theoretical knowledge.
Educational training can take the form of classroom instruction, PowerPoint presentations, review of SOPs, pathogen safety data sheets, and posters. The second activity is a more firsthand approach that demonstrates proper pathogen handling techniques, the proper use of PPE and trains personnel in the use of specific primary containment equipment (e.g., BSC or centrifuges). Individual SOPs, specific to the biohazardous material, the techniques used to manipulate this material and the facilities where the activities will be performed, can be developed, and used as both educational and firsthand training resources.

5.1.1 PI, Faculty, Laboratory Instructors and Laboratory Technician Training

For PI, faculty, laboratory instructors and laboratory technicians training related to the potential hazards associated with the work conducted is of the utmost importance, not only for themselves, but also for those who are under their supervision. Therefore, all previously untrained PI, faculty, lab instructors and lab technicians, regardless of the nature of the work

managed (i.e., CL1 or CL2), are required to undergo training protocols covering the material listed below. Training may include, but is not limited to, the following elements:

- Personnel should be familiar with the contents of the UFV BSM
- Understand the biosecurity measures developed for the containment zone they are using
- Be familiar with UFV's emergency response plan (ERP) and how to respond accordingly in a medical emergency
- Demonstrate proficiency with all required SOPs identified in the LRA
- Demonstrate proper use of all relevant primary containment equipment
- Be informed on the nature of the pathogens and toxins used in the working environment
- Know the signs and symptoms of diseases caused by the pathogens or toxins used
- Know the safe work practices and physical control measures associated with the biohazardous material in use
- Demonstrate the correct choice, use and proper donning and removal of PPE
- Understand the proper and effective decontamination and waste removal procedures for all biohazardous material in use

Training evaluations will be conducted by the IBO through a written online test and by hands-on evaluations by the IBO or their designate. Successful completion of training will be recorded and stored by the PI, Lab supervisor or their designate.

5.1.2 CL1 Training for Students Working Under Supervision

This level of training is for student groups that work with RG1 organisms or work within a CL1 containment zone and who are directly supervised by the PI or lab instructor. It may also apply to students working with PI permit holders that are managing human body fluids that have been designated by a LRA as CL1 biohazardous material (e.g., non in vivo work using sample sources from healthy individuals not likely to harbor an infectious agent).

Training of students is the responsibility of the PI or lab instructor. In conjunction with the IBO, the PI or lab instructor will develop training material. The PI or lab instructor will review with the students any pertinent LRA identified SOPs (e.g., SOP UFV BS01) and demonstrate safety

procedures deemed appropriate for the work being conducted and for the biohazardous material being used. Additional classroom material may also be included.

After all relevant material has been reviewed, the PI or lab instructor will administer an online test. The PI or lab instructor will record and store this material for the duration of the semester for course-based work and for the duration of the Biosafety permit for research- based work. Students must receive a grade of 70% before they are permitted to work with CL1 biohazardous material. At the request of the IBO, the PI or lab instructor will make available all related evaluation material.

The IBO may require retraining of any student demonstrating insufficient biosafety knowledge or who fails to follow all biosafety guidelines.

5.1.3 CL2 Training for Students Working Under Supervision

This level of training is for student groups that work with RG2 organisms or work within a CL2 containment zone and who are directly supervised by the PI or lab instructor. Note: CL2 training is required for all personnel that work within a CL2 containment zone whether they work with CL2 biohazardous materials or not. For example, room A336 on the Abbotsford campus is designated as a CL2 research laboratory. A336 is a multi-use room where undergraduate student projects are conducted. A student researcher, whose project does not manage CL2 biohazardous material, but is working within the A336 CL2 containment zone, is required to undergo CL2 level training. Exceptions are not permitted.

CL2 training will also apply to students working with permit holders that are managing human body fluids that have been designated by a LRA as potentially CL2 biohazardous material.

Training of students is the responsibility of the PI or lab instructor. In conjunction with the IBO, the PI or lab instructor will develop training material. The PI or lab instructor will review with the students any pertinent LRA identified SOPs which will include, at a minimum, UFV BS03, UFV BS13, any other SOP identified in the LRA, and demonstrate safety procedures deemed appropriate for the work being carried out and for the biohazardous material being used. Additional classroom material may also be included.

After all relevant material has been reviewed, the PI or lab instructor will administer an online test. The PI or lab instructor will record and store this material for the duration of the semester for course-based work, and for the duration of the Biosafety permit for research-based work. Students must receive a grade of 70% before they are permitted to work with CL2 biohazardous

material. At the request of the IBO, the PI or lab instructor will make available all related evaluation material.

The IBO may require retraining of any student demonstrating insufficient biosafety knowledge or who fails to follow all biosafety guidelines.

5.1.4 CL2 Training for Students Working Without Supervision

This level of training is for a student who is working independently with RG2 organisms or working within a CL2 containment zone. Prior to the commencement of any work handling biohazardous material, the PI, or a qualified designate, will individually train the student on all SOPs identified in the LRA, which at a minimum will include, UFV BS03, 11, 13, and 15. In addition, students must receive training on:

- biosecurity appropriate for the containment zone and the biohazardous material in use
- proper use of all relevant primary containment equipment
- applicable spill clean-up procedures
- proper waste decontamination and disposal
- transport of CL2 biohazardous materials between containment zones

Upon completion of training, the PI will record the SOPs used for student training. The trainer and student will sign and date the form. The signed original form is to be kept by the PI or supervisor and made available to the IBO upon request.

Students are also required to complete a written test based on information in the UFV Biosafety Manual and the SOPs used for training. Records of completion are to be maintained by the PI, or Lab supervisor, or departmental assistant, or their designate, for the duration of the Biosafety permit.

The IBO may require retraining of any student demonstrating insufficient biosafety knowledge or who fails to follow all biosafety guidelines. The IBO may at any time inspect CL2 containment zones for compliance with UFV biosafety regulations. Any student researcher found in non-compliance will be required to immediately shut down their research until approval from the IBO is reinstated.

5.2 Biosecurity Plan

CBS requires all licensed facilities working with biohazardous materials to develop a Biosecurity plan. Biosecurity refers to the security measures designed to prevent the loss, theft, misuse, diversion, or intentional release of infectious material or toxins. The UFV biosecurity plan is to be implemented by all research and teaching laboratories that manage biohazardous materials.

As part of the LRA the IBO will review a biosafety permit application and assess the level of biosecurity risk posed by the biohazardous material being managed. A local biosecurity risk assessment (BSA) considers the inherent nature of the pathogen or toxin as well as the concentration, quantity, and state of the material. Biohazardous material is prioritized according to its biosecurity risk based on several key factors, including the consequences of malicious use, the ease of use of the material, and the impact of loss of material on the facility. The PHAC maintains the ePathogen website that contains information on the characteristics of many pathogens including if the pathogen is considered a security sensitive biological agent (ssb). In general, biosecurity risk can be assigned to three different levels.

- assets that are deemed to be at low risk of unauthorized access needing minimal management and control measures
- assets that are at medium or high risk of unauthorized access requiring moderate management and risk mitigation
- assets that are at very high risk require extensive management and controls.

In addition, the IBO will consider any potential dual use risks and outline appropriate mitigation strategies. Based on the conclusion of a biosecurity risk evaluation, the IBO has the authority to prohibit the use of any infectious material or toxin. Materials considered by the PHAC to be SSB agents are not permitted for use at UFV.

5.2.1 Inventory of Biohazardous Material

The first step of the biosecurity risk assessment is to identify all the relevant assets. The PI or senior lab instructor or senior lab technician must maintain a current inventory of all biohazardous material in their possession or under their administration. The inventory should routinely be updated as required and a printed copy or working file should be readily available to the IBO. The inventory information should include:

- Pathogen or toxin name
- State of the material including storage vessel (e.g., lyophilized vial, glycerol tube, serum in screw capped vial etc.)
- Quantity on hand
- RG level
- Disposal date (if appropriate)
- Storage location

5.2.2 Physical Security

Just like biosafety measures, biosecurity is not a one size fits all. Specific laboratories and containment zones have unique inherent characteristics and will contain a varied set of equipment and storage facilities. During the LRA the IBO consider these differences while performing the BSA. In general, the following elements are required for each of the different containment levels.

5.2.2.1 CL1 Containment Zones

- Doors are to be kept closed unless the PI or lab instructor is present
- Doors are to be lockable and must be locked when the lab is not in use
- Access to the containment zone is restricted to authorized personnel

5.2.2.2 CL2 Containment Zones

- Doors are to be kept closed at all times
- Doors are to be lockable and must be locked when the lab is not in use
- Access to the containment zone is restricted to authorized personnel
- Primary storage equipment, such as refrigerators or freezers, must be lockable or contained within a lockable area located outside of a shared room

5.2.3 Personnel

All CL1 and CL2 containment zones are restricted to authorized personnel only. Non-authorized personnel, such as third-party contractors or visitors, must be escorted by the PI, lab instructor or their authorized designate. All non-escorted personnel must have received the appropriate biosafety training for the containment zone they are in.

5.2.4 Incident Reporting

All incidents of unauthorized entry or access should be reported to security and the IBO. Missing pathogens or toxins, loss of keys or passwords should be reported to security and the IBO. Depending on the incident, the IBO may consider reporting the incident to local law enforcement and may be obligated to report the incident to the Public Health Agency of Canada (PHAC) under the conditions of license.

5.3 Facility Inspection

To ensure that all facilities with CL2 areas follow the UFV BSM and all applicable biosafety guidelines from the CBS and CBH, periodic inspections will be undertaken by the IBO at regular intervals (yearly for A331 and A336 Abbotsford campus) and re-inspections may occur at any time. In addition, PHAC regulators may also conduct periodic inspections.

5.3.1 Scheduling of Inspections and Issues of Non-compliance

The IBO, or designate, will inspect CL2 labs annually. In general, the IBO will schedule an inspection at the time of the biosafety permit application or renewal. If warranted, the IBO will issue a report identifying items requiring attention and suggest a time for conformance. A follow-up inspection will be scheduled to address any concerns identified as requiring attention.

Labs that fail to address deficiencies identified by the IBO will be in non-compliance and the inspection results will be reviewed by the IBC. Options for the IBC are to allow the lab additional time for compliance (with the possibility of suspended work with biohazardous materials) or permit suspension until all deficiencies have been fully rectified.

6.0 Waste Decontamination and Disposal

The handling of any biohazardous material has the potential to contaminate the workplace. Therefore, to reduce the risk of pathogen release, it is essential that policies, plans, and procedures are in place to ensure all contaminated material is decontaminated and disposed of correctly. Decontamination is the process that renders the work area, and all the equipment and materials in it, safe and free of microorganisms. Disposal refers to an acceptable process for the removal of decontaminated material from the containment zone. The requirements for waste management are specified in Matrix 4.8 of the CBS and are reproduced here. Additional guidelines can be found at the Standards Council of Canada website.

CBS Identifier	CBS Requirement
4.8.1	Gross contamination to be removed prior to decontamination of surfaces and equipment, and disposed of accordingly
4.8.2	Disinfectants effective against the pathogen(s) in use and neutralizing chemicals effective against the toxin(s) in use to be available and used in the containment zone
4.8.3	Sharps to be discarded in containers that are leak-proof, puncture-resistant, and fitted with lids, or specially constructed for the disposal of sharps waste
4.8.4	Primary containment devices to be decontaminated prior to maintenance
4.8.5	All clothing and personal protective equipment (PPE) to be decontaminated when a known or suspected exposure has occurred.
4.8.7	Contaminated liquids to be decontaminated prior to release to sanitary sewers
4.8.8	Contaminated equipment, materials, and waste to be: • decontaminated and labelled as decontaminated prior to cleaning, disposal, or removal from the containment zone or prior to removal from the animal rooms, animal cubicles, or postmortem rooms (PM rooms), as described in SOPs; or

	• placed in closed, labelled, and leakproof containers that have been surface decontaminated prior to removal from the containment zone, animal rooms, animal cubicles, or PM rooms, as described in SOPs for the safe and secure movement or transportation to a designated decontamination area or storage outside of the containment zone.
4.8.10	Decontamination technologies and processes to be validated prior to initial use and when significant changes to the processes are implemented or new pathogens are introduced
4.8.11	Decontamination technologies and processes to be routinely verified, as described in SOPs. Frequency of verification to be determined by a local risk assessment (LRA).
4.8.13	Contaminated bedding to be removed at a ventilated cage changing station or within a certified biological safety cabinet (BSC) prior to decontamination; or decontaminated within containment cages.

6.1 Decontamination of Biohazardous Agents

Decontamination can be achieved by several means, the most common of which are sterilization by moist heat (autoclave) and disinfection through chemical means. During the LRA the IBO will review any containment zone specific waste management procedures for effectiveness.

Sterilization is a process that eliminates all living microorganisms, including bacterial spores. Sterilization is absolute (i.e., there is no middle range of sterility). Given that toxins and prions are not living microorganisms, the concept of sterilization does not apply.

Disinfection is a process that eliminates most forms of living microorganisms but is less lethal than sterilization. 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, and the temperature.

In general, decontamination processes and practices follow the following guidelines:

- Disinfectants effective against the infectious material in use, and neutralizing chemicals effective against the toxins and prions in use, are to be available in the containment

zone and used for contaminated or potentially contaminated material, including equipment, specimen and sample containers, surfaces, rooms, and spills

- Decontamination parameters (e.g., time, temperature, chemical concentration, humidity) consistent with the technology or method used are to be validated to demonstrate they are effective against the infectious material and toxins of concern under the conditions present
- Prisons and toxins can be resistant to the chemical disinfectants commonly used to effectively decontaminate microorganisms due to their proteinaceous nature. When working with prions and toxins, a neutralizing chemical capable of denaturing and inactivating the toxins or prions is needed for effective decontamination in the containment zone
- Clear and strict procedures are to be in place to support routine decontamination and routine verification of the decontamination process
- Decontamination processes and methods are to be conducted in accordance with applicable federal, provincial, or territorial, and municipal regulations
- Decontamination procedures are to be included in personnel training on the hazards and exposure/release mitigation strategies associated with the work being done. This includes information on the products used, and the factors influencing their effectiveness

6.2 Decontamination Processes

6.2.1 Autoclaves

The proper use of the autoclaves at UFV can be found in the SOP UFV BS11. For each biohazardous agent used in a containment zone and prior to the routine use of an autoclave for the decontamination of materials in that zone, the procedure employed must be verified as effective.

Biological indicators can be used to confirm that treatment parameters have been achieved throughout a representative load. Placing indicators at various locations throughout the representative load will enable conditions in different parts of the load to be monitored. The selection of an appropriate biological indicator is critical so that the resistance of the test organism adequately represents the resistance of the pathogens managed in the containment zone. In general, Geobacillus stearothermophilus spores are adequate for heat-based technologies and processes, whereas Bacillus subtilis spores can be used to validate chemical-based technologies and processes.

Validation of the decontamination processes is required prior to initial use and whenever significant changes are implemented or new pathogens are introduced so that decontamination procedures and standard operating procedures (SOPs) can be established, amended, or updated, as necessary. Validation using representative loads is required annually. Performing validation tests on non-contaminated representative loads that simulate a batch of materials of similar type (e.g., gloves, plastics, liquids, reusable personal protective equipment [PPE]) and quantity (i.e., number of items or size) that will be regularly processed allows an operator to place indicators safely to demonstrate that appropriate decontamination parameters are achieved throughout the load (e.g., in the bottom, middle, and top of the batch of materials). By demonstrating this with a representative load, it can be extrapolated that similar conditions are achieved in a routine load (i.e., contaminated waste) of similar type and quantity.

6.2.2 Verifying the Autoclave Run

1. After decontaminated material has been removed from the autoclave, and prior to disposal, it is important to verify that the run has been effective (i.e., that all validated parameters have been reached). Biological indicators can be used for routine monitoring of the decontamination process.
2. Remove the indicator from the autoclaved material and visually inspect. When using a biological indicator, the material cannot be released for disposal or reuse until the results of the biological indicator are known.
3. Biological indicators require incubation for a pre-determined period of time before reading.

6.2.3 Chemical Disinfectants

Chemical disinfectants are used for the decontamination of surfaces and equipment that cannot be autoclaved (e.g., bench top surfaces, BSC), and for spills of infectious materials. It is important that containment zone personnel are knowledgeable about the products required for the disinfection of the infectious material and toxins with which they will be working, including the recommended directions for use (e.g., application method, concentration, contact time, PPE, first aid, disposal) and chemical characteristics (e.g., toxicity, chemical compatibility, storage stability, active ingredient, identity, concentration).

A 0.8% solution of Clinicide, (a quaternary ammonium compound) is recommended for universities, hospitals and veterinary clinics and has been verified to be effective for all biohazardous agents managed in UFV biology labs. For other areas within UFV, a typical testing procedure for laboratory in-use disinfectant testing is outlined below.

1. Apply a known quantity of the microorganism in use in the laboratory to a carrier material or vessel. This quantity should be representative of the concentrations typically encountered in the laboratory.
2. Apply the test disinfectant to the carrier material or vessel for the contact time used in the laboratory.
3. Neutralize the disinfectant to halt its action. This can be accomplished by dilution or addition of growth media or other suitable reagent known to neutralize the active ingredients of the disinfectant.
4. Assess the viability of the microorganism in a suitable growth medium.

If the microorganism survives, altering the contact time or concentration of the disinfectant, or both, may be required to achieve the desired level of disinfection.

6.3 Waste Disposal

Waste leaving the containment zone may be destined for disposal, movement, or transportation to a designated decontamination area outside of the containment zone or transported off-site for decontamination via a third-party biohazardous waste disposal. Even if the waste has been thoroughly and effectively decontaminated prior to removal from the containment zone, it may not be acceptable to simply direct it to the normal waste disposal stream for eventual transfer to a local landfill.

Standard operating procedures (SOPs) for waste disposal are developed to support disposal of solid and liquid hazardous material in a manner that minimizes the risk of harm to personnel, the community, and the environment. The SOPs describe all aspects of waste disposal, including handling procedures, from the classification and segregation of infectious waste to decontamination method(s), to storage and disposal. The UFV BSM has included in the Appendix a waste disposal SOP to allow UFV personnel to consult protocols as needed.

When developing containment zone specific waste disposal SOPs, some aspects to consider are the quantity and type of waste that will be generated, as well as the availability of decontamination systems. Decontaminating all contaminated or potentially contaminated waste prior to disposal minimizes the risk of introducing the infectious pathogens or toxins used in the containment zone into the environment. Failure to follow SOPs can result in the unintentional release of infectious material or toxins from the containment zone, or personnel exposure. It is the responsibility of the PI or laboratory supervisor to ensure that proper procedures are followed, and that containment is not breached. It is also important to note that PI or lab supervisors remain accountable for all waste transported off-site for

decontamination, until the waste has been effectively decontaminated. Shipping records, validation reports, and records of verification of decontamination equipment used by third-party waste disposal companies can be maintained to demonstrate compliance with decontamination requirements specified in the CBS.

All manipulations and processes that will generate contaminated waste should be identified, and the waste categorized according to type. Developing specific handling procedures for each type of waste generated in the containment zone supports disposal of all waste materials in a safe manner. The choice of decontamination method is determined by the nature of the infectious material or toxin and the nature of the item being decontaminated. Typically, biohazardous waste at UFV falls into the general categories outlined below.

6.3.1 Biomedical Waste

Biomedical waste can be defined as waste generated in human and animal health care facilities, medical or veterinary research and training facilities, clinical testing, or research laboratories. Biomedical waste is segregated from the general waste stream as it requires decontamination prior to disposal.

Decontamination of all biomedical waste prior to disposal in the regular waste stream is essential for the protection of public health, animal health, and the environment. It is important to segregate and dispose of biomedical waste near the point that the waste is generated. For example, it is recommended that unbreakable discard containers (e.g., pans, jars) be placed at every workstation to collect microbiological laboratory waste such as contaminated pipette tips. In containment zones where multiple types of biomedical waste are generated, colour-coded waste holding bags or containers can be used to differentiate between types of waste.

It is important that the waste container used is suitable for the type of infectious waste generated. Human anatomical waste, blood and body fluids, and animal waste should be placed in impervious, leak- and tear-resistant waste bags. Waste bags should be sealed, placed in leak-proof containers, and stored in a freezer, refrigerator, or cold room to await decontamination. Reusable containers may be used if they are decontaminated and cleaned after every use. Sharps waste is disposed of directly into a puncture-resistant container in accordance with National Standard of Canada (CAN)/CSA Standard CAN/CSA Z316.6, Sharps Injury Protection- Requirements and Test Methods- Sharps Containers). Broken glassware should never be managed with gloved or bare hands. Forceps, tongs, or a dustpan should be

used to pick up broken glassware and a wet paper towel held in tongs should be used to pick up tiny glass particles.

If waste is not decontaminated and disposed of immediately, it may be stored temporarily if it is in a designated area that is separate from other storage areas and clearly marked with a biohazard symbol. Some types of waste (e.g., human anatomical waste, animal waste) need to be stored in a refrigerated area to prevent putrefaction. Once materials have been decontaminated on-site, the biohazard symbol on the receptacle is removed or defaced to indicate that the infectious material has been inactivated. Decontaminated material may be disposed of as regular waste in areas of heavy traffic or public areas, provided that the facility has specific labelling procedures in place. In other cases, it may be necessary to transport waste off-site for decontamination and disposal. Whether the waste will be decontaminated on-site or off-site, placing waste in appropriate disposal containers promptly and labelling the containers accordingly will keep all infectious waste segregated from regular waste until decontamination and disposal.

Limiting the movement of waste disposal containers to the point of use in the work area, storage (e.g., dedicated area, cold room) or disposal areas, and connecting corridors, will help minimize the risk of release of pathogens and toxins, and personnel exposure.

6.3.1.1 Microbiology Laboratory Waste

Microbiology laboratory waste consists of cultures, stocks, microorganism specimens, prions, toxins, live or attenuated vaccines, human and animal cell cultures, and any material that has come in contact with one of these. Inactivation of pathogens and toxins prior to disposal is a critical step in preventing release of harmful material into the environment. Microbiology laboratory waste is no longer considered biomedical waste once it has been effectively decontaminated.

6.3.1.2 Human Blood and Body Fluid Waste

Human blood and body fluid waste consist of all human blood or blood products, all items saturated with blood, anybody fluid contaminated with blood, and body fluids removed for diagnosis. Human blood and body fluid waste is no longer considered biomedical waste once it has been effectively decontaminated.

6.3.1.3 Sharps Waste

Sharps waste consists of needles, syringes, blades, or glass contaminated with infectious material and capable of causing puncture wounds or cuts. This can include pipettes and pipette tips that have come into contact with infectious material or toxins unless they have been decontaminated prior to disposal. Using puncture-resistant containers located close to the point of use minimizes the risk of injury during handling. Sharps waste may be reduced by product substitution for some applications. Sharps waste is no longer considered biomedical waste once it has been effectively decontaminated.

6.3.1.4 Human Anatomical Waste

Human anatomical waste consists of all human tissues, organs, and body parts, excluding hair, nails, and teeth. Even after disinfection or decontamination, human anatomical waste is still considered biomedical waste and may require special means of disposal (consult with the IBO for more information).

6.3.1.5 Animal Waste

Animal waste consists of all animal anatomical waste (carcasses, tissues, organs, body parts), bedding contaminated with infectious organisms, blood and blood products, items highly contaminated with blood, and body fluids removed for diagnosis or removed during surgery, treatment, or autopsy. Hair, nails, teeth, hooves, and feathers are not considered animal waste. Even after disinfection or decontamination, animal waste is still considered biomedical waste and may require special means of disposal (consult with the IBO for more information).

Course Based Training **Date:**

General Information: Course _____

Lab Instructor	Department	Office Phone	Email

Date of Application		
Application Type*	☐New	
	☐Renewal	Permit Number
	☐Amendment	Permit Number

Administrative Oversight Information

	Department Head	Departmental Assistant	Asset Technician
Campus			
Office Phone			
Email			

Course Information

Department	Course Number	Course Title

Laboratory location(s):

Campus	Room Number	Containment Level	
		CL1	CL2
		☐	☐
		☐	☐
		☐	☐

Biohazardous Material

5.1) Bacteria and Viruses ☐ Not Applicable

Strain Name	Containment Level		Storage Location
	CL1	CL2	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	

5.2) Recombinant DNA ☐ Not Applicable

Recombinant Material	Procedure Used	Host Target

5.3) Blood/Body Fluids/Tissues ☐ Not Applicable

Source of blood?	
What type of tissues?	
What type of body fluids?	
How is it acquired?	
Storage Location?	

5.4) Cell Lines ☐ Not Applicable

Cell Line Name	Primary	Continuous	Source
	☐	☐	
	☐	☐	
	☐	☐	

5.5) Others (e.g., fungus, toxins) ☐ Not Applicable

Type	Organism

Standard Operating Procedures

Standardized UFV SOP Used			

6.1 List all of the standardized UFV SOPs that apply

Lab Specific SOP Used	

6.2) List the titles of any lab specific (non-UFV standardized SOPs and attach them to this application:

Training

All UFV students working in this lab must receive Biosafety training which includes passing (70%) a biosafety quiz. A record of training must be kept for the semester in which the course is run. Indicate below, the training exam type (CL1, CL2) and the name of the person who has the training records. Training methods will be assessed during the LRA.

Record Holder	Exam Type	Office Phone	Email

Biosafety Check List (indicate yes, no, NA (not applicable). Your application may be delayed or rejected if any of your answers to the questions below are not.

Biosafety Check List				
		Yes	No	NA
1	Has the Lab supervisor consulted with the IBO with regard to the work described in this application and has a LRA been scheduled	☐	☐	☐
2	Has the Lab supervisor agreed that all UFV personnel and students under their supervision will be made aware of the potential biohazards involved and will they been trained to correctly use all pertinent primary containment equipment	☐	☐	☐
3	Has the Lab supervisor been informed of their responsibility to be aware of UFV's Biosafety policies as outlined in the UFV Biosafety Manual	☐	☐	☐
4	Has the lab supervisor agreed to train all students under their supervision in accordance with the UFV Biosafety manual and to keep a record of the training	☐	☐	☐
5	If lab specific SOPs are used in the work described in this application, have they been attached	☐	☐	☐
6	Has a Lab manual describing the procedures and manipulations used in this course been attached to this application	☐	☐	☐
7	Has UFV's Emergency Response Plan been posted in a visible place within the containment zone	☐	☐	☐
8	Is the proper signage describing the biohazardous materials in use and the names of the contact person(s) been posted on all doors leading into the containment area	☐	☐	☐
9	Has the Lab supervisor agreed that if human body fluids that are potentially contaminated with infectious agents are being manipulated in this course, all personnel and students will be informed of the dangers	☐	☐	☐
10	If any of the biohazardous agents used in this course are opportunistic pathogens, have all students been made aware that they should let the lab supervisor know if they are currently immunocompromised and that they should inform the lab supervisor if their health status changes	☐	☐	☐
11	If any lab experiments used in this course collect research data on humans, will the Human Research Ethics board been notified	☐	☐	☐
12	If any lab experiments in this course use procedures involving animals, will the Animal Care Committee been notified	☐	☐	☐
13	Is an inventory form of all biohazardous agents used and/or stored, available for inspection by the IBO	☐	☐	☐
14	If applicable, have Biosecurity measures been developed and implemented?	☐	☐	☐
15	If transportation of RG2 biohazardous material between campuses required, does the transport method meets TDGR regulations	☐	☐	☐
16	Is your Department Head, Program Director, or Faculty Dean aware that biohazardous materials are being used in this course	☐	☐	☐
17	If the work involved in this application generates Biomedical waste, has it been either chemically decontaminated or autoclaved prior to disposal	☐	☐	☐

Date:

Course ID:

Print Name
of Applicant

UFV Biosafety Permit Application: Research **Date:**

1) General Information

Project Title	

Institution	Principal Investigators	Contact Number	Email

Date of Application		
Application Type*	☐ New	
	☐ Renewal	Permit Number
	☐ Amendment	Permit Number

2) List of Additional Authorized Personnel

Institution	Name	Contact Number	Biosafety Training (y/n)	Email

3) Administrative Oversight Information

	Department Head	Departmental Assistant	Asset Technician
Campus			
Office Phone			
Email			

4) Location of Research:

4.1) On Campus Research Location

Campus	Room Number	Containment Level	
		CL1	CL2
		☐	☐
		☐	☐
		☐	☐

4.2) Off Campus Research Location. *If the research listed in this application involves the collection, manipulation or testing of any biohazardous materials at a site that is not UFV property, please give an exact location.*

5. **Project Information**: *Please describe in non-scientific terms your research project emphasizing any procedures where biohazardous materials will be used and how any biohazardous waste will be decontaminated and disposed of*.

6) Biohazardous Material *Indicate all biohazardous material that will be used in the application*

6.1 Bacteria and Viruses ☐ Not Applicable

Species and Strain Identification	Containment Level		Storage Location
	CL1	CL2	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	

6.2 Recombinant DNA ☐ Not Applicable

Recombinant Material	Procedure Used	Host Target

6.3 Blood/Body Fluids/Tissues ☐ Not Applicable

Source of blood?	
What type of tissues?	
What type of body fluids?	
How is it acquired?	
Storage Location?	

6.4) Cell Lines ☐ Not Applicable

Cell Line Name	Primary	Continuous	Source
	☐	☐	
	☐	☐	
	☐	☐	

6.5) Others (e.g., fungus, toxins, parasites) ☐ Not Applicable

Species / Toxin Name	Containment Level		Storage Location
	CL1	CL2	
	☐	☐	
	☐	☐	
	☐	☐	

7) Standard Operating Procedures

Standardized UFV SOP Used			

7.1 List all of the standardized UFV SOPs that apply

Lab Specific SOP Used	

7.2) List the titles of any project specific SOPs (non-UFV standardized SOPs) and attach them to this application:

8) Training

All UFV personnel and students collaborating with the authority of this permit must receive Biosafety training which includes passing (70%) a biosafety exam. Individual training on all SOPs identified in the LRA must be documented and records kept for the length of time the Biosafety Permit is valid. Training records are to include the Biosafety quiz and the signed SOPs (or an equivalent training record). The training module will be developed during the LRA for this project.

Record Holder	Exam Type	Office Phone	Email

UNIVERSITY OF THE FRASER VALLEY

Office of Safety and Security
Biosafety Permit Application: Research

Biosafety Check List (indicate yes, no, NA (not applicable). Your application may be delayed or rejected if any of your answers to the questions below are not.

Biosafety Check List				
		Yes	No	NA
1	Has the PI consulted with the BSO with regard to the work described in this application and has a LRA been scheduled	☐	☐	☐
2	Has the PI agreed that all UFV personnel and students under their supervision will be made aware of the potential biohazards involved and will they be trained to correctly use all pertinent primary containment equipment	☐	☐	☐
3	Has the PI been informed of their responsibility to be aware of UFV's Biosafety policies as outlined in the UFV Biosafety Manual	☐	☐	☐
4	Has the agreed to train all students under their supervision in accordance with the UFV Biosafety manual and to keep a record of the training	☐	☐	☐
5	If lab specific SOPs are used in the work described in this application, have they been attached	☐	☐	☐
6	Have the procedures or manipulations used in this course been attached or discussed during the LRA	☐	☐	☐
7	Has UFV's Emergency Response Plan been posted in a visible place within the containment zone	☐	☐	☐
8	Is the proper signage describing the biohazardous materials in use and the names of the contact person(s) been posted on all doors leading into the containment area	☐	☐	☐
9	Has the Lab supervisor agreed that if human body fluids that are potentially contaminated with infectious agents are being manipulated in this application, all personnel and students will be informed of the dangers	☐	☐	☐
10	If any of the biohazardous agents used in this course are opportunistic pathogens, have all personnel been made aware that they should let the PI know if they are currently immunocompromised and that they should inform the lab supervisor if their health status changes	☐	☐	☐
11	If any lab experiments used in this application collect research data on humans, has the Human Research Ethics board been notified	☐	☐	☐
12	If any lab experiments in this application use procedures involving animals, has the Animal Care Committee been notified	☐	☐	☐
13	Has the PI agreed that an inventory form of all biohazardous agents used and/or stored will be kept and updated and will be available for inspection by the IBO	☐	☐	☐
14	If applicable, have Biosecurity measures been developed and implemented?	☐	☐	☐
15	If transportation of RG2 biohazardous material between containment zones is required, has the PI been informed of the transport method	☐	☐	☐
16	If transportation of RG2 biohazardous material between campuses required, does the transport method meets TDGR regulations	☐	☐	☐
17	Is your Department Head, Program Director, or Faculty Dean aware that biohazardous materials are being used in this course	☐	☐	☐
18	If the work involved in this application generates Biomedical waste, will it be either chemically decontaminated or autoclaved prior to disposal	☐	☐	☐

Date:

Project Title:

Print Name of Applicant:

University of the Fraser Valley	Standard Operating Procedure	Page 1 of 4
Title: Safe Operational Practices for CL1 Facilities		
SOP Number: UFV BS01	**Revision. Number: 1**	
Effective Date: March 13, 2022		

Co-chair IBC Approval:	Institutional Biosafety Officer Approval
Name: Dr. Terence Starr	Name: Gerald Van De Ven

1. **Purpose**
   To define the safe working practices in containment level 1 (CL1) zones at the University of the Fraser Valley for the safe handling of Risk Group 1 (RG1) Biohazardous materials

2. **Application**
   For all UFV personnel working in laboratories or other designated work areas classified as CL1 zones that manage biohazardous material categorized as RG1.

3. **References**
   3.1 The most recent version of the Canadian Biosafety Standards
   3.2 The most recent version of the Canadian Biosafety Handbook
   3.3 The most recent version of the UFV Biosafety manual

4. **Definitions**
   4.1 **Containment level 1 zone:** a UFV work area or laboratory space meeting the safe working criteria for handling Risk Group 1 biohazardous materials
   4.2 **Risk Group 1 biohazardous material:** infectious agents or their toxins that pose a low risk of harm to individuals and a low risk to the community

5. Responsibilities

The Principal Investigator (PI) or laboratory supervisor is responsible to ensure all UFV faculty, staff and students under their supervision working with RG1 biohazardous materials follow the procedures detailed in this SOP.

6. Procedure

6.1. The following safe working practices are required for all UFV personnel handling RG1 biohazardous material as defined in the UFV Biosafety Manual

6.1.1. A documented procedural SOP will be made available for review by any person working with RG1 biohazardous material. This SOP will be reviewed annually and updated as required.

6.1.2 All PI and laboratory supervisors handling RG1 biohazardous material will receive training on this SOP regardless of where the work is being done

6.1.3 All UFV personnel and students managing RG1 biohazardous material will receive training on this SOP. They are required to take a level 1 biosafety quiz and receive a passing grade of 70% prior to working with RG1 biohazardous material.

6.1.4 All UFV personnel and students handling RG1 biohazardous materials are to receive hands on training demonstrating: the proper use of any primary containment equipment appropriate for the procedures and biohazardous materials used, proper donning and removal of personal protective equipment (PPE), proper use of sharps disposal, effective decontamination techniques and appropriate spill clean-up procedures.

6.1.5 PI or lab supervisors must record and maintain training documentation for all UFV personnel working in the containment zones that are under their supervision.

6.1.6 Doors to the containment zone must be kept closed and access to the containment zone is restricted to authorized personnel only.

6.1.7 Biohazardous signage, indicating the biohazardous material in use and including the name(s) of contact personnel, must be affixed to all doors leading into the containment zone

6.1.8 All personal belonging (e.g., coats, backpacks, books, laptops, cell phones) must be stored outside of the containment zone away from lab work benches

6.1.9 All personnel, including visitors and trainees, should wear appropriate PPE as determined in the LRA (e.g., properly fastened lab coats, aprons, gloves, protective eyewear, and footwear) suitable to the biohazardous materials present and procedures being used

6.1.10 Protective laboratory clothing must not be worn in non-laboratory areas; personnel leaving the lab (e.g., using the washroom) must remove their lab coat and gloves and wash their hands before leaving the containment area

6.1.11 Laboratories are to be kept clean and tidy. Storage of materials that are not pertinent to the work and cannot be easily decontaminated (e.g., journals, books, correspondence) should be minimized; paperwork and report writing should be kept separate from such biohazardous materials work areas.

6.1.12 Disinfectants effective for the agents in use must be available at all time within the area where the biohazardous material is managed, stored, and transported; a lab spill kit is to be available for the quick and efficient means of cleaning any spills.

6.1.13 Work surfaces should be cleaned and decontaminated using a suitable disinfectant and for an appropriate contact time prior to commencing work with RG1 materials and again after work with RG1 biological material is complete

6.1.14 Oral pipetting is prohibited; Eating, drinking, smoking, applying cosmetics, handling contact lenses, storing food or utensils in the work area is prohibited; Long hair must be tied back or covered

6.1.15 Jewelry (e.g., rings or long necklaces) that may come in contact with biological material or that may puncture protective gloves should not be worn while working with any biohazards

6.1.16 Open wounds, cuts, scratches, and grazes should be covered with waterproof dressings

6.1.17 Gloves must be worn for all procedures that might involve direct skin contact with biohazardous material; gloves are to be removed, and hands must be washed when leaving the laboratory

6.1.18 Eye and face protection is required for any procedures that might cause splashing to the face or eyes with biohazardous materials.

6.1.19 All contaminated materials, solid or liquid, must be decontaminated before disposal or reuse; contaminated materials that are to be decontaminated at a site away from the laboratory must have the outside of the container disinfected or must be double bagged prior to removal for treatment; the material must be contained in such a way as to prevent the release of the contaminated contents during removal;

6.1.20 Biohazardous material must never be discarded in sinks or floor drains

6.1.21 Leak-proof containers are to be used for the transport of infectious materials between laboratories in different containment zones as per SOP UFV BS19

6.1.22 Emergency procedures for spill clean-up, biological safety cabinet failure, fire, animal escape, and other emergencies must be written, easily accessible, and followed.

6.1.23 Large spills, accidents, or exposures to biohazardous materials and any loss of containment must be reported to the PI or laboratory supervisor

6.1.24 The PI or laboratory supervisor must report all large spills, accidents, or exposures to biohazardous materials and any loss of containment as defined within the UFV Biosafety Manual (BSM) to the Biosafety officer (IBO) and fill in an incident report form within 24 hours of the incident.

Appendix 2: UFV BS03

University of the Fraser Valley	Standard Operating Procedure	Page 1 of 4
Title: Good Microbiology Laboratory Practices for CL2 Facilities		
SOP Number: UFV BS03	**Revision. Number: 1**	
Effective Date: March 13, 2022		

Co-chair IBC Approval:	Institutional Biosafety Officer Approval
Name: Dr. Terence Starr	Name: Gerald Van De Ven

1. **Purpose**
   To define the safe working practices in containment level 2 (CL2) zones at the University of the Fraser Valley for the safe handling of Risk Group 2 (RG2) Biohazardous materials

2. **Application**
   For all UFV personnel working in laboratories or other designated work areas classified as CL2 zones that manage biohazardous material categorized as RG2.

3. **References**
   3.1 The most recent version of the Canadian Biosafety Standards
   3.2 The most recent version of the Canadian Biosafety Handbook
   3.3 The most recent version of the UFV Biosafety manual
   3.4 Biology department SOPs. BD01 Operational Practices for Biology Laboratories, BD02 Decontamination of Infectious Materials, BD03 Biosafety Cabinets: Safety and Use, BD04 Operation and Monitoring of Autoclaves, BD06 Control of Biohazardous Spills
   3.5 UFV biosafety SOPs. BS03 Good Microbiological Laboratory Practices for CL2 Facilities, BS11 Operation and Monitoring of Autoclaves, BS13 Control of Biohazardous Spills, BS15 Decontamination of Infectious Materials, BS17 Biological Safety Cabinet: Certification and Use, BS19 Transport of RG2 Biohazardous Materials between Containment Zones

4. **Definitions**

4.1 Containment level 2 zone: a UFV work area or laboratory space meeting the safe working criteria for handling Risk Group 2 biohazardous materials

4.2 Risk Group 2 biohazardous material: infectious agents or their toxins that pose a moderate risk of harm to individuals and a low risk to the community

5. **Responsibilities**

The Principal Investigator (PI) or laboratory supervisor is responsible to ensure all UFV faculty, staff and students under their supervision working with RG2 biohazardous materials follow the procedures detailed in this SOP.

6. **Procedure**

6.1. The following safe working practices are required for all UFV personnel handling RG2 biohazardous material as defined in the UFV Biosafety Manual

6.1.1. A documented procedural SOP will be made available for review by any person working with RG2 biohazardous material. This SOP will be reviewed annually and updated as required.

6.1.2 All PI and laboratory supervisors handling RG2 biohazardous material will receive training on this SOP regardless of where the work is being done

6.1.3 All UFV personnel and students managing RG2 biohazardous material will receive training on this SOP. They are required to take a level 2 biosafety quiz and receive a passing grade of 70% prior to working with RG2 biohazardous material.

6.1.4 All UFV personnel students managing RG2 biohazardous materials are to receive firsthand training demonstrating sterile technique, the proper use of any primary containment equipment appropriates for the procedures and biohazardous materials used, proper donning and removal of personal protective equipment (PPE), effective decontamination techniques and appropriate spill clean-up procedures.

6.1.5 PI or lab supervisors must record and maintain training documentation for all UFV personnel under their supervision.

6.1.6 Doors to the containment zone must be kept closed and access to the containment zone is restricted to authorized personnel only. Visitors, including third party maintenance or repair personnel must be escorted by trained authorized faculty or staff.

6.1.7 All personal belonging (e.g., coats, backpacks, books, laptops, cell phones) must be stored outside of the containment zone

6.1.8 All personnel, including visitors and trainees, should wear PPE (e.g., lab coats, aprons, gloves, protective eyewear, and footwear) suitable and appropriate to the biohazardous materials present and procedures being used

6.1.9 Protective laboratory clothing must not be worn in non-laboratory areas; laboratory clothing should not be stored in the same locker as street clothing.

6.1. 10 Lab coats used within the containment zone must be decontaminated before removal from the zone or left within storage facilities within the containment zone

6.1.13 Laboratories are to be kept clean and tidy. Storage of materials that are not pertinent to the work and cannot be easily decontaminated (e.g., journals, books, correspondence) should be minimized; paperwork and report writing should be kept separate from such biohazardous materials work areas.

6.1.14 Disinfectants effective for the agents in use must be always available within the area where the biohazardous material is managed stored and transported

6.1.15 Work surfaces should be cleaned and decontaminated using a suitable disinfectant and for an appropriate contact time prior to commencing work with RG2 materials and again after work with RG2 biological material is complete

6.1.16 Oral pipetting is prohibited

6.1.17 Eating, drinking, smoking, applying cosmetics, handling contact lenses, storing food or utensils in the work area is prohibited

6.1.18 Long hair must be tied back or covered

6.1.19 Jewelry (e.g., rings or long necklaces) that may come in contact with biological material or that may puncture protective gloves should not be worn while working with biohazardous materials

6.1.20 Open wounds, cuts, scratches, and grazes should be covered with waterproof dressings

6.1.21 Gloves must be worn for all procedures that might involve direct skin contact with biohazardous material; gloves are to be removed when leaving the laboratory and decontaminated with other laboratory wastes before disposal.

6.1.22 Disposable gloves used when managing RG2 biological material should be discarded after use and never reused.

6.1.23 Sterile technique should be used when managing RG2 biohazardous material.

6.1.24 Eye and face protection is required for any procedures that might cause splashing to the face or eyes with biohazardous materials.

6.1.25 Procedures using sharps must immediately discard any used sharps in a puncture-resistant sharps container.

6.1.26 All contaminated materials, solid or liquid, must be decontaminated before disposal or reuse; contaminated materials that are to be decontaminated at a site away from the laboratory must have the outside of the container disinfected or must be double bagged prior to removal for treatment; the material must be contained in such a way as to prevent the release of the contaminated contents during removal; centralized autoclaving facilities are to follow the applicable containment level 2 requirements

6.1.27 Efficacy monitoring of autoclaves using biological indicators will be performed at regular intervals as defined in UFV BS11, and records of the results kept on file.

6.1.28 Biohazardous material must never be discarded in sinks or floor drains

6.1.29 Leak-proof containers are to be used for the transport of infectious materials between laboratories in different containment zones as per UFV BS19

6.1.30 Biological safety cabinets must be used for any procedures that may produce infectious aerosols as identified during a local risk assessment (LRA). Personnel using BSC must be trained on UFV BS17

6.1.31 Biosafety warning signs indicating the nature of the biohazardous agents being used (e.g. name of agent and containment level) must be posted outside each entrance to the containment zone; if infectious agents used in the laboratory require special provisions for entry, the relevant information must be included on the sign; the name and contact information of the laboratory supervisor or other responsible contact person(s) must also be listed.

6.1.32 A health and medical surveillance program must be provided as appropriate (e.g. medical examination, immunization, serum screening); only persons meeting specific medical entry requirements (e.g. immunization, serum screening) may enter containment laboratories unless the facility has been appropriately decontaminated; specified protocols can be developed and implemented to achieve the same level of protection for individuals entering a facility.

6.1.33 Emergency procedures for spill clean-up, biological safety cabinet failure, fire, animal escape, and other emergencies must be written, easily accessible, and followed. A record must be made of other persons entering the facility during an emergency

6.1.34 All large spills, accidents, or exposures to biohazardous materials and any loss of containment must be reported to the PI or laboratory supervisor

6.1.35 The PI or laboratory supervisor must report all large spills, accidents, or exposures of biohazardous materials and any loss of containment as defined within the UFV Biosafety Manual (BSM) to the Biosafety officer (IBO) and fill in an incident report form within 24 hours of the incident.

University of the Fraser Valley	Standard Operating Procedure	Page 1 of 3
Title: Biosafety Training Program for CL1 and CL2 Facilities		
SOP Number: UFV BS05	**Revision. Number: 1**	
Effective Date: March 13, 2022		

Co-chair IBC Approval:	Institutional Biosafety Officer Approval
Name: Dr. Terence Starr	Name: Gerald Van De Ven

1. **Purpose:** To describe the training requirements necessary to manage biohazardous agents within either containment level 1 (CL1) or containment level 2(CL2) facilities

2. **Application:** For all UFV employees or UFV students that manage Risk Group 1 (RG1) or Risk Group 2 (RG2) biohazardous agents within a CL1 or CL2 facility.

3. **References:**
   - **3.1** The most recent version of the Canadian Biosafety Guidelines
   - **3.2** The most recent version of the Canadian Biosafety Handbook
   - **3.3** The UFV Biosafety Manual (BSM)
   - **3.4** Biology department SOPs. BD01 Operational Practices for Biology Laboratories, BD02 Decontamination of Infectious Materials, BD03 Biosafety Cabinets: Safety and Use, BD04 Operation and Monitoring of Autoclaves, BD06 Control of Biohazardous Spills
   - **3.5** UFV biosafety SOPs. BS03 Good Microbiological Laboratory Practices for CL2 Facilities, BS11 Operation and Monitoring of Autoclaves, BS13 Control of Biohazardous Spills, BS15 Decontamination of Infectious Materials, BS17 Biological Safety Cabinet: Certification and Use, BS19 Transport of RG2 Biohazardous Materials between Containment Zones

4. **Definitions**
   - **4.1 Containment level 1 zone:** a UFV work area or laboratory space meeting the safe working criteria for handling RG1 biohazardous materials
   - **4.2 Containment level 2 zone:** a UFV work area or laboratory space meeting the safe working criteria for handling RG 2 biohazardous materials
   - **4.3 Risk Group 1 biohazardous material:** infectious agents or their toxins that pose a low risk of harm to individuals and the community

4.4 Risk Group 2 biohazardous material: infectious agents or their toxins that pose a moderate risk of harm to individuals and a low risk to the community

5. Responsibilities

5.1 The UFV IBO, in consultation with the UFV Institutional Biosafety Committee (IBC), will identify qualified individuals to function as biosafety trainers as required for each Biosafety Permit. Likely trainers include, but are not limited to: IBO, IBC members, Principal Investigator (PI), Lab Supervisor and Senior Lab Technicians.

6. Procedures

6.1.1 An effective training program will be identified during the Local Risk Assessment (LRA) as part of the Biosafety Permit Application. Diverse training needs (e.g., CL1 vs, CL2 or faculty vs. student) require different training programs as outlined below.

6.1.2 Training Supervised Students, CL1. This would include students taking classes in a CL1 designated laboratory or workspace. All students working in a CL1 facility, whether handling biohazardous materials or not and where RG1 biohazardous materials are in active use, are required to be trained on UFV BS01 and any additional SOPs as identified in an LRA. These students are required to take and pass (70%) a CL1 Biosafety quiz, the results of which are to be recorded and maintained by the supervisor or departmental administrator. Students working in a CL1 facility where RG1 biohazardous material is not in active use (e.g., a lab class that does not use any RG1 materials) require only general lab safety and are not required to take a biosafety quiz.

6.1.3 Training Supervised Students, CL2. This would include students taking classes in a CL2 designated laboratory or workspace. All students working in a CL2 facility, whether handling biohazardous materials or not and where RG2 biohazardous materials are in active use, are required to be trained on UFV BS03 and any additional SOPs as identified in the LRA or deemed necessary by the IBO. Students must take and pass (70%) a CL2 Biosafety quiz administered by the lab supervisor, the results of which are to be recorded and maintained by the supervisor or departmental administrator. Students working in a CL2 facility where RG2 or RG1 biohazardous material is not in active use (e.g., a lab class that does not use any RG2 or RG1 materials) require only general lab safety and are not required to take a biosafety quiz.

6.1.4 Training Independent Studies Students, CL2. This would include students engaged in research projects who are at times unsupervised. All students working in a CL2 facility, whether handling RG2 biohazardous agents or not and where RG2 biohazardous material is in active use, are required to be trained on UFV BS03. Additionally, students managing RG2 biohazardous materials may require training by their supervisor, or a trainer designated by the IBO, on any appropriate SOP (reference 3.5) identified in an LRA, or as deemed necessary by the IBO. A signed record of the training must be kept by the supervisor for the duration of the project and made available if requested by the IBO. If students are engaged in more than one project, they require

biosafety training for each. All students are required to take and pass (70%) a CL2 Biosafety quiz, the results of which are to be recorded and maintained by the Project Supervisor or departmental administrator.

6.1.5 Training New Faculty and Staff, CL2 facility: All faculty and staff who are new to UFV, and who are working in a CL2 facility, whether handling RG2 biohazardous agents or not and where RG2 biohazardous material is in active use, are required to be trained on UFV BS03. Personnel handling RG2 biohazardous agents may require additional training on UFV BS11, UFV BS13, UFV BS15, UFV BS17, UFV BS19 (reference 3.5) and any appropriate SOP for primary containment equipment as identified in a LRA or specified by the IBO. Training will consist of, but is not limited to, one-on-one in person training of each SOP listed above, or any training deemed necessary by the IBO. Training records are to be recorded and maintained by the IBO. Retraining is to occur as deemed necessary by the IBO if through an annual inspection, changes have been made.

6.1.6 Training Faculty and Staff, CL2 facility: All faculty and staff working in a CL2 facility, whether handling RG2 biohazardous agents or not and where RG2 biohazardous material is in active use, and who have not received previous training through reference 3.4, are required to be trained on UFV BS03. Personnel handling RG2 biohazardous agents may require additional training on UFV BS11, UFV BS13, UFV BS15, UFV BS17, UFV BS19 (reference 5) and any appropriate SOP for primary containment equipment as identified in a LRA or specified by the IBO. Training will consist of, but is not limited to, one-on-one in-person training of each SOP listed above, or any training deemed necessary by the IBO. Training records are to be recorded and maintained by the IBO. Retraining is to occur as deemed necessary by the BSO if through an annual inspection, changes have been made.

6.2 Training Methods and Training Exams.

6.2.1 Training Protocols and Materials. Training sessions include, but are not limited to: UFV BSM, UFV SOPs, lecture presentations, PowerPoint presentations, firsthand demonstrations, and on-line resources.

6.2.2 Training Exams. Faculty, staff, and students must demonstrate Biosafety competency prior to the start of any work with biohazardous materials. Competency will be measured through the administration of a Biosafety quiz and through an observational evaluation by the Biosafety trainer. Biosafety trainers will be designated by the UFV IBO. Exams will consist of multiple-choice questions based on the UFV BSM and UFV's biosafety SOPs. A passing mark is 70% is required prior to the commencement of any work with biohazardous materials.

6.2.3 Training Records. Training records are to be kept on UFV's Blackboard system. All records are to be kept by the Biosafety trainer (as designated by the IBO) and must be made available to the IBO upon request.

University of the Fraser Valley	Standard Operating Procedure	Page 1 of 2
Title: Pathogen Risk Group Assessment		
SOP Number: UFV BS07	**Revision. Number: 1**	
Effective Date: March 13, 2022		

Co-chair IBC Approval:	Institutional Biosafety Officer Approval
Name: Dr. Terence Starr	Name: Gerald Van De Ven

1. **Purpose:**
   To assign all biohazardous materials in use under the authority of a UFV Biosafety Permit to a pathogen risk group. Bio-samples that come from potentially contaminated sources may contain animal pathogens of unknown risk group (e.g., fecal material, raw sewage, wastewater from unknown sources) and must undergo a Matrix for Assessment of Risk Group (MARG) evaluation. Discernment must be applied as not all unknowns are capable of infecting animals (e.g., humans). For example, extreme thermophiles or photoautotrophs are very unlikely to cause any health issues to animals or people. Documentation supporting any classification must be provided and attached to the biosafety permit application.

2. **Application**:
   All UFV employees making an application for a UFV Biosafety Permit must classify the biohazardous materials in use (as described in the permit application process) to a pathogen risk group. Pathogens not evaluated by the Public Health Agency of Canada (PHAC), Canadian Food Inspection Agency (CFIA) or other health agencies, and are isolated from a source likely to contain animal pathogens, must undergo a MARG evaluation.

3. **References**
   3.1 The most recent version of the Canadian Biosafety Standards (CBS)
   3.2 The most recent version of the Canadian Biosafety Handbook (CBH)
   3.3 The most recent version of the UFV Biosafety Manual (BSM)

4. **Definitions**
   4.1 Risk Group 1 biohazardous material: infectious agents or their toxins that pose a low risk of harm to individuals and a low risk to the community
   4.2 Risk Group 2 biohazardous material: infectious agents or their toxins that pose a moderate risk of harm to individuals and a low risk to the community

4.3 Containment level 2 zone: a UFV work area or laboratory space meeting the safe working criteria for handling Risk Group 2 biohazardous materials

5. **Responsibilities:**
The PI or lab supervisor applying for a UFV Biosafety Permit, must assign all biohazardous material documented in their application to a risk group or discuss with the IBO what risk group would be appropriate for the microorganisms they are using. The IBO has the final decision.

6. **Procedure**

6.1. The following procedures are required for the assignment of Risk Group as defined in the CBS and 4.1 and 4.2 above.

6.1.1 Biohazardous materials defined in a Pathogen Safety Data Sheet (PSDS) by PHAC may be assigned the risk group specified within the PSDS in a UFV Biosafety permit application.

6.1.2 Known pathogens and their toxins (i.e., the Genus and species are known) that are not assigned a risk group by PHAC but are assigned a risk group by other health agencies (e.g., Center for Disease Control) may use the health agencies specified assigned risk group in a UFV biosafety permit application. A reference source must be included in the application.

6.1.3 Known pathogens (i.e., the Genus and species are known) that are not assigned a risk group by PHAC, or any other health agency must undergo a pathogen assessment using the UFV BSM MARG found in appendix 8. All documentation from the primary literature supporting the assigned risk group must be fully referenced.

6.1.4 Sources of bio-samples potentially contaminated with biohazardous material of unknown risk group (e.g., fecal material, raw sewage, wastewater from unknown sources) must undergo a MARG evaluation. The procedures and the types of manipulations must be included in the evaluation. All documentation from the primary literature supporting the risk group assignment must be fully referenced.

6.1.5 Any biohazardous material where the risk group is not defined may not be used without permission from the UFV biosafety officer (IBO). The IBO will assign any undefined biohazardous material at RG2 or higher. The handling of RG2 biohazardous material must be within a Containment Level 2 (CL2) facility. Biohazardous materials assigned to a risk group higher than RG2 cannot be used at UFV.

University of the Fraser Valley	Standard Operating Procedure	Page 1 of 3
Title: Operational Practices and Monitoring of Autoclaves		
SOP Number: UFV BS11	**Revision. Number:** 1	
Effective Date: March 13, 2022		

Co-chair IBC Approval:	Institutional Biosafety Officer Approval
Name: Dr. Terence Starr	Name: Gerald Van De Ven

1. Purpose

To define the proper operation and monitoring of autoclaves.

2. Application

To describe the requirements for the use and monitoring of all autoclaves used at the University of the Fraser Valley (UFV). Proper use and monitoring require the verification that infectious material has been sterilized prior to disposal.

3. References

3.1 The most recent version of the Canadian Biosafety Standards
3.2 The most recent version of the Canadian Biosafety Handbook
3.3 The most recent version of the UFV Biosafety manual

4. Definitions

4.1 Infectious agent: A microorganism (e.g., a bacterium or virus) capable of establishment and multiplication within a host.

4.2 Contaminated materials: Any materials that have been in contact with an infectious agent.

4.3 Biological indicators (BI): A BI is an inoculated carrier contained within its primary pack providing a known resistance to the relevant process. For verification of autoclave efficiency, typically spores of *Geobacillus stearothermophilus* will be used as indicated by the manufacturer or supplier.

4.4 Worst case position: A position within the autoclave loads that steam will have most difficulty reaching (e.g., centre of load within an autoclave bag or equivalent), or that will be

most difficult to heat to higher temperatures (large liquid volumes) for the duration of time required for complete sterilization.

5. Responsibilities

Only personnel trained in UFV BS11 and the use of a BI will operate the autoclaves for sterilizing infectious material. When a BI has been used to monitor autoclave operation, the BI will be incubated as described by the manufacturer, and the results will be documented and recorded. Records are to be kept by the Principal Investigator or senior Lab Technician and will be available for review by the IBO. Autoclaved waste may not be discarded until a successful sterilization cycle has been verified using a BI. Post autoclaved waste that has not been verified as sterilized must be stored in labelled containers until verification has occurred.

6. Procedure

6.1 Autoclave procedure

6.1.1 Check that the autoclave chamber is empty.

6.1.2 Verify that the water valve at the base of the autoclave is closed.

6.1.3 Add deionized water if required (the autoclave requires 4 to 6 quarts for each run).

6.1.4 Select the exhaust type (fast: instruments, or slow: liquids).

6.1.5 Load the autoclave (add a BI if required, see section 6.2) and close the door.

6.1.6 Select the required time (all infectious material requires a minimum of 20 minutes at 121^{o}C).

6.2 Use of a BI for Infectious Materials

6.2.1 A BI must be used at least weekly to verify that the autoclave is functioning appropriately.

6.2.2 Select which type of BI to use based on the source of infectious material being autoclaved. Placed the BI in a worst-case position within the load.

6.2.3 Following completion of the autoclave cycle, store autoclaved infectious waste until verification of effectiveness using a BI.

6.2.3 If the BI shows no indication of growth the waste material may be disposed. Remove or deface any Biohazardous waste signage prior to disposal (e.g., defaced biohazard symbols on biohazard bags).

6.2.4 If the BI indicates growth, the stored Biohazardous materials must be re-autoclaved

6.2.5 A record of all autoclaved infectious materials must be documented and recorded. Records are to be kept by the Principal Investigator or senior Lab Technician and will be available for review by the UFV Biosafety Officer.

University of the Fraser Valley	Standard Operating Procedure	Page 1 of 3
Title: Clean Up of Risk Group 2 Biohazardous Spills		
SOP Number: UFV BS13	**Revision. Number:** 1	
Effective Date: March 13, 2022		

Co-chair IBC Approval:	Institutional Biosafety Officer Approval
Name: Dr. Terence Starr	Name: Gerald Van De Ven

1. **Purpose**
   To define a universal practice for the cleanup of Risk Group 2 (RG2) biohazardous materials

2. **Application**
   For small spills of RG2 biohazardous materials on any UFV campus.

3. **References**
   3.1 The most recent version of the Canadian Biosafety Standards
   3.2 The most recent version of the Canadian Biosafety Handbook
   3.3 The most recent version of the UFV Biosafety manual
   3.4 UFV BS11 Operation and Monitoring of Autoclaves

4. **Definitions**
   4.1 Small Spill: A liquid culture of 10 litres or less.

   4.2 Risk Group 2 biohazardous material: infectious agents or their toxins that pose a moderate risk of harm to individuals and a low risk to the community

   4.3 Authorized personnel: include only those individuals that have undergone the Biohazard Spill Training Protocol. They include but are not limited to laboratory technicians, laboratory instructors, supervising faculty, principal investigators, Biosafety Officer or designate as appointed by the Biosafety Officer

5. **Responsibilities**
   It is the responsibility of the Principal Investigator or Lab Supervisor to ensure that only authorized and trained personnel (see 4.3) cleanup RG2 biohazardous spills

6. Procedure

6.1 The following general practices are required for all laboratories or any personnel working with infectious material in which a small biohazard spill has occurred (see 4.1).

6.1.1. Immediately notify any nearby persons and have them leave the area.

6.1.2. Any authorized personnel (see 4.3) should be immediately notified. If no authorized personnel are present, leave the room and close the door. Post a temporary warning sign indicating the nature of the spill then contact the Biosafety Officer or UFV Security.

6.1.3. Spills should only be cleaned up by authorized and trained personnel (see 4.3). Appropriate personal protective equipment (e.g., Lab coats, gloves, goggles, respirator) should be worn when cleaning up RG2 spills.

6.1.4. Find the Lab spill kit and bring to the spill location.

6.1.5. Use only disinfectants that have been verified to be effective against the RG2 agent (e.g., 0.8% solution of Clinicide, 10% solution of Bleach). Cover the spill with cloth or paper towels to contain it. Slowly and carefully pour disinfectant around the outer perimeter of the spill and allow it to flow into the spill. Allow the disinfectant to be in contact with the spill for up to 30 minutes

6.1.6. If any broken glass is present, use forceps from the spill kit to pick up the glass and transfer it to a solid container lined with a biohazard bag. DO NOT use your hands. Autoclave as per ref. 3.4.

6.1.7. After the appropriate time, discard the absorbent materials into a biohazardous waste container and autoclave according to ref. 3.4.

6.1.8. Using absorbent material (e.g., paper towels) wipe up the spill and discard the paper towels in a biohazard autoclave bag. Discard any other contaminated materials (e.g., gloves and other wastes from clean-up) into an autoclave bag. Autoclave according to ref. 3.4.

6.1.9. Remove any contaminated garments (lab coats, shoe covers) or other safety equipment (e.g., goggles, face shield) and place into a biohazardous bag or container for autoclaving (see ref. 3.4.). Thoroughly wash your hands and face with antibacterial soap and water.

6.1.10 Complete a Biohazard Spill Incident Report Form (UFV Biosafety Manual Appendix 6)

University of the Fraser Valley	Standard Operating Procedure	Page 1 of 2
Title: Decontamination of RG2 Biohazardous Laboratory Waste		
SOP Number: UFV BS15	**Revision. Number:** 1	
Effective Date: March 3, 13		

Co-chair IBC Approval:	Institutional Biosafety Officer Approval
Name: Dr. Terence Starr	Name: Gerald Van De Ven

1. Purpose

To define the general practices for decontaminating Risk Group 2 (RG2) laboratory wastes.

2. Application

For all laboratories and teaching facilities at the University of the Fraser Valley (UFV) handling RG2 biohazardous materials

3. References

3.1 The most recent version of the Canadian Biosafety Standards
3.2 The most recent version of the Canadian Biosafety Handbook
3.3 The most recent version of the UFV Biosafety manual (BSM)
3.4 UFV BS11 Operation and Monitoring of Autoclaves
3.5 UFV BS13: Control of Biohazardous Spills
3.6 UFV BS21 Transport of RG2 Biohazardous Materials between Containment Zones

4. Definitions

4.1 Biohazardous Agent: A microorganism, as defined in the UFV BSM section 3.2, or their toxins, capable of establishment and multiplication within a host.

4.2 Contaminated materials: Any materials that have been in contact with a Biohazardous agent.

4.3 Disinfection: The removal of microorganisms from inanimate objects by chemical or physical treatment.

4.4 Sterilization: The destruction or removal of all living cells, viable spores and viruses from an inanimate object or habitat

5. Responsibilities

The Principal Investigator or Laboratory Supervisor working with infectious materials will ensure that all UFV personnel and students follow the procedures as set out below.

6. Procedures:

6.1. The following general practices are required for all laboratories handling RG2 biohazardous materials.

6.1.1 Prior to the commencement of each laboratory and again at the end, all working surfaces will be cleaned with a chemical disinfectant (e.g., 0.8% Clinicide solution) verified to be effective against the RG2 material in use.

6.1.2. All disposable equipment (e.g., pipette tips, disposable loops, Petri plates, gloves) in contact with any infectious material will be immediately placed into sterilizing trays or autoclave bags and autoclaved according to ref 3.4.

6.1.3. All small non-disposable lab equipment (e.g., beakers, Erlenmeyer flasks, pipettes, laboratory cultures, stocks, clinical specimens, cell cultures, protective clothing,) in contact with any Biohazardous material will be placed into autoclaving bins and autoclaved according to ref. 3.4.

6.1.4. All lab equipment or building materials not capable of being autoclaved (e.g., water baths, incubators, centrifuges, cupboards, floors etc.,) in contact with any infectious material will be disinfected with a chemical disinfectant (e.g., 0.8% Clinicide solution) verified to be effective against the RG2 material in use.

6.1.5. Spills of infectious material are to be immediately reported to the laboratory instructor or supervising faculty and are to be cleaned up according to ref. 3.5.

6.1.6. All RG2 biohazardous waste materials collected at sites outside of the decontamination area (e.g., area where autoclaved is housed) must be transported between containment areas in leak-proof containers as in ref. 3.6.

University of the Fraser Valley	Standard Operating Procedure	Page 1 of 3
Title: Operational Practices and Certification of Biological Safety Cabinets		
SOP Number: UFV BS17	**Revision. Number:** 1	
Effective Date: March 13, 2022		

Co-chair IBC Approval:	Institutional Biosafety Officer Approval
Name: Dr. Terence Starr	Name: Gerald Van De Ven

1. Purpose

1.1 To define universal procedures for the use of Class II type B Biological safety cabinets (BSC).
1.2 To establish requirements for the certification and recertification of Class II type B Biological safety cabinets.

2. Application

Applies to all Class II type B Biological Safety Cabinets in use in containment level 2 work areas.

3. References

3.1 The most recent version of the Canadian Biosafety Standards (CBS)
3.2 The most recent version of the Canadian Biosafety Handbook (CBH)
3.3 The most recent version of the UFV Biosafety manual (BSM)
3.4 UFV BS11 Operation and Monitoring of Autoclaves
3.5 UFV BS13 Control of Biohazardous Spills
3.6 UFV BS15 Decontamination of RG2 Biohazardous Laboratory Waste
3.7 UFV BS19 Transport of RG2 Biohazardous Materials between Containment Zones

4. Definitions

4.1 Biohazardous Materials: A microorganism, as defined in the UFV BSM section 3.2, or their toxins, capable of establishment and multiplication within a host.

4.2 Contaminated materials: Any materials that have been in contact with a Biohazardous agent.

4.3 Disinfection: The removal of microorganisms from inanimate objects by chemical or physical treatment.

4.4 Containment level 2 zone: a UFV work area or laboratory space meeting the safe working criteria for handling Risk Group 2 biohazardous materials

4.5 Risk Group 2 biohazardous material: infectious agents or their toxins that pose a moderate risk of harm to individuals and a low risk to the community

5. Responsibilities

5.1 The Principal Investigator or Lab Supervisor will ensure that users will receive firsthand training in the use of the BSC prior to the commencement of any work handling RG2 biohazardous agents.

5.2 The Principal Investigator or Lab Supervisor will ensure that the BSC is installed and certified as per 5.1 of CBS. Annual recertification is required.

6. Procedures:

6.1. The following general practices are required for all laboratories handling RG2 biohazardous materials within a BSC.

6.1.1. Use of the BSC is required for any procedure using RG2 biohazardous agents (or their toxins) that may generate aerosols.

6.1.2. Use of the BSC is required when using any human or animal cell lines.

6.1.3. The UV light must be operating for 1 hour prior to managing any RG2 biohazardous agents. After 1 hour, switch off the UV light and turn on the fluorescent light and fan for 10 minutes. Leave on while working.

6.1.4. Disinfect the interior surfaces with a 70% ethanol solution. Optional: the working surface may be lined with absorbent paper with plastic backing.

6.1.5. Gather all working materials and place them in the BSC taking care not to obstruct the air grilles. Include a biohazardous waste container (e.g., biohazard bag) and autoclaving bins.

6.1.6. Donn personal protective equipment (PPE) (e.g., lab coat, gloves) and work as far back in the cabinet as possible.

6.1.7. To avoid generating aerosols, limit the movement of hands and arms; enter and exit the BSC perpendicular to the BSC face.

6.1.8. Place any contaminated disposable materials (e.g., Pipette tips, loops, gloves, absorbent paper etc.) immediately into the biohazard bag or container.

6.1.9. After finishing the experiment and before removal from the BSC, all small non-disposable lab equipment (e.g., beakers, Erlenmeyer flasks, laboratory cultures, stocks, clinical specimens, cell cultures) in contact with any Biohazardous material should be surface cleaned with a chemical disinfectant (e.g., 0.8% Clinicide solution) verified to be effective against the RG2 material in use and placed into autoclaving bins and autoclaved according to **ref**. 3.4.

6.1.10. If a spill occurs, follow **ref**. 3.5, 3.6, 3.7. Spills should be cleaned up while the BSC is operational.

6.1.11. Donn clean gloves and remove materials from the BSC. If the autoclave is not in the same containment area as the BSC, follow **ref**. 3.7.

6.1.12. Disinfect working surfaces with a 70% ethanol solution; allow the fan to be on for an additional 5 minutes before turning the BSC off.

6.2 Certification

6.2.1 The operation of the BSC will be evaluated and certified by experienced and qualified individuals using test equipment with valid calibration certificates as required in the CBS Matrix 5.1. Testing is required upon initial installation, annually and after any repairs, modifications, or relocations.

6.2.2 A label indicating the date of certification, the date for recertification, the standards to which the cabinet was evaluated, and the name of the certifier must be affixed to the exterior of the cabinet.

University of the Fraser Valley	Standard Operating Procedure	Page 1 of 3
Title: Transport of RG2 Biohazardous Materials between Containment Zones		
SOP Number: UFV BS19	**Revision. Number:** 1	
Effective Date: March 13, 2022		

Co-chair IBC Approval:	Institutional Biosafety Officer Approval
Name: Dr. Terence Starr	Name: Gerald Van De Ven

1. Purpose

To define general operating procedures for the transfer of Risk Group 2 (RG2) biohazardous materials from one containment zone to another.

2. Application

For all UFV personnel working with RG2 biohazardous materials that requires transport from one containment zone to another in either: a) the same building or b) between buildings or c) from off campus sites to UFV facilities.

3. References

3.1 The most recent version of the Canadian Biosafety Standards (CBS)
3.2 The most recent version of the Canadian Biosafety Handbook (CBH)
3.3 The most recent version of the UFV Biosafety manual (BSM)
3.4 The most recent version of the Canadian Transport of Dangerous Goods Regulations
3.5 UFV BS11 Operation and Monitoring of Autoclaves
3.6 UFV BS13 Control of Biohazardous Spills
3.7 UFV BS15 Decontamination of RG2 Biohazardous Laboratory Waste

4. Definitions

4.1 Biohazardous Materials: A microorganism, as defined in the UFV BSM section 3.2, or their toxins, capable of establishment and multiplication within a host.

4.2 Contaminated materials: Any materials that have been in contact with Biohazardous materials.

4.3 Disinfection: The removal of microorganisms from inanimate objects by chemical or physical treatment.

4.4 Containment level 2 zone: a UFV work area or laboratory space meeting the safe working criteria for handling Risk Group 2 biohazardous materials

4.5 Risk Group 2 biohazardous material: infectious agents or their toxins that pose a moderate risk of harm to individuals and a low risk to the community

5. Responsibilities

The Principal Investigator (PI) or laboratory supervisor is responsible to ensure all UFV faculty, staff and students under their supervision working with RG2 biohazardous materials follow the procedures detailed in this SOP.

6. Procedures:

6.1. Transport of RG2 biohazardous materials between containment zones within the same building (e.g., from benchtop in a lab prep room to a lab that is in another part of the building outside of the original containment zone).

6.1.1. Transferring Biohazardous materials, such as bacterial cultures, must be done in leak-proof and impact resistant containers. A wheeled cart should be used If there is lots of material being transferred or if the material is large or heavy.

6.1.2. Surface decontamination must be performed prior to removing the container from the containment zone (**ref**. 3.7).

6.1.3. The container must be labeled with the name of all the RG2 material being transported.

6.1.4. A spill kit (**ref**. 3.6) should be available at both containment zones to aid in the quick cleanup of any spills.

6.2. Transport of RG2 biohazardous materials between containment zones in different buildings (e.g., between the Abbotsford and Chilliwack campuses or between the off-campus site of collection to a UFV CL2 facility).

6.2.1. The transport of RG2 biohazardous materials between facilities at different locations falls under the Transport of Dangerous Goods Regulations.

6.2.1. Biohazardous materials must be packaged in labelled containers that are sealed, leak-proof, and impact resistant.

6.2.2. The outside of any package or container must be surfaced cleaned with a disinfectant verified to be effective against the RG2 material in use (e.g., 0.8% solution of Clinicide).

6.2.3. Contaminated waste must be doubled bagged in biohazard bags and the outside bag must be surfaced cleaned with a disinfectant verified to be effective against the RG2 material in use (e.g., 0.8% solution of Clinicide).

6.2.3. Any package or container must be labelled with a Biohazardous Materials sign that includes the identification of the material(s) being transported, contact name, and the destination.

6.2.4. An inventory record must be maintained for all transported materials.

University of the Fraser Valley	Standard Operating Procedure	Page 1 of 3
Title: Operational Practices for Handheld Portable Lactate Analyzers		
SOP Number: UFV BS21	**Revision. Number:** 1	
Effective Date: March 13, 2022		

Co-chair IBC Approval:	Institutional Biosafety Officer Approval
Name: Dr. Terence Starr	Name: Gerald Van De Ven

1. Purpose

To describe the correct procedures for the collection, handling, and disposal of capillary (fingertip) blood samples for the measurement of lactate by a handheld lactate analyzer. This SOP covers the collection of the samples from the participants, the handling of the samples/test strips, and disposal of contaminated waste.

2. Application

Applies to all UFV personnel collecting blood samples for the purpose of lactate measurements using a portable lactate analyzer.

3. References

3.1 The most recent version of the Canadian Biosafety Standards (CBS)
3.2 The most recent version of the Canadian Biosafety Handbook (CBH)
3.3 The most recent version of the UFV Biosafety manual (BSM)
3.4 UFV BS11 Operation and Monitoring of Autoclaves
3.5 UFV BS13 Control of Biohazardous Spills
3.6 UFV BS15 Decontamination of RG2 Biohazardous Laboratory Waste
3.7 UFV BS19 Transport of RG2 Biohazardous Materials between Containment Zones

4. Definitions

4.1 Biohazardous Materials: Any materials, as defined in the UFV BSM section 3.2, that are either directly or indirectly capable of transmitting infectious agents to UFV personnel or a participant.

4.2 Contaminated materials: Any materials that have been in contact with Biohazardous materials.

4.3 Disinfection: The removal of microorganisms from inanimate objects by chemical or physical treatment.

4.4 Risk Group 2 biohazardous material: infectious agents or their toxins that pose a moderate risk of harm to individuals and a low risk to the community

5. Responsibilities

The Principal Investigator or Lab Supervisor will ensure that users will receive training on this SOP and receive firsthand training in the proper use of the Lactate Analyzer prior to the commencement of any work collecting participant samples.

6. Procedure

6.1. The following general practices are required for all UFV personnel collecting blood samples from participants for use in a handheld lactate analyzer.

6.1.1. Lab personnel must wash their hands thoroughly with warm water and soap and then don personal protective equipment (e.g., lab coat, disposable gloves, and protective eyewear).

6.1.2. Calibrate lactate analyzer with calibration test strips.

6.1.3. All work surfaces must be disinfected with either a 0.8% solution of Clinicide or a 10% solution of Bleach (or any other disinfectant approved by the UFV biosafety officer).

6.1.4. Have all participants wash their hands thoroughly with warm water and soap then dry completely.

6.1.5. Select the fingertip from which the sample will be collected and wipe it with a 70% alcohol swab. Discard the swab into a biohazard bag.

6.1.6. Insert a single use lactate test strip/sensor into the lactate analyzer.

6.1.7. Prepare the single use lancet by removing the protecting covering and selecting the desired depth setting.

6.1.8. Make a puncture on the side of the subject's finger by pressing the lancet firmly against the finger and pressing the button. Immediately dispose of the used lancet in the biohazard sharp's container.

6.1.9. Wipe away the first drop of blood with a clean tissue and discard the tissue into a biohazard bag.

6.1.10. Place the lactate test strip/sensor next to the drop of blood. Blood will be drawn into the test strip/sensor. When enough blood (2 μL) has been drawn into the test strip the lactate analyzer will beep. The lactate analyzer will then take 30 seconds to 1-minute to provide a lactate measurement.

6.1.11. Wipe any remaining blood off the subject's finger with a clean tissue and apply a Band-Aid. Discard the tissue into a biohazard bag.

6.1.12. Once a lactate reading is displayed, remove the test strip and discard into the biohazard sharps container.

6.1.13. After all samples have been collected, remove your lab coat and eye wear. Remove your gloves and place them in biohazard disposal bag. Wash your hands thoroughly with warm water and soap.

6.1.14. All biohazard waste material will be transported (**ref**. 3.7) to the CEP lab (A2111) at Chilliwack campus, UFV, for autoclaving (**ref**. 3.4) and disposal (**ref**. 3.6).

6.1.15. Any spills requiring clean-up must follow UFV BS13 (**ref**. 3.5).

University of the Fraser Valley	Standard Operating Procedure	Page 1 of 3
Title: Operational Practices for Saliva Collection and Handling		
SOP Number: UFV BS23	**Revision. Number:** 1	
Effective Date: March 13, 2022		

Co-chair IBC Approval:	Institutional Biosafety Officer Approval
Name: Dr. Terence Starr	Name: Gerald Van De Ven

1. Purpose

This Standard Operating Procedure (SOP) describes the accepted procedures for the collection, handling, storage, and transport of human saliva samples.

2. Application

Applies to all UFV personnel collecting human saliva samples.

3. References

3.1 The most recent version of the Canadian Biosafety Standards (CBS)
3.2 The most recent version of the Canadian Biosafety Handbook (CBH)
3.3 The most recent version of the UFV Biosafety manual (BSM)
3.4 UFV BS03 Good Microbiological Practices for CL 2 Facilities
3.5 UFV BS11 Operation and Monitoring of Autoclaves
3.6 UFV BS13 Control of Biohazardous Spills
3.7 UFV BS15 Decontamination of RG2 Biohazardous Laboratory Waste
3.8 UFV BS19 Transport of RG2 Biohazardous Materials between Containment Zones

4. Definitions

4.1 Biohazardous Materials: Any materials, as defined in the UFV BSM section 3.2, that are either directly or indirectly capable of transmitting infectious agents to UFV personnel or a participant.

4.2 Contaminated materials: Any materials that have been in contact with Biohazardous materials.

4.3 Disinfection: The removal of microorganisms from inanimate objects by chemical or physical treatment.

4.4 Risk Group 2 biohazardous material: infectious agents or their toxins that pose a moderate risk of harm to individuals and a low risk to the community

5. Responsibilities

The Principal Investigator or Lab Supervisor will ensure that UFV personnel will receive training on this SOP, as well as UFV BS03, prior to the commencement of any work collecting participant samples.

6. Procedures:

6.1 The following safe working practices are required for all UFV personnel handling human saliva.

6.1.1. Don personal protective equipment (PPE) (lab coat and disposable gloves).

6.1.2. Label an Eppendorf collection tube with Participant ID, Date and Time of collection. Use a permanent ink marker.

6.1.3. Check to make sure that the participant has not ingested anything (food and fluids) for at least 30 minutes before collection.

6.1.4. When ready, have the participant put on disposable gloves and provide them with a labeled Eppendorf collection tube and a straw. Using the provided straw, the participant collects 1.5 mLs of their saliva into the Eppendorf tube and seals the tube.

6.1.5. The participant transfers the sealed Eppendorf tube to a Ziploc bag, seals the bag, and places the saliva sample into an impact resistant storage container displaying a Biohazardous Materials label. All contaminated wastes (e.g., transfer straw, disposable gloves) are discarded into a Biohazard bag.

6.1.6 When finished collecting their saliva, have the participant thoroughly clean their hands with hand sanitizer (70% ethanol) and dry with paper towels. Waste products are discarded into biohazardous bags.

6.1.7. After all samples have been collected, UFV personnel remove their PPE, thoroughly clean their hands with hand sanitizer (70% ethanol) and dry with paper towels. Waste products are discarded into biohazardous bags.

6.1.8. If required, the saliva samples are transported (**ref. 3.8**) to a UFV containment level 2 lab for storage in a -20^{O}C freezer displaying a Biohazardous materials label or directly to an off-campus lab for analysis.

6.1.9. Stored saliva samples transported from a UFV lab to an off-campus lab for analysis must follow UFV BS19 (**ref 3.8**).

6.1.10. Any spills requiring clean-up must follow UFV BS13 (**ref. 3.5**).

6.1.11. All biohazardous waste materials are to be transported (**ref**. **3.8**) to a UFV containment level 2 lab for autoclaving (**ref**. **3.7**) and disposal (**ref**. **3.6**).

University of the Fraser Valley	Standard Operating Procedure	Page 1 of 3
Title: Operational Practices for Human Urine Collection and Handling		
SOP Number: UFV BS25	**Revision. Number:** 1	
Effective Date: March 13, 2022		

Co-chair IBC Approval:	Institutional Biosafety Officer Approval
Name: Dr. Terence Starr	Name: Gerald Van De Ven

1. Purpose

To describe the accepted procedures for the collection, handling, storage, and transport of human urine samples.

2. Application

Applies to all UFV personnel collecting human urine samples.

3. References

3.1 The most recent version of the Canadian Biosafety Standards (CBS)
3.2 The most recent version of the Canadian Biosafety Handbook (CBH)
3.3 The most recent version of the UFV Biosafety manual (BSM)
3.4 UFV BS03 Good Microbiological Practices for CL 2 Facilities
3.5 UFV BS11 Operation and Monitoring of Autoclaves
3.6 UFV BS13 Control of Biohazardous Spills
3.7 UFV BS15 Decontamination of RG2 Biohazardous Laboratory Waste
3.8 UFV BS19 Transport of RG2 Biohazardous Materials between Containment Zones

4. Definitions

4.1 Biohazardous Materials: Any materials, as defined in the UFV BSM section 3.2, that are either directly or indirectly capable of transmitting infectious agents to UFV personnel or a participant.

4.2 Contaminated materials: Any materials that have been in contact with Biohazardous materials.

4.3 Disinfection: The removal of microorganisms from inanimate objects by chemical or physical treatment.

4.4 Risk Group 2 biohazardous material: infectious agents or their toxins that pose a moderate risk of harm to individuals and a low risk to the community

5. Responsibilities

The Principal Investigator or Lab Supervisor will ensure that UFV personnel will receive training on this SOP, as well as UFV BS03, prior to the commencement of any work collecting participant samples.

6. Procedures

6.1 The following safe working practices are required for all UFV personnel handling human urine samples.

6.1.1. Don personal protective equipment (PPE) (lab coat and disposable gloves).

6.1.2. Hand the participant a sterile urine collection container and instruct them on the proper procedure to collect a urine sample. Prior to leaving the washroom, have the participant cover the urine collection container, place the container into a Ziploc bag and into a labelled impact resistant container for transport to the lab (**ref. 3.8**). Instruct the participant to wash their hands prior to leaving the washroom.

6.1.3. Calibrate the refractometer with 3 ml of distilled water using a sampling pipette and drain the distilled water into a water collection container.

6.1.4. Obtain a urine sample, remove the lid, draw 3 mLs of urine into a disposable pipette and transfer the urine to the refractometer. Discard the pipette into a Biohazard bag. After analysis, drain the urine from the refractometer back into the urine collection container. Wash and recalibrate the refractometer draining the rise water into the urine collection container and re-cover. Discard any contaminated materials into a Biohazard bag.

6.1.5. Place the collection container back into a Ziploc bag and into a labeled impact resistant container for transport back to the washroom (**ref. 3.8**). In the company of the participant, have the participant pour the contents of the sample container into a toilet.

Discard the collection container, Ziploc bag and any other contaminated materials into a biohazard bag.

6.1.6. All biohazardous waste materials are to be transported (**ref**. **3.8**) to a UFV containment level 2 lab for autoclaving (**ref**. **3.7**) and disposal (**ref**. **3.6**).

6.1.7. Any spills requiring clean-up must follow UFV BS13 (**ref. 3.5**).

University of the Fraser Valley	Standard Operating Procedure	Page 1 of 4
Title: Operational Practices for Measuring Maximal Aerobic Capacity Using a Metabolic Cart		
SOP Number: UFV BS27	**Revision. Number:** 1	
Effective Date: March 13, 2022		

Co-chair IBC Approval:	Institutional Biosafety Officer Approval
Name: Dr. Terence Starr	Name: Gerald Van De Ven

1. Purpose

To describe the accepted procedures for determining an individual's maximal aerobic capacity (VO_2 max) during a graded exercise test using a metabolic cart. A graded exercise test is used to determine VO_2 max by measuring the highest (i.e., maximum) amount of oxygen that can be utilized by the body during intense exercise.

2. Application

For all Principal Investigators (PI), UFV Lab Supervisors, UFV personnel and students working in laboratories using a metabolic cart.

3. References

3.1 The most recent version of the Canadian Biosafety Standards (CBS)
3.2 The most recent version of the Canadian Biosafety Handbook (CBH)
3.3 The most recent version of the UFV Biosafety manual (BSM)
3.4 UFV BS11 Operation and Monitoring of Autoclaves
3.5 UFV BS15 Decontamination of RG2 Biohazardous Laboratory Waste
3.6 UFV BS19 Transport of RG2 Biohazardous Materials between Containment Zones

4. Definitions

4.1 Biohazardous Materials: Any materials, as defined in the UFV BSM section 3.2, that are either directly or indirectly capable of transmitting infectious agents to UFV personnel or a participant.

4.2 Contaminated materials: Any materials that have been in contact with Biohazardous materials.

4.3 Disinfection: The removal of microorganisms from inanimate objects by chemical or physical treatment.

4.4 Risk Group 2 biohazardous material: infectious agents or their toxins that pose a moderate risk of harm to individuals and a low risk to the community

5. Responsibilities

The Principal Investigator (PI) or laboratory supervisor is responsible for ensuring all UFV faculty, staff and students under their supervision working with metabolic carts follow the procedures detailed in this SOP, as well as UFV BS03.

6. Procedures:

6.1 The following safe working practices are required for all UFV personnel and students operating a metabolic cart.

6.1.1. Turn on the metabolic cart at least 30 minutes prior to testing.

6.1.2. Perform a calibration of the flow sensors and gas analyzers according to manufacturer recommendations.

6.1.3. Ensure participants (healthy adults) have completed the PAR-Q or equivalent health assessment form without any health concerns or have medical clearance for maximal effort exercise from their primary physician.

6.1.4. Ensure participants are wearing proper attire and a heart rate monitor that is actively recording.

6.1.5. Explain the test procedures to the participant and confirm the participant understands the incremental nature of the test and how to stop the test if needed (i.e., signaling to the tester with a predetermined signal, grabbing the handrails and straddling the treadmill belt, identification of the emergency stop button, etc.).

6.1.6. Don personal protective equipment (disposable gloves)

6.1.7. Verify all equipment has been decontaminated and cleaned according to the manufacturer's recommendations. Have the participant place the facemask over their mouth and nose or insert the mouthpiece into their mouth. Secure a nose clip on the nose. Secure the facemask or mouthpiece to the participant's head with straps or headset.

6.1.8. Connect the exhale port of facemask or mouthpiece to the collection hose of metabolic cart. Verify metabolic cart is functioning properly

6.1.9. Have participant perform a warm-up (3 to 5 minutes) on the appropriate exercise modality

6.1.10. Conduct a specific graded exercise test (e.g., speed, grade, resistance) every 1-5 minutes until the test is stopped.

6.1.11. At the end of the test or once the participant has elected to stop the test (e.g., grabbed the treadmill handrails or stopped pedaling) the tester will stop the treadmill (if a treadmill test is performed) or reduce resistance (if a cycle test). The participant's mask or mouthpiece will then be removed, and the tester will ensure that the participant is feeling well.

6.1.12. The facemask or mouthpiece and nose clip should be disassembled, and each piece should be rinsed with water and then submerged/soaked in disinfecting solution according to the manufacturer's recommendations (e.g., Glutaraldehyde). Discard disposable gloves into a biohazardous waste bag.

6.1.13. Donn new disposable gloves. Following disinfection, facemask or mouthpiece items and nose clip should be thoroughly rinsed with water and then placed in the drying rack for the next use.

6.1.14. All biohazardous waste materials are to be transported (**ref**. **3.6**) to a UFV containment level 2 lab for autoclaving (**ref**. **3.4**) and disposal (**ref**. **3.5**).

6.2. Risks and Safety procedures

6.2.1. Risk of infection from exposure to saliva: Multiuse facemasks, mouthpieces, and accessories: facemasks, mouthpieces, and nose clips will be cleansed and disinfected between each participant according to manufacturer recommendations. Experimenters must wear disposable gloves when managing the facemask or mouthpiece and accessories.

6.2.2. Risk of falling (applies to exercise test performed on treadmill only): A minimum of two trained personnel must be present at all times during the test. Participants will be briefed on what to do at the end of the test (or at any time during the test). Specifically, on how to grab the handrails and straddle the treadmill belt to avoid injury.

6.2.3. Side effects of exhaustive exercise: To reduce these effects, the PAR-Q (Physical Activity Readiness Questionnaire) or equivalent health assessment form must be completed by the participant before the exercise test is performed.

Appendix 3 Training Modules

Biosafety training programs at UFV share a common goal irrespective of the biohazardous material being managed. That goal is to educate and train UFV personnel about the potential biohazards present in their environment, and to establish mitigating practices that can protect them from these hazards. Regardless of the biohazardous material managed, biosafety training is not a one size fits all. Many activities may require one training module for faculty and another for inexperienced personnel. For example, students new to a lab activity are much more likely to expose themselves or others to an infectious agent compared to an experienced lab technician. During the LRA the IBO, or their designate, will undergo a training needs evaluation to help the PI or lab supervisor understand the differences to help them develop an appropriate training program.

A training program encompasses two related but quite different instructional activities. The first is education which provides personnel with general information and theoretical knowledge. Educational training can take the form of classroom instruction, PowerPoint presentations, pathogen safety data sheets, posters, and video review. The second activity is a more firsthand approach that demonstrates proper pathogen handling techniques, the proper use of PPE and trains personnel in the use of specific primary containment devices (e.g., BSC or centrifuges). Individual SOPs, specific to the biohazardous material, the techniques used to manipulate this material, and the facilities where the activities will be performed, can be developed, and used as both educational and firsthand training resources.

The modules in this appendix are there to direct the PI or Lab supervisor with their first steps in establishing an effective training program. The suggested minimum requirement for students is to be familiar with the UFV biosafety manual (BSM) and UFV SOP BS01 (CL1 training) or BS03 (CL2 training). BSM was developed, in part, from CBS and the CBH. Its emphasis focuses on a basic understanding of biosafety from a practical viewpoint. In other words, what are the primary concepts of biosafety and biosecurity most pertinent to UFV personnel who are inexperienced and who can easily make mistakes and may harbour many misconceptions with respect to the proper handling of infectious agents.

The PIs or Lab Supervisors are not limited to only using the BSM and UFV's SOPs. The IBC encourages the development of additional training material in the form of PowerPoint presentations, posters, and videos. Towards this end, you will find listed below some resources available for your use. If you have developed your own biosafety training material (e.g., PowerPoint lectures, links to appropriate videos) the IBC welcomes you to share these with your UFV colleagues by forwarding any materials to the IBO for review and inclusion with the materials listed below.

Training Module: Containment Level 1

- UFV BSM review
- UFV BS01 Safe Operational Practices for Containment Level 1 Facilities
- PowerPoint Presentation (send request to IBO@ufv.ca)
- CL1 Biosafety Quiz (send request to IBO@ufv.ca)
- Biosafety 101 (PHAC requires free sign up)

Training Module: Containment Level 2

- UFV-BSM review
- UFV BS03 Good Microbiological Laboratory Practices for Containment Level 2 Facilities
- UFV BS13 Control of Biohazardous Spills
- UFV BS15 Decontamination of RG2 Biohazardous Laboratory Waste
- If identified in the LRA
    - UFV BS11 Operation and Monitoring of Autoclaves
    - UFV BS17 Biological Safety Cabinet: Certification and Use
    - UFV BS 19 Transport of RG2 Biohazardous Materials Between Containment Zones
- PowerPoint Presentation (send request to IBO@ufv.ca)
- CL2 Biosafety Quiz (send request to IBO@ufv.ca)
- Biosafety 101 (PHAC requires free sign up)
- Containment Level 2 Operational Practices (PHAC requires free sign up)

Appendix 3 CL2 Biosafety Quiz

1. Biosafety requires a cooperative effort from different groups. At UFV, Biosafety is the responsibility of
   a) Biosafety Officer
   b) Students
   c) Faculty
   d) Staff
   e) All of the above

2. Infectious agents and / or their toxins are more likely to cause health issues to individuals that are immunocompromised. Within the UFV biosafety manual it is recommended that immunocompromised individuals managing any biohazardous materials inform their lab supervisor.

A = true

B = false

3. The health status of an individual can change with time due to many different circumstances. Some reasons for changing health status include, but are not limited to, changes due to an illness, pregnancy, drug use, or prescription medication. Within the UFV biosafety manual it is recommended that individuals managing any biohazardous material whose health status has changed, inform their lab supervisor.

A= true

B = false

4. Many RG1 materials are actually consumed by the public in products such as yogurts and other food sources. The Public Health Agency of Canada (PHAC) has determined Risk Group 1 (RG1) biohazardous agents pose a low risk of harm to individuals and the public. Because RG1 materials are low risk
   a. They can be considered completely safe
   b. They can be used by all individuals under all circumstances
   c. They do not require any biosafety considerations
   d. They can be harmful to some individual under specific circumstances
   e. More than one of the above is true

5. Which of the following is **not** considered a potential source of biohazardous material?
    a. Bacteria
    b. Primate cell lines
    c. Human body fluids
    d. Genomic DNA
    e. Prions

6. Biohazardous materials can be classified according to risk groups. The Public Health Agency of Canada considers pathogens classified as risk group _____ to be the greatest risk to individuals and the public.
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5

7. Which of the following is not a common method of transmission of RG2 pathogens?
    a. Ingestion of contaminated materials
    b. Inhalation of allergens
    c. Needle stick from a contaminated source
    d. Splash of contaminated material to the face or skin
    e. All are normal and common means of RG2 transmission

8. Which of the following are Biosecurity measures required for containment level 2 facilities?
    a. Entrance doors to CL2 facility are lockable
    b. CL2 facilities are restricted to authorized personnel only
    c. Bench tops are to be cleaned with disinfectants before and after using biohazardous materials
    d. A and B
    e. A, B and C

9. During a lab experiment using risk group 2 pathogens, a student accidentally spills 5 mL of a broth culture breaking the culture tube in the process. Which of the following measures should the student do first?
   a. Pick up the broken glass with forceps and put into the sharp's container
   b. Cover the spill with paper towels soaked in disinfectant
   c. Find the lab supervisor and let them know a spill has occurred
   d. Inform any others in the immediate vicinity that a spill has occurred and inform the lab supervisor
   e. Start immediately cleaning up the spill

10. In the UFV containment level 2 research room a student sets up an important timed DNA digest (which requires 4 hours for completion). After carefully setting up the digest, the student leaves the lab, returning 4 hours later. When arriving at the lab, there is a hand-written note taped to the door indicating a biohazardous spill has occurred and not to enter. No one is around. What should the student do?
   a. Enter the lab and continue with their experiment because digesting DNA is not a biohazardous procedure.
   b. Enter the lab and continue with their experiment because it is a timed experiment, and handwritten notes are student pranks
   c. Enter the lab to use the lab phone and call UFV security to let them know that a biohazardous spill has occurred.
   d. Leave and come back tomorrow since someone else wrote the note and knows what is going on
   e. Inform supervisory personnel or the UFV Biosafety officer or UFV security that a biohazardous spill has occurred.

11. A student in a CL2 facility is collecting cells from a risk group 2 bacterial pathogen by spinning aliquots of the culture for 5 minutes at a time in a microcentrifuge. During one of the spins the fire alarm rings. What should the student do?
   a. Quickly and safely leave the lab and move to the assembly point. Inform the fire marshal that RG2 material has been left in the microcentrifuge. Give the fire marshal as much information as possible about the location and nature of the RG2 material.
   b. Wait for the microcentrifuge to stop so they can safety remove and safely store the RG2 material preventing others from exposure then quickly and safely leave the lab
   c. Find a pen and paper to tape a note to the microcentrifuge to let others know that RG2 material is in the microcentrifuge then quickly and safely leave the lab.
   d. Find a pen and paper then quickly leave the lab. On the way out, wait until everyone has left the lab and then tape a note to the outside of the door to let others know that RG2 materials have been left in the microcentrifuge
   e. Quickly and safely leave the lab and move to the assembly point. Wait until all clear has been given then return to the lab continuing with the collection of the bacterial culture.

12. One day the biosafety officer (BSO) makes an unannounced visit to UFV's research CL2 lab making notes on the conditions and the materials in use. The BSO notices a student working without their lab coat on. When asked why they were not wearing a lab coat the student explains that today they are only working with RG1 materials and lab coats are not necessary. The BSO explains the situation and asks the student to put on their lab coat. What is a possible reason why the student was required to put on a lab coat?
    a. The student is working in a CL2 facility and RG2 material is present in the lab requiring everyone to wear a lab coat
    b. Under the conditions of the UFV biosafety permit that the student is working under, a local risk assessment (LRA) determined that lab coats were necessary for the types of operational practices in use
    c. Even though RG1 materials pose a low risk of infection it is not a zero risk and a LRA determined there were individuals in the lab who were immunocompromised.
    d. All of the above all reasons

13. In a shared CL2 lab facility where different research groups are actively working, one group using only RG1 materials and the other using RG2, both groups must be trained at CL2 levels

A = true B = false

14. Which of the following is not found within the standard operating procedure UFV BS03 "Good Microbiological Laboratory Practices for CL2 Facilities"
    a. All personnel, including visitors and trainees, should wear PPE (e.g., lab coats, aprons, gloves, protective eyewear, and footwear) suitable and appropriate to the biohazardous materials present and procedures being used
    b. Work surfaces should be cleaned and decontaminated using a suitable disinfectant and for an appropriate contact time prior to commencing work with RG2 materials and again after work with RG2 biological material is complete
    c. Oral pipetting is prohibited; Eating, drinking, smoking, applying cosmetics, handling contact lenses, storing food or utensils in the work area is prohibited; Long hair must be tied back or covered
    d. Protective laboratory clothing must not be worn in non-laboratory areas; personnel leaving the lab (e.g., using the washroom) must remove their lab coat and gloves and wash their hands before leaving the containment area
    e. All of the above are contained within UFV BS03

15. After obtaining a UFV biosafety permit a research group follows a lab procedure designed to grow and culture a strain of E. coli that produces a proteinaceous enterotoxin. At the end of the experiment the excess culture media is autoclaved and is ready for disposal however the BSO intervenes citing that the waste material has not been properly decontaminated. A reason for the BSO intervention is likely
    a. Autoclaving does not kill enterotoxin E. coli
    b. E. coli produces spores, and autoclaving does not kill spores
    c. The researchers are not following the decontaminating SOP identified in the local risk assessment (LRA)
    d. Toxins are not alive therefore autoclaving cannot be used to decontaminate proteinaceous toxins
    e. Enterotoxin E. coli is RG3 pathogens and cannot be used at UFV so all waste must be sent for external decontamination

Local Risk Assessment Evaluation Form

1) General Information

Applicant	
Department	
Email	
Office Phone	
Date of Application	
Application Type*	☐ Lab Course
	☐ Research
	☐ Clinical Training

2) On Site Location

	Site 1	Site 2
Campus		
Room Number		
Containment Level		

3) Off Site Location

Location Details and Containment Level

4) Biohazardous Material: *Briefly describe the type of biohazardous material used and the risk group*

5) Operational Practices: *Briefly describe the procedures used and note if any Primary Containment Devices are required*

Is there any dual-use potential for the pathogens in use? (☐ No.). If yes, the application cannot proceed as written. Dual-use projects are NOT permitted at UFV.

6) Spill Clean-Up: *Briefly describe the procedure for cleaning up spills and any required chemical disinfectant or indicate the UFV SOP that will be followed*

6.1 Will you be using UFV SOP BS 13 for cleaning up spills of biohazardous materials? (☐ yes.). If no, detail the steps you will follow.

7) Decontamination and Waste Disposal: *Briefly describe the procedures required for the decontamination and disposal of all contaminated materials or indicate the UFV SOP that will be followed*

7.1 Will you be using UFV SOP BS 15 for decontaminating equipment and waste that has come in contact with biohazardous materials? (☐ yes.). If no, detail the steps you will follow.

8) Required SOPs: *Indicate the UFV SOPs required for this application*

- ☐ UFV-BS01 Safe Operational Practices for CL1 Facilities
- ☐ UFV-BS03 Good Microbiological Laboratory Practices for CL2 Facilities
- ☐ UFV-BS05 Biosafety Training for CL1, CL2 facilities
- ☐ UFV-BS07 Pathogen Risk Group Assessment
- ☐ UFV BS11 Operation and Monitoring of Autoclaves
- ☐ UFV-BS13 Clean Up of Risk Group 2 Biohazardous Spills
- ☐ UFV-BS15 Decontamination of RG2 Biohazardous Laboratory Waste
- ☐ UFV-BS17 Operational Practices and Certification of Biological Safety Cabinets
- ☐ UFV-BS19 Transport of RG2 Biohazardous Materials between Containment Zones
- ☐ UFV-BS21 Operational Practices for Handheld Portable Lactate Analyzers
- ☐ UFV BS23 Operational Practices for Saliva Collection and Handling
- ☐ UFV BS25 Operational Practices for Human Urine Collection and Handling
- ☐ UFV BS27 Operational Practices for Measuring Maximal Aerobic Capacity Using a Metabolic

9) Lab Specific SOP Used: *List the titles of any lab specific (non-UFV standardized SOPs*

9.1 Are there any lab specific protocols not covered in the SOPs listed in section 8? (☐ no). If yes, attach the SOP.

10) Training Requirements: *Indicate all training requirements*

11) Biosecurity: *Indicate any biosecurity requirements*

11.1 Are the assets deemed to be at low risk of unauthorized access needing minimal management and control measures (☐ Yes). If no, detail biosecurity measures below.

12) Lab Inspection:

Was the lab was inspected for compliance with UFV's BSM manual at the time of this LRA? (☐ Yes).

13) Issues of Non-Compliance: *Indicate any identified or missing administrative, operational, or regulative biosafety measures*

14) Final Comments and Recommendations

LRA Check List				
		Yes	No	NA
1	Has the PI or Lab Supervisor been made aware of the required signage	☐	☐	☐
2	Has the PI or Lab Supervisor been made aware of the required training program(s) and the need to record and retain the training records	☐	☐	☐
3	Are there any special medical surveillance requirements deemed necessary for this application.	☐	☐	☐
4	Has the PI or Lab Supervisor been made aware of UFV's Emergency Response plan and has it been posted	☐	☐	☐
5	Has the PI or Lab Supervisor been made aware of the requirements for transporting RG2 materials between different containment facilities	☐	☐	☐
6	Has the PI or Lab Supervisor been made aware of any required biosecurity measures	☐	☐	☐
7	Are the biohazardous materials deemed to be at low risk of unauthorized access needing minimal management and control measures	☐	☐	☐
8	Has the PI or Lab Supervisor been made aware of the required spill clean-up procedures	☐	☐	☐
9	Is a spill kit available and up to date?	☐	☐	☐
10	Has the PI or Lab Supervisor been made aware of the required method of transporting contaminated materials to the site of decontamination	☐	☐	☐
11	Has the PI or Lab Supervisor been made aware of the required waste disposal procedures	☐	☐	☐
12	Has the PI or Lab Supervisor been made aware of the requirement to record and report any biosafety incidents to the BSO within 24 hours	☐	☐	☐
13	Has the PI or Lab Supervisor been made aware of the requirement to report to the BSO if any physical or operational changes occur within the application	☐	☐	☐
14	Has the researcher been informed that all participants were human body fluids are collected, must go through a COVID self-assessment before sample collection?	☐	☐	☐
15	Has the biohazardous material and the research protocols been confirmed **not** to have any dual-use potential	☐	☐	☐
16	Was the lab was inspected for compliance with UFV's BSM manual at the time of this LRA?	☐	☐	☐

Date of LRA:

Name of Applicant

BSO

IBC Co-chair

Department
Representative

Appendix 5: Biohazardous Material Inventory

Identification of Person(s) Maintaining Inventory

Name	Contact Number	Email

Inventory of Assets

Material (bacteria, virus etc.)	Material Type (glycerol tube, lyophilized vial etc.)	RG	Storage Site	Quantity on Hand

Upon completion of this form an e-copy is to be sent to the UFV BSO and another copy maintained and stored by PI, Lab supervisor or their designate.

Appendix 6: Incident Report Form: Spills and Exposure

The reporting of spills, personal exposure, and loss of containment of RG2 materials is required by the HPTA Biohazardous license agreement. Incident reporting helps to protect the health and safety of university employees and students and provides a mechanism to assess the effectiveness of UFV's Biosafety procedures. Incidents must be reported to the UFV IBO within 24 hours of occurrence.

The types of incidents that are reportable include, but are not limited to:

- Spills containing RG2 biohazardous materials
- A needle stick injury, or injury with other sharps, which have been in contact with RG2 biohazardous materials or with human blood, blood products or other potentially infected primate body fluids
- Direct contact of RG2 biohazardous materials to the skin, eyes, nose or mouth or exposure through an open wound or inhalation of aerosols.
- Breach of containment of primary containment equipment (e.g., Biosafety Cabinet) or failure to follow approved containment conditions for infectious substance as stipulated in UFV's BSM

Note: Spills involving personal exposure of 10 mLs or less or spills of RG1 materials do not need to be reported. Proper decontamination and disposal are required.

PI or Lab Supervisor	
Contact Information	
Date and Time of Incident	
Location	
Names of People Involved	
Contact Information	
Were there any injuries	
Materials Involved	

Detailed description of event. *Include as much specific information as possible. Include any information on treatment and how any exposed materials were decontaminated and disposed of. After signing, scan this form and forward to the UFV IBO*

Click here to enter text.

Signature / date

Appendix 7: Incident Report Form: Biosecurity Incident

The reporting of loss of RG2 materials is required by the HPTA Biohazardous license agreement. Incident reporting helps to protect the health and safety of university employees and students and provides a mechanism to assess the effectiveness of UFV's Biosafety procedures. Incidents must be reported to the UFV IBO within 24 hours of occurrence.

The types of incidents that are reportable include, but are not limited to:

- Theft of any RG 2 materials
- Breach of CL2 containment zones by unauthorized personnel
- Security equipment malfunction (e.g., locks not working)

PI or Lab Supervisor	
Contact Information	
Date and Time of Incident	
Location	
Names of People Involved	
Contact Information	
Were there any injuries	
Materials Involved	

Detailed description of event. *Include as much specific information as possible. Include any information on treatment and how any exposed materials were decontaminated and disposed of. After signing, scan this form and forward to the UFV IBO*

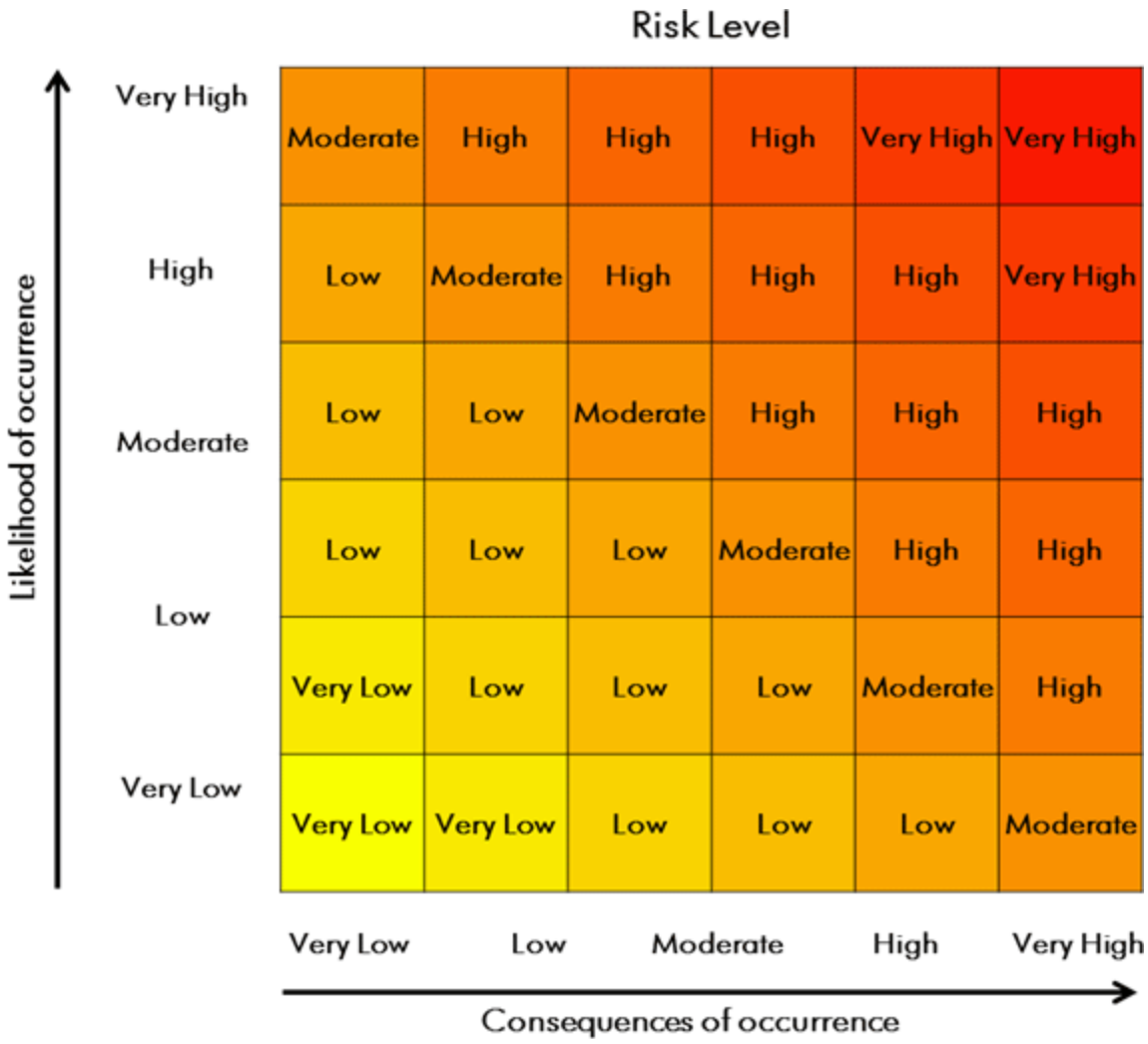
Click here to enter text.

Signature / date

Appendix 8: Matrix for the Assessment of Risk Group

Attach to your permit application after completing.

Environmental sampling is the most common source of biohazardous materials of unidentified origins. If the sample source contains biohazardous materials of undetermined origin or composition, it is logical to assume that the Risk Group level of the sample is also uncertain. Therefore, for any samples containing biological material where the risk group is uncertain, the PI or Lab Supervisor must evaluate the potential health issues that could occur if personnel, animals, or the environment are exposed to the biological materials in question.



The matrix shown above can be used as a quick estimate for determining risk group levels. When considering the likelihood and consequences of occurrence, the PI or Lab Supervisor must consider not only the source of material but also what procedures will be used when managing the

sample. For example, the chances of exposure significantly increase if aerosols are produced or if the infectious agent is propagated or cultured. If the initial assessment produces results that are moderate or high, the IBC recommends that an alternative source of material be sought (if possible). This might mean that the source material could remain the same but sampled from a different location (e.g., a water sample taken upstream from a contaminated area rather than downstream).

After the initial assessment, further evaluations must be performed in order to assign the sample to a specific risk group. For samples that contain multiple infectious agents (e.g., raw sewage), the PI or Lab supervisor should first focus on the infectious agents that have the highest pathogenicity or virulence. Since the risk group assignment will reflect the highest RG level, preceding with the highest virulence first will be the most time efficient. Note: Samples containing RG3 biohazardous materials are not permitted in any UFV laboratories. PIs wishing to work with RG3 biohazardous agents must do so in conjunction with co-researchers at facilities other than UFV. For any samples containing unidentified infectious agents the PI and Lab supervisors are required to fill in the table below.

Risk Group Assessment		
Risk Factors	**Comments**	**References**
Pathogenic to humans or animals		
Environmental pathogen		
Route of infection		
Communicable		
Survivability		
Host range		
Naturally present in the environment		
Economic consequences		
Available treatment		
Genome modifications		