Biosafety Plan

Year: 2024

Facility: Omics Resource Centre (IntegrOmes/WCVM)

Permit Holder Name: Dr. Martin Mau

Biosafety Permit Number: ORC-01

University of Saskatchewan

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Revision History

Revisions to the biosafety plan are documented in Table 1, Revision History (e.g. New Biosafety Plan, Addition of new biohazardous materials, etc.).

Table 1: Revision History

Document Sections	Details of Amendments	Date	Author (Initials)
All	New Biosafety Plan	Sept 2024	MM
4, 7 and 8	Change Micro-Chem Plus to Virox PREempt Disinfectant	May 2025	MM
1	Change contact information	Nov 2025	MM

****For new amendments, please highlight the revised portions of the Biosafety Plan.****

1 Contact Information

Biosafety Permit Holder Information

Biosafety Permit Number: ORC-01
Biosafety Permit Issue Date: Oct 2024
Permit Holder Name: Martin Mau
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Emergency Contact Information

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2 Nature of Work

The Omics Resource Centre (ORC) is a fee-for-service laboratory funded by Integromes (CFI-40023) and WCVM that offers next generation sequencing (NGS) services to users from WCVM, AgBio, LFCE and others from USask campus and additionally external clients. ORC will become one of four service platforms at WCVM besides the Imaging Centre, the Molecular Microbiology Lab and the Clinical Science Research Lab.

The primary workflows are subdivided into three parts assigned to three different laboratories/rooms.

- WCVM C616: Storage in designated -80 freezers (accessed by authorized personnel only).
- WCVM 2259: Crude sample handling and nucleic acid extraction (accessed by authorized personnel - third-party staff in lab but does not have authorization to use sample extraction suite (i.e. common-use lab)).
- WCVM 2207: Clean sequencing suite (accessed by authorized personnel only).

Preferentially all samples should be inactivated for pathogens prior to submission or submitted submerged in a non-volatile fixative reagent (i.e. Zymo Research DNA/RNA Shield™; cat# R1100-50) following the instructions provided in the 'Crude Sample Requirements' sheet of the Sample Submission Template.

Sample types received by the ORC may include, but are not limited to:

- Hair follicles
- Human cell lines
- Animal cell lines
- Animal feces, swabs, blood, etc. (potentially pathogenic and non-pathogenic)
- Environmental samples (potentially pathogenic)
- Soil samples (potentially pathogenic)
- Human blood, tissue, and bodily fluids
- Viruses (enveloped and non-enveloped)
- Bacteria (spore forming and non-spore forming)
- Inactivated parasites

A large majority of the samples submitted to the ORC are pre-processed nucleic acids or crude samples inactivated by the researcher prior to submission. However, the ORC may accept crude samples that are unknown or known to contain pathogen(s) that require processing by ORC staff prior to sequencing. All potentially pathogenic samples will be treated as RG2 until they have been inactivated.

All open crude samples will be handled in a Biosafety Cabinet (BSC) and either directly prepared for homogenization by LN2 treatment or immersed into appropriate lysis buffers prior to homogenization (HG-600 Geno/Grinder 2010) and centrifugation. LN2 treatment alone is not sufficient to disinfect samples.

Subsequently, all samples are fed to the automated RNA/DNA extraction (Thermo Fisher Scientific KingFisher Apex) and the quality/quantity assessment (Agilent Synergy LX and Agilent TapeStation 4200). Only processed and barcoded nucleic acid samples will leave WCVM 2259 and enter the sequencing suite (WCVM 2207).

The ORC will accept both non-pathogenic and potentially pathogenic samples and will require the following information from clients prior to sample submission:

1) The sample type
2) Pathogen present (if any)
3) Inactivation procedure (if completed prior to submission)

Submission of samples will be under guidance of a consultation process. Customers must comply to the 'Nucleic Acid Sample Requirements' and 'Crude Sample Requirements' tabs and must provide all necessary sample information in the 'Critical Info' & 'Checklist' tab of the Sample Submission Template. ORC reserves the right not to process samples without this data or detailed information.

Upon receipt of submission documents for samples which are known to be pathogenic or are unknown (i.e., potentially pathogenic), the ORC will confirm the human and animal Risk Group (RG) by consulting PHAC's ePATHogen database and the Biosafety Group. For samples containing active pathogens that are human and/or animal RG2 and are not currently approved for use under the ORC Biosafety Permit (ORC-01), the ORC will submit a permit amendment and updated Biosafety Plan to the Biosafety Group (biosafety@usask.ca), subject to BPAC approval. The ORC is not authorized to handle or store human and animal RG3 or RG4 samples.

3 Biological Assessment and Inventory

3.1 Table 2: Inventory of Biological/ Biohazardous Material.

Biological Material Description [1]	Supplier/ Source	Purpose or Use (*in vivo*, *in vitro*, storage)	Concentration [2]	Max. quantity to be cultured at one time?	Human Risk Group [3] (1, 2, 3)	Animal Risk Group [3] (1, 2, 3)	Contain-ment Level [3] (1, 2, 3)	Location (room, freezer number)	rDNA/ GMMO [4] (Yes or No)	Dual-use Potential [5] (Yes or No)	Reference(s) [6]
Level 1 Material											
Animal blood, tissue, and bodily fluids (non-pathogenic)	Clients	In vitro	N/A	Max 1 mL or 25 mg received	1	1	1	WCVM C616	No	No	
Inactivated pathogens	Clients (inactivated prior to submission)	In vitro	N/A	Max 1 mL or 25 mg received	1	1	1	WCVM C616	No	No	
Plant material (tissue/cells) (indigenous)	Clients	In vitro	N/A	Max 1 mL or 150 mg received	1	1	1	WCVM C616	No	No	
Nucleic acids from animal samples, bacteria, viruses, & parasites	Clients	In vitro	N/A	Max 1 mL received	1	1	1	WCVM C616	No	No	
Hair follicles (cattle)	Clients	In vitro	N/A	Max 1 mL or 25 mg received	1	1	1	WCVM C616	No	No	
Soil isolates	Clients	In vitro	N/A	Max 1 mL or 50 mg received	1	1	1	WCVM C616	No	No	
Level 1 Escherichia coli	Clients	In vitro	N/A	Max 1 mL received	1	1	1	WCVM C616	No	No	
Hamster cell lines (BHK-21)	Clients	In vitro	N/A	Max 1 mL received	1	1	1	WCVM C616	No	No	https://www.atcc.org/products/ccl-10
Level 2 Material											

Biological Material Description [1]	Supplier/ Source	Purpose or Use (*in vivo*, *in vitro*, storage)	Concentration [2]	Max. quantity to be cultured at one time?	Human Risk Group [3] (1, 2, 3)	Animal Risk Group [3] (1, 2, 3)	Contain-ment Level [3] (1, 2, 3)	Location (room, freezer number)	rDNA/ GMMO [4] (Yes or No)	Dual-use Potential [5] (Yes or No)	Reference(s) [6]
Human samples: Human blood, tissue, and bodily fluids **Human cell lines:** A549, HEp-2 (contains HPV), HEK-293 (contains Adenovirus), Caco-2, uterine smooth muscle cell line, placenta cell lines, MDA-MB-231, NCI-H295R, MCF-7, MDA-T68	Clients	In vitro	≤5 x 10^7/mL	Max 1 mL or 25 mg received	2	2	2	WCVM C616	No	No	A549 HEp-2 HEK-293 Caco-2 MDA-MB-231 NCI-H295R MCF-7 MDA-T68
Level 2 Animal cell lines: Bovine BPAE/CPAE (Contains BVDV), Bovine MDBK (Contains BVDV), Monkey African green cell line (Vero)	Clients	In vitro	≤5 x 10^7/mL	Max 1 mL received	2	2	2	WCVM C616	No	No	BPAE/CPAE MDBK Vero
Level 2 Viruses (enveloped): Bovine Herpesvirus (Type 1), Bovine Respiratory Syncytial Virus (BRSV), Bovine Viral Diarrhea Virus (BVDV), Canine distemper virus, Canine parainfluenza virus, Influenza A (avian, swine and equine samples), Porcine Epidemic	Clients	In vitro	≤10^7 CFU/mL	Max 1 mL received	2	2	2	WCVM C616	No	No	Bovine Respiratory Disease Complex Canine Distemper Canine parainfluenza. Influenza A PEDV

Biological Material Description [1]	Supplier/ Source	Purpose or Use (*in vivo*, *in vitro*, storage)	Concentration [2]	Max. quantity to be cultured at one time?	Human Risk Group [3] (1, 2, 3)	Animal Risk Group [3] (1, 2, 3)	Contain-ment Level [3] (1, 2, 3)	Location (room, freezer number)	rDNA/ GMMO [4] (Yes or No)	Dual-use Potential [5] (Yes or No)	Reference(s) [6]
Diarrhea Virus (PEDV), Porcine Reproductive and Respiratory Syndrome (PRRS)											PRRS
Level 2 Viruses (non-enveloped): Animal papillomaviruses (including canine & camelid), Avian encephalomyelitis virus, Bovine adenoviruses, Bovine parvovirus, Canine parvovirus, Porcine circovirus (Types 1 & 2)	Clients	In vitro	≤10^7 CFU/mL	Max 1 mL received	2	2	2	WCVM C616	No	No	Avian encephalomyelitis Bovine adenovirus Bovine parvovirus Canine Parvovirus Porcine Circovirus
Level 2 Bacteria (non-spore forming): Brachyspira spp., Brucella anthropi, Escherichia coli, Enteropathogenic Escherichia coli (EPEC), Enterococcus spp., Salmonella enterica serovar Typhimurium, Streptococcus spp., Staphylococcus spp., Pseudomonas spp. (not B. mallei or B. pseudomallei)	Clients	In vitro	≤10^8 bacterial	Max 1 mL received	2	2	2	WCVM C616	No	No	Brachyspira Enterococcus EPEC Pseudomonas Staphylococcus Streptococcus
Level 2 Bacteria (spore forming): Actinomyces spp,	Clients	In vitro	≤10^8 bacterial	Max 1 mL received	2	2	2	WCVM C616	No	No	Actinomyces Bacillus cereus

Biological Material Description [1]	Supplier/ Source	Purpose or Use (*in vivo*, *in vitro*, storage)	Concentration [2]	Max. quantity to be cultured at one time?	Human Risk Group [3] (1, 2, 3)	Animal Risk Group [3] (1, 2, 3)	Contain-ment Level [3] (1, 2, 3)	Location (room, freezer number)	rDNA/ GMMO [4] (Yes or No)	Dual-use Potential [5] (Yes or No)	Reference(s) [6]
Bacillus cereus (excluding biovar anthracis), Clostridium spp., Rhodococcus spp., Serratia spp.											Clostridium Serratia
Level 2 Fungi: Candida albicans, Microsporum spp.	Clients	In vitro	≤10^7 yeast cells	Max 1 mL received	2	2	2	WCVM C616	No	No	Candida albicans Microsporum
Risk Group 2 Other											
Animal blood, tissue, and bodily fluids (potentially pathogenic)	Clients	In vitro	N/A	Max 1 m or 25 mg L received	2	2	2	WCVM C616	No	No	
Environmental samples (potentially pathogenic)	Clients	In vitro	N/A	Max 1 mL or 50 mg received	2	2	2	WCVM C616	No	No	
Soil isolates (potentially pathogenic)	Clients	In vitro	N/A	Max 1 mL or 50 mg received	2	2	2	WCVM C616	No	No	

[1] When identifying the biological material, ensure to state the most descriptive name (e.g., *genus* species) and include the strain, if applicable. For cell lines, include the species, name of the cell line, if the cells are known to contain anything infectious (e.g., Adenovirus, EBV, etc.), and if they've been modified (e.g., Modified by lentiviral vector).

[2] State the typical concentration of the biological material that will be used (e.g., cells: 10^6 cells per plate; bacteria: colony forming units; virus: plaque forming units/tissue culture infectious dose; toxins: unit of mass/unit of volume).

[3] Human Risk Groups, Animal Risk Groups, and Containment Levels may be specified by PHAC's ePATHogen database, the USask Biosafety Manual, or local risk assessments. For help determining RGs and CLs, reach out to the Biosafety Group.

[4] Biological materials identified as rDNA/GMMOs that are newly constructed or otherwise not commercially available will require a *Risk Assessment for rDNA/Genetically Modified Organisms (GMO) Form* be completed and submitted to the Biosafety Group.

[5] Use the Dual-use assessment flow chart (Fig. 2) in Section 3 of the *Biosafety Plan Guide*.

[6] Provide link to reference(s) for information provided in this table (e.g., risk assessment performed by researcher, PSDSs, ATCC product page, relevant publications).

4 Health and Safety Hazard Assessment

4.1 Table 3: Hazards Assessment

NOTE: Minimum safety mitigation requirements for Containment Level 2 have been provided in the first row of the table below. Address any additional safety mitigation procedures for all biological agents listed in the inventory table 2. Similar biological agents, such as cell lines, can be grouped together if the processes are the same. See examples below:

Biological Materials [1]	Procedures Hazard Assessment		
	List of Procedures using Biological Materials	Potential Route(s) of Exposure from Procedures	Safety Mitigation Controls
All samples submitted for sequencing (Risk Group 1 & 2)	Homogenization of frozen samples or samples preserved in buffer	All routes	- Wear proper PPE (safety glasses, lab coat, disposable gloves) long pants, and closed toe shoes - All homogenization preparations take place in the BSC - All homogenization procedures take place within primary containment (BSC or bead beater) - Sample tubes are loaded and unloaded in the BSC to prevent spread of aerosols - Follow specific procedural SOP - Ensure proper training has been received - Ensure SHARPs training has been received - Wash hands with soap and water for 20 seconds - Follow good lab practices
	Centrifugation	All routes	- Wear proper PPE (safety glasses, lab coat, disposable gloves) long pants, and closed toe shoes - Use a sealed rotor cup while centrifuging infectious materials. Open sealed rotor cups inside the biosafety cabinet. - Sample tubes are loaded and unloaded in the BSC to prevent spread of aerosols. - Follow specific procedural SOP - Ensure proper training has been received - Ensure SHARPs training has been received - Sharps containers that are ¾ full are closed and placed inside a grey biohazardous waste bin for disposal

Biological Materials [1]	Procedures Hazard Assessment		
	List of Procedures using Biological Materials	**Potential Route(s) of Exposure from Procedures**	**Safety Mitigation Controls**
			- Wash hands with soap and water for 20 seconds - Follow good lab practices Disinfect work surfaces with 1:40 dilution of Virox PREempt Concentrate for at least 5 minutes. Shelf life of dilution is 30 days.
	Nucleic Acid Extraction	All routes	- Wear proper PPE (safety glasses, lab coat, disposable gloves) long pants, and closed toe shoes - Follow specific procedural SOP - Ensure proper training has been received - Ensure SHARPs training has been received. SHARPs are disposed of - Wash hands with soap and water for 20 seconds - Follow good lab practices - UV light mounted in sequencing equipment may used for secondary decontamination of devices
	QC & QA	All routes	- Wear proper PPE (safety glasses, lab coat, disposable gloves) long pants, and closed toe shoes - Follow specific procedural SOP - Ensure proper training has been received - Ensure SHARPs training has been received - Wash hands with soap and water for 20 seconds - Follow good lab practices - Disinfect work surfaces with 70% Ethanol for 5 minutes
	Disinfection & Waste Disposal	All routes	- Generally, surface disinfection involves the following as appropriate: o 70% Ethanol for 5 minutes o 1:40 dilution of Virox PREempt Concentrate for at least 5 minutes. Shelf life of dilution is 30 days. - Liquid waste is inactivated with final concentration of 10% v/v household bleach for 20 minutes. Bleach dilutions must be prepared fresh. - Contaminated consumables are disposed directly into biohazardous waste bin after use - Refer to the Biohazardous Waste Disposal Guideline
Inactivated pathogens (inactivated by researchers, inactivation method disclosed at submission)	Inactivation prior to submission for homogenization &	All routes	- Samples should be submitted fully submerged in DNA/RNA Shield (Zymo Research) which has the ability to inactivate pathogens including viruses, bacteria, fungi, and parasites. Refer to the 'Crude Sample Requirements' sheet of the Sample Submission Template.

Biological Materials [1]	Procedures Hazard Assessment		
	List of Procedures using Biological Materials	Potential Route(s) of Exposure from Procedures	Safety Mitigation Controls
	nucleic acid extraction procedures		- Any samples previously inactivated using classical fixatives (GA, FA, formalin, acetone, AA, TFA) and decontaminants with high VOC emission, must be washed twice with 70% ethanol, and ethanol removed prior to sample submission.
Human samples and cell lines (inactivated)	homogenization & nucleic acid extraction procedures	All routes	- Disinfection for human samples and cell lines generally involves using 70% Ethanol for 5 minutes or other appropriate disinfectant. - For cell lines containing a pathogen (e.g., Adenovirus or HPV), use 1:40 dilution of Virox PREempt Concentrate for at least 5 minutes. Shelf life of dilution is 30 days.
Level 2 Animal cell lines	homogenization & nucleic acid extraction procedures	All routes	- Disinfection for animal cell lines generally involves using 70% Ethanol for 5 minutes or other appropriate disinfectant. - For cell lines containing a pathogen (e.g., Adenovirus or HPV), use 1:40 dilution of Virox PREempt Concentrate for at least 5 minutes. Shelf life of dilution is 30 days.
Level 2 Viruses (enveloped)	homogenization & nucleic acid extraction procedures	All routes	- Disinfection for enveloped viruses generally involves using 70% Ethanol for 5 minutes or another appropriate disinfectant.
Level 2 Viruses (non-enveloped)	homogenization & nucleic acid extraction procedures	All routes	- Disinfection for non-enveloped viruses generally involves using bleach or Virox PREempt Concentrate: o 10% v/v household bleach for 20 minutes (liquid waste) & 1% v/v household bleach for 10 minutes (surface disinfection). Bleach dilutions must be prepared fresh. o 1:40 dilution of Virox PREempt Concentrate for at least 5 minutes. Shelf life of dilution is 30 days.
Level 2 Bacteria (non-spore forming)	homogenization & nucleic acid extraction procedures	All routes	- Disinfection for non-spore forming bacteria generally involves using 70% Ethanol for 5 minutes or another appropriate disinfectant.
Level 2 Bacteria (spore forming)	homogenization & nucleic acid extraction procedures	All routes	- Disinfection for spore-forming bacteria generally involves using bleach: o Liquid waste: 10% v/v household bleach for 20 minutes Bleach dilutions must be prepared fresh. o Surface Disinfectant: PeridoxRTU® sporicide is used following manufacturer's label instructions.
Level 2 Fungi	homogenization & nucleic acid extraction procedures	All routes	- Disinfection for fungi generally involves using 1:40 dilution of Virox PREempt Concentrate for at least 5 minutes. Shelf life of dilution is 30 days.

Biological Materials [1]	Procedures Hazard Assessment		
	List of Procedures using Biological Materials	Potential Route(s) of Exposure from Procedures	Safety Mitigation Controls
Risk Group 2 Other: • Animal samples involving RG2 materials • Environmental samples (potentially containing RG2 material) • Soil isolates (potentially containing RG2 material)	homogenization & nucleic acid extraction procedures	All routes	- Handle according to all CL2 requirements listed above.

[1] Identify all unique level 2 biologicals used in the research program (Refer to biological material inventory listed in Table 2).

4.2 Table 4: Biological Material Pathogenicity Assessment.

NOTE:

- **Include all Risk Group 2 or higher biological materials in Table 4.**
- **Ensure both the human and animal perspectives are included in the pathogenicity assessment.**

Biological Materials [1]	Host Range[2]	Routes of Exposure [3]	List of Disease(s) [3]	Symptoms [3]	Incubation Period [3]
Supervisor and workers must ensure they are fully informed of all risks and potential pathogens for any samples submitted to the Omics Lab and monitor for symptoms of disease.					
Human samples: Human blood, tissue, and bodily fluids **Human cell lines:** A549, HEp-2 (contains HPV), HEK-293 (contains	Human	Mucosal membrane (skin, eyes), inoculation	Blood born pathogens (Hepatitis B &C, HIV, West Nile virus, Zika virus)	Hepatitis B & C: Fever, Fatigue, loss of appetite, Nausea, Vomiting, Joint pain, Jaundice, abdominal pain. HIV: Headache, Diarrhea, fatigue, nausea and vomiting, aching muscles West Nile Virus: fever, headache, body aches, skin rash, and swollen lymph nodes. Severe symptoms and signs may include stiff neck, sleepiness, disorientation, coma, tremors, convulsions, and paralysis	Hepatitis C: 2-12 weeks Hepatitis B: 2-6 months HIV: 2-6 weeks West Nile: 3-14 days

Biological Materials [1]	Host Range[2]	Routes of Exposure [3]	List of Disease(s) [3]	Symptoms [3]	Incubation Period [3]
Adenovirus), Caco-2, uterine smooth muscle cell line, placenta cell lines, MDA-MB-231, NCI-H295R, MCF-7, MDA-T68				Refer to Public Health Agency of Canada's Pathogen Safety Data Sheets (Refer to PSDS)	
		Inhalation, ingestion, mucosal membranes	Adenovirus	Inflammation response, redness Refer to Public Health Agency of Canada's Pathogen Safety Data Sheets (PSDS)	Acute and chronic
			Human papillomavirus (HPV)	HPV does not usually cause any symptoms. Most people who have it do not realise and do not have any problems. But sometimes the virus can cause painless growths or lumps (genital warts).	2 to 3 months, with a range of 1 to 20 months for genital warts. It can take up to 10 years for a high-risk HPV infection to develop into cancer.
	Animal	n/a	No known disease	n/a	n/a
		Inhalation, ingestion, mucosal membranes	Adenoviral components	Inflammation response, redness, abdominal pain, vomiting, diarrhea, edema, jaundice, fever, lethargy	Acute and chronic
NHP cell lines (Vero)	Human & Animal (primates)	Mucosal membrane, inhalation, ingestion, inoculation	Blood born pathogens (Hepatitis B &C, HIV, West Nile virus, Zika virus)	Hepatitis B & C: Fever, Fatigue, loss of appetite, Nausea, Vomiting, Joint pain, Jaundice, abdominal pain. HIV: Headache, Diarrhea, fatigue, nausea and vomiting, aching muscles West Nile Virus: fever, headache, body aches, skin rash, and swollen lymph nodes. Severe symptoms and signs may include stiff neck, sleepiness, disorientation, coma, tremors, convulsions, and paralysis Refer to Public Health Agency of Canada's Pathogen Safety Data Sheets (Refer to PSDS)	Hepatitis C: 2-12 weeks Hepatitis B: 2-6 months HIV: 2-6 weeks West Nile: 3-14 days
Bovine Herpesvirus (Type 1)	Human	n/a	No known disease	n/a	n/a
	Animal	Inhalation, direct contact	Bovine Respiratory Disease	Ocular and nasal discharges, cough, fever, and increased respiratory rate and breath sounds	2-6 days
Bovine Respiratory Syncytial Virus (BRSV)	Human	n/a	No known disease	n/a	n/a
	Animal	Inhalation, direct contact	Bovine Respiratory Disease	Fever, depression, decreased appetite, increased respiratory rate, cough, nasal and lacrimal discharge	2-5 days

Biological Materials [1]	Host Range[2]	Routes of Exposure [3]	List of Disease(s) [3]	Symptoms [3]	Incubation Period [3]
Bovine Viral Diarrhea Virus (BVDV)	Human	n/a	No known disease	n/a	n/a
	Animal	Inhalation, direct contact	Bovine Respiratory Disease	Bloody diarrhea, high fever, off-feed, mouth ulcers, pneumonia	3-5 days
Canine distemper virus	Human	n/a	No known disease	n/a	n/a
	Animal	Inhalation	Canine distemper	Walking in circles, head tilt, lack of coordination, muscle twitches, convulsions, drooling, seizures, partial or complete paralysis	3-21 days
Canine parainfluenza virus	Human	n/a	No known disease	n/a	n/a
	Animal	Inhalation	Infectious tracheobronchitis	Coughing, low-grade fever, nasal discharge, decreased energy, decreased appetite	2-8 days
Influenza A (avian, swine and equine samples)	Human	Inhalation	Upper respiratory, pneumonia	Fever (temperature 37.8ºC or above), headache, myalgia, malaise, sore throat, non-productive cough, sneezing and nasal discharge.	1-3 days
	Animal	Inhalation, Inoculation	Respiratory infection	pneumonia	1-3 days
Porcine Epidemic Diarrhea Virus (PEDV)	Human	n/a	No known disease	n/a	n/a
	Animal	Ingestion, Inoculation	Gastroenteritis	diarrhea, death	2-3 days
		Inhalation	Mild respiratory infection	nasal discharge, redness, sneezing	1-3 weeks
Porcine Reproductive and Respiratory Syndrome (PRRS)	Human	n/a	No known disease	n/a	n/a
	Animal (pigs)	Ingestion, Inoculation, Inhalation	pneumonia, fetal death	pneumonia, fever, dyspnea, lymphadenopathy, lethargy, infertility, abortions, fetal death	1-2 weeks
Animal papillomaviruses (including canine & camelid)	Human	n/a	No known disease	n/a	n/a
	Animal	Direct contact	Papillomatosis in cattle, equine sarcoidosis, canine oral papillomatosis	Cattle: pain, disfigurement, infection of genitals Horses: warts on muzzle, face, and mouth Dogs: pain, swelling, bad breath	1-2 months
Avian encephalomyelitis virus	Human	n/a	No known disease	n/a	n/a
	Animal	Direct contact, fomites	Avian encephalomyelitis	Tremors, weight loss, blindness, paralysis	1-7 days
Bovine adenoviruses	Human	n/a	No known disease	n/a	n/a
	Animal	Fecal-oral, direct contact, inhalation	Conjunctivitis, rhinotracheitis, pustular vulvovaginitis, balanoposthitis, abortion, encephalomyelitis, and mastitis	pneumonia, enteritis, conjunctivitis, keratoconjunctivitis, weak calf syndrome, and abortion	2-6 days
Bovine parvovirus	Human	n/a	No known disease	n/a	n/a
	Animal	Fecal-oral	Gastrointestinal, reproductive infection, respiratory infection	Coughing, dyspnea, nasal discharge, abortion, stillbirth	1-2 days
Canine parvovirus	Human	n/a	No known disease	n/a	n/a

Biological Materials [1]	Host Range[2]	Routes of Exposure [3]	List of Disease(s) [3]	Symptoms [3]	Incubation Period [3]
	Animal	Fecal-oral, direct contact, fomites	Acute gastrointestinal infection	lethargy, depression, and loss or lack of appetite, followed by a sudden onset of high fever, vomiting, and diarrhea	3-7 days
Porcine circovirus (Types 1 & 2)	Human	n/a	No known disease	n/a	n/a
	Animal (pigs)	Ingestion, Inoculation, Inhalation	multisystemic wasting	weight loss, diarrhea, pneumonia, lymphadenopathy	2-3 weeks
Brachyspira spp.	Human	Ingestion	Spirochetosis (B. aalborgi and B. pilosicoli only)	Diarrhea	2-21 days
	Animal	Ingestion	Swine dysentery (mucohaemorrhagic diarrhea), intestinal spirochetosis	Diarrhea ranging from watery to mucoid to bloody depending on species of Brachyspira.	2-21 days
Brucella anthropic	Human	Inhalation, ingestion, absorption through mucosal surfaces, accidental inoculation	Opportunistic infections have been reported in immunocompromised humans	Fever	Unknown
	Animal	n/a	No known disease	n/a	n/a
Escherichia coli	Human & Animal	Ingestion, exposure to contaminated surfaces	gastrointestinal, UTI	nausea, vomiting, headache, fever, stomach cramps, watery/bloody diarrhea, frequent/painful urination¬	1-10 days
Enteropathogenic Escherichia coli (EPEC)	Human & Animal	Ingestion, exposure to contaminated surfaces	gastrointestina	Acute, profuse, watery diarrhea, which rarely becomes persistent. Stools are typically not bloody, mucoid, or dysenteric. Low-grade fever with nausea and vomiting may be present	6-48 hrs
Enterococcus spp.	Human	Ingestion, inoculation	urinary tract, wound, and soft tissue infections in immunocompromised, endocarditis	Wound/soft tissue infections: inflammation at inoculation site, fever Urinary tract infection: frequent, painful urination, abdominal pain, fever	1-21 days
	Animal	Ingestion, inoculation	enterococcosis in birds	Acute: (septicemia) depression, pale combs and wattles, ruffled feathers, diarrhea, reduced egg production Chronic: depression, weight loss, lameness	5-21 days
Salmonella enterica serovar Typhimurium	Human	Ingestion Inoculation	Gastroenteritis, bacteremia	Gastroenteritis: sudden nausea, vomiting, abdominal cramps, diarrhea, headache, shills, fever	Enteritis: 6-72hrs

Biological Materials [1]	Host Range[2]	Routes of Exposure [3]	List of Disease(s) [3]	Symptoms [3]	Incubation Period [3]
				Bacteremia: septic shock, endocarditis, infection of aorta, mesenteric lymphadenitis, osteomyelitis, UTI, pneumonia, pulmonary abscess, brain abscess, empyema, meningitis, CNS infections	Bacteremia: rare complication of enteritis
	Animal (pigs)	Ingestion Inoculation	gastroenteritis	diarrhea, dehydration, anorexia	7-14 days
Streptococcus spp.	Human	genital tract, hand-to-mouth, fecal-oral, environmental/ fomites, cattle zoonosis	sepsis, pneumonia and meningitis, peripartum choriomamniotitis and bacteremia, skin and soft tissue infections, endocarditis, osteomyelitis and UTIs	Early onset (newborns): respiratory distress, fever, lethargy, irritability, apnea and hypotension; Late onset (age >7 days): inflammation, fever, chest pain, flu-like symptoms, chest pain, aching joint, fatigue, swelling, shortness of breath, frequent/painful urination¬	early onset: <7 d, late onset: unknown
		Wounds, contact with blood, medical devices, aerosolized liquid droplets	bacteraemia, meningitis, pericarditis, spontaneous bacterial peritonitis, acute jejunitis, pancreatic abscess, multimicrobial endocarditis, early neonatal sepsis, sinusitis, endophthalmitits, bullous impetigo and femoral osteitis, dental caries	fever, inflammation, nausea, vomited, diarrhea, pain, trouble breathing, cough, fatigue, headache, sore throat, eye pain, swollen/red eyes, pus/discharge from eyes, altered vision, itch	unknown, normal residents of flora, generally opportunists and infect individuals with underlying conditions
	Animal	normal flora, opportunistic pathogens	mastitis	Inflammation of mammary gland, redness, fever, lack of appetite, impacts milk production	variable/unknown
		Wounds, contact with blood, medical devices, aerosolized liquid droplets	acteraemia, meningitis, pericarditis, spontaneous bacterial peritonitis, acute jejunitis, pancreatic abscess, multimicrobial endocarditis, early neonatal sepsis, sinusitis, endophthalmitits, bullous impetigo and femoral osteitis, dental caries	fever, inflammation, nausea, vomited, diarrhea, pain, trouble breathing, cough, fatigue, headache, sore throat, eye pain, swollen/red eyes, pus/discharge from eyes, altered vision, itch	unknown, normal residents of flora, generally opportunists and infect individuals with underlying conditions
Staphylococcus spp.	Human	Inoculation,	toxic shock syndrome	high fever, nausea, vomiting, rash on palms/soles, confusion, muscle aches, diarrhea, abdominal pain	extremely variable: 1-10 d post-infection

Biological Materials [1]	Host Range[2]	Routes of Exposure [3]	List of Disease(s) [3]	Symptoms [3]	Incubation Period [3]
		direct skin exposure, ingestion (human and animal opportunistic pathogen)	skin infections (boils, impetigo, cellulitis, scalded skin syndrome)	Red/swollen skin, rash, pockets of pus/oozing discharge	
			food poisoning	Nausea, vomiting, diarrhea, dehydration, low blood pressure	
			septicemia	fever and low blood pressure	
			septic arthritis	fever, red, irritated/painful skin, pus-filled blisters	
	Animal	Inoculation, direct skin exposure, ingestion (human and animal opportunistic pathogen)	mastitis	Fever, loss of appetite, lethargy, bloodstained milk, uniformly bloody udder secretions, enlarged, painful, discoloured and hard udders, and the occasional presence of necrotic mammary gland tissue in milk	extremely variable: 1-10 d post-infection
Pseudomonas spp.	Human	Inhalation, ingestion, skin exposure, contact with broken skin, mucosal membranes	Pneumonia, UTI, meningitis, septicemia, wound infections, eye infection	Pneumonia: fever, chills, dyspnea, cyanosis, confusion, productive cough, green or yellow sputum Meningitis: fever, headache, vomiting Wound infection: Abscess, sepsis, edema, discoloration, green pigment	Varies, suggested 24-72 hours
	Animal	Inhalation, ingestion, skin exposure	Opportunistic infections	Purulent inflammation: abscess in skin, purulent, sepsis, mastitis (dairy cow), endometritis (horse).	Varies depending on infection.
Actinomyces spp.	Human & Animal	Break in mucosal barrier Opportunistic pathogen	Opportunistic infections	Common in mixed infections, and infection with Actinomyces spp. alone is often associated with lower pathogenicity than when it is part of a mixed infection.	Days to months
Bacillus cereus (excluding biovar anthracis)	Human	Ingestion, exposure to contaminated surfaces	Food poisoning, local and systemic infections	Food poisoning: watery diarrhea, abdominal pain, fever, and vomiting, often lasts for 12-24 hours, or up to several days Local/systemic: septicemia, endophthalmitis, pneumonia, endocarditis, meningitis, and encephalitis, particularly in immunocompromised individuals and neonates	Food poisoning: 0.5-16 hrs Local/systemic: variable
	Animal	Ingestion, exposure to contaminated surfaces	Gastrointestinal infections, local and systemic infections	Gastrointestinal: watery diarrhea, abdominal pain, fever, and vomiting, often lasts for 12-24 hours, or up to several days	Variable, within hours to days

Biological Materials [1]	Host Range[2]	Routes of Exposure [3]	List of Disease(s) [3]	Symptoms [3]	Incubation Period [3]
				Local/Systemic: septicemia, endophthalmitis, pneumonia, endocarditis, meningitis, and encephalitis, particularly in immunocompromised individuals and neonates	
		Direct contact	Mastitis (cattle & goats)	Fever, loss of appetite, lethargy, bloodstained milk, uniformly bloody udder secretions, enlarged, painful, discoloured and hard udders, and the occasional presence of necrotic mammary gland tissue in milk	extremely variable: 1-10 d post-infection
Clostridium spp.	Human	Ingestion, direct contact, mucosal membranes	Bacteremia	Vary greatly but will typically include fever, chills, and leukocytosis	6 hrs to 3 days
			Myonecrosis (Gas Gangrene)	Rare but extremely fatal disease that results from the infection of muscle tissue by exotoxin producing Clostridium bacteria. symptoms include severe pain in affected area, fever and tachycardia. Skin discoloration, appearance of haemorrhagic bullae, and subcutaneous gas appear in the late stages of infection	
			Necrotizing Enterocolitis (NEC)	Most common gastrointestinal emergency in infants (1 to 3 cases per 1,000 live births). The etiology of NEC is not understood, although bacterial colonization of the gut is believed to play a role	
			Clostridium sordellii Toxic Shock Syndrome	Rapid onset of severe illness with shock (edema, effusion, profound leukocytosis and hemoconcentration, followed by shock and multiorgan failure)	
	Animal	Opportunistic	Enterotoxemia type C (hemorrhagic enteritis, bloody scours)	Caused by Clostridium perfringens type C and affects lambs causing a bloody infection of the small intestine. Often related to indigestion and predisposed by a sudden change in feed such as beginning creep feeding or sudden increase in milk supply	
		Opportunistic	Enterotoxemia type D ("classic" overeating disease, pulpy kidney disease)	Caused by Clostridium perfringens type D and is caused by a sudden change in feed that causes the organism, which is already present in the lamb's gut, to proliferate causing a toxic reaction.	
		Direct contact, mucosal membranes	Tetanus (lock jaw)	Caused by Clostridium tetani, found in the soil. Stiff gait, "lockjaw", third eyelid may protrude across the eye. Convulsions may occur.	
Rhodococcus spp.	Human	Inhalation, inoculation, ingestion, exposure to animals	Pneumonia, Opportunistic pathogen (mainly in immunocompromised)	Fever, malaise, cough, chest pain, dyspnea, hemoptysis, weight loss	Possible chronic or relapsing
	Animal	Inhalation, ingestion, direct contact, mucosal membranes	Opportunistic infection, local infection	Diarrhea, ulcerative colitis, colic, weight loss, mesenteric lymphadenitis, abdominal abscesses, typhlitis, and peritonitis	3-6 days

Biological Materials [1]	Host Range[2]	Routes of Exposure [3]	List of Disease(s) [3]	Symptoms [3]	Incubation Period [3]
Serratia spp.	Human	ingestion, hand, direct contact, fomite transfer	bacteremia, conjunctivitis, pneumonia, intravenous catheter-associated infections, osteomyelitis, endocarditis, UTI, endogenous and exogenous endophthalmitis	fever, cough, shortness of breath, eye swelling/redness & itchiness/inflammation, frequent urination, dysuria, pyuria, or pain upon urination erythema, ocular pain, periorbital swelling, and hypopyon	unknown
	Animal	n/a	No known diseases	n/a	n/a
Candida albicans	Human	Inoculation and Direct skin exposure (human and animal opportunistic pathogen)	thrush/oral candidiasis	Ragged single or multiple white patches on tongue, palate, throat or other mucosal surface	One reported incident of folliculitis developing 2 days after skin exposure
			Paronychial, onychomycotic candidosis, Esophageal candidiasis	Mucosal type infections	
			endophthalmitis	Eye infection	
			paronychial and onychomycotic candidosis	Hair and nail infection	
			immunodeficient and immunocompetent individuals at higher risk of infection, which can be life threatening	Pregnant women, HIV patients, patients undergoing chemotherapy etc	
	Animal (Cows, Pigs, Horses, Cats and Dogs)	Inoculation and Direct skin exposure (human and animal opportunistic pathogen)	Candidiasis	Cows: watery diarrhea, anorexia, and dehydration, with gradual progression to prostration Pigs: inflammation of oral, esophageal, and gastric mucosa with diarrhea and emaciation Horses: terrycloth-like texture to the tongue and oral mucosa Cats & Dogs: urinary issues	unknown
Microsporum spp.	Human	Direct contact	Ringworm, Dermatophytosis	Can affect all keratinized areas of the body (hair, skin and nails). If hair is infected (tinea capitis, tinea barbea), there may be hair loss (ectotrix) or breakage (endotrix). On the skin, lesions may look circular or annular and elevated, producing a ringworm infection form. Zoophilic dermatophyte infections are more inflammatory (vesicle, pustules and blisters) than those caused by antropophilic dermatophytes. Infection of human nails may present as discoloration, dystrophy, hyperkeratosis and occasionally onycholysis	Several days to a few weeks
	Animal	Direct contact	Ringworm	Areas of hair loss with red, crusting, or scaling skin. Brittle, broken fur and nails.	10-12 days

Biological Materials [1]	Host Range[2]	Routes of Exposure [3]	List of Disease(s) [3]	Symptoms [3]	Incubation Period [3]
Animal samples which may contain Level 2 pathogens Environmental samples (potentially pathogenic) Soil isolates (potentially pathogenic)	Human & Animal	All potential lab exposures: (e.g. inhalation, ingestion, needle pokes)	unknown: material may contain multiple sources of zoonotic agents, including bacteria, fungi, viruses and parasites from host or invertebrates in the material (e.g. insects in fecal matter)	unable to define	unable to define

[1] Biological materials may be grouped by type (e.g., Human cell lines (HEK293, A549) or Level 2 *E. coli*).
[2] Identify the host range. If pathogenic material can affect Humans and Animals, please list in separate rows. All animals affected can be listed in one row.
[3] Refer to supplier product page, *Biosafety Plan Sample*, and Pathogen Safety Data Sheet (PSDS) for exposure, disease, symptoms and incubation period.

4.3 Table 5: Medical Surveillance and Immunization Assessment.

NOTE:
- **Include all Risk Group 2 or higher biological materials in Table 5.**
- **Include Risk Group 1 biologicals materials that can cause individuals to develop allergies.**
- **This table is to be completed from the human perspective to inform staff and students working under this plan what to do in the case of an exposure.**

Biological Materials [1]	Vaccinations			Treatment [3]		Medical Surveillance [4]		Other	
	Available (yes or no)	Effective (yes or no)	Vaccination Waiver Needed (yes or no) [2]	Available (yes or no)	Type of Treatment	Serum Collection for Baseline Reference Needed (yes or no)	Annual Medical Monitoring Required (yes or no)	Do individuals with compromised immune systems risk developing disease? (yes or no)	Can individuals develop an allergy to material? (yes or no)
Supervisor and workers must ensure they are fully informed of all risks and potential pathogens for any samples submitted to the Omics Resource Laboratory. If you suspect you have been exposed to pathogenic material, seek medical attention as soon as possible. Contact the Biosafety Group at Safety Resources if you need assistance. Submit an incident report using the online Incident Portal.									
Animal blood, tissue, bodily fluids and cells (potentially pathogenic)	No	N/a	N/a	Yes	Antibiotics, antivirals, antifungals, antiparasitics	No	No	Yes	Yes
Human samples and cell lines (HIV, Hepatitis B & C, West Nile)	Yes (Hepatitis B vaccine)	Yes (Hepatitis B)	no	Yes	Antivirals	n/a	n/a	Yes	No
Human papillomavirus (HPV)	Yes	Yes	no	Yes	Salicyclic acid, imiquimod, podofilox, trichloroacetic acid, and surgical procedures	n/a	No	Yes	No
Adenovirus	No	n/a	n/a	Yes	Antivirals	n/a	n/a	Yes	No
NHP cell lines	Yes (Hep B)	Yes	No	No	No	No	No	Yes	No
Influenza A (avian, swine and equine samples)	Yes (annual vaccine)	Yes	No	Yes	Antivirals	n/a	n/a	Yes	No
Brachyspira spp.	No	n/a	n/a	Yes	Antibiotics	No	No	Yes	No

Biological Materials [1]	Vaccinations			Treatment [3]		Medical Surveillance [4]		Other	
	Available (yes or no)	Effective (yes or no)	Vaccination Waiver Needed (yes or no) [2]	Available (yes or no)	Type of Treatment	Serum Collection for Baseline Reference Needed (yes or no)	Annual Medical Monitoring Required (yes or no)	Do individuals with compromised immune systems risk developing disease? (yes or no)	Can individuals develop an allergy to material? (yes or no)
Brucella anthropic	No	n/a	n/a	Yes	Antibiotics	No	No	Yes	No
Escherichia coli, Enteropathogenic Escherichia coli (EPEC)	No	n/a	n/a	Yes	Antibiotics	No	No	Yes	No
Enterococcus spp.	No	n/a	n/a	Yes	Antibiotics	No	No	Yes	No
Salmonella enterica serovar Typhimurium	No	n/a	n/a	Yes	Antibiotics	No	No	Yes	No
Streptococcus spp.	No	n/a	n/a	Yes	Antibiotics	No	No	Yes	No
Staphylococcus spp.	No	n/a	n/a	Yes	Antibiotics (most often penicillin or derivative with potential exposure)	No	No	Yes	No
Pseudomonas spp.	No	n/a	n/a	Yes	Antibiotics	No	No	Yes	No
Actinomyces spp.	No	n/a	n/a	Yes	Antibiotics	No	No	Yes	No
Bacillus cereus (excluding biovar anthracis)	No	n/a	n/a	Yes	Antibiotics	No	No	Yes	No

Biological Materials [1]	Vaccinations			Treatment [3]		Medical Surveillance [4]		Other	
	Available (yes or no)	Effective (yes or no)	Vaccination Waiver Needed (yes or no) [2]	Available (yes or no)	Type of Treatment	Serum Collection for Baseline Reference Needed (yes or no)	Annual Medical Monitoring Required (yes or no)	Do individuals with compromised immune systems risk developing disease? (yes or no)	Can individuals develop an allergy to material? (yes or no)
Clostridium spp.	No	n/a	n/a	Yes	Antibiotics	No	No	Yes	No
Rhodococcus spp.	No	n/a	n/a	Yes	Antibiotics (often resistant)	No	No	Yes	No
Serratia spp.	No	n/a	n/a	Yes	Antibiotics	No	No	Yes	No
Candida albicans	No	n/a	n/a	Yes	Antifungals	No	No	Yes	No
Microsporum spp.	No	n/a	n/a	Yes	Antifungals	No	No	Yes	No

[1] Biological materials may be grouped by type if medical surveillance is similar (e.g., Lentiviral vector systems and cell lines modified by lentiviral vectors).
[2] If an individual declines a recommended vaccination, they must complete the Vaccination Waiver Form. If an effective vaccine is available but is not recommended, please indicate the reason the vaccine is not recommended.
[3] State the treatment or action taken to prevent disease after exposure (i.e., antibiotics, antivirals, etc.). Where possible, be specific with what treatment should be sought and details about the response to take in the event of an exposure.
[4] Medical surveillance is a proactive exposure-specific initiative that monitors the effectiveness of workplace safety precautions over time (e.g., checking Rabies titers, regular HIV or chlamydia testing)

5 Work Locations

5.1 Table 5: Work and Storage Locations.

Location		Type of Research (*in vitro, in vivo, &/or both*)	Purpose of Work Area[1]	Containment Level[2]
Building	Room #			
WCVM	2207	*In vitro*	Sequencing suite	1

WCVM	2259	*In vitro*	Nucleic acid extraction	2
WCVM	C616	storage	storage	2

[1] State the activities conducted at each location: research, diagnostic, storage, autoclave, animal housing, biowaste storage area, etc.
[2] Depending on the required containment level, there may be room specifications, room design elements, and safety equipment required. Refer to the PHAC and CFIA's Canadian Biosafety Standards (3rd Ed., 2023) and contact the Biosafety Group for assistance.

5.2 Table 6: Safety Equipment Inventory and Location.

Equipment [1]			**Location of Equipment**	
Type of equipment	**Model (if applicable)**	**Serial number**	**Building**	**Room**
Fume hood	NA	NA	WCVM	2259
Shower and eyewash	NA	NA	WCVM	2259
Biosafety cabinet	Thermo Scientific Model 1375 Class 11 - type A2 Biological safety cabinet 4 ft	300594791	WCVM	2259
Deep Freezer (lockable)	Thermo Freezer TSX Series – TSX50086A	1116923401210824	WCVM	C616
Deep Freezer (lockable)	Thermo Freezer TSX Series – TSX70086A	1130300701230202	WCVM	C616
Deep Freezer (lockable)	Thermo Freezer TSX Series – TSX70086A	1130301501230202	WCVM	C616
Shower and eyewash	NA	NA	WCVM	Hallway

[1] Safety equipment includes but is not limited to, biosafety cabinet, fume hood, autoclave, emergency eyewash, and shower equipment.

6 Biosecurity Assessment & Operational Requirements

The development, implementation, evaluation, and maintenance of a biosecurity plan, based on a biosecurity risk assessment, is required for facilities where biohazardous material or toxins are handled and/or stored.

6.1 Risk Threat Analysis (for Biosafety Group Use ONLY)

Risk Level Analysis FOR BIOSAFETY GROUP USE ONLY		
Threat Scenario	**Identified Threat Level**	**Risk Statement**

6.2 Table 7: Summary of Operational Requirements

7.1 Biosecurity & Inventory Control
Who is allowed, or authorized in the containment zone (e.g., graduate students, technicians, other faculty, custodial staff, building service technicians, Operations and Maintenance trades, etc.)?
Individuals listed as Authorized Workers on the Biosafety Permit are allowed to work in laboratories listed on the Permit and will have keys/codes to access these laboratories. Custodial staff, building service techs., and Operations and Maintenance trades are permitted into laboratories to perform their required tasks only. Visiting students, faculty, and scientists require full supervision and need to sign in/out log in ELN/LIMS. No children or pets are allowed in laboratories.
How is access to the containment zone controlled (e.g., access cards, assigned keys, key codes, etc.)?
Only those authorized and trained receive access to the facility (rooms 2259, 2207) controlled by key fob access. Room C616 will only allow supervised access for clients by the lab manager, Dr. Martin Mau.
Are doors to the containment zone kept closed/locked at all times?
Doors are kept closed at all times. Doors are kept locked at night and when they are left unattended during the day.
How is visitor access controlled? Are visitors supervised at all times during their visit?
By key fob usage and visually by manager, Dr. Martin Mau.
How is intellectual property, such as lab books and electronic files, secured?
An electronic laboratory notebook (ELN) and LIM system will be in place to trace all samples. All samples will be barcoded from sample receiving via sample processing to data generation & storage. In addition, a shared laboratory drive will be used to backup data and IP.
Who has access to the biological and biohazardous material inventory and documentation. Where is the inventory kept?
The biological and biohazardous material inventory and documentation will be present through the LIM system (tbd) and will be also present in print form in each lab (2207 and 2259)
Who is responsible to ensure the biological and biohazardous material inventory is up to date? How often is the inventory updated?

The lab manager (Dr. Martin Mau) is responsible for a yearly update of the inventory.
Are any biological and biohazardous materials stored outside of the facility? If yes, is the storage device lockable?
N/A
How are suspicious or illicit activities reported?
Ask other staff/students if they know anything about what was seen. Authorized workers instructed to contact PI and U of S Protective Services (966-5555) to report any suspicious or illicit activities.
How are missing or stolen biological/hazardous materials reported?
If a biological material was reported missing or stolen, PI and Safety Resources will be notified immediately. Protective Services may be called if required.
Other biosecurity measures (if applicable):
NA
7.2 Training & Training Records
List the institutional and site-specific training required for all authorized workers.
Records of required training will be kept in each SOP and Safety Training binder in WCVM 2207 The following required training for authorized workers: - Employee safety orientation - Laboratory safety - WHMIS 2015 - Biosafety - Biowaste online course - Site specific training and ERP All personnel must read all relevant SOPs and list these on their site-specific training records which are signed and dated by the lab manager, Dr. Martin Mau.
How is site-specific training delivered, verified, and documented (e.g., probationary period with supervision, quizzes, spot checks, direct supervision)?
Individuals will read the required SOPs and sign and date the training record. Each first-time user will receive an onboarding lab tour through the facility (2207 and 2259) to show the locality of machinery and safety-relevant items also noted on the lab door sign (e.g. shower, fire extinguisher, spill kit, first aid kit, emergency contact numbers). Then the users will be instructed and/or watch the procedure being performed and then perform the procedure under supervision. The supervisor will sign and date the training record when the individual is adequately trained to perform the task themselves.
How often is a *Training Needs Assessment* conducted, documented, and reviewed?
Site specific training (reviewing SOPs) will be required yearly. Also specified in each SOP.
Where is training documented and how long are training records maintained for each worker?
Training type (e.g. lab tour, hands-on training for a specific device) will be documented in a folder with signature, name, supervisor name, department and date in WCVM 2207 in a specific folder on one of the lefthand side shelves (and later be integrated into the ELN LIMS).

7.3 Facility Entry & PPE
Is there signage posted for the facility, including PPE entry requirements, emergency contact information, and containment level?
yes
What are the minimum PPE and entry requirements for entry into the containment zone?
• Long pants • Fully enclosed boots and socks • Lab coat (provided) • long hair tied back
Are personal items allowed in the containment zone? If yes, where are they kept?
No. Personal items are kept outside of the lab or in an office
State how the PPE is donned and doffed when entering/exiting the laboratory.
Working with hazardous materials requires lab coat, gloves, and safety glasses. Lab coat, gloves and safety glasses to be removed prior to leaving the lab, wash hands with soap and water for 20 seconds. Lab coats are all on individual labelled hooks at the entrance to the lab. No lab coats, gloves, or safety glasses are allowed outside of the lab.
7.5 Procurement & Transport of Biohazardous materials
Describe how the lab procures biohazardous materials.
Samples will be delivered by clients, entered into the LIM system using barcode stickers or already barcoded sample storage containers provided from the ORC to the clients and stored at -80C in locked and monitored freezers by authorized personnel. Refer to the Biosafety Group's *Procurement and Transfer of Organisms and Biological Materials* procedure. Biosafety is notified of any new biological materials to be procured. The Permit Holder must ensure material is listed on the biosafety permit by submitting a *Biosafety Permit Amendment Form* to the Biosafety Group. A *Biological Agent Transfer (BAT) Notification Form*, an import permit through CFIA, or other certifications may be required. Material Transfer Agreements (MTA) may be required and can be obtained through Innovation Mobilization and Partnerships.
State who is notified if materials are transferred to other researchers, facilities, or institutions.
Contact the Permit Holder and Biosafety Group (biosafety@usask.ca). CL2 materials may only be transferred to another permit holder at the U of S with appropriate approvals by the Biosafety group and BPAC.
Describe how biohazardous materials are moved within the building (i.e. between labs).
Transport of sample outside of the containment zone follow practices described in Section 20.1.2 of the Canadian Biosafety Handbook. All movement is using a closed, sealed primary container (e.g., sealed conical tube) placed into a secondary leak proof, impact resistance container (e.g., Rubbermaid container) with absorbent material. This secondary container is labelled with a biohazard symbol and contact information. A surface decontamination of the secondary material required with 70% ethanol with a contact time of 5 minutes.

The secondary container may be placed into a labelled Styrofoam container for transport if necessary. Large or heavy items should be transported on a cart.
Describe how biohazardous materials are transported between buildings or off campus.
Transport of sample outside of the containment zone follow practices described in Section 20.1.2 of the Canadian Biosafety Handbook. All movement is using a closed, sealed primary container (e.g., sealed conical tube) placed into a secondary leak proof, impact resistance container (e.g., Rubbermaid container) with absorbent material. This secondary container is labelled with a biohazard symbol and contact information. A surface decontamination of the secondary material required with 70% ethanol with a contact time of 5 minutes. The secondary container may be placed into a labelled Styrofoam container for transport if necessary. Large or heavy items should be transported on a cart. For transport to another building, contact the USask Biosafety Group to ensure the other PI or location has necessary approvals in place.
Describe how biohazardous materials are packaged prior to shipping.
N/A
7.6 Immunization & Medical Surveillance (reflect on answers from Table 5)
If a medical assessment is required prior to an individual beginning work (e.g., identifying known allergies, prior immunizations, immune status, etc.), please detail this requirement below. If needed, complete the *Medical Risk Assessment Form*.
NA
If an on-going medical surveillance program is in place, please describe.
NA
If applicable, how is the medical surveillance program monitored and tracked?
NA
7.7 Work Practices & Working Alone/After Hours
How frequently are self-inspections performed? How are these inspections documented?
Self-inspections are carried out every 3 months and documented in a binder in lab WCVM2207 above the computer workstation and on the LIMS under \\Desktop\Lab_safety_&_inventory (TBD).
How are safety matters communicated with faculty/staff/students?
When working alone, staff will have access to a phone (cell phone) so that they are able to contact emergency services immediately. Supervisors check on their staff either by phone or by person during the scheduled work period.
Identify which areas of the containment zone are “clean” from biohazardous materials and which are “dirty”. How are these areas separated?
Biohazardous material is only handled in biosafety cabinet in WCVM 2259. In all other areas biohazardous material are not permitted to enter (e.g. WCVM 2207) or they are enclosed and sealed in containers for processing (WCVM 2259 extraction suite) or storage (C616).

How are BSCs maintained and certified?
Biosafety Cabinets (BSCs) will be certified to manufacturer's specifications or NSF49 standards upon initial installation, annually, and after any repairs, modifications, or relocation. External service providers at the University provide this service (Con-TEST). Contact the U of S exclusive service provider for certification and servicing of BSCs on campus (Con-TEST, Biosafety Cabinet Certification Information and Pricing).
Are there any other requirements for safety equipment in the lab?
Training will be provided for all equipment and documented.
What work is permitted to be carried out alone or after hours? Who is permitted to work alone (e.g., senior grad students, technicians, etc.)?
Working alone, especially after hours, should be avoided whenever possible. Only ORC staff and trained visitors (site-specific training such as orientation (Workplace hazards, equipment, safety equipment, First aid kit, proper waste disposal, etc.), emergency response plan (ERP-WCVM) and local Standard Operating Procedures (SOPs, e.g. 'Work Alone' SOP001)) with approval by PI and ORC Lab Manager are allowed to work after hours in ORC labs. Situations were working alone may occur include: • Periodic attendance to check laboratory equipment/experiments • Cleaning and maintenance activities in laboratories • Working with analytical equipment • Working in storage areas and temperature-controlled rooms • Working in offices, libraries and at computer workstations
Describe the approval process to work alone or after hours (e.g., submission of a Working Alone and/or After Hours Plan).
Supervisor/Principal Investigator (PI) and ORC Lab Manager approve laboratory staff or students to conduct work with hazardous materials alone in the ORC research laboratory or work area. PI and the ORC Lab Manager are responsible to determine what level of hazards are permissible for working alone in their group. The ORC Lab Manager also needs to ensure that proper engineering, administrative and PPE controls are in place to conduct that work. Students, Researchers, or Workers need to obtain PI and ORC Lab Managers approval before working alone in the research laboratory or work area, complete proper safety trainings and follow the proper procedure outlined in the standard operating procedure for 'Work Alone' (SOP001).
What procedures are in place to protect individuals working alone (e.g. restricted activities, regular check-ins, buddy system)?
Protective Services sticker will be affixed to internal lab and office telephones. Employees will be encouraged to use the "Safewalk" program so that they can be escorted for evening walks on the campus grounds. Protective services: 966-5555
7.8 Decontamination & Waste Management
Describe waste disposal procedures for all types of biohazardous waste generated. Refer to Biohazardous Waste Disposal Guideline.
Chemical waste must be collected in containers with screw cap lids. Each container must be clearly labelled to WHMIS 2015 standard and stored in designated area until disposed of through Waste Management (306-966-8497). Biohazardous waste (pathogen contaminated consumables, disposable PPE) is disposed of in the grey Biomed bins provided, following Waste Management's Biohazardous waste disposal guideline.

Pathogen contaminated liquid waste is inactivated with 10% v/v household bleach for 20 minutes before disposal down the drain, flushed with plenty of water. Bleach dilutions must be prepared fresh.

Anatomical waste (animal tissues) is disposed of in the red incinerate pails, following Waste Management's Biohazardous waste disposal guideline.

SHARPs (needles, razor blades, glass slides, etc.) are placed into a commercially available SHARPs container and disposed of in the Biomed grey bins provided

Are any other types of hazardous waste generated? If yes, how is it collected, packaged, stored, and disposed?

NA

List disinfectant(s) used for each biological/biohazardous material, including concentration and contact time.

Main disinfectant for surface decontamination:

- 70% ethanol with 5-minute contact time; Mix date of ethanol solution to be placed on spray bottle
- 10% v/v household bleach with 20 minutes contact time. Bleach is prepared fresh daily as the shelf life is only 24 hours.
- 1:40 dilution of Virox PREempt Concentrate Disinfectant (EPA Reg. No. 1839-95-2296) with 5 minute contact time. Shelf life of dilution is 30 days.

Describe additional decontamination procedures in place (if any).

NA

7.9 Animal Work Considerations (if applicable)

Please list the applicable AUPs in place for *in vivo* animal work.

NA

What additional training is required for individuals performing animal work?

NA

7.10 Human Work Considerations (if applicable) (Includes clinical samples, phlebotomy)

Please list the applicable human ethics approvals (BIO, behavioral, or exemption number).

NA

What additional training is required for individuals performing human work?

NA

7.12 Emergency Preparedness and Incident Management

Which Emergency Response Plan (ERP) is followed for emergency procedures? Where is the ERP located?

WCVM ERP Feb 2016

Are Emergency Medical Contact Cards in place for personnel?

On the desktop of the lab computer, in the ELN/LIMS (tbd) and will be in a binder labelled ERP on the lefthand sided shelves in WCVM 2207.
State how the annual ERP training is provided and documented.
ERP review is conducted annually at lab meetings and training is documented. Reminders are provided periodically in lab meetings.
How are hazards, incidents, and near misses reported and managed?
Hazards – The Safety Channel on PAWS has a *Report a Hazard* button for when you observe a health or safety concern. If you see something immediately dangerous to the health and safety of the campus community, contact Protective Services at 306-966-5555. **Incidents & Near Misses** - The Safety Channel on PAWS has a *Report Injuries or Incidents* button. Click "Report an Incident" and fill out the reporter section to detail the incident or near miss that has occurred. This should be done within 24 hours of the incident occurring. In the event of an injury, ensure appropriate medical attention is received.
Who is contacted if an exposure to biohazardous material occurs or is suspected?
Notify Permit Holder and Usask Biosafety Group immediately: • Dr. Mau at martin.mau@usask.ca, 306-380-5380 • Usask Biosafety Group at biosafety@usask.ca, 966-8190 & 966-8496 Report the incident, as described above, within 24 hours. In the event of an exposure, ensure appropriate medical attention is received. This may include seeking the treatment(s) outlined in Table 5. Detailed information about the biohazardous material involved in the exposure may need to be provided to your health care provider.
7.13 Standard Operating Procedures (SOPs)
Who is responsible for developing, approving, and reviewing SOPs? How often are the specific laboratory procedures reviewed and updated?
The Omics Resource Centre laboratory manager, Dr. Martin Mau. SOPs will be assessed on a yearly basis.
Who is responsible for SOP training of new staff and students?
The Omics Resource Centre laboratory manager, Dr. Martin Mau.
Where are SOPs stored (e.g, Lab SOP binder, lab computer, DataStore, etc.)?
On the desktop of the lab computer, in the ELN/LIMS (tbd) and will be in a binder labelled SOPs on the lefthand sided shelves in WCVM 2207.
Do procedures include appropriate health and safety requirements (e.g., potential health risks, required PPE)?
Yes.

7 Standard Operating Procedures (SOPs)

All SOPs are available as link on the desktop of the lab computer in WCVM2207, the ELN/LIMS (tbd) and in a binder labelled 'SOP' on one of the shelves lefthand from the entrance into WCVM 2207:

1. Working alone

2. General SOPs for ORC (lab etiquette, safe handling, waste disposal, incidents, PPE)
3. Sample submission guidelines
4. Sample homogenization procedures
5. Sample extraction procedures

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8 References

1. Canadian Biosafety Standard, 3rd Ed.
2. Public Health Agency of Canada (PHAC) ePATHogen and Pathogen Safety Data Sheets (PSDS)
3. PROTOCOL_ZymoResearch_dna_rna_shield (https://files.zymoresearch.com/protocols/_r1100-50_r1100-250_r1200-25_r1100-125_dna_rna_shield.pdf)
4. Sample_submission_template_ORC_v6_09202024: link will be provided soon (TBD)
5. Virox PREempt Concentrate Application Note: https://info.virox.com/hubfs/PREempt/documents/PREempt-Concentrate-Reference-Sheet-ENG.pdf
6. PeridoxRTU Sporicidal Disinfectant application notes and efficacy data: https://cleanroom.contecinc.com/product/2265684113

Appendix 1: Training Needs Assessment

Permit Holder:	**Martin Mau**	**Permit Number:**	**ORC-01**

1	I have read, understood, and will comply with the University of Saskatchewan's *Biosafety Code of Practice*.
2	I have read, understood, and received training of the current copy of the Biosafety Plan and I know where to find a current copy of the Biosafety Plan.
3	I have read, understood, and received training on the building Emergency Response Plan (ERP) and I know where to find a current copy of the ERP.
4	I have been trained on the use of and know the exact location of the eyewash, safety shower, fire exit, spill kit and first-aid kit.
5	I have been fully trained on the specifics of my work and am confident performing research on my own. I have been informed of the risks associated with this research, and I am participating voluntarily. I have read all applicable Safety Data Sheet (SDS) and Pathogen Safety Data Sheet (PSDS).
6	I will immediately notify my supervisor or his/her designate of any accident or exposure incident and will also notify the Biosafety Group and complete an incident report as soon as possible.
7	I will immediately notify my supervisor or his/her designate, and the Biosafety Officer, of any missing biological agents and/or toxins, inadvertent production/release of biological agents and/or toxins, and violations of safety requirements. I will cooperate fully in any investigation of these matters.
8	I have been trained on and am able to properly operate the following equipment (check-off applicable): ☐ Agilent TapeStation 4200 ☐ centrifuge ☐ biosafety cabinet ☐ fume hood ☐ Plate Reader Agilent SynergyLX ☐ Kingfisher Apex ☐ Liquid handler Eppendorf EpMotion 5073l ☐ water bath ☐ -80°C ☐ LN_2 ☐ vacuum apparatus List others, as applicable: •
9	While working I will wear PPE appropriate for the task, long pants, and footwear with closed toes and heels.
10	I know that if I have a medical condition or concern, that I must discuss this with a medical practitioner, notify my supervisor, and complete a medical assessment form.

11	I recognize my responsibility and legal obligation to observe these practices and precautions while present in the laboratory and understand their importance for the safety and welfare of myself, others, and the environment.

Authorized Worker – Print Name	NSID	Signature of Authorized Worker	Comments/Training gaps	Date

Permit Holder Signature

Date

ATTENTION PERMIT HOLDERS:

This form must signed by all current authorized workers annually and must be kept on file for a minimum of 10 years. Note that your records may be audited during a scheduled inspection or by PHAC/CFIA Inspectors.

All site-specific training must be documented using the USask Site Specific Training Record Template.