

Section:	Biosafety Program	Issued By:	Environmental Health and Safety
		Issued Date:	2006-01-01
Part:		Revised Date:	2017-09-15
		Reviewed Date:	
Pages:	16	Revision #:	2
		Issued/Revised By:	EO

1. SCOPE

The Biosafety Manual applies to all persons performing controlled activities involving the handling or storage of biohazards for research and teaching purposes within facilities managed and controlled by the University. The University is committed to adhere to the relevant, most current version of: Human Pathogens and Toxins Act and Regulations, Health of Animals Act and Regulations, Canadian Biosafety Standard, Containment Standards for Facilities Handling Aquatic Animal Pathogens, Containment Standards for Facilities Handling Plant Pests, Arthropod Containment Guidelines; and other applicable Federal and Provincial acts, regulations, standards and Municipal bylaws. Biohazards include, but are not limited to, infectious material (e.g. bacteria, viruses, fungi, cell lines, blood, prions, animal pathogens, aquatic animal pathogens, vector-borne pathogens and plant pests) and microbial toxins (e.g. botulinum toxin, cholera toxin and diphtheria toxin).

2. PURPOSE

The University of Calgary is required to implement and maintain a Biosafety Program to protect its people, assets and the environment from **exposure** to, and contamination with, **biohazards** that are being used for research and teaching purposes within its facilities. The **Biosafety Manual** is an essential component of the Biosafety Program designed to provide direction through standards and procedures to minimize the **risks** when working with biohazards.

3. BIOSAFETY PROGRAM

The University of Calgary Biosafety Program is designed to promote and monitor compliance with acts, regulations, directives, standards and guidelines published by the Public Health Agency of Canada (PHAC), the Canadian Food Inspection Agency (CFIA), provincial regulators and other parties with oversight over biosafety and **biosecurity**. All persons working with biohazards are responsible to read, understand and comply with the requirements the Biosafety Program.

4. Responsibilities

All employees at the University of Calgary have a shared responsibility for maintaining a safe and healthy work environment. As a part of the University of Calgary Occupational Health and Safety Management System (OHSMS), responsibility checklists have been developed for specific employee groups. The specific roles and responsibilities are further described in the Biosafety Program.

4.1. Managers and Supervisors

Managers and Supervisors (e.g. Principal Investigators [PIs]) are responsible for facilitating the protection of the health and safety of people within their areas of responsibilities by knowing,

understanding and complying with the components of the Biosafety Program and OHSMS that apply to their areas of responsibility which are detailed in the OHSMS Responsibilities Checklist.

4.2. Employees

Employees are responsible to know, understand and comply with the applicable components of the Biosafety Program and OHSMS which are detailed in the OHSMS Responsibilities Checklist.

4.3. Biosafety Committee

The Biosafety Committee is an advisory committee to the Vice-President (Research), ensuring the effectiveness of the Biosafety Program. It is responsible for developing standards or procedures to be followed when handling biohazards in accordance with the applicable acts, regulations, directives, standards and guidelines. The specific role of the committee is outlined in the Terms of Reference.

4.4. Environmental Health and Safety

The Environmental Health and Safety (EHS) department develops comprehensive health and safety programs and standards (as part of the OHSMS) to direct and provide guidance to the University community with respect to health and safety, including biosafety. EHS advises the Biosafety Committee on the development of the Biosafety Program to achieve compliance with relevant legislation. EHS also develops the Laboratory Safety Program, a key foundational feature that supports the Biosafety Program. The University Biosafety Officer (BSO) is responsible for directing the University of Calgary Biosafety Program.

5. WORKING WITH BIOHAZARDS

5.1. Risk Groups

The Public Health Agency of Canada has developed a classification system of human and animal **pathogens** described in their Canadian Biosafety Standard (CBS). Four levels of **risk** have been defined as follows:

Risk Group 1 (low individual and community risk)

Any biological agent that is unlikely to cause disease in healthy workers or animals. These pathogens are not regulated by the PHAC or the CFIA due to the low risk, but care should be exercised and safe work practices should be followed when handling these materials.

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

These pathogens are able to cause serious disease in a human or animal but are unlikely to do so. Effective treatment and preventative measures are available and the risk of spread of diseases caused by these pathogens is low.

Risk Group 3 (high individual risk, low community risk)

These pathogens are likely to cause serious disease in a human or animal. Effective treatment and preventive measures are usually available and the risk of spread of disease caused by these pathogens is low for the public. The risk of spread to livestock or poultry, however, can range from low to high depending on the pathogen.

Risk Group 4 (high individual risk, high community risk)

These pathogens are likely to cause serious disease in a human or animal which can often lead to death.

Effective treatment and preventive measures are not usually available and the risk of spread of disease caused by these pathogens is high for the public. The risk of spread of disease to livestock or poultry, however, ranges from low to high depending on the pathogen.

The University of Calgary houses facilities that permit the handling and storage of risk group 1, 2 and 3 **biohazards**. For more information on a specific pathogen the PHAC has a list of Pathogen Safety Data Sheets (PSDS) which describes the hazardous properties and recommended handling of these biohazards.

5.2. Working with Human Immunodeficiency Virus (HIV)

Under certain circumstances, specific risk group 3 pathogens (e.g. HIV) may be handled and stored in a Containment Level 2 laboratory with additional operational requirements. Work involving HIV is restricted to specific, approved laboratories that must meet the requirements described in the CBS and as described by PHAC in the Biosafety Directive for HIV and HTLV-1.

5.3. Working with Animals and Biohazards

All work involving live animals and biohazards is required to be carried out in a laboratory or facility designed and operated in accordance with the CBS, and the Canadian Council on Animal Care Guide to the Care and Use of Experimental Animals. Containment zones for small and large animals must meet requirements as described in the CBS.

The University of Calgary Animal Health Unit has policies and procedures in place when handling animals in a research setting. For further information refer to the Animal Health Unit.

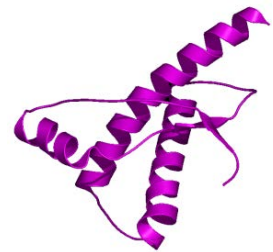
5.4. Microbial Toxins

Microbial **toxins** are poisonous substances that are naturally produced by certain **microorganisms**. Microbial toxins are regulated by PHAC as described in the Human Pathogens and Toxins Act and Regulations.

5.5. Prions

Prions are small proteinaceous infectious particles which are responsible for causing certain fatal degenerative diseases of the central nervous system and in both humans and animals. Prions resist typical inactivation procedures that modify nucleic acids including irradiation, boiling, dry heating and chemical treatment.

Work involving prions is restricted to specific, approved laboratories that must meet the requirements described in the CBS.



5.6. Non-Indigenous Animal Pathogens

Any **pathogen** that is not native to Canada is considered non-indigenous. Work involving non-indigenous animal pathogens is regulated by CFIA and is restricted to specific, approved laboratories that must meet the requirements described in the CBS.

5.7. Biohazards Transmitted by Vectors

All work involving vectors is regulated by PHAC and/or CFIA, is restricted to specific, approved laboratories and must be carried out in accordance with the facility and operational parameters

described in the Arthropod Containment Guidelines.

5.8. Aquatic Animal Pathogens

All work involving aquatic animal pathogens is regulated by the CFIA, is restricted to specific, approved laboratories and must be carried out in accordance with the facility and operational parameters described in the Containment Standards for Facilities Handling Aquatic Animal Pathogens and the CBS.

5.9. Plant Pests

All work involving plant pests is regulated by CFIA, is restricted to specific, approved laboratories and must be carried out in accordance with the facility and operational parameters described in Containment Standards for Facilities Handling Plant Pests and the CBS.

6. BIOHAZARD MANAGEMENT

6.1. Hazard Identification, Assessment and Control

A formal hazard assessment is required for all job descriptions, laboratories and workshops at the University of Calgary prior to work initiation. Assessments are to be completed using the Hazard Assessment and Control Forms (HACF) as outlined in the Hazard Assessment & Control Procedure. Hazards are controlled using engineering controls, administrative controls, and Personal Protective Equipment.

It is the responsibility of managers or supervisors to provide, implement, and enforce the use of controls for hazards identified on the HACF. Managers or supervisors are also required to ensure the HACF is reviewed and updated, as required. All individuals conducting formal hazard assessments must complete the Hazard Assessment and Control training.

Laboratory self-inspections are required to be performed as outlined in the Workplace Inspection Procedure as a systematic way of monitoring the workplace to ensure a safe working environment. Inspections are required to be conducted using the web-based Inspection Module in Chematix. Inspection training is provided by EHS and guidance documents/resources are available to assist with correcting deficiencies which are the responsibility of the PI/Department/Faculty.

6.2. Containment Levels and Containment Zones

Containment levels are designed to provide the end-user with a description of the minimum **containment** required for handling a biohazard safely in a laboratory setting and are regulated by the PHAC and the CFIA. The CBS describes the containment level housed by the University of Calgary, namely, Containment Level 2. A containment zone is a physical area that satisfies the requirements of a specific containment level.

6.3. Physical Design

All laboratory spaces at the University of Calgary must meet the design requirements outlined in the CBS. The University of Calgary Design Standards describes laboratory design specifically detailing Containment Barriers, Surface Finishes and Casework, Air Handling, Facility Services and Emergency Equipment.

6.4. Laboratory Access

Access to laboratory areas is limited to authorized personnel only. All Laboratory spaces must be separated from public spaces by a locked door and must be left closed to ensure access control. For

further information on laboratory access and visitors refer to the University of Calgary Laboratory Safety Manual.

6.5. Biohazard Laboratory Safety Rules

Operational requirements are documented in the Laboratory Safety Rules Poster. Additionally, the Biohazard Laboratory Safety Rules Poster documents the specific rules that must be followed while working with biohazards. This poster must be posted in all laboratories that handle or store biohazards. Contact the University BSO to obtain a printed, colour poster.

6.6. Biohazard Registration and Biosafety Permit

Principal Investigators must obtain a **Biosafety Permit** from the Biosafety Committee for the handling or storage of **biohazards**. The Biosafety Permit is conditional upon adherence to all applicable Federal and Provincial legislation, regulations, directives, standards, guidelines, Municipal bylaws and University programs. The permit is conditional upon receiving official clearance from EHS for previously-occupied laboratories.

Biosafety Permit application/modification/renewal and biohazard inventory are managed online through BioLogistix, a module of Chematix. The PI must keep the Biosafety Permit current by identifying changes in biohazards or locations, as required. The PI must annually renew the permit. Biosafety Permits are automatically issued to the PI and Chematix Laboratory Supervisor (for insertion into the Laboratory Safety Manual) and Research Services Office (for communication to Research Accounting, Animal Care Committees and Research Ethics Boards). For biohazard-specific activities in the Animal Resource Centre, the University BSO supplies the Animal Resource Centre with a Biohazard Laboratory Placard for each PI and location which is to be accessible for others to review, as required.



For more information on Biosafety Permits contact the University BSO.

6.7. Importation, Exportation, Receipt and Transfer of Biohazards

Importation, exportation, receipt and transfer of biohazards are governed by the PHAC and the CFIA. For further information refer to the relevant Biohazard Transfer Procedure.

6.8. Health Surveillance Program

Staff Wellness manages the following Occupational Health Programs.

6.8.1. Immunization Program

The University of Calgary provides an Immunization Program to protect employees from potential health risks associated with exposure to vaccine-preventable diseases.

6.8.2. Respiratory Protection Program

The University of Calgary provides a Respiratory Protection Program to protect employees from potential health risks associated with exposure to airborne contaminants, including biohazards.

6.8.3. Hearing Conservation Program

The University of Calgary provides a Hearing Conservation Program to protect employees from hearing

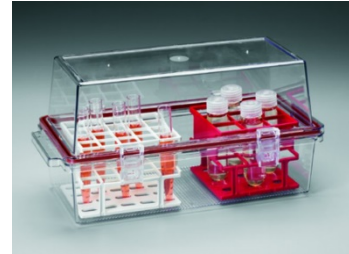
loss due to occupational noise exposure, including handling biohazards with equipment that could affect hearing.

6.9. Biosafety Cabinets

When properly maintained and used in conjunction with good laboratory techniques, BSCs provide **primary containment** for work with **biohazards** and protection for personnel, the product and the environment. For further information refer to the Biosafety Cabinet Standard.

6.10. Movement of Biohazards

When moving **biohazards** within buildings, procedures must be followed to prevent potential **exposure** or contamination from spills or leaks. All biohazards must be transported in leak-proof, impact resistant containers that have been surface decontaminated. For information regarding the movement of biohazards refer to the Movement of Hazardous Materials Within Buildings.



For further information on movement of biohazards outside the university, refer to the relevant Biohazard Transfer Procedure.

6.11. Equipment Safety

There are many different types of equipment used in a laboratory. All equipment should be operated in accordance with the manufacturer's specifications and in a manner that minimizes potential **exposure** to **biohazards**. Additionally, all personnel are required to be trained and follow Standard Operating Procedures (SOPs) when working with any laboratory equipment.

6.11.1. Personal Protective Equipment

Personal Protective Equipment (PPE) includes equipment and clothing that provide a barrier to minimize the **risk** of exposure to biohazards. PPE may include, but is not limited to, gloves, lab coats, safety glasses, safety goggles, protective footwear, full-body suits, masks and respirators. The selection of appropriate PPE is determined by HACF and is specific to both the biohazard and the work activities to be performed. For more information on PPE refer to the Personal Protective Equipment Program and the CBS.

6.11.2. Centrifuges

There is the potential for **aerosol** production and leakage during centrifugation of biohazards.

The CBS outlines recommendations when centrifuging biohazards:

- decontaminate the outside surface of cups/rotors, as required
- use equipment in accordance with manufacturer instructions, which includes balancing of rotors to prevent rotor damage or explosion
- use plastic tubes that are suitable for centrifuge use (e.g. thick wall plastic tubes with exterior thread screw caps)
- use sealed centrifuge cups/rotors to prevent the release of aerosols during centrifugation
- inspect cup/rotor seal integrity regularly
- unload cups/rotors in a BSC

- allow time for aerosols to settle prior to opening cups/rotors
- use of centrifuges within a Class II BSC is prohibited

For further information refer to the CBS requirements and recommendations when centrifuging biohazards.

6.11.3. Microtomes and Cryostats

A microtome is a mechanical instrument used to cut biological specimens into very thin segments for microscopic examination. Cryostats are essentially microtomes operated at sub zero temperatures, and are used to cut frozen biological specimens.

The blades are extremely sharp, and must be handled with great care. Safety precautions must be taken in order to avoid any contact with the cutting edge of the blade and to prevent exposure to solvents and biohazards.

For further information refer to the CBS requirements and recommendations when using microtomes or cryostats with biohazards.

6.11.4. Safety-Engineered Medical Sharps

A safety-engineered medical sharp is a medical sharp designed to minimize or eliminate the **risk** of accidental parenteral contact (piercing mucous membranes or the skin) while or after the sharp is used.



Specially designed medical sharps (e.g. hollow-bore needles, suture needles, scalpels, etc.) reduce the risk of needlestick injuries and other puncture wounds from contaminated sharps. Self-sheathing needles have a built-in sheath or sleeve that extends to cover the needle. Retractable syringes are designed so the needle can be pulled up inside the syringe.

Needleless systems use threaded ports on IV tubing, so healthcare employees can remove the needle from the syringe after drawing up medication, and then simply screw the syringe directly into the port. Disposable safety scalpels have a built-in sheath that covers the blade between use and disposal, and suture needles for sewing tissues other than skin are available with blunted tips.

The Alberta Occupational Health and Safety Code requires that supervisors must provide and ensure that any medical sharp is a safety-engineered medical sharp. The code also states that supervisors must ensure that waste needles are not recapped and are discarded immediately in an appropriate sharps container.

This requirement does not apply if:

- use of the required safety-engineered medical sharp is not clinically appropriate
- the required safety-engineered sharp is not available in commercial markets

The supervisor must establish safe work procedures for the use and disposal of medical sharps if an employee is required to use or dispose of a medical sharp. The safe work procedures must be in writing and available to employees. The procedures must include a discussion of:

- the hazards associated with the use and disposal of medical sharps
- the proper use and limitations of safety-engineered medical sharps
- procedures to eliminate accidental contact with medical sharps
- any other relevant information

The purpose of the procedures is to limit the possibility of employees coming into contact with medical sharps that could cause a cut or puncture wound. Employees must be trained in the safe work procedures so that the procedures are understood and followed. Employees are required to use and dispose of medical sharps in accordance with the training they have received by the supervisor.

6.11.5. Additional Equipment

Exposure to **aerosols** may pose the greatest **biohazard risk** to laboratory personnel (Collins 1999). The main risks associated with aerosolization are exposure via inhalation, ingestion or mucous membrane contact. Additional equipment that may be used in a biohazard laboratory and lead to aerosol production includes:

- vacuums/aspirators
- mixing apparatus
- freeze dryers
- French presses
- cell sorters
- fermenters
- pipettes

Special attention must be paid to minimize aerosol production to avoid possible exposure. It is important to always use care when using equipment with biohazards and to follow the manufacturer's instructions.

For further information refer to the CBS requirements and recommendations for equipment use when working with biohazards.

6.11.6. Laboratory Decommissioning

EHS has developed a Laboratory Check-Out Standard and Laboratory Check-Out Procedure to provide an organized and systematic approach to ensure that laboratories and supporting areas are clean, free of hazardous materials, hazardous and non-hazardous wastes, and unwanted equipment after being vacated.

7. DECONTAMINATION AND WASTE MANAGEMENT

7.1. Decontamination

Decontamination is the process of eliminating **biohazards** from surfaces or materials and rendering them safe to handle. Decontamination is an essential principle of biosafety and biohazard **containment**. **Disinfection** (e.g. chemical disinfectants) and **sterilization** (e.g. autoclaving) are the most common methods of decontamination of biohazards. The method of decontamination is determined by the nature of the material to be treated.

The chemical disinfectant chosen should be one whose concentration and contact time has been shown to be effective against the biohazard used (ethanol, bleach, virkon, etc.). Personnel using disinfectants should understand the directions for use with the biohazard they are working with and the chemical characteristics of the product (e.g. toxicity, chemical compatibility, storage stability, active ingredient, identity, concentration). Laboratory personnel are responsible for ensuring that the bench tops, equipment and surfaces are decontaminated, as required.

Microorganisms ranked according to relative susceptibility to chemical disinfectants

Susceptibility	Microorganisms	Disinfectants reported to be effective
Extremely resistant	Prions	Unusually resistant to chemical disinfectants. High concentrations of sodium hypochlorite or heated strong solutions of sodium hydroxide are reported to be effective.
Highly resistant	Protozoal oocysts	Ammonium hydroxide, halogens (high concentrations), halogenated phenols
	Bacterial endospores	Some acids, aldehydes, halogens (high concentrations), peroxygen compounds
Resistant	Mycobacteria	Alcohols, aldehydes, some alkalis, halogens, some peroxygen compounds, some phenols
	Non-enveloped viruses	Aldehydes, halogens, peroxygen compounds
Susceptible	Fungal spores	Some alcohols, aldehydes, biguanides, halogens peroxygen compounds, some phenols
	Gram-negative bacteria	Alcohols, aldehydes, alkalis, biguanides, halogens, peroxygen compounds, some phenols, some quaternary ammonium compounds
	Enveloped viruses	
	Gram-positive bacteria	
Highly susceptible	Mycoplasmas	Acids, alcohols, aldehydes, alkalis, biguanides, halogens, peroxygen compounds, phenols, quaternary ammonium compounds

Reproduced from Canadian Biosafety Handbook.

Important notes on chlorine:

- Household bleach (e.g. Javex, Clorox) contains approximately 5.25% sodium hypochlorite (52,500 ppm free available chlorine). The following concentrations of available chlorine are typically used:
 - General disinfection of soiled surfaces: 10,000 ppm (1 part bleach: 4 parts water)
 - General disinfection of pre-cleaned surfaces: 5,000 ppm (1 part bleach: 9 parts water)
- when mixed with water, bleach solutions rapidly lose effectiveness therefore solutions should be made fresh daily
- solutions are light sensitive and are best stored in light-protected containers
- chlorine is highly corrosive to metals and is neutralized by organic material.
- gloves should be worn when handling bleach; concentrated solutions may be toxic to humans
- reaction of chlorine with some organic molecules may lead to the production of carcinogens
- bleach residue on non-porous surfaces should be wiped off with water or 70% ethanol
- not suitable for autoclaving

Important notes on alcohols:

- available as ethyl or isopropyl alcohol; 70% in water is the most effective concentration.
- longer contact times are difficult to achieve due to evaporation
- variable compatibility with certain materials (e.g. may harden rubber and deteriorate glues and some plastics)

- not effective on bacterial spores

For further information on disinfectants refer to the CBS and relevant PSDS.

Some faculties and departments offer central autoclave services (sterilization of media/supplies and disposal of biohazardous waste) and laundry services. For details contact your faculty/department.

For laboratories that house and operate autoclaves, proper validation and monitoring, as described in the CBS, must be employed to ensure decontamination is achieved.

Laboratory equipment may require decontamination in certain circumstances (eg. prior to servicing, maintenance, disposal, or transfer to other locations). It is the responsibility of laboratory personnel to ensure that equipment is free of all biohazards allowing contractors and service personnel to carry out their work.

For disposal of equipment that contains or has been exposed to hazardous material a Hazardous Material Clearance Form must be completed as described in the Hazardous Materials Disposal Handbook.

For further information regarding BSC decontamination refer to the Biosafety Cabinet Standard.

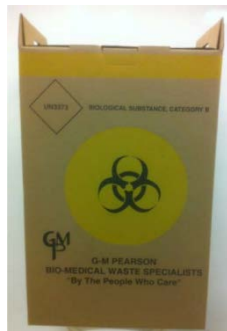
For further information on decontamination and special considerations for **toxin** and **prion** decontamination refer to the CBS.

7.2. Waste Management

Laboratory personnel are required to dispose of **biohazards** in a manner that protects people, property and the environment. Biohazards are not to be disposed in the sanitary sewer (sinks or toilets) or in the regular garbage waste stream.

There are different containers and methods for waste disposal depending on the type of waste including:

- Clear Plastic Autoclave Bags for Biohazard Waste
- Yellow Biomedical Waste Containers (needles, sharps, glass sharps contaminated with biohazards, blood, items visibly soiled with blood)
- Biomedical Waste Boxes
- Small Sharps Containers



All **biohazards** are to be prepared and disposed as outlined in the University Hazardous Materials Disposal Handbook. Pickup of biomedical waste and sharps is requested online through Chematix.

If waste is a mixture of biohazard and radioactive waste, then chemically treat the biohazard with an appropriate disinfectant, then dispose of as radioactive waste. If waste is a mixture of biohazard and chemical waste, then chemically treat the biohazard with an appropriate disinfectant, then dispose of as chemical waste. Ensure to always keep in mind disinfectant incompatibilities (e.g. bleach and radioactive iodine).

For information on animal carcasses and animal waste disposal refer to the Animal Health Unit.

For further information on waste management and special considerations for **toxin** and **prion** waste refer to the CBS.

8. FACILITY AND EQUIPMENT MAINTENANCE

8.1. Biosafety Cabinets

For further information refer to the Biosafety Cabinet Standard.

8.2. Fume Hoods

Facilities is responsible for performing preventative maintenance and repairs to fume hoods and associated exhaust systems. Supervisors are responsible for performing periodic inspections of their lab to ensure proper fume hood usage and operation. For further information refer to the Laboratory Fume Hood User Standard.

8.3. Facility Maintenance

Critical infrastructure, located in or around **biohazard** laboratories, supported and maintained by Facilities includes, but is not limited to:

- Fire Extinguishers
- Emergency eyewash stations
- Emergency showers
- Hand wash sinks

If there is a deficiency in the infrastructure maintained by Facilities, a request must be submitted through ARCHIBUS.

8.4. Caretaking

Cleaning services may be requested (e.g. floor cleaning) but it is the responsibility of laboratory personnel to ensure that the area is clear of all safety hazards allowing Caretaking personnel to carry out their work.

For more information on Caretaking Standards, refer to the Facilities website.

8.5. Equipment Maintenance

All equipment used in **biohazard** laboratories should be maintained properly in accordance with the manufacturer's specifications and the CBS.

9. ORIENTATION AND TRAINING PROGRAM

It is a requirement that personnel working in a containment zone are adequately qualified, suitably trained and have sufficient experience to handle the specific **biohazards** in the workplace. This is carried out through the University of Calgary Orientation and Training Program.

9.1. Orientation

All Managers or Supervisors are required to ensure all personnel complete the Health and Safety Orientation within the first week of working at the University. This introduces new faculty and staff to the University of Calgary health and safety program and provides an overview of procedures, responsibilities and resources available.

All laboratory personnel are also required to complete a site-specific Occupational Health and Safety Orientation within the first week of working in a laboratory. The Laboratory Health and Safety Orientation and Training Record is found in the Laboratory Safety Manual.

9.2. Training

All Managers or Supervisors are required to identify and provide the appropriate training for personnel working in a **biohazard** laboratory. Training requirements must be identified by the Manager or Supervisor on the HACF for the job description/laboratory/workshop.

The University offers a variety of job-specific courses for personnel working with biohazards. All training courses offered by the University are accessed via Enterprise Learning, a course registration and tracking system for personnel. Courses offered are designated as either mandatory or recommended/optional for specific personnel groups. Site-specific training is the responsibility of the PI based on the HACFs.

9.3. Documentation of Training

All training must be documented for each employee on the Laboratory Health and Safety Orientation and Training Record found in the Laboratory Safety Manual.

10. BIOSECURITY PLAN

Biosecurity involves measures designed to prevent the loss, theft, misuse, diversion, or intentional release of pathogens, toxins, and other related assets (e.g. personnel, equipment, non-infectious material, and animals). Determining risks and implementing mitigation strategies is an important part of the biosecurity plan. Implementing the Laboratory Safety Rules, maintaining physical security of the lab, maintaining an inventory, plus responding and reporting incidents are integral components of the plan.

11. EMERGENCY RESPONSE PLAN

The University of Calgary Emergency Management department develops and maintains policies and procedures related to the Emergency Response Plan.

For further information refer to the Biosafety and Emergency Response Standard.

12. STANDARD OPERATING PROCEDURES (SOPs) FOR SAFE WORK PRACTICES

Environment, Health and Safety has developed a number of comprehensive programs and standards to provide guidance to laboratory personnel to address specific biosafety issues.

13. DEFINITIONS

The definitions listed below are bolded throughout the text.

Aerosol	A suspension of fine solid particles or liquid droplets in a gaseous medium (e.g. air) that can be created by any activity that imparts energy into a liquid/semi-liquid material.
Biohazard	Biohazards include, but are not limited to, infectious material (e.g. bacteria, viruses, fungi, cell lines, blood, prions, animal pathogens, aquatic animal pathogens, vector-borne pathogens & plant pests) and microbial toxins (e.g. botulinum toxin, cholera toxin & diphtheria toxin).
Biosafety Permit	A document issued by the Biosafety Committee to a Principal Investigator authorizing the handling and storage of specific biohazards in identified laboratories.
Biosecurity	Security measures designed to prevent the loss, theft, misuse, diversion, or intentional release of pathogens, toxins, and other related assets (e.g. personnel, equipment, non-infectious material, and animals).
Containment	The combination of physical design parameters and operational practices that protect personnel, the immediate work environment, and the community from exposure to biological material. The term "biocontainment" is also used in this context.
Containment Level (CL)	Minimum physical containment and operational practice requirements for handling infectious material or toxins safely in laboratory, large scale production, and animal work environments. There are four containment levels ranging from a basic laboratory (containment level 1 [CL1] to the highest level of containment (containment level 4 [CL4]).
Decontamination	The process by which materials and surfaces are rendered safe to handle and reasonably free of microorganisms, toxins, or prions; this may be accomplished through disinfection, inactivation, or sterilization.
Disinfection	Process that eliminates most forms of living microorganisms; disinfection is much less lethal to infectious material than sterilization.
Exposure	Contact with, or close proximity to, infectious material or toxins that may result in infection or intoxication, respectively. Routes of exposure include inhalation, ingestion, inoculation, and absorption
Exportation	The activity of shipping (e.g. transferring or transporting) pathogens, toxins, or other regulated infectious material from Canada to another country.

Importation	The activity of bringing (e.g. transferring or transporting) pathogens, toxins, or other regulated infectious material into Canada from another country.
Incident	An event or occurrence with the potential of causing injury, harm, infection, intoxication, disease, or damage. Incidents can involve infectious material, infected animals, or toxins, including a spill, exposure, release of infectious material or toxins, animal escape, personnel injury or illness, missing infectious material or toxins, unauthorized entry into the containment zone, power failure, fire, explosion, flood, or other crisis situations (e.g. earthquake, hurricane). Incidents include accidents and near misses.
Infectious Material	Any isolate of a pathogen or any biological material that contains human or animal pathogens and, therefore, poses a risk to human or animal health.
Microorganism	A cellular or non-cellular microbiological entity, capable of replication or transferring genetic material and that cannot be reasonably detected by the naked human eye. Microorganisms include bacteria, fungi, viruses, and parasites, and may be pathogenic or non-pathogenic in nature.
Pathogen	A microorganism, nucleic acid, or protein capable of causing disease or infection in humans or animals.
Personal Protective Equipment (PPE)	Equipment and/or clothing worn by personnel to provide a barrier against biohazards, thereby minimizing the risk of exposure. PPE may include, but is not limited to, lab coats, gowns, full-body suits, gloves, protective footwear, safety glasses, safety goggles, masks, and respirators.
Primary Containment	The first level of physical barriers designed to contain pathogens and toxins and prevent their release. This is accomplished by the provision of a device, equipment, or other physical structure situated between the infectious material or toxins and the individual, the work environment, or other areas within the containment zone. Examples include biosafety cabinets, glove boxes, and animal microisolators. In animal cubicles, the room itself provides primary containment, and personal protective equipment serves as primary protection against exposure.
Prion	Small proteinaceous infectious particle generally considered to be responsible for causing a group of neurodegenerative diseases in humans and animals known as transmissible spongiform encephalopathies.
Risk	The probability of an undesirable event (e.g. accident, incident, breach of containment) occurring and the consequences of that event.
Risk Group	The classification of biological material based on its inherent characteristics, including pathogenicity, virulence, risk of spread, and availability of effective prophylactic or therapeutic treatments, that describes the risk to the health of individuals and the public as well as the health of animals and the animal population.
Sterilization	Process that completely eliminates all living microorganisms, including bacterial spores.
Toxin (microbial)	A poisonous substance that is produced or derived from a microorganism and can lead to adverse health effects in humans or animals. Human toxins are listed in Schedule 1 and Part 1 of Schedule 5 in the <i>Human</i>

Pathogens and Toxins Act.

Zoonoses

Diseases that are transmissible between living animals and humans. Zoonoses include anthroozoonoses (i.e., diseases transmitted from animals to humans) and zooanthroozoonoses, also known as reverse zoonoses (i.e. diseases transmitted from humans to animals).

14. REFERENCES AND ADDITIONAL RESOURCES

University of Calgary Occupational Health and Safety Management System
University of Calgary Laboratory Safety Manual
University of Calgary Biosafety Program
University of Calgary Biosafety Manual
University of Calgary Design Standards
Alberta Occupational Health and Safety Act, Regulation and Code
Public Health Agency of Canada - Human Pathogens and Toxins Act and Regulations
Public Health Agency of Canada – Canadian Biosafety Standard
Public Health Agency of Canada – Canadian Biosafety Handbook
Public Health Agency of Canada – Pathogen Safety Data Sheets
Canadian Food Inspection Agency - Health of Animals Act and Regulations
Canadian Food Inspection Agency - Containment Standards for Facilities Handling Aquatic Animal Pathogens
Canadian Food Inspection Agency - Containment Standards for Facilities Handling Plant Pests
American Committee of Medical Entomology and American Society of Tropical Medicine and Hygiene - Arthropod Containment Guidelines
National Sanitation Foundation/American National Standards Institute Standard 49 Biosafety Cabinetry
Centers for Disease Control and Prevention - Biosafety in Microbiological and Biomedical Laboratories National Institutes of Health
American Biological Safety Association
Collins, C.H., and Kennedy, D.A. *Exposure, sources and routes of infection*. In: *Laboratory-acquired infections: history, incidence, causes and preventions*. Oxford, U.K: Butterworth-Heinemann, 1999; 38-53.
Canadian Council on Animal Care
University of Calgary Animal Health Unit
University of Calgary Immunization Program
University of Calgary Hearing Conservation Program
University of Calgary Hazardous Materials Handbook
University of Calgary Facilities
University of Calgary Emergency Management