UNIVERSITY OF MANITOBA

BIOSAFETY GUIDE

As approved by the U of M Biological Safety Advisory Committee

Environmental Health and Safety Office

Draft Revisions 2012 Jan.27 (with BSAC recommendations for signage and project approval revisions)

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1. INTRODUCTION

The goal of Biosafety is to prevent personal, laboratory and environmental exposure to actual or potential infectious agents or biohazards by the application and integration of knowledge, techniques and equipment into the daily work.

The Environmental Health & Safety Office (EHSO) works on behalf of the University of Manitoba (U of M) in the establishment of policies and procedures to **protect the health and safety of staff, students and visitors** and to assist all responsible owners in achieving and maintaining compliance with relevant legislation and guidelines.

To assist the University of Manitoba in the establishment of policies and procedures, a series of advisory committees have been established. The Biological Safety Advisory Committee (BSAC) is responsible for providing advice and direction on all aspects pertaining to the use of biologically hazardous agents at the University of Manitoba.

As such, the Biological Safety Advisory Committee (BSAC) has adopted, and the Biosafety Guide references the following legislation and guidelines. Links to these and other biosafety resources can be found in Section 2.3.

- **Public Health Agency of Canada (PHAC) '*Laboratory Biosafety Guidelines*' (**current edition),
- **Canadian Food Inspection Agency(CFIA)** Containment Standards for Veterinary Facilities (CSVF) **(**current edition),
- Provincial Workplace Safety and Health Act (Chapter W210 10/02) and WHMIS Regulations (Part 35 and 36).
- Federal Transportation of Dangerous Goods Act
- The City of Winnipeg bylaw on Sharps and Biomedical Waste.
- Federal acts regulating the importation of human and animal pathogens and toxins.
- U of M Biosafety Policy and Biosafety Procedure
- Human Pathogens and Toxins Act (2009)
- Tri-Council Agency Memorandum of Understanding – Schedule 13- Biosafety.

1.1 Scope

The University of Manitoba Biosafety Guide has been developed as part of the university's overall Biosafety Program for faculty, staff and students working in research, teaching and clinical labs in U of M owned buildings, and additionally the Manitoba Institute of Cell Biology located in Cancer Care Manitoba, Manitoba Institute of Child Health and the Health Sciences Research Foundation labs located on the 7-8th floors of the John Buhler Research Centre (JBRC).

1.2 Purpose

This document is intended to:

- Direct biological agent users to the **current biosafety standards** and select **U of M Safe Work Practices** (SWPs) required for work with biological agents at the university.
- Provide the process and guidelines ***for responsible owners*** of the biological agents to hold a U of M Biosafety Permit to work with biological materials and the Project Approval Certificate for a procedural peer review of their safe work practices and for release of grant and contract funds.
- For some programs/risk assessments, this guide and select appendices may be used in part or in full to fulfil the permit requirement for SWP and site-specific lab biosafety manual. In this respect it becomes the reference document for the PI's site-specific training.

2. WHO TO CALL

2.1 Emergency Contacts

2.1.1 24 HOUR EMERGENCY

(Fire, Security, Medical, Maintenance):

From University phones
(272-, 474-, 480-, 789-, 975-, 977- exchanges) **555**

From any Roger's or MTS cell phone **#555**

From all other phones **474-9341**

Post Exposure Protocol **Appendix 2 and 3**
Also available of the Occupational Health Program web-site

2.1.2 During Regular Office Hours

General Assistance
Environmental Health and Safety Office **474-6633**
191 Frank Kennedy Bldg.
ehso@umanitoba.ca
http://umanitoba.ca/admin/human_resources/ehso/

2.2 Biosafety at the U of M

2.2.1 How to Get Started

2.2.1.1 Biosafety Permits

Before beginning work with Biological agents PIs/Responsible owners of biological agents must register their lab and biological agent inventory and agree to the follow the conditions under which the work with the registered materials can proceed.

Complete instructions for obtaining a permit can be found in the Biosafety Permit Application Instructions . Secure access to the EHSA database is required. If you do not have access, refer to 'Section A. Getting Started' and then follow all the remainder of the instructions.

After you have submitted all the required information, Biosafety Program personnel will review and process your information. After satisfactory completion, you will receive a Biosafety Permit # which you will find attached to your questionnaire on the database.

2.2.1.2 Biosafety Project Approval Certificate

The Permit holder is also responsible for obtaining an institutional review of their biosafety risk assessment and related project safety procedures. This is required by the University's Biosafety Policy and Procedure, regulatory agencies (PHAC, CFIA) and by the ORS/Tri-Council Agency for the release of grant funds.

FAQs and a Summary of the Complete Permit and Biosafety Project Approval requirements can be found in Section 3 of this Guide and on the Biosafety Program website.
http://www.umanitoba.ca/admin/human_resources/ehso/bio_safety/biosafety.html

2.2.2 Biosafety Program Contacts – BSAC, BSO, EHSO

2.2.2.1 Biosafety Program and Importing Permit Information

Institutional Biological Safety Officer – Steve Cole **789-3675**
T248 Basic Sciences Building
cole3@cc.umanitoba.ca
http://www.umanitoba.ca/admin/human_resources/ehso/bio_safety/biosafety.html

2.2.2.2 Biosafety Project Approval Certificate Information

Chair, Biological Safety Advisory Committee **789-3375**
Currently: Dr. Peter Nickerson
A108 Chown Building
http://www.umanitoba.ca/admin/human_resources/ehso/bio_safety/biosafety.html

2.2.2.3 Occupational Health Information (immunizations, medical surveillance, accident reporting and WCB)

Occupational Health & Biosafety Program Coordinator **474-6438**
Judy Shields
191 Frank Kennedy Bldg.
Jshields0@cc.umantioba.ca
http://umanitoba.ca/admin/human_resources/ehso/occ_health_comp/occhealthwcb.html

2.2.2.4 Biosafety Permit Info including PI Registration & EHSA database access

Biosafety Specialist
Evelyn Froese **789-3477**
T248 Basic Sciences Building
evelyn_froese@umanitoba.ca
http://umanitoba.ca/admin/human_resources/ehso/ehs_db/ehsassist.html

2.3 REGULATORY LINKS AND USEFUL RESOURCES

2.3.1 Federal

2.3.1.1 Public Health Agency of Canada (PHAC) – Human Pathogens

- Pathogen Regulation Directorate (PDR) (previously the Office of Laboratory Security)
  Ph: (613) 957-1779, Fax: (613) 941-0596
  Email – biosafety.biosecurite@phac-aspc.gc.ca
  http://www.phac-aspc.gc.ca/ols-bsl/about-propos/index-eng.php
- Laboratory Biosafety Guidelines:
  http://www.phac-aspc.gc.ca/lab-bio/res/blk-acb/lbg-ldmbl-eng.php
- Human Pathogen Safety Data Sheets (MSDSs)–
  http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/index-eng.php
- Importing -Application and Permits for Human Pathogen
  http://www.phac-aspc.gc.ca/lab-bio/permits/imp-permit/index-eng.php
- Human Pathogens and Toxins Act:
  http://lois-laws.justice.gc.ca/eng/acts/H-5.67/index.html

2.3.1.2 Canadian Food Inspection Agency (CFIA) – Animal and Zoonotic Pathogens

- Biohazard Containment and Safety Unit,
  Ph: (613) 225-2342 (4256)
  http://www.inspection.gc.ca/english/sci/bio/bioe.shtml
- Containment Standards for Veterinary Facilities: Manual (Available Only On-Line)
  http://www.inspection.gc.ca/english/sci/bio/anima/convet/convete.shtml
- Importing Animal Pathogens: Application, Permits, Facility certifications -
  http://www.inspection.gc.ca/english/sci/bio/anima/path/animae.shtml
- Animal Pathogen Safety Data Sheets
  http://www.inspection.gc.ca/english/sci/bio/anima/disemala/disemalae.shtml
- Health of Animals Act
  http://laws-lois.justice.gc.ca/eng/acts/H-3.3/

2.3.1.3 Tri-Council Agency -Memorandum of Understanding – Schedule 13

- Roles and Responsibilities in the Management of Federal Grants and Awards: Phase 2-Schedule 13: Research Involving Biohazards
  http://www.nserc-crsng.gc.ca/NSERC-CRSNG/Policies-Politiques/MOURoles-ProtocolRoles/13-Biohazards-RisquesBiologique_eng.asp

2.3.1.4 Transportation of Dangerous Goods

- EHSO website. at

2.3.2 Provincial

2.3.2.1 Workplace Health and Safety Act

- Most pertinent (i.e. WHMIS) http://safemanitoba.com/table_of_contents.aspx

2.3.2.2 City of Winnipeg Water and Waste By-Laws-

- Most specifically-Bio-Medical Waste Sharps Bylaw No 6061/92
  http://www.winnipeg.ca/waterandwaste/dept/default.stm
  http://www.winnipeg.ca/CLKDMIS/DocExt/ViewDoc.asp?DocumentTypeId=1&DocId=577

2.3.3 U of M Governance Policy and Procedures

2.3.3.1 General Health and Safety Policy

- http://www.umanitoba.ca/admin/governance/governing_documents/staff/551.htm

2.3.3.2 Biosafety

- Biosafety Policy
  http://www.umanitoba.ca/admin/governance/governing_documents/staff/928.htm
- Biosafety Procedure-
  http://www.umanitoba.ca/admin/governance/governing_documents/staff/929.htm

2.3.3.3 Safety-Related U of M Policy and Procedures

- http://www.umanitoba.ca/admin/governance/governing_documents/staff/index.html
- Scroll down to the Health and Safety heading to also find these lab-related policies and procedures:
  - Controlled Products Standard Procedure
  - Immunization Standard
  - Laboratory Safety Procedure
  - Minor in Laboratories
  - Response to Health and Safety Concerns

2.3.3.4 U of M Animal Care Occupational Health Program

- http://umanitoba.ca/admin/human_resources/ehso/chembio_safety/AnimalCare.html

2.3.4 International (For Resource)

Biosafety in Microbiological and Biomedical Laboratories (BMBL)
http://www.cdc.gov/biosafety/publications/index.htm
American counterpart to the LBG.

World Health Organization (WHO) Laboratory Biosafety Manual
(Available in English and Chinese)
http://www.who.int/csr/delibepidemics/WHO_CDS_CSR_LYO_2004_11/en/

NIH rDNA Guidelines
http://oba.od.nih.gov/rdna/nih_guidelines_oba.html

ATCC- American Type Culture Collection
http://www.atcc.org/
Catalogue/Repository of a large collection of microorganisms, cell cultures, Molecular Biology products etc. Information on Cell Line origins. **Note:** US guidelines vary from Canadian standards so consider them a guide post not an authority. Review their Cell line MSDS.

CDC on-line Biosafety/Biosecurity training course.
http://www.cdc.gov/biosafety/index.htm

AIHA (American Industrial Hygiene Association) Laboratory Safety Web-site:
http://www.aiha.org/insideaiha/volunteergroups/labHandScommittee/Pages/default.aspx/htmljavascript.htm
This is a good general laboratory safety reference and starting point. Check out their Laboratory Safety Incidents for a list of real life lab accidents and links to other incident lists.

3. U of M BIOSAFETY PERMITS & PROJECT APPROVAL CERTIFICATES

The principal investigator or laboratory director is responsible for assessing the risks in order to determine the containment level and any specific or additional safe work practices for the work with a specific biological agent in their facility.

You must register your work with biological agents before beginning your work by submitting a Biosafety Permit Application on the EHSA database website. This includes providing, for example, an inventory of the biological agents in use and in storage; a list of personnel and their training; location of facilities and safety equipment. After successfully completing the registration requirements you will receive a Biosafety Permit. A Biosafety Permit is issued on condition that you as Principal Investigator agree to implement and maintain the additional conditions outlined on the permit. See Section 3.3 for the list of permit requirements and permit conditions.

The release of grant and contract funds requires that you additionally submit a Biosafety Project Approval Certificate form for review by the Chair or a Sub-committee of the Biological Safety Advisory Committee. The risk assessment will document safe work practices which are special or specific to their program or facility and are in addition to those covered in the U of M Biosafety Guide.

3.1 Biological Agents Covered

- Conventional microorganisms like viruses, bacterial, fungi, ricketssia, etc.
- Human and animal tissue, blood and body fluids
- Human and animal cell lines; primary and continuous
- Recombinant organisms
- Toxins derived from biological agents
- Prions and other non-conventional infectious material
- Other potentially infectious material, e.g. vaccines, sewage

3.2 Frequently Asked Questions

Who is eligible to hold a Biosafety Permit?

Biosafety permit holders are the responsible owners of the biological agents and are working in University of Manitoba owned buildings. Usually they are Academics or Professional Associates who report to U of M Deans, Directors, and Department Heads.

How do I know if I need a Biosafety Permit?

A biosafety permit is a registration process that is required for **the possession and use** of biological agents (Risk Group 1-3) or potentially biohazardous material that may contain these agents in all research, teaching and clinical/diagnostic laboratories **in University of Manitoba controlled buildings**. There are no facilities at the U of M for working with Risk Group 4 biological agents.

How do I Submit a Biosafety Permit Application?

Biosafety permit application information is submitted and maintained on the EHSA database. Secure access to the EHSA database is required. If you do not have access, complete the **New PI Lab Registration form** and fax it to the number indicated on the form.

What is required for a Biosafety Permit?

See section 3.3 for a summary of the requirements. Detailed Instructions for completing and submitting a Biosafety permit are available on the Biosafety Program web-site.

Do I need to submit both a Biosafety Permit Application and a Biosafety Project Approval Certificate form? Why?

Yes, in most cases you will need both.

The Biosafety Permit registers your lab, i.e. workers, locations, bioagent inventory and their risk groups, safety equipment and intended Containment Level. It allows you to start working with biological agents and is issued with your assurance that you will follow the permit conditions.

The Biosafety Project Approval Certificate provides a review of your biosafety risk assessment and safe work practices **as required** by the regulators and major granting agencies.

What is a Risk Assessment?

Information on risk assessment steps can be found in the Risk Assessment and Safe Work Practices Section 5 of this Guide as well as by referencing the original regulatory documents or other resource links in Section 2.3.

Where do I find information on the Risk Group Classifications?

Section 6 of this guide provides definitions for the risk groups and information on other potentially infectious material.

How often are Permit's renewed?

Complete Permits renewals are required every 5 years. However, if any of the information provided changes in the interim, you must submit an amendment to your permit.

How do I Submit a Biosafety Project Approval Certificate form for release of Grant and contract funds?

The form(s) is available on the EHSO web-site as well as the Research Office Web-site. Project Approvals are reviewed by the Chair/Sub-committee of the Biosafety Advisory Committee. Forms are submitted to the BSAC, C/O EHSO, 191 Frank Kennedy, Fort Garry Campus.

Who can help me with my application?

People Contacts- Environmental Health and Safety Office

BSO – Institutional Biological Safety Officer
Steve Cole
cole3@cc.umanitoba.ca
Phone: 789-3675
Fax: 789-3906
Bannatyne Campus: T248B Basic Sciences Bldg.

Occupational Health and Biological Safety Program Co-ordinator
Judy Shields
shieldso@cc.umanitoba.ca
Phone; 474-6438
Fax: 474-7629
Fort Garry Campus:191 Frank Kennedy Bldg.

Biological Safety Specialist
Evelyn Froese
evelyn_froese@umanitoba.ca
Phone: 789-3477
Fax: 789-3906
Bannatyne Campus: T248C Basic Sciences Bldg.

3.3 Biosafety Permit Requirement Summary - Containment Level 1 & 2

3.3.1 Biosafety Permit Application Process

To receive a current Biosafety Permit and Number, please ensure that the following items are in place.

1. All the required schedules in the EHSA Biosafety Permit Application are completed and submitted on the EHSA web-database. Instructions for using the database application can be found in a separate document *Biosafety Permit- Instructions for Completing Initial Applications, Renewals, and Amendments*.

2. Your Biological Agent Inventory is completed in the EHSA web-bioagent inventory forms. Instructions are included in the above mentioned instructional document.

3. A hard-copy permit application with the required signatures: PI, Department Head, WHMIS Coordinator, is submitted to EHSO. A hard-copy of the web application can be printed from the 'Report' link in the table on your Biosafety Permit Application Tracking Screen. IF your work is located in two or more different departments/units, signatures from both WHMIS Coordinators and Department Heads/Unit Directors are required.

The WHMIS Coordinators signature will verify that the following items are in place.

1. U of M Lab signage (Workplace Hazard Information Placard) is in place for all labs (including shared labs and BSC locations) listed on the permit application.

2. All personnel (including the PI) have completed the departmental Generic WHMIS and Basic Lab Safety training.

3. All the Biological Safety Cabinets listed on the application are currently certified.

3.3.2 As part of the permit conditions, you agree to maintain the following in your lab(s) at all times:

1. In the main lab:
The following documents are maintained in the applicant's lab in a format and location which is readily accessible to all workers in the lab, and to institutional and federal inspectors without prior notice of audit or inspection.

- Signed copy of Permit application
- A copy of the PHAC Laboratory Biosafety Guidelines
- A copy of the Human Pathogens and Toxins Act.
- A copy of the University of Manitoba Governance document Biosafety Policy & Procedure (2011) and
- The University of Manitoba Biosafety Guide 2012

2. In all the permitted labs:
The following are conspicuously and visibly posted:
- A signed hard copy of all Biosafety Permits applicable to the space upon issue.
- A copy of the University of Manitoba Biohazardous Waste Disposal Chart.
- An up to date WHIP sign
- Copy of the U of M PEP for their campus

3.3.3 As part of the permit conditions, all Biosafety Permit Holders are also responsible to ensure that the following are implemented and maintained in their lab:

1. A thorough **risk assessment must be completed** on the hazards associated with the agents used and the processes carried out under the permit holder's supervision.

2. **Training** is provided for all personnel working with biological agents as listed on the permit:
   a. Departmental Generic WHMIS and Basic Lab Safety training with testing before starting work in the lab.
   b. Attend the EHSO Generic Biosafety Training within six months of starting work.
   c. Effective and documented site-specific biological safety training on the biological agents, procedures and safety equipment used in the lab. Laboratory Safety Checklist for New Lab Personnel

3. All work in the permit holder's facilities will be conducted in accordance with all applicable federal, provincial, municipal and institutional regulations, guidelines and procedures including but are not limited to:
   a. **Federal** - The Human Pathogens and Toxins Act, Public Health Agency of Canada's (PHAC) Laboratory Biosafety Guidelines 3rd edition, and the Canadian Food Inspection Agency's (CFIA) Containment Standards for Veterinary Facilities.
   b. **Provincia**l - The Workplace Safety and Health Act and Regulations W210.
   c. **Municipal** – Any applicable City of Winnipeg bylaws.
   d. **Institutional** - The U of M Biosafety Policy and Procedure, The U of M Biosafety Guide (2012).

4. The Permit holder will **investigate and report all incidents involving direct worker exposure to biological agents** or personal injury related to biohazardous work to the Institutional Biosafety officer within 30 days of the incident.
   U of M Accident and incident reporting procedures and forms

5. Any **changes to the information** provided as part of this permit application will be updated and submitted on the web application amendments options within 30 days of said change being made. This is to include, but is not limited to: personnel, agents acquired or used, facilities/labs, Biosafety cabinets or autoclaves.

6. The applicant agrees that no biological agent classified as risk group 3 or higher according to the Human Pathogens and Toxins Act Schedules 1, 2, 3, 4, and 5 will be acquired, stored or manipulated in their listed facilities.

7. **Additional for Containment Level 2**:
   a. The applicant's research facilities and operational practices are to meet all mandatory containment level 2 criteria according to the Public Health Agency of Canada's Containment Level 2 Checklist requirements. When using animal pathogens they are to meet the Canadian Food Inspection Agency of Canada Animal Pathogen Containment Level 2 Facilities Checklist requirements.
   b. The permit holder is to complete, sign and maintain a PHAC CL2 checklist in the lab. The Biosafety Officer's signature is only required for importation.
   c. MSDS for all ≥ RG 2 material are required to be available in the lab. PHAC now refers to these as **Pathogen Safety Data Sheets**.

8. **Additional For Containment Level 3 -** Consult with the EHSO for specific requirements. A PHAC certified facility is required to hold a U of M CL3 Biosafety permit.

9. **Containment Level 4 - there are no CL4 facilities at U of M.**

3.4 Biosafety Permit Amendments

Submit amendments to the information on your permit through the EHSA database permit application.

1. Log-on to the database with your personal security access and select the Bioagent Questionnaire icon.
2. Select the "**Change Request**" tab. This will reload your latest submission. In the Modification Summary field in the introduction section briefly summarize your changes. E.g. added personnel and removed 2 rooms.
3. Then go to the specific section (drop down for the sections is in the top left-hand corner of the screen) and edit the information so that it is current. Additions to your inventory must be added separately under the separate Bioagent Inventory icon.
4. Return to the Application Tracking Screen and submit your changes.

3.5 Biosafety Permit Termination

Permit holders leaving the university or retiring, must decommission their permits. All biological material in their possession must be decontaminated or transferred to another permit holder.

1. Select the "TERMINATION" tab on the U of M Bioagent Questionnaire in the EHSA database. This will reload your latest submission and open it for changes in the specific sections. When completed submit the request for termination.
2. Submit the Declaration of Decommissioning Form (Appendix) that documents that the decommissioning of the biological agents and permitted work and storage areas is complete.
3. Resources for decommissioning can be found on the EHSO Decommissioning web-site. http://umanitoba.ca/admin/human_resources/ehso/chembio_safety/Decomm.html

3.6 Biosafety Permit Audit Process (Under construction)

3.7.1 Containment Level 1 -comprehensive checklist is under development

3.7.2 Containment Level 2 - Will follow PHAC CL2 Facility Certification checklist

3.7 Biosafety Project Approval Certificates

The Biosafety Procedure 2011 requires a Biosafety Project Approval Certificate for all Biosafety Permits. A separate Project Approval Certificate is required for each grant application for release of funds.

To obtain a Biosafety Project Approval Certificate:

1. Obtain a Biosafety Permit #. The information submitted on the Biosafety Permit Application must be current and complete.
2. Complete the "Biosafety Project Approval Certificate" form which can be found on the Biosafety program web-site and submit it to the BSAC at the address below.
3. As the process is in transition over the Winter-Spring 2012, please refer to the Biosafety Program web-site for the most up-to-date information.

The form is submitted to:

Biological Safety Advisory Committee
C/O Environemental Health and Safety Office
191 Frank Kennedy
Fort Garry Campus

4. Responsibilities for Work with Biological Agents

4.1 When working at the U of M

The complete information is found in the U of M Biosafety Policy and Procedure. Links to this can be found in Section 2.3.3.3.

4.1.1 Biosafety Permit Holder is responsible to:

1. ensure that all Biological Workers as listed on their Permit are aware of all biological safety procedures.
2. ensure that all Biological Workers are trained to work safely with biological materials, agents and other sources of biological hazards and to provide site-specific training in the safe use of biological materials, agents and other sources of biological hazards.
3. regularly assess and inspect their areas for compliance with biological safety procedures.
4. ensure that any incidents that occur in their area are promptly reported to the Environmental Health and Safety Office and investigated in accordance with University reporting requirements .
5. adhere to all duties and responsibilities as listed on the Permit.

4.1.2 Biological Workers Duties

Personnel, including staff and students, listed on a Biosafety Permit shall adhere to all responsibilities as listed in the Biosafety Procedure, in their PIs Biosafety Permit conditions and as required by their supervisor.

4.1.3 Biological Safety Advisory Committee is authorized to:

1. advise on the safe use of biological materials, agents and other biological hazards in all areas under the control of the University and prescribed equipment such as biosafety cabinets, autoclaves and the like
2. make recommendations on University governing documents relating to Biological Safety
3. approve standard operating procedures and guidelines
4. issue Biosafety Project Approval Certificates to users of biological materials, agents and other biological hazards under specified conditions to control the safe and healthy use of such materials, agents and other biological hazards
5. revoke Certificates from individuals who contravene these Procedures or the Policy on Biological Safety.

4.1.4 Biological Safety Officer Duties

1. administers the Biological Safety Program in consultation with the Biological Safety Advisory Committee (BSAC)
2. signs off on completed permit applications and is the university contact and signature with respect to HPTA registration and on PHAC and CFIA import permits.

4.1.5 Departmental WHMIS Coordinator Role

As part of their general duties will have duties and responsibilities related specifically to biological safety, including performing laboratory audits using standard checklists, verification of safety equipment certification, completeness and accuracy, including signatory of permit questionnaires and training records.

4.2 Importing Biological Agents

4.2.1 Importing Human Pathogens

The *Human Pathogens Importing Regulation* (HPIR) allows the Public Health Agency of Canada to assess and manage the risk of inadvertent transmission of communicable diseases caused by human pathogens. Under these regulations, every person importing a human pathogen in Risk Group 2, 3 or 4 must obtain an importation permit.

Importing Forms & Checklists:

Public Health Agency of Canada
Pathogen Regulation Directorate
Ph. (613) 957-1779 Fax (613) 941-0596
E-mail: biosafety.biosecurite@phac-aspc.gc.ca
http://www.phac-aspc.gc.ca/lab-bio/permits/imp-permit/index-eng.php

Biosafety Officer's signature & PHAC Registration Number:

Steve Cole
Ph. (204)789-3675
E-mail: cole3@cc.umanitoba.ca

Risk Group 1
No Permit is required but to facilitate the import process for unusual samples, PHAC will upon request, provide a cover letter confirming that the material is Risk Group 1.

Risk Group 2
In addition to the Import Permit Application, PHAC requires a **Containment Level 2 facility certification**. At the U of M this requires a current Biosafety Permit and a site-visit from the Biosafety Officer ensuring the CL2 checklist requirements have been met.
The permit must be sent to the shipper of the infectious substance and attached to outside of the shipping container. Multiple shipments of the same infectious species from the same source are possible for 1 year on the same multiple entry permit.

Risk Group 3
Apply for a permit as for Level 2. Permits may be issued for one single entry only, and only for shipments to Health Canada certified Level 3 Laboratory facilities.

Risk Group 4
Entry into Canada is prohibited.

Importing Cell Lines
Primary or established human cell lines that contain human pathogens must have an import permit as per the risk group of the agent involved (e.g. RG 2, 3, etc.). If you wish to import a cell line that does not contain human pathogens a notice letter stating that an import permit is not required can be requested from PHAC to facilitate import. A signed statement of status form (available from PHAC) which states that the cell line(s) does not contain human pathogens must be submitted to the PHAC office. See Appendix XVIII. PHAC indicates that any supporting documentation that can be provided regarding the testing/screening performed on the cell lines by the supplier is helpful.

4.2.2 Importing Animal Pathogens

The *Health of Animals Act* and its regulations give the CFIA the legislative authority to control the use of imported animal pathogens and pathogens associated with reportable animal diseases. Permits are required for the importation of all animal pathogens into Canada. For an agent brought into Canada under an import permit which restricts its distribution, further approval must be obtained before transferring the agent to another location.

Importing Forms & Checklists:	Canadian Food Inspection Agency Animal Biohazard Containment and Safety Unit 59 Camelot Dr. Nepean, ONT K1A 0Y9 Tel. (613) 225-2342 http://www.inspection.gc.ca/english/sci/bio/bioe.shtml Check the web site for the most current Fax # and Contact person.
Biosafety Officer's signature	Steve Cole Ph. (204)789-3675 E-mail: cole3@cc.umanitoba.ca

Laboratories handling animal pathogens should refer to the Containment Standards for Veterinary Facilities to verify that their operational practices and physical containment facilities are adequate for the animal pathogen they wish to work with. Laboratories importing pathogens at Animal Pathogen (AP) containment level 2 may be inspected by regional CFIA inspectors to ensure compliance with the conditions specified in the import permit, or they may be requested to fill in a detailed inspection checklist.

4.2.3 Importing Zoonotic Pathogens

An infectious agent that is known to cause disease in human and in animals requires permit from both Health Canada and the Animal Health Division.

4.2.4 Importing Plant Pests

Laboratories planning on importing Plant Pests should refer to the procedures and checklists described by CFIA at the following web-site: http://www.inspection.gc.ca/english/sci/bio/plaveg/biopve.shtml. Import permits will only be issued to facilities certified as meeting the appropriate physical and operational requirements described in the Containment Standards for Facilities Handling Plant Pests.

4.2.5 Facility Certification Checklists

Generally, when importing human or animal biological agents requiring Containment Level 2 facilities and now also plant pests requiring PPC-1 facilities , the regulating agency will require that a Containment Level 2 or PPC-1 facility certification checklist is completed by the importer and is verified by a biosafety professional. At the U of M this is the Institutional Biological Safety Officer.

The **facility certifications** will be valid for two years. Containment Level 2 **import permits** are good for either of one-year multiple entries or a one- time entry as specified by the authorizing agency. At the U of M please use this process.

1. Contact the Institutional Biosafety Officer (BSO), Steve Cole, (789-3675) to arrange for a site visit.
2. Before the site-visit, complete the PHAC and/or CFIA checklist **and** import permit applications as applicable.
3. Submit the completed and signed import permit application and facility certification to the required agency, that is, PHAC or CFIA.
4. Ensure that all shipping and receiving follows TDG guidelines. See below.

4.3 Shipping & Receiving Biological Agents

Any University staff or student shipping dangerous goods must be certified for the applicable means of transport. EHSO offers two one-day courses in dangerous goods for ground transport and air transport respectively. These courses are available to University only, at no cost to the participants or departments.

To pre-register please call Terry Neufeld at 474-9031. View more information at the following web-site http://umanitoba.ca/admin/human_resources/ehso/emanagement/tdg.html .

4.3.1 Transportation of Dangerous Goods (Ground)

Persons who ship receive or transport dangerous goods by ground (truck) must be certified for the ground transport for dangerous goods. This one day course will cover aspects related to shipping, transporting and receiving dangerous goods. This course is required for all University drivers who may transport dangerous goods. Past attendees to this course have also included laboratory staff that routinely ship materials by truck. Certification is valid for 3 years.

4.3.2 Transportation of Dangerous Goods (Air)

Persons who ship or receive dangerous goods by air need to be certified for the air transport of dangerous goods. Ground transport training is not required provided that the ground transport is limited from the shipping location to the air carrier's depot. Typical course attendees include laboratory staff that ship medical samples by air (medical samples and dry ice are both regulated as dangerous goods). However shipping or receiving any dangerous goods by air requires certification. Certification is valid for 2 years.

5. Risk Assessments

5.1 Why Do A Risk Assessment?

The intent of the risk assessment process is to:

- prevent laboratory acquired infections (LAIs)
- prevent escape of biological agents into the environment and/or the community with subsequent public health and economic consequences.
- classify biological agents according to risk, and laboratories according to use, to optimize safety and economy of research.
- verify the host range of the agents so that the appropriate guidelines can be followed.

Both biological agent hazard 'Risk Groups' and facility 'Containment Levels' are designated 1-4 according to the degree of hazard or protection provided to personnel, the environment, and the community respectively. One (1) being the lowest level of agent risk or containment and four (4) being the highest.

Risk Group classifications presume ordinary circumstances and growth in small volumes in a clinical/diagnostic lab or research laboratory. For the characteristics/factors used to determine the relative hazard or Risk Group of biological agents see Section 6.

Containment Levels provide the end user with a description of the **minimum containment** required for handling the organism safely in these lab settings. The containment level descriptions include **facility design elements and regular and special operational practices** (i.e, engineering, technical, administrative and physical requirements) to be integrated into the daily work. See Section 7 for a further description of Containment Levels.

Typically, the required containment level matches the risk group number. A further risk assessment however needs to be done to determine if any experimental procedures would increase or decrease the ability to work safely at the comparable risk group level. The risk assessment may also determine that the work can proceed at the comparable risk group level but require special or additional administrative controls, engineering controls, PPE and/or safe work practices.

For work with **human pathogens, i**n Canada the guiding document for the classification of pathogens and description of laboratory containment levels is the Public Health Agency of Canada's (PHAC's) *"Laboratory Biosafety Guidelines"*.

For work with **strictly animal pathogens** the Canadian Food Inspection Agency's (CFIA's) *"Containment Standards for Veterinary Facilities"* provides guidance for containment levels and facility design and operational requirements for work **in laboratories** as well as **small and large animal care facilities**. In some cases the animal pathogen containment level requirements are stricter than the comparable PHAC containment level requirement because of concern for escape of the pathogens into the environment and subsequent public health and economic consequences. For facilities working with aquatic and plant pathogens refer to Sections 7.3-7.4 which provide further links to newly developed guidelines.

For **zoonotic organisms**, both sets of regulations may need to be reviewed depending on the particular characteristics of the organism and the type of work that is undertaken. The two agencies are currently collaborating to produce a standardized guideline. When importing, both a CFIA and PHAC import permit are currently required and if CL2, then both facility certification checklists need to be submitted.

These guidelines have been accepted as the standard by federal granting agencies, importing legislation, and adopted by the U of M BSAC.

A more detailed discussion of risk assessments can be found

1. in the Centers for Disease Control and Prevention/National Institutes of Health '*Biosafety in Microbiological and Biomedical Laboratories*', available by accessing the following Web site: http://www.cdc.gov/od/ohs/ . The Laboratory Biosafety Guideline references this document.

2. the World Health Organization (WHO) '*Laboratory Biosafety Manual*' http://www.who.int/csr/delibepidemics/WHO_CDS_CSR_LYO_2004_11/en/ which is Available in **English and Chinese.**

5.2 Risk Assessment Summary

1. Identify biological agents and their hazards
    a. E.g. host range, modes of transmission, disease severity, availability of prophylaxis, etc.(see Section 6.1 for further information and resources)

2. Perform an initial assessment of pathogen hazards and risk group classification (Section 6.2-6-4)
    a. The appendices also provide U of M specific guidelines for certain biological agents.

3. Review the intended protocol and identify steps in the protocol that would increase or decrease the degree of severity/consequence of a potential accidental exposure. e.g.
    a. aerosol production and opportunity for inhalation/ingestion, use of sharps and puncture hazards (see Section 6.2)
    b. ability to revert to wild type
    c. work with large volumes
    d. *invitro* or *in vivo* work

4. Determine if the appropriate Containment Level is comparable, higher or lower than the comparable Risk Group.

5. Based on specific pathogen hazards and procedures, develop any site specific operational practices (e.g. additional safe work practices, administrative controls, engineering controls, PPE) required to work safely. Section 8 and the appendices of this guide also provide U of M specific guidelines for certain, biological agents, equipment, processes or operational practices. Individual PIs may need to identify still more additional requirements for their specific facility and work.

6. Evaluate a worker's competencies in safe work practices, health status and the integrity of safety equipment.

7. Review the risk assessment with a knowledgeable peer. At the U of M this is provided through the Biosafety Permit Application and Biosafety Project Approval Certificate form.

*The Pathogen Regulation Directorate, **PHAC** and the Office of Biohazard Containment and Safety, **CFIA**, have developed **e-learning training modules that cover the basic concepts in Biosafety and expand on the information found in the following sections of the Biosafety Guide**.*

The modules are available on the PHAC/CFIA e-Learning Portal . Select the Laboratory Biosafety and Biosecurity icon. You will need to register a user name, password and email address to log-in to the modules.
*Located at various points in the module are **.pdf resource files** on a variety of topics including:*
- ***PHAC Matrix for Assessment of Risk Group***
- ***PHAC Determination of Risk Group and Containment Level***

*The portal also contains **instructional videos on biosafety**. Upon logging-in you will find them in the top menu bar on the right under 'Tools and Resources/Videos'. It is recommended that after you complete the modules, you **watch the following two videos** which will review and pull together all the concepts covered in the modules*
- ***Biosafety 101***
- ***Containment Level 2 Laboratory: Operational Practices***

*The portal also contains a number of **Reference posters, procedures, and resource documents** that can be downloaded and printed.*
- ***Procedures to Minimize Aerosol Hazards***
- ***Biosafety in the Laboratory***

6. Risk Groups

6.1 Conventional Pathogens- Risk Group 1-4

HOW DO I DETERMINE THE RISK GROUP OF THE BIOLOGICAL AGENTS I AM USING?

Definitions for the risk groups and information on other potentially infectious material follow in Section 6.1.2. A list of human toxins and pathogens categorized according to Risk Group 2-4 is also available in Schedules 1-4 of the Human Pathogens and Toxins Act.
http://www2.parl.gc.ca/HousePublications/Publication.aspx?Docid=3865169&file=4
Schedule 1-Toxins;
Schedule 2- Risk Group 2 Human Pathogens,
Schedule 3- Risk Group 3 Human Pathogens,
Schedule 4 -Risk Group 4 Human Pathogens.
No work with Risk group 4 agents can be done at the U of M.

A list of Risk Group 4 **animal pathogens** is available on the Canadian Food Inspection Agency web-site and consultation is available for Risk Group 1-3 biological agents.
NOTE:

- There is no listing of level l agents and no MSDS for Level 1 agents.
- Infectious agent not listed as Risk Group 2, 3, or 4 in the Schedule 2-4 of the HPTA cannot be assumed to be in Risk Group 1. The PI must be able to qualify its inclusion as a Risk Group 1 agent. Assistance may be received through the BSO, BSAC and ultimately may require that the pathogenicity be verified in consultation with the Public Health Agency of Canada's Pathogen Regulation Directorate (PDR).
- Likewise if an organism is listed at Level 2 and you as an expert investigator are aware of or discover previously unknown higher risk factors you should inform PHAC, PDR of these risk factors and proceed with your work at a higher level.
- **No work with Risk group 4 agents can be done at the U of M. A CL 3 U of M Biosafety Permit requires a PHAC facility certification.**

6.1.1 Pathogen Hazards.

The factors used to determine which risk group an organism falls into is based upon the particular characteristics of the organism, such as:

- pathogenicity/disease severity
- host range
- infectious dose and concentration
- mode of transmission /route of infection
  - direct skin, eye or mucosal membrane exposure
  - parental inoculation by e.g. syringe, contaminated sharps, animal bites
  - ingestion of contaminated liquid or by contaminated hand-to-mouth exposure
  - inhalation of infectious aerosols
- availability of effective preventive measures
- history of laboratory acquired infections
- recombinants/modifications
- vectors
- communicability including economic/Public Health Aspects
- availability of effective treatment
- environmental stability
- toxin production

6.1.2 Risk Group Definitions

These classifications presume ordinary circumstances in the research laboratory or growth in small volumes for diagnostic and experimental purposes. Four levels of risk have been defined; Level 1 being the lowest risk level and Level 4 the highest.

RISK GROUP 1 ***(low individual and community risk)*****:**

Any biological agent that is unlikely to cause disease in healthy workers or animals.

- *These may typically involve saprophytic soil organisms or normal flora of laboratory animals.*

RISK GROUP 2 ***(moderate individual risk, low community risk)*****:**

Any pathogen that can cause human disease but, under normal circumstances, is unlikely to be a serious hazard to laboratory workers, the community, livestock or the environment. Laboratory exposures rarely cause infection leading to serious disease; effective treatment and preventive measures are available, and the risk of spread is limited.

- *Examples of Level 2 agents are: Neisseria gonorrhoeae, Helicobacter pylori, and Mammalian Cell Cultures (See the Appendix for the complete risk assessment and safe work practices for more info on cell cultures)*
- *Risk Group 2 agents fall under provincial WHMIS regulations and therefore an MSDS is required. PHAC, Office of Biosafety provides some on these on their web-site. PHAC now calls these Pathogen Safety Data Sheets(PSDS).*

RISK GROUP 3 ***(high individual risk, low community risk):***

Any pathogen that usually causes serious human disease or can result in serious economic consequences but does not ordinarily spread by casual contact from one individual to another, or that causes diseases treatable by antimicrobial or antiparasitic agents.

- *Example of Level 3 agent is Mycobacterium tuberculosis.*
- *At the U of M, a PHAC certified facility is required for a CL3 Biosafety Permit. Contact the U of M Biosafety Officer to initiate this process.*

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

Any pathogen that usually produces very serious human disease, often untreatable, and may be readily transmitted from one individual to another, or from animal to human or vice-versa, directly or indirectly, or by casual contact. A list of human pathogens categorized according to Risk Group can be obtained by calling the Office of Laboratory Security directly at (613) 957-1779 or accessing their Web site: http://www.phac-aspc.gc.ca/ols-bsl/

- *There are no bacterial and fungal agents at level 4.*
- *No work with Risk Group 4 agents is allowed at the U of M.*

6.1.3 Pathogen Safety Data Sheets (PSDS) previously also called MSDSs

Risk Group 2 and higher biological agents fall under provincial WHMIS regulations and therefore a PSDS is required.

PHAC has Pathogen/Material Safety Data Sheets for about 180 different agents that are infectious for humans. These PSDSs provide information on health hazards, risk groups and containment levels, decontamination, recommended precautions and safe handling information and spill procedures. The information is developed specifically for the laboratory setting where workers are usually working in a scientific setting and are potentially exposed to higher concentrations of the pathogens than the general public.

PHAC developed PSDSs for human pathogens can be found on their web-site @ http://www.phac-aspc.gc.ca/msds-ftss/index-eng.php

The Public Health Agency of Canada's Pathogen Safety Data Sheets are written from the perspective of protecting human health only. Depending on the nature and purpose of research, additional information and precautions may be necessary for working with animal and zoonotic pathogens.

CFIA's Office of Biohazard Containment and Safety has also prepared **Pathogen Safety Data Sheets** (PSDS) as a quick reference to provide information intended to promote the safe use and containment of animal pathogens in importing laboratories and animal facilities. They are similar to the Pathogen Safety Data Sheets for human pathogens. Additionally they also have some Animal Disease Fact Sheets for immediately notifiable and annually notifiable animal diseases. These focus on the characteristics of disease in animals.

Animal Pathogen Safety Data Sheets and Animal Disease Fact Sheets can both be found at http://www.inspection.gc.ca/english/sci/bio/anima/disemala/disemalae.shtml

Where an MSDS is not available from any of these sources, the Principal Investigator is responsible for developing and providing one. A blank template is available in the Appendices.

6.2 Other Potentially Infectious Material

6.2.1 Blood Borne Pathogens

All work with human blood, tissues and fluids regardless of source, needs to be handled with Universal Precautions which equates to Containment Level 2 . Refer to the Appendices for a full discussion and recommended Safe Work Practices(SWPs) for human material. This appendix can be referenced as the combined MSDS and SWP.

6.2.2 Mammalian Cells in Tissue Culture

Cells which contain a known infectious agent should be handled in the risk group of that infectious agent. Primate cell lines derived from lymphoid or tumour tissue, all cell lines exposed to or transformed by a primate oncogenic virus, all primate tissue, all virus-containing primate cell lines and all mycoplasma-containing cell lines should always be handled at Containment Level 2 and may require additional safe work practices.

All primary and immortalized mammalian cell cultures may also potentially contain infectious agents. These cells should be handled at Containment Level 2 in a Biological Safety cabinet for aerosol creating procedures until proven to be free of infectious agents. A full discussion and SWPs for human and animal cell cultures is found in the Appendices.

Researchers ordering cell lines from ATCC (American Type Culture Collection) or other cell line collections should take note of the MSDS provided. ATCC categorizes the cell line according to the American BMBL 'Biosafety Level (BSL)'category. Note that ATCC only indicates that a cell line is considered as BSL-2 when it is known to contain a Risk Group 2 agent.

6.2.3 rDNA and Molecular Biology

Because of the numerous possible host-vector transfers of genetic materials, the 'Laboratory Biosafety Guidelines' do not offer specific risk classification.

Work with recombinant DNA should include an assessment of each individual component: **the Host, Vector and Insert**. The work should be done at the highest risk level of any of the individual components or a combination thereof.

NIH Office of Recombinant DNA Activities provides guidelines for classification and work with recombinant DNA molecules.
* For further information consult NIH Website:-NIH Guidelines for Recombinant DNA Molecules
http://oba.od.nih.gov/rdna/nih_guidelines_oba.html

6.2.4 Polio Virus.

The World Health Organization (WHO) has issued guidance documents related to work with wild poliovirus in the near and long-term future.

Current information can be found on the WHO web-site at:
http://www.who.int/mediacentre/factsheets/fs114/en/

and at the PHAC web-site at http://www.phac-aspc.gc.ca/lab-bio/res/advi-avis/polio-eng.php.

Starting in 1999, BSL-2/polio laboratories should be established for all workers wishing to manipulate wild poliovirus. BSL-2/polio follows traditional BSL-2 requirements for facilities, practices, and procedures. Anyone planning to work with poliovirus at the U of M should consult with the Institutional Biosafety Officer first and with the PHAC PSDS.
1) all poliovirus stocks and potentially infectious materials are disposed of when there are no programmatic or research needs for retention;
2) all persons entering the laboratory are fully immunized against polio;
3) access to the laboratory is restricted;
4) all wild poliovirus retained in the laboratory is inventoried and stored in a separate secure area with limited access;
5) only viruses that are readily identifiable by molecular methods are used if wild virus reference strains or working stocks are required; and
6) Appropriate sterilization and/or incineration is used for disposing of wild polioviruses, infectious materials, and potentially infectious materials.

All laboratories wishing to retain wild poliovirus infectious or potentially infectious materials must begin implementing BSL3/polio containment procedures one year after detection of the last wild poliovirus and provide documentation of implementation by the second year. Laboratories wishing to qualify as a BSL-3/polio facility and retain wild poliovirus infectious materials must then be listed on Agency/Institutional and National Inventories. Laboratories not wishing to convert to BSL-3/polio containment must destroy all wild poliovirus and potentially infectious materials by autoclaving or incineration. Alternatively, laboratories may contact a WHO-designated BSL-3/polio repository to arrange for transfer and storage of selected materials.

When OPV immunization stops, all work with wild poliovirus will be restricted to maximum containment (BSL-4) laboratories. These may be suit or cabinet laboratories (Section III).
World Health Organization (WHO) and 1999 Poliovirus Regulations
(From CDC- NIH Guidelines; See Reference # 2)
see also : http://www.phac-aspc.gc.ca/lab-bio/res/advi-avis/polio-eng.php

6.2.5 Prions

Prions (From CDC- NIH Guidelines; See Reference # 2)
See also latest CFIA publication " Draft: Containment Standards for the Laboratories, Animal Facilities and Post Mortem Rooms Handling Prion Disease Agents" (2005).
http://www.inspection.gc.ca/english/sci/bio/consult/prionconsulte.shtml

Physical properties of prions. The smallest infectious prion particle is probably a dimer of PrPSc; this estimate is consistent with an ionizing radiation target size of 55±9 kDa. Therefore, prions may not be retained by most of the filters that efficiently eliminate bacteria and viruses. Additionally, prions aggregate into particles of non-uniform size and cannot be solubilized by detergents, except under denaturing conditions where infectivity is lost. Prions resist inactivation by nucleases, UV-irradiation at 254 nm, ‘ and treatment with psoralens, divalent cations, metal ion chelators, acids (between pH 3 and 7), hydroxylamine, formalin, boiling, or proteases.

Inactivation of prions. Prions are characterized by extreme resistance to conventional inactivation procedures including irradiation, boiling, dry heat, and chemicals (formalin, betapropiolactone, alcohols). While prion infectivity in purified samples is diminished by prolonged digestion with proteases, results from boiling in sodium dodecyl sulfate and urea are variable. Sterilization of rodent brain extracts with high titres of prions requires autoclaving at 132°C for 4.5 hours (h). Denaturing organic solvents such as phenol or chaotropic reagents such as guanidine isothiocyanate or alkali such as NaOH can also be used for sterilization. Prions are inactivated by 1N NaOH, 4.0 M guanidinium hydrochloride or isocyanate, sodium hypochlorite (>2% free chlorine concentration), and steam autoclaving at 132°C for 4.5 h. It is recommended that dry waste be autoclaved at 132°C for 4.5 h or incinerated. Large volumes of infectious liquid waste containing high titers of prions can be completely sterilized by treatment with 1N NaOH (final concentration) or autoclaving at 132°C for 4.5 h. Disposable plasticware, which can be discarded as a dry waste, is highly recommended. Because the paraformaldehyde vaporization procedure does not diminish prion titres, the biosafety cabinets must be decontaminated with 1N NaOH, followed by 1N HCI, and rinsed with water. HEPA filters should be autoclaved and incinerated.

Although there is no evidence to suggest that aerosol transmission occurs in the natural disease, it is prudent to avoid the generation of aerosols or droplets during the manipulation of tissues or fluids and during the necropsy of experimental animals. It is further strongly recommended that gloves be worn for activities that provide the opportunity for skin contact with infectious tissues and fluids. Formaldehyde-fixed and paraffinembedded tissues, especially of the brain, remain infectious. Some investigators recommend that formalin-fixed tissues from suspected cases of prion disease be immersed for 30 min in 96% formic acid or phenol before histopathologic processing, but such treatment may severely distort the microscopic neuropathology.

7. Containment Levels 1-4

What Are Containment Levels?

The containment system includes the **operational practices and facility design** elements. That is, engineering, technical and physical requirements for handling the organism safely in a laboratory research and/or clinical setting.

How Do I Choose The Appropriate Containment Level For My Research?

The **containment level** required for work with a particular agent **often correlates to its risk group,** but in addition, factors associated with the laboratory operation should also be examined. This **risk assessment of the work to be done with a specific agent** will provide the final determination of the required containment level and any special procedures for a given protocol.

The following factors associated with the specific **laboratory operation** should also be examined to determine if a higher or lower containment level would be more appropriate **OR if additional site-specific safety considerations need to be integrated in the protocol:**

-potential for aerosol generation
-quantity and concentration of material in use
-agent stability in the environment (inherent biological decay rate)
-type of work proposed (e.g., *in vitro* , *in vivo* , aerosol challenge studies)
-use of sharps
-complexity of procedure
-use of recombinant organisms (e.g., gene coding for virulence factors or toxins; host range
-alteration; oncogenicity; replication capacity; capability to revert to wild type

If a particular procedure, such as preliminary identification, poses a lower hazard than manipulation of a live culture, then a lower containment level may be appropriate. For example, primary diagnostic tests for HIV may be done in a containment level 2 physical laboratory with the use of containment level 3 operational protocols, but growing and manipulating a culture of HIV may require both containment level 3 physical facility and operational protocols.

On the other hand, an increase in containment may be required if the local risk assessment indicates that the procedures pose a higher risk, for example larger than routine laboratory scale, animal aerosol inhalation challenges.

Does This Guide Have All The Required Protocol?

In a university research setting, a biosafety guide can not provide specific guidance on all possible combinations of biological agents and procedures in use. Where there are specific U of M EHSO programs or guidelines that support a requirement, these have been described in the pertinent sections or the appendices. The unique research of the Permit Holders/Principal Investigators may however additionally require special site-specific protocol/safe work procedures and training to be developed and documented in the lab's biosafety manual.

At the U of M, the Biosafety Permit application and Project Approval Form help the PI/Permit holder to document this risk assessment in the context of the regulatory requirements. A review of the risk assessment by knowledgeable individuals is always beneficial and is supported through peer review by the BSAC as required for release of grant funds.

The Centers for Disease Control and Prevention/National Institutes of Health *Biosafety in Microbiological and Biomedical Laboratories (BMBL)* provides further guidance on carrying out a risk assessment and related information that can be used to assist in the risk assessment procedure. This information is also available by accessing the following Web site:
http://www.cdc.gov/biosafety/publications/bmbl5/index.htm

7.1 Work with Human Pathogens

PHAC 'Laboratory Biosafety Guidelines' (LBG) provide guidance for facilities working with human pathogens in Canada. The Tri-Council Agency and the Human Pathogens and Toxins Act reference these guidelines as the basis for work with biological agents. The Guidelines consider the following general practices to be required for all laboratories handling infectious substances.

7.1.1 General Operational Practices (PHAC- LBG- Section 3.1)

1. A documented procedural (safety) manual must be available for all staff, and its requirements followed; it must be reviewed and updated regularly.

2. Personnel must receive training on the potential hazards associated with the work involved and the necessary precautions to prevent exposure to infectious agents and release of contained material; personnel must show evidence that they understood the training provided; training must be documented and signed by both the employee and supervisor; retraining programs should also be implemented.

3. Eating, drinking, smoking, storing of food, personal belongings, or utensils, applying cosmetics, and inserting or removing contact lenses are not permitted in any laboratory; the wearing of contact lenses is permitted only when other forms of corrective eyewear are not suitable; wearing jewelry is not recommended in the laboratory.

4. Oral pipetting of any substance is prohibited in any laboratory.

5. Long hair is to be tied back or restrained so that it cannot come into contact with hands, specimens, containers or equipment.

6. Access to laboratory and support areas is limited to authorized personnel.

7. Doors to laboratories must not be left open (this does not apply to an open area within a laboratory).

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

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

10. Protective laboratory clothing, properly fastened, must be worn by all personnel, including visitors, trainees and others entering or working in the laboratory; suitable footwear with closed toes and heels must be worn in all laboratory areas.

11. Where there is a known or potential risk of exposure to splashes or flying objects, whether during routine operations or under unusual circumstances (e.g., accidents), eye and face protection must be used. Careful consideration should be given to the identification of procedures requiring eye and face protection, and selection should be appropriate to the hazard.

12. Gloves (e.g., latex, vinyl, co-polymer) must be worn for all procedures that might involve direct skin contact with biohazardous material or infected animals; gloves are to be removed when leaving the laboratory and decontaminated with other laboratory wastes before disposal; metal mesh gloves can be worn underneath the glove.

13. Protective laboratory clothing must not be worn in non-laboratory areas; laboratory clothing must not be stored in contact with street clothing.

14. If a known or suspected exposure occurs, contaminated clothing must be decontaminated before laundering (unless laundering facilities are within the containment laboratory and have been proven to be effective in decontamination).

15. The use of needles, syringes and other sharp objects should be strictly limited; needles and syringes should be used only for parenteral injection and aspiration of fluids from laboratory animals and diaphragm bottles; caution should be used when handling needles and syringes to avoid auto-inoculation and the generation of aerosols during use and disposal; where appropriate, procedures should be performed in a BSC; needles should not be bent, sheared, recapped or removed from the syringe; they should be promptly placed in a puncture-resistant sharps container (in accordance with Canadian Standards Association [CSA] standard Z316.6-95(R2000))[6] before disposal.

16. Hands must be washed after gloves have been removed, before leaving the laboratory and at any time after handling materials known or suspected to be contaminated.

17. Work surfaces must be cleaned and decontaminated with a suitable disinfectant at the end of the day and after any spill of potentially biohazardous material; work surfaces that have become permeable (i.e., cracked, chipped, loose) to biohazardous material must be replaced or repaired.

18. Contaminated materials and equipment leaving the laboratory for servicing or disposal must be appropriately decontaminated and labelled or tagged-out as such.

19. Efficacy monitoring of autoclaves used for decontamination with biological indicators must be done regularly (i.e., consider weekly, depending on the frequency of use of the autoclave), and the records of these results and cycle logs (i.e., time, temperature and pressure) must also be kept on file.

20. All contaminated materials, solid or liquid, must be decontaminated before disposal or reuse; the material must be contained in such a way as to prevent the release of the contaminated contents during removal; centralized autoclaving facilities are to follow the applicable containment level 2 requirements.

21. Disinfectants effective against the agents in use must be available at all times within the areas where the biohazardous material is handled or stored.

22. Leak-proof containers are to be used for the transport of infectious materials within facilities (e.g., between laboratories in the same facility).

23. Spills, accidents or exposures to infectious materials and losses of containment must be reported immediately to the laboratory supervisor; written records of such incidents must be maintained, and the results of incident investigations should be used for continuing education.

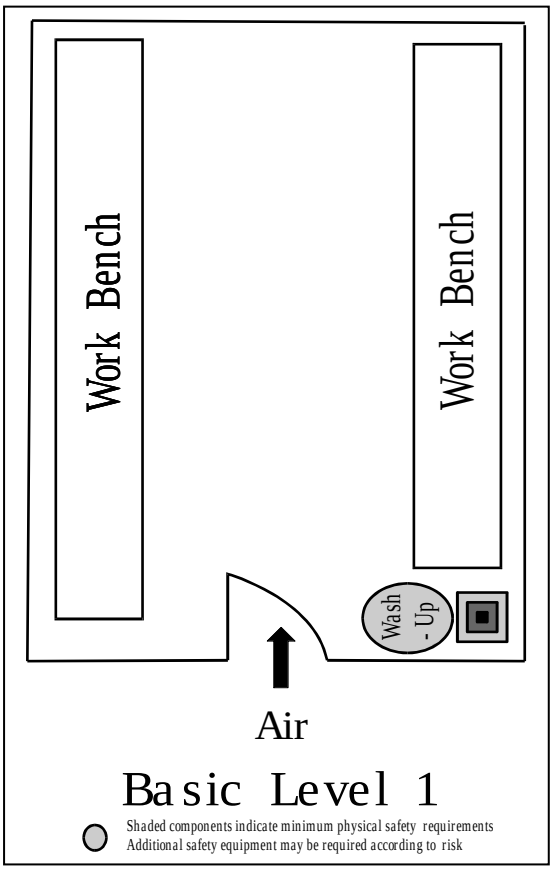
24. An effective rodent and insect control program must be maintained.

7.1.2 CONTAINMENT LEVEL 1

7.1.2.1 Laboratory Design and Physical Requirements:

- A well designed Biological laboratory with washable walls and countertops is acceptable.
- Separated from public areas by a door
- Hand wash station is required, as close to the exit as possible.
- Fly screens on windows
- Hooks for lab coats
- Street and lab wear separated

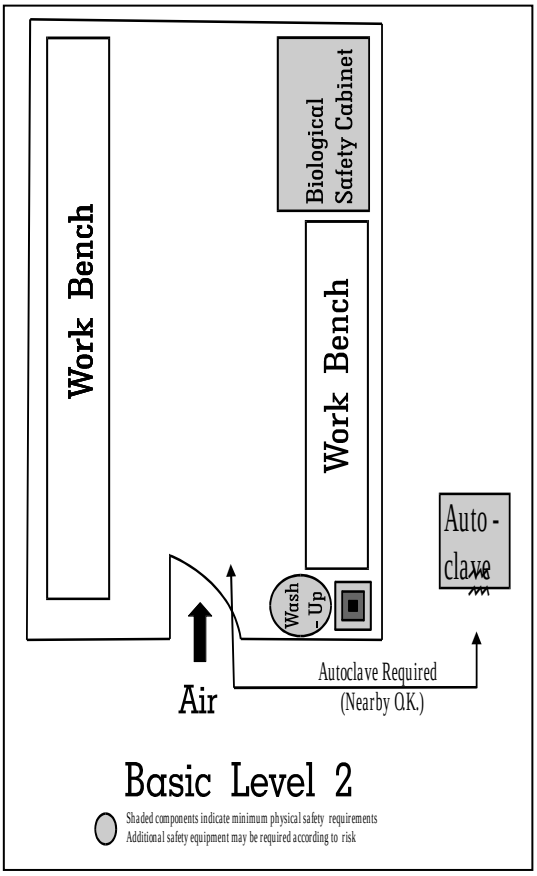
Autoclave: Availability of an autoclave in the building is desired but not required. Follow U of M guides for transport between floors and buildings available in Section 8.6.



7.1.2.2 Operational Practices:

- **As per general operational practices -See Section 7.1.1**
- Bench work with biological agents is acceptable.
- Follow all pertinent U of M Biosafety Guide requirements, e.g. signage, generic biosafety and WHMIS training
- Biohazardous waste disposal as per U of M Biohazardous Waste Chart including effective concentrations and contact times for disinfectants.
- Similar for waste autoclaving
- 'Good Laboratory Practices' as hand-washing and disinfections of countertops should be practiced

At the U of M
Responsible owners of biological material who have determined that their work with biological agents is appropriate for work at Containment Level 1, must apply for a Biosafety Permit and Biosafety Project Approval Certificate.



7.1.3 Containment Level 2

7.1.3.1 Laboratory Design and Physical Requirements:

As per Containment Level 1 **PLUS**

- Doors to Containment Level Lockable.
- Paper work areas can be within the lab provided they are located away from lab work areas
- Hand washing sink required, preferred near door and hands-free
- Work surfaces are intact and chemically and heat resistant
- Interior coatings gas and chemically resistant according to function
- Negative directional air flow into the labs preferred or work is to be done in a BSC.
- Emergency eye wash and shower as per ANSI standard.

Autoclave: Must be available in the building. An autoclave on the same or different floor is acceptable. Precautions when transporting infectious material to autoclave can be found in Section 8.5. The Lab/Area where the Autoclave is located must meet the all of the CL2 requirements

7.1.3.2 Operational Practices

In addition to the CL1 requirements the following describe the **minimum additional operational practices required for Containment Level 2. Additional U of M requirements that support these practices are found in Section 8.**

1. Good microbiological laboratory practices intended to avoid the release of infectious agents

2. BSCs must be used for procedures that may produce infectious aerosols and that involve high concentrations or large volumes of biohazardous material. Laboratory supervisors, in consultation with the Biological Safety Officer/Institutional Biosafety Committee, should perform a risk assessment to determine which procedures and what concentrations and volumes necessitate the use of a BSC. *See the PHAC e-learning modules and the lab poster in the Appendices for more information on aerosol producing procedures*.

3. Appropriate signage indicating the nature of the hazard being used (e.g., biohazard sign, containment level) must be posted outside each laboratory; if infectious agents used in the laboratory require special provisions for entry, the relevant information must be included on the sign; the contact information of the laboratory supervisor or other responsible person(s) must also be listed. *At the U of M this is the Workplace Hazard Information Placard (WHIP).*

4. Entry must be restricted to laboratory staff, animal handlers, maintenance staff and others on official business. *See also Section 8.2 Access Control.*

5. All people working in the containment area must be trained in and follow the operational protocols for the project in process. Trainees must be accompanied by a trained staff member. Visitors, maintenance staff, janitorial staff and others, as deemed appropriate, must also be provided with training and/or supervision commensurate with their anticipated activities in the containment area. *See Section 8.1 for more information on training at the U of M.*

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

7. MSDS must be available for all RG 2 and above biological agents

7.1.3.3 Containment Level 2 Enhanced & Containment Level 2+

Containment Level 2 enhanced and Containment Level 2+ are not 'official' PHAC or CFIA containment levels, however, these terms are starting to be used informally in the biosafety community. The U of M Biosafety program and Principal Investigators may use these terms to describe Containment Level 2 labs that have implemented or will be required to implement operational practices that are unique or at a level considerably above the norm for the area. *For example, authorizing access only to workers who are immunized to specific agents or those wearing special PPE during certain processes.*

Containment Level 2 enhanced is a term that the Biosafety program will use to describe Containment Level 2 facility design requirements coupled with additional operational or safe work practices or PPE as defined by the risk assessment of the Principal Investigator or Biological Safety Advisory Committee Project Approval Review Committee.

Containment Level 2 + is not an official category. It generally describes a situation where the risk assessment indicates that an appropriate measure of safety can be achieved with **Containment Level 2 facility design parameters, coupled with Containment Level 3 Operational Practises.** A description of these requirements can be found in the appendices.

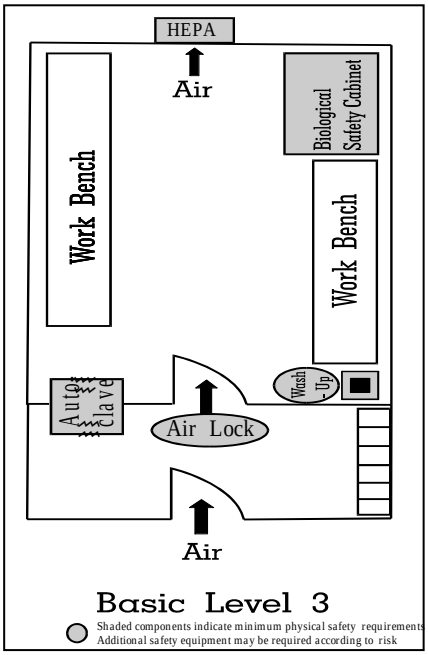
Where the Permit Holder's risk assessment has recognized that special requirements for access for trades/caretaking personnel will need to be implemented, the additional procedures need to be identified in the PI's Project Approval Certificate. If the procedures indicate that special caution door signs are required, these need to be approved through the Project Approval Certificate Form and reviewed by the BSAC.

7.1.4 Containment Level 3

Laboratory Design and Physical Requirements:
There are substantial engineering features designed into a Level 3 Laboratory such as air-tight perimeter of laboratory, air filtration, entry through an air lock, on-site autoclave and many other detailed requirements. THE DESIGN OF A LEVEL 3 LABORATORY SHOULD BE DONE WITH THE HELP OF A BIOSAFETY PROFESSIONAL.

At the U of M, PHAC is required to certify all Containment Level 3 facility prior to a U of M Biosafety Permit or Project Approval Certificate being issued. Contact the U of M Biosafety Officer to initiate this process.

PHAC has a variety of resource material available for the development of CL3 labs. Visit their web-site http://www.phac-aspc.gc.ca/ols-bsl/containment/index-eng.php



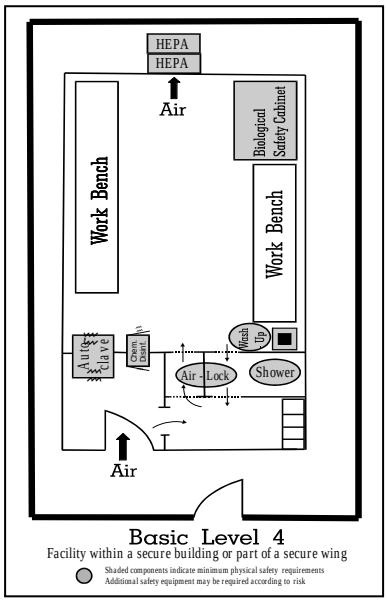
7.1.5 Containment Level 4

Risk Group 4 is assigned to infectious agents that present a high risk to the researcher and a high risk to the community in case of an escape from the laboratory. The agents are usually not endemic to the country or region where the work is being done.

Examples: Ebola virus and Lassa Fever virus.

Design features of a Containment level 4 lab include a self contained secure laboratory with many safety features within a secure building or wing of a building.

There are no Containment Level 4 labs at the U of M and only one in Canada.



7.2 Work with Animal and Zoonotic Pathogens

The Canadian Food Inspection Agency (CFIA) works to establish the biocontainment levels, procedures and protocols that are needed to work safely with animal and zoonotic pathogens and plant pests of quarantine significance, and to protect laboratory staff, the Canadian public, and the environment. http://www.inspection.gc.ca/english/sci/bio/bioe.shtml

Laboratories handling animal pathogens should refer to the Containment Standards for Veterinary Facilities to verify that their operational practices and physical containment facilities are adequate for the animal pathogen they wish to work with. Please note again that the animal containment level requirements may be more stringent than for the comparable PHAC Containment Level.

An Animal Containment Level 2 inspection checklist is available. Laboratories importing pathogens at Animal Pathogen (AP) containment level 2 will be required to submit this checklist along with the import permit application. They may be physically inspected by regional CFIA inspectors to ensure compliance with the conditions specified in the import permit concurrent with the import application or at a later date.

7.3 Work with Plant Pests

NEW! Containment Standards for Facilities Handling Plant Pests
http://www.inspection.gc.ca/english/sci/bio/plaveg/placone.shtml
Frequently Asked Questions
http://www.inspection.gc.ca/english/sci/bio/plaveg/biopve.shtml

7.4 Work with Aquatic Animal Pathogens

NEW! Containment Standards for Facilities Handling Aquatic Animal Pathogens
Frequently Asked Questions

7.5 Other resources

Foreign Animal Disease Diagnostic Laboratory Containment Standard

Biosafety Advisory for Veterinary Facilities Highly Pathogenic Avian Influenza - Interim Guidelines

8. U of M Biosafety -Operational Practices

In addition to the general practices for laboratories handling infectious substances described in the Laboratory Biosafety Guidelines, consider these to be required at the U of M. As part of the U of M Biosafety Program and permit application, PIs agree to follow/implement these U of M protocol or have alternate safe work practices approved by the Biological Safety Advisory Committee (BSAC).

8.1 Training

All the regulators are consistent in requiring that workers receive, and understand the training received, before beginning work with hazardous materials. The BSAC is committed to ensure that training remains an important aspect of the U of M biosafety program. This includes both general and laboratory-specific training in the handling of biohazardous material.

Training starts as soon as an individual joins a lab. The 'Generic WHMIS' training offered by the Departmental WHMIS Coordinator and the 'Generic Biosafety' offered by EHSO are there to ensure that certain information is provided. This training however, does not cover all the possible materials, hazards and safe-work practices and equipment scenarios in place at a large educational and research institute like the U of M.

Therefore, attendance at the EHSO Generic Biosafety training alone, is not adequate competency for working unsupervised with biohazardous materials. The PI is responsible for ensuring that lab-specific training is provided and competency in site –specific procedures is shown.

The following should be considered minimum for persons working unsupervised with biohazardous material.

8.1.1 Generic Training

1. Generic WHMIS and Basic Lab Safety or departmental equivalent and evaluation of competency by the **departmental WHMIS Coordinator.**
2. **EHSO Generic Biosafety** – Generally offered in September, January and May.
3. *PHAC Biosafety e-Learning and Training Resources Portal modules available at http://lab-bio.pensivo.com/index.php?fuseaction=public.home&id=1.*

*The Pathogen Regulation Directorate, **PHAC** and the Office of Biohazard Containment and Safety, **CFIA**, have developed **e-learning training modules that cover the basic concepts in Biosafety and expand on the information found in the Biosafety Guide**.*

The modules are available on the PHAC/CFIA e-Learning Portal . Select the Laboratory Biosafety and Biosecurity icon. You will need to register a user name, password and email address to log-in to the modules.

*The portal also contains **instructional videos on biosafety**. Upon logging-in you will find them in the top menu bar on the right under 'Tools and Resources/Videos'. It is recommended that after you complete the modules, you **watch the following two videos** which will review and pull together all the concepts covered in the modules*

- ***Biosafety 101***
- ***Containment Level 2 Laboratory: Operational Practices***

*The portal also contains a number of **Reference posters, procedures, and resource documents** that can be downloaded and printed.*

- ***Biosafety in the Laboratory***
- ***Procedures to Minimize Aerosol Hazards***

*Located at various points in the module are **.pdf resource files** on a variety of topics including:*

- ***PHAC Matrix for Assessment of Risk Group***
- ***PHAC Determination of Risk Group and Containment Level***

4. Lab personnel working with biological agents should also be familiar with the **EHSO Biosafety program Web site and links to pertinent resources including the 2012 Biosafety Guide and U of M Biohazardous Waste Disposal Chart** .

8.1.2 Laboratory-Specific Training

1. The Principle Investigator (PI) is responsible for ensuring that all personnel in their lab receive safety training in the site-specific protocol. The PI or designated alternate are the only people who can evaluate whether the new worker has received the appropriate information and is competent to work independently with the biological agents in their lab.
2. The document Laboratory Safety Checklist for New Lab Personnel, is a checklist that the PI can use to document that this training has been received. The checklist is intended as a basic resource document and the checklist is a list of the typical/major lab-related topics that would need to be addressed in such training. While some of the items on the list are very specific items, other items are more generic and will need to be expanded upon depending on the type of work being done in the particular lab.
3. Some more suggestions for lab-specific training include:
    a. Have new workers read the PI Biosafety Permit application and Permit, review the PI's bioagent inventory and read pertinent MSDSs, review any other risk assessment and project approval documents.
    b. Have new workers read the PI's Lab Biosafety manual and any other safe work procedures specific to the project and materials in use.
    c. Provide information on medical conditions that could make an individual more susceptible to the biohazardous agents used in the lab.
    d. Provide written protocol on how to initiate an emergency response in the lab/in the department including location of emergency safety equipment, spill clean-up, report accidents/incidents and post-exposure protocol.
4. Lab personnel should:
    a. Note any medical conditions that could make them as an individual, more susceptible to the biohazards available/used in their lab.
    b. Take note of symptoms of infection and modes of transmission.
    c. Inform their supervisor if they are at greater risk so that measures can be taken for their protection.
    d. Take note that if their health status changes, that this is again reported.
    e. Participate in other training as required by their PI or department. E.g. autoclave, centrifuge use training, shared equipment /area rules.
    f. Know how to initiate an emergency response; location of the emergency safety equipment, spill clean-up, report accident/incident and post exposure protocol.

Reference:
The U of M Governance Procedure- Lab Training Standard – is under review.

8.2 Access Control

8.2.1 Lab Signage

The U of M Workplace Hazard Information Placard (**WHIP**) is the standardized sign format at the U of M. All labs working with Controlled Substances (including biological agents) must have a WHIP. You will usually find this sign located right next to the lab door. Information for obtaining a WHIP can be found on the EHSO website @ http://umanitoba.ca/admin/human_resources/ehso/geninfo/signage.html

PHAC Containment Level 2 and greater labs require signage that includes the nature of the hazard being used (e.g. biohazard sign, containment level) and any special provision for entry.

At the U of M CL 1 labs will show a box with only CL1 displayed. CL 2 labs will show the Biohazard sign and CL2 displayed.

Where a PI's lab area is set-up in more than one room a WHIP sign is required for each room where biological agents are used or stored. Where the work is done in an open area or shared space, the WHIP risk assessment will need to be done by all involved. Please refer to the Appendix: **Guidelines for Open Area Labs and Shared Equipment Spaces.**

8.2.1.1 VERY IMPORTANT Additional Access Considerations:

CAUTION!
Entrance requirements in effect…….
After hours ……

RED BORDER SIGNS: EHSO has developed standardized red border signs to identify areas where additional **CAUTION** or **RESTRICTED ACCESS** conditions are required. Permit holders should consult with the BSO to obtain this signage or it may be specified as a condition on your Biosafety Project Approval Certificate.

1. All personnel should be aware that caretaking and trades personnel have **24/7**access to their labs. Caretaking staff have a Safe Job Procedure that limits their work in the lab to picking up non-hazardous waste and basic floor cleaning duties. **Caretakers are not trained to assist with biohazardous spill clean-up and cannot provide tools for this.**

2. Trades are trained to contact the persons listed on the WHIP before beginning service or maintenance work in the lab during regular working hours. However, they may also enter and walk through a lab to access adjacent mechanical rooms or check-out unusual circumstances, for example noises or leaks, during regular working hours or after-hours.

3. During regular working hours, the Permit holder is responsible for ensuring that the specific piece of equipment or area is decontaminated and cleaned before the work begins and/or that you or a responsible alternate person supervises the work of tradespeople in the lab. This may include for example, advising and providing any additional PPE. Physical Plant may also request that a decommissioning form is completed to document that any hazards have been identified and appropriate steps have been taken to decontaminate an area or piece of equipment.

4. If the PI risk assessment shows a requirement for **special/additional** access restrictions, these should be included in the information provided on the Project Approval Certificate form for review by the BSAC. For example this may include- additional immunizations or PPE, like wearing an N-95 respirator). These labs may be designated as CL2 enhanced or CL2+ on their Biosafety permit and may have additional conditions added to the PIs Biosafety Permit by the BSAC Project Approval Review.

8.2.2 Biosecurity

From the Laboratory Biosafety Guidelines:
- *"Today, facilities handling infectious agents need not only a biosafety program but also a biosecurity plan in place. .....biosecurity is implemented to prevent the theft, misuse or intentional release of pathogens.....,there is unfortunately a dual use potential in the nature of the work (i.e., procedures, equipment, etc.) that takes place with these agents."*

As part of a PI or departmental biosafety manual, a risk assessment is required to evaluate the scope and specific requirements for biosecurity. The following is a sample plan that should be considered the minimum default.

If this plan does not meet your specific requirements, provide your site-specific alternate plan in your lab binder and ensure training on the protocol.

U of M Sample plan:

1. Keep laboratory doors closed.
2. Keep laboratory doors locked when unoccupied.
3. Keep all stocks of other organisms locked during off hours.
4. Keep an accurate record of chemicals, stocks, cultures, project materials, growth media, and those items that support project activities.
5. Notify appropriate authorities (Security service and EHSO) if materials are missing from laboratories.
6. Inspect all packages arriving at the work area.
7. When research is completed for the day, ensure that chemicals and biological materials have been stored properly and securely.
8. Ask strangers (someone you do not recognize as a co-worker or support staff person) to exit the room if they are not authorized to be there.

8.3 Medical Surveillance

8.3.1 Immunizations –General Requirements

All new and current laboratory staff and students are advised and encouraged to consult with their personal health care provider to ensure that their general immunization status meets with current Manitoba Health/Canadian Immunization Guidelines.

- **PIs** must determine if any laboratory staff or students for whom they are responsible and who work with or near animal or human blood/body fluids or other human pathogens have an occupational risk of contracting a vaccine -preventable potentially infectious disease.
- Employees and students are encouraged to initiate discussions with supervisors regarding any immunization concerns they may have.
- PIs are responsible for documenting any requirements in their Lab site-specific safety manual as part of their Permit Risk Assessment and communicating this to new staff and students.

- For assistance in determining immunization requirements, an **Immunization Risk Assessment Worksheet** is available and can be submitted to the Occupational Health Coordinator (EHSO) phone 474-6633 for review and consultation. http://umanitoba.ca/admin/human_resources/ehso/media/090205RiskAssessmentForm.doc

- **The Immunization Record / Vaccination Declination Form** can be used to document immunization, or refusal with counseling.

- For work with Human Blood and Body fluids and Mammalian Cell lines the Hazard Assessment, including SWPs and Immunization recommendations, can be found in the Appendix and shall be the minimum standard at U of M.

Complete details of the U of M Immunization Standard are available at :
http://umanitoba.ca/admin/governance/governing_documents/staff/727.htm

Further information is also available on the EHSO website at
http://umanitoba.ca/admin/human_resources/ehso/media/ImmunizationAppAug06.pdf

8.3.1.1 Immunization Procedure

-as taken from the U of M Procedure: Immunization Standard. Some departments PIs may have their own specific procedure.

Currently employed staff (only) working at a University of Manitoba clinical or research laboratory and animal facility work site:
a) If a current staff member is at risk for a vaccine preventable potentially infectious disease, he/she will be advised of this immunization standard by the department/researcher and given the opportunity to receive immunization to protect against any occupationally related potential exposure.
b) The University will pay for the cost of any occupationally required immunization not covered by Manitoba Health for all current University of Manitoba staff.
c) Documentation of immunization will be provided by the health care provider on the appended immunization form (Appendix A) http://umanitoba.ca/admin/human_resources/ehso/occ_health_comp/Immunization.html and maintained in the employee's departmental office in accordance with PHIA guidelines.
d) If at risk staff members refuse to accept immunization, counseling and documentation must be obtained and stored in a similar fashion. Refer to **the Immunization Record/Vaccination Declination Form**
e) All current staff who refuse to safeguard their health through immunization shall be considered for any reasonable accommodation, including a transfer of employment. In no case shall an employee be placed at serious risk of contracting a vaccine preventable potentially infectious disease.

Current students working in a University of Manitoba clinical or research laboratory and animal facility work site:
a) If a current student is at risk for a vaccine preventable potentially infectious disease, he/she will be advised of this standard and it will be recommended that the student consult with a personal health care provider regarding immunization.
b) If a current at risk student refuses to accept immunization, he/she must still receive counseling regarding the risks the student will be accepting by the refusal. The same form (Appendix A) can be used to document that counseling has been received. http://umanitoba.ca/admin/human_resources/ehso/media/ImmunizationAppAug06.pdf
c) All current students who refuse to safegaurd their health through immunization shall be considered for any reasonalbe accomodation. In no case shall a student be placed at serious risk of contracting a vaccine preventable potentially infectious disease.

New staff or students who will be working at a University of Manitoba clinical or research laboratory and animal facility work site:
a) Contracts and/or agreements that govern acceptance of staff or students for positions or a course of study shall include a provision requiring the department to notify the incumbent staff or student of this procedure and shall include this procedure as an appendix.
b) Departments will confirm that staff and students have met the conditions of this procedure before beginning work with any of the identified vaccine-preventable potentially infectious material. A copy of the appended immunization form (Appendix A) can be used to document compliance and be kept in the departmental office in accordance with PHIA guidelines.

8.3.2 Post Exposure Protocol and Medical Surveillance Statements

For work with many Risk Group 2 and 3 biological agents, immunizations and/or prophylactic or post-exposure anti-microbials are not available. Working at the appropriate containment level and following documented procedures and safe work practices remains critical to protecting the health of workers.

Where a known incident/exposure occurs (e.g. sharps injury, unforeseen splash to mucous membranes, broken tubes, spill outside of the biosafety cabinet), an incident report shall be filed and post-exposure protocol as determined appropriate by the PI shall be initiated immediately. A **Post Exposure Protocol** (PEP) for animal and human blood and body fluids can be found in the Appendix 2 and3 and should be considered standard and immediately initiated. The PEP must be posted in the lab.

Original studies of laboratory acquired infectious (LAIs) and accidents indicated that up to 80% of LAIs could not be attributed to a known lab accident or exposure. Organisms transmitted through aerosols were considered to be the most plausible cause of these infections. Exposure was presumed to have occurred either by direct inhalation or through touching of surfaces where these aerosols may have landed and subsequent transmission from hand –to-mouth or other mucous membrane.

The PI is responsible for determining if a more extensive **medical surveillance program** is warranted to detect immunological exposures to any microorganisms used within their laboratory. For example, this may be as simple as including a statement in the PI's lab manual and training that states the symptoms of any illnesses associated with the microoganism(s) (refer to MSDS) and requires that if these symptoms appear, the workers must seek medical attention and give their health care provider a list of organisms and MSDSs with which they work. Alternately this may be as extensive as including initial serum banking, or annual or periodic medical evaluations.

8.4 PPE

Protective laboratory clothing, properly fastened, must be worn by all personnel, including visitors, trainees and others entering or working in the laboratory.

8.4.1 Shoes

- Suitable footwear with **closed toes and heels must** be worn in all laboratory areas.

8.4.2 Lab Coats

*Lab coats protect your clothes and your skin in the event of a reagent spill. They also help you avoid bringing contaminated clothing into your home***.**

Lab coats properly fastened,

- Should be worn at all times when in the lab
- Must be worn by all personnel, including visitors, trainees when working with controlled products.
- Should be in good repair and cleaned regularly -properly fastened means an adequate number of functional buttons or snap fasteners and with no major holes.
- Workers should have at least two lab coats: one to wear and one that is off for cleaning; three is preferred.

Protective laboratory clothing must not

- be stored in contact with street clothing
- be worn in non laboratory areas including offices, bathrooms, elevators, departmental libraries, coffee/lunch rooms, student carrels
- be taken home for laundering.

Refer to the APPENDIX for complete guidelines for lab coat use and care. Lab Coats used in a CL2 lab must be autoclaved or chemically decontaminated before laundering if they have been involved in a known exposure (versus general use and incidental contamination).

8.4.3 Gloves

- Gloves (e.g., latex, vinyl, co-polymer) must be worn for all procedures that might involve direct skin contact with biohazardous material or infected animals.
- Inside the lab area, gloves must not be worn when touching common fixtures. E.g. telephone, computer keyboard, door handles, printers/copiers, catalogues and reference books. If this creates an issue in your area you may need to develop specific alternate plans, e.g. keyboard covers, double glove/clean glove techniques etc.
- Gloves are to be removed when leaving the laboratory and decontaminated with other laboratory wastes before disposal.
- For some higher risk work additional gloves, for example, metal mesh gloves can be worn underneath the disposable glove.
- An additional risk assessment may be required for work with chemicals and require additional chemically resistant gloves.
- Change disposable gloves often.

8.4.3.1 Glove Selection

- Choose a glove that is appropriate for the task / chemical.
- Consult MSDS for any glove specifications for chemical hazards
- Consult supplier glove charts or check directly with manufacturer if unsure
- Check for pin holes in gloves before putting them on

8.4.4 Eye, Face and Respiratory Protection

- Personal Safety Glasses should be available for everyone in the lab and should be worn where there is a potential risk of splashes or flying objects
- ***All work with liquid nitrogen requires thermally resistant gloves, full face shield, lab coat, long pants and closed shoes and must only be done during regular working hours.***
- Vapour resistant goggles may be required based on specific procedures and risk assessments.
- Where the PI's risk assessment indicates the need for respiratory protection (e.g. N95, full face or half face N100 or other) all personnel must be fit tested and registered in the U of M respiratory protection program. Contact the EHSO main office (474-6633)

8.5 Decontamination

Laboratory Biosafety Guidelines, Chapter 8, provides the following information.

> "It is a basic biosafety principle that all contaminated materials be decontaminated prior to disposal. **Decontamination** includes both **sterilization** (the complete destruction of all microorganisms, including bacterial spores) and **disinfection** (the destruction and removal of specific types of micro-organisms). A list of various decontaminants, their effectiveness against different microbial groups, their important characteristics and their most appropriate application in research and clinical laboratories have been amply summarized by others[1-4]. It is the responsibility of all laboratory workers to ensure the effective use of products for decontamination of materials, equipment, and samples from containment zones; of surfaces and rooms; and of spills of infectious materials.
> These procedures represent a critical containment barrier whereby failure in the decontamination procedure can result in occupational exposure to infectious agents and/or the unintentional release of agents from a containment facility."

Every PI must have an operational protocol in place that includes 'how to use' instructions for an appropriate disinfectant. Effective disinfectants are recommended on each MSDS.

8.5.1 Definitions

Disinfection: Reduction in the number of microorganisms in or on an inanimate matrix to an acceptable level.

Sterilization: Complete destruction of all living or viable organisms (p=1/1x106)

8.5.2. Disinfecting with Bleach

Household Bleach (5.25% concentration of Sodium Hypochlorite, NaOCl) is widely recommended as a disinfectant to inactivate viruses and bacteria.

Activity	Dilution of Bleach- concentration of Bleach refers to Household Bleach -5.25% hypochlorite
Inactivation of HIV & Hepatitis B	Bleach diluted 1:10 ≅0.50% NaOCl (5,000 ppm)

Routine wipe down of surfaces:	Bleach diluted 1:100 ≅ 0.05% Sod. Hypochlorite (NaOCl) (500 ppm)
For Biohazard Spills	Bleach diluted 1:5 ≅ 1.0% Sod. Hypochlorite NaOCl (10,000 ppm)

NOTE:

- **Working dilutions should be prepared daily or at a minimum, weekly.** Full strength household bleach (Javex) looses most of it's activity in six months at room temperature. The rate of break down accelerates rapidly at low dilutions.
- Sodium hypochlorite is corrosive to metals and prolonged contact with metals, particularly at high concentrations, should be avoided. Alternately ensure that surfaces are rinsed with water and alcohol after the appropriate contact time with the bleach.
- Bleach rapidly looses its effectiveness in the presence of organic material and a higher concentration or alternate disinfectant should be used.

Biohazard Spills – Spill clean-up details can be found in the PHAC e-learning modules and in **the Appendix.**

8.5.3 Disinfecting with Alcohol

70% Ethyl or 70% isopropyl alcohol are effective against many bacteria and viruses. Alcohols are non-corrosive, BUT are flammable have a high evaporation rate. Ensure that you can maintain effective contact times.

8.5.4 Other Disinfectants

Phenolics:	(Lysol, Fullphene)
Iodophores:	(Wescodyne)
Gluteraldehydes:	Cidex
Quaternary Ammonium Compounds:	(not considered a high level disinfectant)

For any disinfectant:

1. Use as per manufacturer's directions. Obtain Material Safety Data Sheet (MSDS)
2. Perform your 'In Use' test if possible, using your 'Target' organism with the disinfectant which is prepared under local conditions, i.e. – dilute with local water and use under actual protein load –or -
3. For general surface disinfectants, look for independent laboratory test results which may show antimicrobial activities against any one of these:
   Staphyloccus aureus, Mycobacterium bovis , Salmonella typhimurium, Pseudomonas aeruginosa, Polio virus, Rota virus.

8.6 Biohazardous Waste Disposal

Please note that in most areas, waste disposal and landfill regulations are a Civic responsibility and therefore the procedures can vary a great deal from institution to institution. For example at the U of M we do not allow autoclave bags that are coloured or printed with the biohazard logo or words. At some institutions this is mandatory.

Please refer the section 8.6.2 when developing your protocol. The information in that section is also provided in the **Biohazardous Waste Disposal Chart found in the Appendix and on the web. The Waste Disposal Chart must be posted in each lab as a condition of the permit.**

Each PI or supervisor must establish appropriate protocol for their agents and methods. Waste disposal is an integral part of every experiment and each lab has site specific variations.

8.6.1 Biohazardous Waste – What is Included?

Biohazardous waste includes material that contains biological material or substances present in or arising from the work environment that are infectious or potentially contain material that may present a hazard to the health of the worker or community.

- Cultured animal cells and the potentially infectious agents which these cells may contain
- Primate body fluids and other potentially infectious clinical specimens
- Tissue or microbial cultures, and materials contaminated by such cultures, stocks or specimens of micro-organisms
- Containers or materials saturated with blood products
- Parasites
- Allergens
- Plant viruses, bacteria, fungi
- Toxins (bacterial or plant)
- Vaccines
- Human and animal anatomical waste (body parts or organs)
- Animal anatomical waste (carcasses, body parts, organs and tissue from experimental animals including animal dander)

8.6.2 Developing Site-Specific Waste Disposal Protocol

- **All waste should be segregated at source**.
- **Only clear/opaque autoclave bags**. No coloured or printed autoclave bags.
- As per WHMIS regulations all biohazardous waste must be clearly labeled with the Biohazard label when it is biohazardous, (including in the lab and during transport) and have all biohazard labels removed after decontamination. Use Biohazardous Tape or ensure support stands AND transport containers have the Biohazardous Waste Label.
- All biohazardous waste, must be appropriately decontaminated (treated) before final disposal regardless of risk level of agent. You must consult with the safety office to receive an exemption from decontaminating your biological material before disposal
- Containers with a biohazard sign may only be used for biologically contaminated material and not for other types of waste.(e.g. ethidium bromide or other chemical or radioactive waste must have their own appropriate container and hazard logo).
- Acceptable methods of treatment include steam autoclaving, chemical decontamination and incineration. Not all methods are appropriate for all types of waste. See (page24) for recommendations on disinfectants and refer to the APPENDIX for requirements for autoclaving waste. EHSO may be contacted for consultation.
- Biohazardous waste containers must hold the waste without leaking, puncturing or tearing and must be disinfectable. NO cardboard boxes..
- **Transport of untreated biohazardous material between floors must be in secondary containers with a secure lid. At a minimum, containers should be surface disinfected before leaving the lab and again after removal of biomedical waste. Transport should be done using service elevators (if available) and not on passenger elevators.**
- All biohazardous waste must be left secured at all times (Do Not leave it in hallways)

- Biohazardous wastes should be disposed of frequently to reduce accumulation in the laboratories. Daily is preferred, minimum is weekly. If weekly, the container MUST have a lid.

8.6.3 Autoclaving Guidelines

8.6.3.1 Radioactive Waste May Not Be Autoclaved.
Biohazardous Wastes involving radioisotopes are considered mixed waste. Follow directions given in the U of M "Waste Disposal Chart for Radioisotope Users" or contact Radiation Safety Co-ordinator-789-3613

8.6.3.2 Biohazardous Waste Involved With Chemicals May Not Be Autoclaved
These are also considered mixed wastes. For further information and/or guidance contact Environmental Health & Safety Office 474-6633.

8.6.3.3 Autoclave Parameters

- A minimum of 1 hr autoclave time @ 121°C (40 minutes @132°C) unless you can prove valid decontamination in less. This also assumes that number, size and distribution of the bags in subsequent loads remains relatively similar to the test load.
- Documented waste autoclave log books containing date, origin of waste, number of bags, autoclaving time and temperature.
- Autoclave chart recording is kept for waste autoclaving loads.
- Maintain an autoclave maintenance and repair log.
- A minimum of monthly biological indicator testing in “as used” scenario.
- Refer to the APPENDIX for other biological indicator testing and autoclave efficacy testing guidelines and sources for biological indicators.

8.6.3.4 Solid Biohazardous Waste
e.g. petri dishes, tissue culture flasks, plastic test tubes (but not sharps, glass, rigid tips)

- Collect in a plain clear autoclave bags, autoclave and then over-pack **in dark garbage bags for disposal.** In this manner they can be disposed of as regular trash with the caretakers.
- They must still be clearly labelled “BIOHAZARDOUS” in the lab and during transport before autoclaving as warning to other laboratory and custodial staff.
- Biohazard labelling must be removed after autoclaving.
- It is recommended that autoclave tape is used as well and left on as indication of decontamination status.
- Consult with EHSO for disposal of mixed waste.

8.6.3.5 Biomedical Sharps-
Biomedical Sharps represent both a physical and potentially infectious hazard.
The disposal of Biomedical Sharps is subject to the City of Winnipeg By-Law No.6001/92

Biomedical Sharp	Source of contamination	Method of collection	Final disposal
Needles, syringes, razor and scalpel blades	Biological only (any type of biohazard)	Follow steps #1-7 below	Through EHSO hazardous waste program
	Chemical only	Follow steps # 1-5 below	Through EHSO hazardous waste program
	Radioactive only	Follow steps #1-5 below	Through EHSO hazardous waste program
	Mixed Waste	Consult with EHSO	Consult with EHSO
Any glass, plastic or metal object which can be reasonably expected to cut or puncture an	human or animal blood, tissues, body fluids but no mixed waste	Follow steps #1-7 below	Through EHSO hazardous waste program

individual's body(examples: broken glass test tube, glass pasteur pipettes, rigid pipetteman tips, microscope slides)	If contaminated with biohazardous waste other than human or animal blood and tissues or body fluids but no mixed waste e.g. cell lines or microbial cultures	Collect and decontaminate as in Glass Biohazardous Waste below.	Can be disposed through caretaker – following 9.3 Glass Biohazardous Waste below

- Recapping of needles is prohibited. Needles and other sharps shall not be bent, sheared or purposely broken. The entire syringe and needle assembly must be disposed of into the sharps container of appropriate size.
- After using, sharps must be deposited only into an approved, appropriately labelled sharps container. An approved container would be non-breakable, rigid, puncture-resistant, autoclavable or chemically resistant container as per method of disposal, and labeled with the biohazard warning logo.
- A non-removable lid with a mail-slot type opening that does not allow access to the disposed material is preferred. (consult EHSO if you have questions).
- Sharps containers must not be filled to more than ¾ of their total volume and contents must be secured with a tightly fitting lid when ¾ full.
- These containers are not to be reused as all sharps containers are to be disposed of through the hazardous waste program
- If contaminated with Biohazardous material the container and contents should be autoclaved or otherwise appropriately decontaminated.
- Leave autoclave tape on the sharps container as indication that the biohazardous material has been autoclaved.

8.6.3.6 Glass Biohazarodus Waste

Examples- any glass, plastic or metal object which can be reasonably expected to cut or puncture an individual's body(examples: broken glass test tube, glass pasteur pipettes, rigid pipetteman tips, microscope slides) ***and has only*** *been in contact with biohazardous material* ***other than*** *human or animal blood, tissues, body fluids*.

- Collect in the lab in a non-breakable, rigid, autoclavable or chemically resistant container, labeled with the biohazard warning logo. These containers can be of the reusable type. E.g. see examples at end of section
- Decontaminate and remove labeling. Package into a plastic bag lined, sturdy cardboard container, securely taped shut and labeled "Broken Glass" prior to disposal as regular trash with the caretakers.
- **Serological pipettes** (for example 1-25 ml) Glass or plastic, disposable or reusable, serological pipettes should only be collected and autoclaved in puncture resistant containers. Intact, they are typically not able to puncture the skin, but they do easily puncture autoclave bags creating a potential physical hazard and potential biohazardous spill hazard. If they break inside the autoclave bag, they are a definite sharps hazards. We have had U of M caretakers harmed by improperly disposed serological pipettes.

8.6.3.7 Liquids

Biohazardous agents in a non-hazardous, water soluble liquid, once sterilized by a method that is proven effective may be poured down the laboratory drain with copious amounts of water. See 'Disinfection' page 24 of University of Manitoba "Biosafety Guide"

8.6.3.8 Animal Anatomical Waste-(excluding preserved specimens)

- Must be refrigerated at 4° C or lower. Carcasses are to be placed in carcass bags (double bagged) and stored in a designated freezer until disposal.
- Consult Radiation Safety manual for disposal of radioactively contaminated pathological waste.
- Consult Central Animal Care Services manual for the appropriate disposal of animal waste and carcasses. Refer to S.O.P. # F3, F11, F13.
- **Bannatyne Campus:** - Contact Bob Madziak (Central Animal Care Services) 789-3362 for in-house incineration at the Chown Building. Check with your department or Unit for any special steps such as keyed access etc., that are required.

- **Fort Garry Campus**: - Contact Terry Smith (Zoology Department) 474-6873 for in-house incineration.
  - Check with your department or Unit for any special directives.
  - Consult with EHSO hazardous waste for disposal of human anatomical material.

8.6.3.9 Specific Questions about Laboratory Waste Disposal –Contact the Environmental Management Program Co-ordinator 474-6316

Treated biohazardous waste that is to be land filled through regular means, should not display biohazards signs or other labelling that could give the impression that the waste is still biohazardous. Waste is moved through a compacting system at both Fort Garry and Bannatyne campuses. This process could potentially rip the outer dark garbage bags and expose the coloured or labelled bags giving the impression that the waste poses a risk that is higher or different than what it actually is. The use of orange or other autoclave bags with pre-printed biohazard warning logos or words is <u>still</u> acceptable for the disposal of biohazardous material that is to be <u>incinerated.</u>

Plain clear autoclave bags are available in a variety of sizes Fisher Catalogue (2001)is one source:

Cat # 01-826, 01-814-(1-3) but not (A-D), 01-832	-page 42-43
Biohazard Warning Tape -250 labels/role, Cat# 11-884-7	-page 939
Autoclave Indicator Tape	-page 41

9. Biological Safety Equipment

9.1 Biological Safety Cabinets (BSCs)

When properly maintained and used in conjunction with good laboratory techniques, BSCs provide effective primary containment for work with human pathogens. Biological Safety Cabinets offer protection from aerosols only, not from vapours, and are no substitute for good aseptic technique.

In containment level 2 facilities, BSCs are used for procedures with the potential to produce infectious aerosols and for high concentrations or large volumes of infectious material. Every employee working in a BSC must be trained in its correct use and have a good understanding of the different types of cabinets and how they work.

Chapter nine of the Laboratory Biosafety Guidelines has a detailed discussion on the **different types of biological safety cabinets** as well as specific information on the safe use of the cabinets which is reproduced in the section below. Virtually all the BSC at the U of M are of the Class ll Type A or B variety.

9.1.1 Purchase of Biological Safety Cabinets

The U.S. Department of Health and Human Services (Centers for Disease Control and Prevention and National Institutes of Health) has a comprehensive guideline on the Selection, Installation and Use of Biological Safety Cabinets (http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5_appendixA.pdf).

The guide includes pictures and diagrams of all the different classes of cabinets.
As well, information can be found on the web site of the manufactures listed on the next page.

WHAT ARE YOUR NEEDS?

- Personal Protection only?
- A Sterile Work Area?
- Both – a sterile work area and personal protection?
- Are you handling minute amounts of volatile chemicals with infectious substances?
- Will you be using Radioactive Material?
- Do you need a 4 foot or 6 foot cabinet? (Mark a 4 foot and 6 foot section of a laboratory bench and test the position of all materials you need to place in a cabinet on this section to establish your needs.)
- Look for a unit that has been certified by National Sanitation Foundation Standard NSF-49 for performance and design standards and CSA label for electrical compliance when purchasing a cabinet. Class II cabinets only. Class I and III cabinets are not certified by NSF-49 Standards.
- Examine ergonomic factors of different models (30" vs 36" height, footrest etc.) and
- Finally look at the cost of cabinets.
- The Safety Office will advise on the purchase of Biological Safety Cabinets.

The following manufacturers have cabinets that are certified by NSF-49:

The Baker Co.
P.O. Drawes E. Sanford, Maine 04073
1-800-992-2538

Forma Scientific Inc.
P.O. Box 649 Marietta, OH 45750-0649
1-800-843-3080

Microzone Corp.
Box 11336, Station H. 25 Northside Rd, Nepean, ON
613-829-1433

NuAire Inc.
2100 Fernbrook Land,
Plymouth, Minnesota 55447
1-800-328-3352

Labconco
8811 Prospect Avenue
Kansas City, MO 64132
1-800-821-5525 or 816-333-8811

9.1.2 Proper Use Of Biological Safety Cabinets

When properly installed and certified, these cabinets protect your work area, the environment and the worker from infectious aerosols. To maximize this protection, the worker must understand the workings of the cabinet and follow a strict working protocol.

PHAC/CFIA e-Learning Module 8 provides excellent discussions and videos of the proper use of BSCs and a printable reference sheet for work practices in the BSC.

Annual certification is required to recalibrate the cabinet to CSA-Z316.3.95 or NSF-49 performance standards. The following provides information on **BSC Certification information for the U of M**

Follow these **start-up procedures** when preparing for work in the BSC:

1. Turn off UV lights if in use and ensure that the sash is in the appropriate position.
2. Turn on fluorescent light and cabinet blower, if off.
3. Check the air intake and exhaust grilles for obstructions.
4. If the cabinet is equipped with an alarm, test the alarm and switch it to the "on" position.
5. Confirm inward airflow by holding a tissue at the middle of the edge of the viewing panel and ensuring that it is drawn in.
6. Disinfect the interior surfaces with a suitable, noncorrosive disinfectant.
7. Assemble all materials required for the procedure and load them into the cabinet; do not obstruct the air grilles; the working surface may be lined with absorbent paper with plastic backing; segregate "clean" items from "contaminated" items.
8. Wait 5 minutes to purge airborne contaminants from the work area.

Follow these procedures for **working in the cabinet** :

1. Don protective clothing and gloves as appropriate.
2. Perform operations as far to the rear of the work area as possible.
3. Avoid movement of materials or excessive movement of hands and arms through the front access opening during use; when you do enter or exit the cabinet, do so from straight on; allow the cabinet to stabilize before resuming work.
4. Keep discarded, contaminated material to the rear of the cabinet; do not discard materials in containers outside of the cabinet.
5. Do not work with open flames inside the cabinet.
6. If there is a spill during use, surface decontaminate all objects in the cabinet; disinfect the working area of the cabinet while it is still in operation (do not turn the cabinet off).

Follow these procedures upon **completion of the work** :

1. Allow the cabinet to run for 5 minutes with no activity.
2. Close or cover open containers before removing them from the cabinet.
3. Surface disinfect objects in contact with contaminated material before removal from the cabinet.
4. Remove contaminated gloves and dispose of them as appropriate; wash hands.
5. Don clean gloves, and ensure that all materials are placed into biohazard bags within the cabinet.
6. Using a suitable non-corrosive disinfectant (e.g., 70% ethanol), disinfect interior surfaces of cabinet; periodically remove the work surface and disinfect the area beneath it (including the catch pan) and wipe the surface of the UV light with disinfectant.
7. Turn off the fluorescent light and cabinet blower when appropriate (some cabinets must be left on at all times; if you are unsure, check with your cabinet certifier, safety officer or building maintenance personnel).
8. Turn on the UV light if appropriate (do not turn on when people are working close by); UV must be tested to ensure that it is emitting a germicidal wavelength (ask your cabinet certifier to perform this test).

9.2 Centrifugation

Centrifugation of Level 2 and Level 3 agents should be done in aerosol proof safety tubes or rotors. Tubes with screw-on tops should be used instead of snap –on tops.

These tubes or rotors must only be opened in a Biological Safety Cabinet.

9.3 References

1. 'Laboratory Biosafety Guidelines' 3rd Edition -2005 Public Health Agency of Canada
2. 'Biosafety In Microbiology and Biomedical Laboratories' CDC-NIH, 4th Edition – 1999 U.S. Dept. of Health and Human Sciences
3. Canadian Standard Association Z316.3 'Biological Containment Cabinets (Class I and II)
4. NSF International (NSF) Standard 49Class II (Laminar Flow) Biohazard Cabinetry
5. Containment Standards for Veterinary Facilities' 1st Edition – 1996 Agriculture and Agri-Food Canada
6. 'Biohazards Reference Manual' Reprinted 1986 American Industrial Hygiene Association

9.4 Other Web Resources And References

Others:

Latex Glove information
http://www.sustainablehospitals.org/HTMLSrc/IP_Latex_GloveFacts.html

European Federation of Biotechnology:
http://www.boku.ac.at/iam/efb/efb_wp.htm

EPA website on antimicrobial pesticides:
http://www.epa.gov/oppad001/