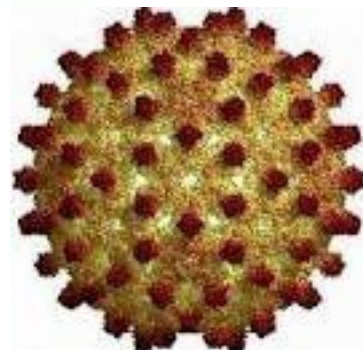
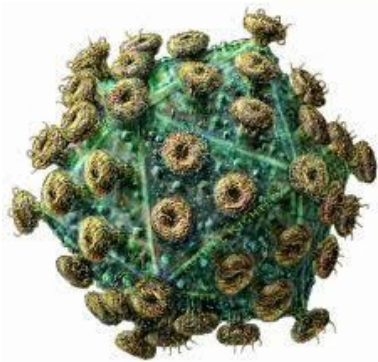




# ENVIRONMENTAL AND EMERGENCY MANAGEMENT ENVIRONMENTAL HEALTH AND SAFETY

## I. EXPOSURE CONTROL PLAN

Compliance with OSHA Bloodborne Pathogen Standard  
29 Code of Federal Regulations 1910.1030





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## I. INTRODUCTION

### **OSHA BLOODBORNE PATHOGEN STANDARD - 29 CFR 1910.1030<sup>1</sup>**

Blood and other potentially infectious materials have long been recognized as a threat to the health of employees who may be exposed to these materials by percutaneous contact (penetration of the skin). Injuries from contaminated needles and other sharps have been associated with an increased risk of disease from more than 20 infectious agents. The primary agents of concern in current occupational settings are the human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV).

To reduce the health risk to workers whose duties involve exposure to blood or other potentially infectious materials, Occupational Safety and Health Administration (OSHA) promulgated the Bloodborne Pathogens (BBP) standard (29 CFR 1910.1030) on December 6, 1991 (56 FR 64004). The provisions of the standard were based on the agency's determination that a combination of engineering and work practice controls, personal protective equipment (PPE), training, medical surveillance, hepatitis B vaccination, signs and labels, and other requirements would minimize the risk of disease transmission.

### **UMASS LOWELL BLOODBORNE PATHOGEN PROGRAM**

The UMass Lowell Department of Environmental Health and Safety (EHS) is committed to providing a safe and healthy work environment for students, faculty, and staff. The Bloodborne Pathogen (BBP) Program has been developed with the purpose to eliminate or minimize occupational exposure and covers all students, faculty and staff who could “reasonably be anticipated” to be exposed to human blood, body fluids, or other potentially infectious materials. The BBP Program identifies personnel at risk by reviewing job descriptions and tasks prior to job placement and provides further opportunities to employees during training.

EHS has developed an Exposure Control Plan (ECP) that provides all guidelines, practices, and procedures for the safe handling of BBP; and an ECP-Supplement that should be customized by the person in charge of any facility, lab, group and/or Principal Investigator (PI), where BBP and other infectious materials are handled. Vaccination against Hepatitis B and personal protective equipment (PPE) is offered free of charge to all participants of the program.

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<sup>1</sup> [Osha.gov/laws-regs/regulations/standardnumber/1910/1910.1030](https://www.osha-slc.gov/laws-regs/regulations/standardnumber/1910/1910.1030)





## II. UMASS LOWELL-EXPOSURE CONTROL PLAN

### Purpose

In accordance with OSHA Standard 29 Code of Federal Regulation (CFR) 1910.1030, EHS has created this Exposure Control Plan (ECP) with the purpose to eliminate or minimize student, faculty, and staff occupational exposure to blood, body fluids or other potentially infectious materials. The ECP is a key document that allows the UMass Lowell administration to comply with the OSHA Bloodborne Pathogen (BBP) Standard and to protect the university community.

### Definitions

The following terms and definitions are used in this ECP and in the Bloodborne Pathogen Standard.

**Blood** means human blood, human blood components, and products made from human blood.

**Bloodborne Pathogens (BBP)** means pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV) and human immunodeficiency virus (HIV).

**Clinical Laboratory** means a workplace where diagnostic or other screening procedures are performed on blood or other potentially infectious materials.

**Contaminated** means the presence or the reasonably anticipated presence of blood or other potentially infectious materials on an item or surface.

**Contaminated Laundry** means laundry that has been soiled with blood or other potentially infectious materials.

**Contaminated Sharps** means any contaminated object that can penetrate the skin including, but not limited to, needles, scalpels, broken glass, broken capillary tubes, and exposed ends of dental wires.

**Decontamination** means the use of physical or chemical means to remove, inactivate, or destroy bloodborne pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handling, use, or disposal.

**Engineering Controls** means controls (e.g., hand-washing facilities, biological safety cabinets, sharps disposal containers, self-sheathing needles, and other safer medical devices such as sharps with engineered sharps injury protections and needleless systems) that isolate or remove the bloodborne pathogens or sharps hazard from the workplace.

**Exposure Incident** means a specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with blood or other potentially infectious materials that result from the performance of a person's duties.

**Handwashing Facilities** means a facility providing an adequate supply of running potable water, soap and single use towels or hot air-drying machines.

**Licensed Healthcare Professionals** are professionals who are legally permitted to independently perform the activities required for hepatitis B vaccination and post-exposure evaluation and follow-up.

**HBV** means hepatitis B virus.

**HIV** means human immunodeficiency virus.

**Needleless Systems** means a device that does not use needles for:

- The collection of bodily fluids or withdrawal of body fluids after initial venous or arterial access is established;
- The administration of medication or fluids;
- Any other procedure involving the potential for occupational exposure to bloodborne pathogens due to percutaneous injuries from contaminated sharps.

**Occupational Exposure** means reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties.

**Other Potentially Infectious Materials (OPIM)**

- The following human body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic

- fluid, saliva in dental procedures, any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids;
- Any unfixed tissue or organ (other than intact skin) from a human (living or dead);
  - HIV-containing cell or tissue cultures, organ cultures, and HIV- or HBV-containing culture medium or other solutions; and blood, organs, or other tissues from experimental animals infected with HIV or HBV.

**Parenteral** means piercing mucous membranes or the skin barrier through such events as needle sticks, human bites, cuts, and abrasions.

**Person(s)/Personnel** in the UMass Lowell-ECP means all individuals, faculty, staff, and students working in settings where potential exposure can occur.

**Personal Protective Equipment (PPE)** is specialized clothing or equipment worn by persons for protection against a hazard. General work clothes (e.g., uniforms, pants, shirts, or blouses) are not intended to function as protection against a hazard, and are not considered to be PPE.

**Regulated Waste** is the term used for the following type of materials:

- Liquid or semi-liquid blood or other potentially infectious materials;
- Contaminated items that would release blood or other potentially infectious materials in a liquid or semi-liquid state if compressed;
- Items that are caked with dried blood or other potentially infectious materials and are capable of releasing these materials during handling;
- Contaminated sharps;
- Pathological or microbiological wastes containing blood or other infectious materials as body fluids or secretions.

**Research/Teaching Lab** means a laboratory where human materials or other potential infectious materials are used.

**Sharps with Engineered Sharps Injury Protections** means a non-needle sharp or a needle device used for withdrawing body fluids, accessing a vein or artery, or administering medications or other fluids, with a built-in safety feature or mechanism that effectively reduces the risk of an exposure incident.

**Source Individual** means any individual, living or dead, whose blood or other potentially infectious materials may be a source of occupational exposure to the

person. Examples include, but are not limited to: hospital and clinic patients, clients in institutions for the developmentally disabled, trauma victims, clients of drug and alcohol treatment facilities, residents of hospices and nursing homes, human remains, and individuals who donate or sell blood or blood components.

**Sterilize** means the use of a physical or chemical procedure to destroy all microbial life including highly resistant bacterial endospores.

**Universal Precautions** is an approach to infection control. According to the concept of Universal Precautions, all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV, and other bloodborne pathogens.

**Work Practice Controls** means controls that reduce the likelihood of exposure by altering the manner in which a task is performed (e.g., prohibiting recapping of needles by a two-handed technique).

## **Responsibilities**

### **Environmental Health & Safety (EHS)**

1. Take the lead in identify and determining employment positions considered at risk of “occupational exposure” to bloodborne pathogens within each department and specify those tasks or procedures in which occupational exposure is likely to occur;
2. Provide guidance and supervision to ensure compliance with the implementation of the Exposure Control Plan;
3. Assist departments, schools, laboratories and facilities in determining appropriate PPE, work practices, engineering controls, and housekeeping schedules;
4. Support schools, laboratories, and facilities to establish a program for evaluating and handling sharps with safety devices design to eliminate or minimize occupational exposure;
5. Provide training programs for all employees who have potential occupational exposure to bloodborne pathogens and maintain a master file of employees trained in this program;
6. Coordinate Hepatitis B vaccinations for all persons covered by the UMass Lowell-ECP;
7. Manage and coordinate biowaste disposal according to federal and state regulations;
8. Supervise and coordinate emergency response to accidental exposure to blood or

other potential infectious material (OPIM);

9. Maintain, review, and update the UMass Lowell-ECP annually and whenever necessary to include new or modified tasks and procedures.

### **Department Heads and Directors**

1. Assist EHS and Human Resources (HR) in determining those employment positions or tasks that qualify for reasonable anticipation of exposure to bloodborne pathogens;
2. Provide a budget for maintaining necessary PPE for all personnel working in settings where potential exposure can occur;
3. Enforce all elements of the ECP within the work setting;
4. Ensure that all new and existing employees receive information and are familiar with all elements of the ECP.

### **Faculty, Lab Managers, Lab Supervisors and Principal Investigators (PIs)**

1. Customize the ECP for specific work done in their laboratory;
2. Ensure that all personnel working under their supervision follow the UMass Lowell-ECP;
3. Provide training to their respective students in specific techniques;
4. Provide personnel working in the lab with appropriated PPE.
5. Report incidents and/or accidents involving exposures to infectious materials within 24 hours to: HR and EHS;

### **Employees**

1. Attend required training sessions on controlling exposure to bloodborne pathogens in the workplace;
2. Comply with all elements of the ECP that apply to work-related tasks and procedures with potential for exposure;
3. Report all exposure incidents to work supervisors or other responsible parties.

## **UMass Lowell Institutional Biosafety Committee (UMass Lowell-IBC)**

1. Oversee all research work involving human and biological materials;
2. Review and approve all research or teaching activities involving biological, blood, or other potentially infectious materials.

## **Licensed Healthcare Professionals**

Employees (i.e. faculty, staff, and graduate students) can receive occupational health services from Occupational Health Medicine Program Lowell General Hospital.

### **Occupational Health Medicine Program Lowell General Hospital**

1. Provide the HepB vaccination to faculty and staff referred by EHS;
2. Provide determination of titer for HepB immunity if necessary;
3. Evaluate employees reporting exposure incidents and provide appropriate diagnostic tests, treatment, and follow-up evaluation;
4. Maintain employee records relative to the HepB vaccination and post-exposure incidents and treatment.

### **III. BLOODBORNE PATHOGENS AGENTS**

#### **Bloodborne Pathogens (BBP)**

BBP are microorganisms that are present in blood, other body fluids and materials derived from human and non-human primates. They are highly infectious and can cause diseases in healthy individuals.

#### **Hepatitis B Virus (HBV)**

The HepB virus belongs to the *Orthohepadnavirus* genus and the *Hepadnaviridae* family. HBV causes a disease that affects the liver. HBV poses great risk for infection among health care providers and laboratory researchers because it can be easily transmitted through parenteral inoculation (needle stick), and droplet exposure of mucous membrane. Unprotected sexual contact is also a mode of transmission.

Half of all people infected with the HepB virus have no symptoms, and for those who do get sick, symptoms usually develop within 1 - 4 months after exposure to the virus. The initial symptoms are often similar to the flu: appetite loss, tiredness, nausea, vomiting, itching all over the body, pain over the location of the liver, jaundice (skin and whites of the eyes turn yellow), and dark color urine.

The virus is present in blood or blood products, urine, semen, cerebrospinal fluid (CSF) and saliva. The virus may be stable in dried blood or blood components up to seven days.

An effective vaccine for HBV is available and is offered free of charge to all UMass personnel who have potential for exposure when performing certain tasks during work.

#### **Hepatitis C Virus (HCV)**

HCV belongs to the *Hepacivirus* genus in the *Flaviviridae* family. This virus causes serious inflammatory disease in the liver and occasionally can be fatal. It is spread predominantly by parenteral (blood contact) route. HCV is present in blood, serum, and less frequently in saliva.

It is rarely present in urine and semen. The virus can be infective outside the body for up to four days. Although HCV damages the liver, 80% of people with the disease do not have symptoms. In those who do, symptoms may not appear for 10-20 years, or even longer periods. A minority of people have symptoms during the early acute phase of the

infection. These symptoms typically develop 5-12 weeks after exposure to HCV and are described as being flu-like such as appetite loss, tiredness, nausea, vomiting, body itching, pain over the location of the liver, jaundice (skin and whites of the eyes turn yellow), and dark color urine. These symptoms are indistinguishable of those developed in patients infected with HBV. The symptoms may last a few weeks or months.

HCV infection can occur in a laboratory setting. The prevalence of antibody to this virus (anti-HCV) is slightly higher in medical care workers than the general population. There is no vaccine available for use in humans against the Hepatitis C virus although some drugs have been approved by the CDC for treatment.

### **Human Immunodeficiency Virus (HIV)**

HIV belongs to the family *Retroviridae*, sub-family *Orthoretrovirinae*, genus *Lentivirus*, and species HIV-1 and HIV-2. HIV suppresses the immune system leaving the infected individual vulnerable to opportunistic infections and cancers. These infections become increasingly severe and eventually can lead to death.

Scientists and medical authorities agree that HIV does not survive well in the environment, making the possibility of environmental transmission remote. Studies from the Center for Disease Control (CDC) have shown that drying high concentrations of HIV reduces the number of infectious viruses by 90-99 percent within several hours. HIV is sensitive to fluctuations in temperature and the presence of oxygen. One place that HIV has been known to survive is in drug injection syringes since these are airtight and often contain blood from the injector.

Occupational risk for workers is primarily through exposure to infected-blood and other human body fluids such as semen, feces, saliva, urine, sweat, vomitus, and human breast milk. The use of PPE, engineering controls, and good laboratory practices can reduce the potential for exposure to this and other bloodborne pathogens.

The symptoms of HIV infection vary, depending on the phase of infection. When first infected with HIV, the person may not have signs or symptoms at all, although they are able to transmit the virus to others. Many people develop a brief flu-like illness 2-4 weeks after becoming infected. Signs and symptoms may include fever, headache, sore throat, swollen lymph glands, and rash.

Some people can remain symptom-free for years. However, as the virus continues to multiply and destroy immune cells, the person may develop mild infections or chronic symptoms such as swollen lymph nodes (often one of the first signs of HIV infection),



diarrhea, weight loss, fever, cough and shortness of breath. If patients do not receive treatment, the disease typically progresses to a full Acquired Immune Deficiency Syndrome (AIDS) in about 10 years.

There is no vaccination against HIV. Drug prophylaxis such as Azidothymidine (AZT) is available, although its efficacy is debated within the medical community. Protease inhibiting drugs have slowly become a part of the treatment process and seem to hold promise according to some medical experts.

### **Additional Bloodborne Pathogens**

In addition to HIV, HBV, and HCV; other viruses, bacteria and parasites may also be present in blood, tissues or body fluids.

### **Bacteria and Parasites**

The bacterial and parasitic diseases listed below are treatable with antibiotics or other therapy.

1. *Plasmodium* species – Malaria;
2. *Treponema pallidum* – Syphilis;
3. *Babesia microti* – Babesiosis;
4. *Brucella* species – Brucellosis;
5. *Leptospira interrogans* – Leptospirosis.

### **Viruses**

Below are some examples of highly pathogenic viruses that can be present in blood and are transmitted by contact with blood and the disease that they produce.

1. Simian Immunodeficiency Virus (SIV) - SIV Infection;
2. Arboviruses – Encephalitis;
3. Hemorrhagic viruses such as Ebola virus, Marburg fever virus, Lassa fever viruses – Viral Hemorrhagic Fever.

## Other Potentially Infectious Materials (OPIM)

1. **Body Fluids** or bodily fluids are liquids from inside the body from living people. These fluids can be excreted or secreted from the human body and potentially can carry microorganisms that can produce diseases. The following are some examples of body fluids: semen, pleural fluid, vaginal secretions, amniotic fluid, cerebrospinal fluid, saliva containing traces of blood (like in dental procedures), synovial fluid, body fluids visibly contaminated with blood, peritoneal fluids in situations where it is impossible to differentiate fluids, and pericardial fluids.
2. **Cell Lines or Tissues and Infected Animals** include cell lines or tissue cultures containing HIV, HBV, or HCV; culture media or other effluents which contain HIV, HBV or HCV; primary human cell and tissue cultures; Human T-lymphocyte cultures; blood and tissues from experimental animals infected with HIV, HBV or HCV; animals that have been experimentally infected with HIV, HBV or HCV.
3. **Neural Tissue**, particularly brain tissue, although rare, can be infected with Prions. Prions are abnormal, very stable proteins that produce rare forms of diseases called prion-diseases. There is no treatment for this type of disease. Creutzfeldt-Jakob disease (CJD) is one of them. Additional information on prions can be found at Section VIII-H, BMBL 6<sup>th</sup> Ed.<sup>2</sup>

## Transmission of Bloodborne Pathogens

Transmission of BBP requires a route of entry into the body. Direct contact of any infectious material with broken, damaged, or non-intact skin such as rash, puncture, cut, abrasion, acne, cold sore, hang nail, or any wound can potentially cause the transmission of BBP agents. Broken skin can occur in accidents with sharps as through needle sticks, punctures, scratch, bites from infected animals, etc.

Moreover, the contact of eyes, nose, or mouth membranes with splash and/or aerosols can also transmit BBP. Splashes and aerosols can occur when there are accidental spills of blood or infectious liquids; during certain procedures; by using equipment known to create aerosols such as mixing with vortex, grinding tissue, using homogenizer, or centrifugation.

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<sup>2</sup> <https://www.cdc.gov/labs/bmbi/index.html>

## **Working Safely with Bloodborne Pathogens**

At UMass Lowell, any work involving materials that contain or could contain BBP requires the approval of the IBC.

Once approved, lab workers will be able to handle human material, blood, and other potential infectious materials (OPIM) in a safe environment by following several controls. Some of these controls have to do with location, equipment or practices. Work should be limited to specific areas (containment) and laboratories should have the Biohazard sign on the door. Lab workers should use engineering controls or equipment designed to create a barrier between the biohazard and the worker. They should practice universal precautions, wear PPE, and an emergency response plan for possible incidents or accidents should be available in the lab.

All these mentioned controls will be discussed in the following chapters of this ECP.



#### **IV. IDENTIFICATION OF EMPLOYEES AT RISK FOR OCCUPATIONAL EXPOSURE TO BLOODBORNE PATHOGENS**

The University of Massachusetts Lowell adheres to the OSHA requirement of identifying all employees who are considered at risk of occupational exposure to bloodborne pathogens and extend this Program to the students when working in laboratory doing research.

Anyone who has a reasonable chance of encountering human blood, body fluids and other potentially infectious materials while performing their normal job duties is covered by the standard.

##### **Risk Determination at UMass Lowell**

Faculty, staff and students at risk are identified at UMass Lowell, based on their job classification and the tasks they perform while on campus. A screening tool (Appendix A) is used at the first orientation meeting for new employees or at time of BBP training. The screening questionnaire can also be used any time that an employee considers that his/her job scope has changed. All students participating in research are covered by or through the IBC registration process.

##### **Job Classification and Tasks with Potential Risk for Occupational Exposure**

Personnel holding the following positions are considered at risk for potential exposure to human material:

1. Clinical personnel from Health Services, providing first aid to students in emergency situations;
2. Emergency Medical Technicians (EMT), administering first aid, responding to spills and other emergencies;
3. Environmental Health and Safety personnel, handling OPIM and biohazardous waste;
4. Faculty/Staff with approved IBC registration handling human materials (tissue, cell lines);
5. Students and graduate students, working in labs where blood or OPIM are handled;
6. Teaching Assistants working in labs where blood or OPIM are handled;
7. Animal Care staff working with or in areas housing infected animals with BBP or human materials;
8. Athletic Trainers providing initial assistance, in case of accident;
9. Camp Recreation staff providing initial assistance in case of accident;

10. Custodial staff cleaning places (laboratories, bathrooms, others) where human materials could be present (also responding to clean small spills that involve blood or OPIM);
11. Faculty with clinical assignments that have potential contact with clinical samples;
12. Nursing laboratory professional technicians (phlebotomy, blood processing);
13. Plumbers repairing sanitary systems, labs plumbing, pools;
14. University Police responding to emergencies

All personnel participating in the program will receive training, adequate PPE and be offered the HepB vaccination at no cost to them. The vaccination is not obligatory; however, a declination form (Appendix B) must be signed if the person decides to not get the vaccine.

## V. METHODS OF IMPLEMENTATION AND CONTROL

### Universal Precautions

Universal Precautions is an approach to infection control where all blood and other potentially infectious materials are treated as if known to be infectious with HIV, HBV, HCV, and other BBP.

At UMass Lowell, Universal Precautions are observed by all employees and students in order to prevent exposure to blood or other potentially infectious materials.

### Facilities and Containment

Laboratory facilities are the primary barrier to protect people and animals working inside and outside the laboratory or in the community from infectious agents, which may be accidentally released from the laboratory. Facilities must be commensurate with the laboratory's function and the recommended biosafety level for the agent being manipulated. The recommended level of containment will depend on the risk of transmission of specific agents. For example, the exposure risks for most laboratory work in Biosafety Level 1 (BL-1) and Biosafety Level 2 (BL-2) facilities will be direct contact with the agents or inadvertent contact exposures through contaminated work environments. Secondary barriers in these laboratories may include separation of the laboratory work area from public access, and the availability of decontamination (e.g., autoclave) and hand washing facilities. In general, there are four levels of biosafety containment (BL-1 to BL-4).

At UMass Lowell, all labs are BL-1 or BL-2. There are no BL3-laboratories at present. Additional information on biosafety level and characteristics of containment are explained on Appendix C.

### Engineering Controls

Engineering controls are equipment designed to create a barrier between the biological hazards and the worker. They can be as simple as using forceps to pick up broken glass, or as complex as a biosafety cabinet (BSC) and an autoclave. All equipment should be maintained on a regular basis to ensure their effectiveness.

1. **Handwashing Facilities** must be located near the exit of the lab with soap and paper towels available.

2. **Biosafety Cabinets (BSCs)** are the principal device used to provide containment of infectious droplets or aerosols generated by many procedures using blood and human materials. BSCs are designed to provide personnel with environmental and product protection when appropriate practices and procedures are followed.

EHS has a specific program to routinely inspect, test and certify all BSCs by trained personnel following strict protocols to verify that they are working appropriately. Most BSCs use “high efficiency particulate air” (HEPA) filters in the exhaust and supply systems.

BSCs can be class I, II or III depending on research and clinical needs.

**Class I BSCs** provide personnel and environmental protection, but not product protection. It does not have HEPA filtered supply air, but the HEPA filter is in the exhaust system to protect the environment. It is commonly used to enclose equipment (e.g. centrifuges, harvesting equipment) or for procedures that generate aerosols like animal cage dumping.

**Class II BSCs** are the most common type of BSCs for working with biological materials. There are several types: A1, A2, B1, and B2. The Class II BSC provides protection to the worker and the environment from external contamination of the materials (e.g. cell cultures, microbiological stocks) being manipulated inside the cabinet. The supply air flows through a HEPA filter and provides a particulate-free air to the work surface. The exhausted air also goes through a HEPA filter. Depending on the type of BSC, the air will recirculate in the lab or vent to the environment.

**Class III BSC** is a gas-tight BSC with a non-opening view window. The BSC also provides the highest attainable level of protection to personnel and the environment. Class III BSCs are used when working with highly infectious organisms.

Complete information on this BSC is found at the Appendix A from the BMBL-CDC/NIH 6<sup>th</sup> Ed.<sup>3</sup>

3. **Sharps Disposal Containers and Needle Safe Devices** must be closable, puncture-resistant, leak-proof on all sides and bottom, and have the universal biohazard symbol on the containers.

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<sup>3</sup> <https://www.cdc.gov/labs/bmbl/index.html>



All sharps containers should be size-appropriate and located in areas where sharps such as needles are being used.

Examples of sharps include: needles, scalpels, razor blades, lancets, glass Pasteur pipettes, glass capillary tubes, contaminated broken glass, and contaminated microscope slides and cover slips. These sharps are disposed of following the SOP Bio-002 Sharps Use and Disposal.

UMass Lowell, in compliance with OSHA Needlestick Safety and Prevention Act,<sup>4</sup> recommends the use of needle safety devices to avoid needle stick injuries. Examples of safer needle devices such as self-blunting needles, self-sheathing needles, and devices with safety locks can be used to eliminate or lessen employee exposure to BBP.

Do not shear, bend, break, or re-cap by hand any needle or sharps. Also, do not put items in the sharps container that are not sharps. Do not leave sharps unattended on lab benches. Needles should be disposed immediately after use or as soon as feasible in a labeled sharps container.

Any person who encounters improperly disposed needles should notify the police department (978-934-4911) or EHS (978-934-2618). When reporting about improperly disposed needles, give your name and the location where you found the needles. In addition, the appropriate authorities at the location shall be notified (i.e., lab manager, PI, Faculty).

EHS provides sharps-containers to all laboratories. To request a sharps container, or for pick-up of a used container (3/4 full), contact EHS at 4-2618.

## **Work Practices**

Students and employees working at UMass Lowell will use work practices controls to eliminate or minimize exposure to infectious materials or other biohazards.

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<sup>4</sup> <https://www.osha.gov/laws-regs/federalregister/2001-01-18>

## Best Practices Summary<sup>5</sup>

1. No eating, drinking, smoking, applying cosmetics or lip balm, or handling contact lenses is allowed in a work area where there is a reasonable likelihood of occupational exposure;
2. No food or drinks shall be kept in refrigerators, freezers, cabinets, shelves, on counter tops or bench tops that are designated for biological products;
3. Persons must wash their hands immediately (or as soon as feasible) after removal of gloves or other PPE;
4. Employees must perform all procedures involving blood or OPIM in such a manner as to minimize splashing, spraying, splattering, and generation of droplets of these substances;
5. Specimens of blood or other potentially infectious materials must be placed in a labeled or color-coded container which prevents leakage during collection, handling, processing, storage, transport, or shipping;
6. Secondary containers (puncture resistant) should be used during storage, transport, or shipping;
7. Persons must wash their hands or other skin area with soap and water, or flush mucous membranes with water, as soon as possible following an exposure incident (such as a splash of blood to the eyes or an accidental needle stick injury) with copious amounts of water for at least 15 minutes;
8. Persons conducting research must be listed on approved IBC registration.

## Personal Protective Equipment (PPE)

Minimum PPE required in a lab is lab coat, safety glasses and proper gloves. PIs, faculty and department supervisors shall provide gloves, lab coats, eye protection, face shields, and aprons in appropriate sizes at no cost to students and employees. In addition, the University will replace or repair PPE as necessary at no cost to students and employees. All PPE will be chosen based on the anticipated exposure to blood or other potentially infectious materials.

PPE will be considered appropriate only if it does not permit blood or other potentially infectious materials to pass through or reach the employee's clothing, skin, eyes, mouth, or mucous membranes under normal conditions of use and for the duration of time for which the protective equipment will be used.

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<sup>5</sup> <http://osp.od.nih.gov/office-biotechnology-activities/biosafety/nih-guidelines>

EHS offers to all staff, faculty, students working in labs two personalized lab coats, under the UMass Lowell Lab Coat Program. Contact EHS office at 4-2618 to get your lab coat. Obtain more information about the lab coat program at EHS website<sup>6</sup>.

### **Use of PPE by Students and Employees**

1. Wear PPE (such as lab coat, safety glasses, and gloves) all the time when working in lab where occupational exposure situations can occur;
2. Remove garments that become contaminated by blood or other potentially infectious material immediately or as soon as feasible;
3. Replace all garments that are torn, punctured, or lose their ability to function as a barrier to BBP;
4. Remove all PPE before leaving the work area;
5. Place all garments in the appropriate designated area or container for storage, cleaning, decontamination, or disposal;
6. Wash hands immediately or as soon as feasible after removing gloves or other PPE.

### **Emergency Response: Decontamination and Spills**

General recommendation for decontamination and cleaning small spills containing biological materials:

1. Small spills should be cleaned by personnel that have an understanding of the hazards associated with the material, and have appropriate training and spill cleanup materials available to them;
2. Personnel should be vaccinated for HBV and must have the appropriate PPE, tools, and materials to safely absorb and disinfect all surfaces, as well as biohazard waste bags to collect all spill debris;
3. Personnel are required to report spills of any hazardous material including blood or other potentially infectious materials by contacting UMass Lowell Police Dispatch at extension 978-9344-4911. In addition, spills should be reported to EHS using the Incident Report Form that can be downloaded from the EHS website<sup>7</sup>.

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<sup>6</sup> <https://www.uml.edu/eem/ehs/hazardous-materials/lab-coats/>

<sup>7</sup> <https://www.uml.edu/eem/ehs/accident-near-miss-reporting-form.aspx>

## **General Procedures**

1. Wear PPE when decontaminating and cleaning small blood spills or other potentially infectious material spills. PPE should include latex or nitrile gloves, eye protection, and lab coat;
2. Use a freshly, daily prepared 10% (minimum) solution of sodium hypochlorite (household bleach) in water.
3. Lysol or other EPA-registered disinfectants may also be used depending on the organism of concern;
4. Do not pick up broken glassware directly with your hands. Use hand tools and/or sweep or brush materials into a dustpan. Collect this material into a sharps container;
5. The freshly made bleach solution or disinfectant must be left in contact with the contaminated work surfaces, tools, objects, or potentially infectious materials for at least 20-30 minutes before cleaning;
6. All contaminated work surfaces, tools, objects, etc. will be decontaminated immediately or as soon as feasible after any contact with blood or other potentially infectious materials (SOP Bio-005 Decontamination and Cleaning of Reusable Labware, Work Surface and Equipment);
7. Reusable containers shall not be opened, emptied, or cleaned manually or in any other manner that would expose employees to the risk of percutaneous injury;
8. Equipment that may become contaminated with blood or other potentially infectious materials will be examined and decontaminated before servicing or use;
9. All equipment and exercise mats associated with Athletics and Campus Recreation shall be wiped clean after each use with an EPA registered disinfectant such as Lysol®, Virex®, etc.

## **Housekeeping**

The PI or supervisor is responsible for ensuring that the work place is maintained in a clean and sanitary condition.

## **Laundry**

1. Wear the following PPE when handling and/or sorting contaminated laundry: lab coat, gloves, and safety glasses;
2. Handle contaminated laundry as little as possible, with minimal agitation;

3. Place wet contaminated laundry into leak-proof and labeled containers (i.e. red biohazard bags) before transport;
4. Obtain more information about the lab coat program at the EHS website<sup>8</sup>.

## **Regulated Waste**

Chemical toxic waste and Biohazard toxic waste are regulated waste. The following are some important consideration about regulated waste.

1. The disposal of solid biological waste follows the SOP Bio-003;
2. Regulated waste is placed in containers which are closable, constructed to contain all contents and prevent leakage, appropriately labeled, and closed prior to removal to prevent spillage or protrusion of contents during handling;
3. The waste must be closed before removal to prevent spillage or protrusion of contents during handling, storage, or transport;
4. In the event that outside contamination of the waste container occurs, it must be placed within a secondary container that is leak-proof and puncture resistant;
5. PPE contaminated with blood or other potentially infectious material shall be handled as little as possible. Such PPE should be placed in a biohazard waste container;
6. A certified biological waste contractor shall handle incineration of biohazard waste. At UMass Lowell, this process is coordinated by EHS;
7. Red bags are used as required for regulated waste and contaminated equipment;
8. Employees are to notify EHS if they discover regulated waste containers, containing blood or OPIM, that are not labeled with the biohazard sign;

For removal of biohazard waste bags, boxes or sharps containers and to request new supplies, contact the EHS at Hazardous\_Receiving@uml.edu or Ext. 4-2618.

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<sup>8</sup> <https://www.uml.edu/eem/ehs/hazardous-materials/lab-coats/>



## **VI. HEPATITIS B VACCINATION PROGRAM**

The Hepatitis B (HepB) vaccine is safe and effective. Three injections are required for full protection. This vaccine only provides protection against Hepatitis B virus. Long-term protection is provided in 90% of the individuals who complete the vaccination series.

### **Characteristics of the Vaccination Program**

1. The HepB vaccination is available at no cost to all employees and students who have the potential for occupational exposure unless the person has previously received the complete series, antibody testing has revealed that the person is immune, or the vaccine is contraindicated for medical reasons;
2. The HepB vaccination is available after the employee or student has received the EHS BBP training and within 10 working days of initial assignment;
3. If the person initially declines the HepB vaccination, but at a later date decides to accept the vaccination, the vaccination is then made available;
4. All persons who decline the HepB vaccination offered shall sign the OSHA-required waiver indicating their refusal (Appendix B). These signed forms will be kept by the office of EHS;
5. If a routine booster dose of HepB vaccine is recommended by U.S. Public Health Service or a licensed physician at a future date, such booster doses shall be made available at no cost to the employee and coordinated by EHS;
6. The HepB Vaccine is offered to all housekeeping staff, plumbers, university police, athletics staff, nursing laboratory professional technicians, animal care staff, clinical personnel from Health Services, EHS staff, EMT Emergency Responders, faculty with clinical assignments, and faculty/staff/students participating in research laboratories, with approved IBC registrations;
7. Depending on their job situation and likelihood of exposure, the vaccine is also offered to preventive maintenance personnel, trades persons, PIs, faculty, lab technicians, and other personnel as necessary;
8. EHS will provide training to employees on HepB vaccinations, addressing safety, benefits, efficacy, methods of administration, and availability;
9. Vaccination for all UMass Lowell faculty, staff, and students working in labs will be provided by:

Occupational Health Medicine  
Lowell General Hospital  
Chelmsford Campus  
Phone: 978-458-6868

10. Students can receive vaccinations at:

Health Services  
220 Pawtucket Boulevard  
University Crossing, Suite 300  
Lowell, MA 01854  
Phone: 978-934-6800, Extension 4-6800

For more information on Hep.B Vaccination, contact the EHS at 978-934-2618.



## VII. POST- EXPOSURE EVALUATION AND FOLLOW-UP

This section outlines procedures and responsibilities of persons, UMass Lowell, and Health Care Facilities following an exposure. All exposure incidents and accidents should be reported according to the next guidelines:

In response to an exposure call **UMass Lowell Police Department** at **978-934-4911** or extension **44-911**

1. Report, investigate, and document all exposure incidents using the EHS Incident Report form. It can be accessed from the EHS website<sup>9</sup>;
2. When an **employee** sustains an exposure incident, it shall be reported immediately to their supervisor, EHS at 978-934-2618 and Human Resources at 978-934-3560;
3. When a **student** experiences an exposure incident, it shall be reported immediately to their Faculty, Lab Responsible, Clinical Preceptor and EHS at 978-934-2618.
4. Following a report of an exposure incident, the University recommends that the exposed worker go for a confidential medical evaluation and follow-up, to any of the described below.
5. The exposed individual may decline medical evaluation or seek medical attention from their own primary care physician if they so choose;

### Healthcare Professional Offices and Where to Get Help

Call **UMass Lowell Police Department** at **978-934-4911** or extension **4-4911**

For all staff, faculty, and students:

1. **Occupational Health Medicine Program**  
Lowell General Hospital  
Chelmsford Campus  
Phone: 978-458-6868
2. **Lowell General Hospital**  
295 Varnum Avenue  
Lowell, MA 01854-2134  
Phone: 978-937-6000

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<sup>9</sup> <https://www.uml.edu/eem/ehs/accident-near-miss-reporting-form.aspx>

## **Information Provided by Human Resources (HR) Office to the Healthcare Professional that Evaluates Individuals Exposed to BBP.**

UMass Lowell will provide the healthcare professional evaluating the employee after an exposure incident with the following information:

1. A description of the employee's duties and the circumstances under which the exposure occurred;
2. Documentation of the route(s) of exposure, date and time;
3. Results of the source individual's blood testing, if available. (The identification is not required if the employer can establish that identification is impossible or prohibited by state or local law);
4. The collection and testing of the source individual's blood for HBV and HIV serological status will occur as soon as feasible after consent is obtained in order to determine HBV and HIV infectivity;
5. Results of the source individual's testing will be made available to the exposed employee;
6. All medical records relevant to the appropriated treatment of the employee, including vaccination status;
7. Describe all PPE used or to be used.

## **Healthcare Professional's Written Opinion Post-Exposure Evaluation**

The report from the Healthcare Professional post-exposure evaluation and follow-up should be limited to the following information:

1. The employee has been informed of the results of the evaluation;
2. The employee has been told about any medical condition resulting from exposure to blood or OPIM which require further evaluation or treatment;
3. The employee has been informed of the recommended limitations upon use of PPE;
4. All other findings or diagnoses will remain confidential and should not be included in the written report;
5. Copy of this report will be kept at the Human Resources Office. All medical records will be kept in accordance with 29 CFR 1910.1020.

## **Accidents or Incidents at Different Institutions other than UMass Lowell**

Faculty, staff or students doing work at different institutions should follow the guidelines of the institution where accident/incident could occur. An incident report on the UMass Lowell-EHS Incident Report form should be sent to EHS.

Incident Report forms can be filled out on the EHS website.<sup>10</sup>

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<sup>10</sup> <https://www.uml.edu/eem/ehs/accident-near-miss-reporting-form.aspx>



## **VIII. TRAINING AND HAZARDS COMMUNICATION TO EMPLOYEES**

UMass Lowell and the Department of Environmental Health and Safety are committed to provide a safe and healthy work environment for students, faculty, and staff by developing safety programs and providing adequate training to all members of the UMass Lowell community. Federal regulations and university policies require annual training in OSHA-Bloodborne Pathogens, Lab Safety and General Biosafety.

### **Bloodborne Pathogens (BBP) and Biosafety Training**

OSHA-BBP Training is offered to employees, students, faculty and staff working with human blood, body fluids, or other potentially infectious materials. Those persons who are identified at risk of occupational exposure to BBP will require training, proper PPE, and will be offered the HepB vaccination at no cost to them. OSHA-BBP Training is valid for one year. Persons at risk must attend training annually

EHS offers BBP-Biosafety training to all persons working with any kind of biological agents. Training is offered and can be found on the EHS website.<sup>11</sup>

### **Contents of the OSHA BBP Standard Training**

The training program will include the following components:

1. An accessible copy of the regulatory text of 29 CFR 1910.1030 and an explanation of its contents;
2. A general explanation of the epidemiology and symptoms of bloodborne diseases;
3. An explanation of the modes of transmission of BBP;
4. An explanation of the UMass Lowell ECP and the means by which the employee can obtain a copy of the written plan;
5. Information on the HepB vaccine, including information on its efficacy, safety, method of administration, and the benefits of being vaccinated;
6. An explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to blood or other potentially infectious materials;
7. An explanation of the use and limitations of methods that will prevent or reduce exposure, including appropriate engineering controls, work practices, and PPE;

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<sup>11</sup> <https://www.uml.edu/eem/ehs/biosafety/#Agent-training>

8. Information on PPE including the types, proper use, location, removal, handling, decontamination, and disposal;
9. An explanation of the basis for selection of personal protective equipment;
10. Awareness of the term and intent of Universal Precautions;
11. An explanation of the procedure to follow if an exposure incident occurs, including the method of reporting the incident and the follow up that will be made available;
12. Information on the post-exposure and evaluation follow up provided for the employee after an exposure incident;
13. Explanation of signs and labels or color-coding used to communicate a biological hazard;
14. A multiple-choice test.

### **Labels and Signs**

1. All areas and equipment used when performing a task involving the potential exposure to human material must be labeled with the universal biohazard label;
2. The orange biohazard sign should be located on doors, equipment, refrigerators and freezers to indicate the presence of biological hazards;
3. The label should be fluorescent orange-red with lettering and symbols in contrasting color as shown below;
4. If employees discover refrigerators or freezers containing blood and/or OPIM, or contaminated equipment that are not labeled with the biohazard sign, they are to notify EHS 978-934-2618 or [biosafety@uml.edu](mailto:biosafety@uml.edu), and request the labels needed.



*Figure 1a: The Biohazard symbol*

5. The following sign is a reminder to follow Universal Precautions when working with blood and/or OPIM.



*Figure 1b: Biohazard Label (Universal Precautions)*





## **IX. RECORDKEEPING**

### **Training Records**

OSHA BBP Training is valid for one year. Persons at risk must attend training annually. Training records will be kept with the EHS office and contain the following information:

- Employee's name
- Date of training

### **Immunization Status Records**

Immunization records will be maintained in accordance with OSHA Standards. These records will be kept confidential, and must be maintained for at least the duration of employment plus 30 years. All UMass Lowell employee medical records will be kept at the Human Resources Office, and students' medical records at the Health Services Office.

### **BBP-Incident Report Records**

All incident reports will be kept at the EHS office and in the Human Resources office for at least three years.



## **X. APPENDICES**

**APPENDIX A:** Identification of Employees at Risk for Occupational Exposure to Bloodborne Pathogens Form

**APPENDIX B:** Hepatitis B Vaccination/Declination Form

**APPENDIX C:** Characteristics of Containment BL-1, BL-2, and BL-3

**APPENDIX D:** References, Resources, and Website Links for Supporting Information



## APPENDIX A



Environmental Health and Safety  
1 University Ave  
Lowell, MA 01854  
Phone: 978-934-2618 Fax: 978-934-4018

### EHS BLOODBORNE PATHOGEN PROGRAM (29 CFR 1910.1030) IDENTIFICATION of OCCUPATIONAL RISK of EXPOSURE to BBP FORM

The Occupational Safety and Health Administration (OSHA) requires the **identification of all employees who can be considered at risk of occupational exposure to bloodborne pathogens (BBP)**, found in human blood and other potential infection materials (OPIM) of human origin.

Please print the following information and respond by marking **YES** or **NO** to all the questions according to the tasks performed on your job.

I, (name) \_\_\_\_\_ Date \_\_\_\_\_  
Job title \_\_\_\_\_ Department \_\_\_\_\_  
Supervisor \_\_\_\_\_ Building-Room # \_\_\_\_\_  
E-mail \_\_\_\_\_

- YES NO** Work as a responder to accidents providing first aid and/or other emergency medical procedures (e.g. Police Officers, EMT, Sports Trainers, Coaches and EHS personnel)
- YES NO** Work in the laboratory and performs tasks where anticipated exposure to infectious materials could occur such as handling or transporting human material or other infectious materials
- YES NO** Handle human blood or blood components (plasma, serum, and cells), blood products, tissues, biopsy samples when doing research or when working in clinical laboratories
- YES NO** Enter areas where others may handle infectious materials and it is reasonably anticipated that the employee can be at risk of occupational exposure due to his/her job tasks:
- Laboratory cleaning where research with human materials is done
  - Fixing plumbing in a laboratory where human material is present,
  - Work in areas or clean areas where there is blood due to an accident with sharp objects (glass bottle broken in a fight) or a fall or a wet surface)
- YES NO** Handle sharps when working with human materials. Handle waste containing sharps or waste that contains human materials. Perform any I.V. blood drawing (e.g. Phlebotomist, Clinical Laboratory Technician, and Clinical Laboratory Trainee)
- YES NO** Work with animals infected with human material (e.g. Animal Care Technician, Research Assistant and Research Trainees)

If you respond **"YES"**, to **ANY** of the above questions, the employee must be considered at occupational risk of exposure to bloodborne pathogens. In compliance with the OSHA BBP, the employee must be offered the HepB vaccine (at no cost), appropriate BBP training and must be provided with personal protective equipment (PPE). If you have any questions, contact the Biosafety Officer at [biosafety@uml.edu](mailto:biosafety@uml.edu) or 4-2816



**APPENDIX B**



Environmental Health and Safety  
1 University Ave.  
Lowell, MA 01854  
Phone: 978-934-2618 Fax: 978-934-4018

**EHS BLOODBORNE PATHOGEN PROGRAM (29 CFR 1910.1030)**

**HEPATITIS B VACCINATION/DECLINATION FORM  
(29 CFR 1910.1030 (f)(1) and (f)(2)(iv))**

The University of Massachusetts Lowell in compliance with the OSHA "Bloodborne Pathogen Standard" offers the Hepatitis B Vaccine (HepB) to employees with potential for exposure to bloodborne pathogens.

As an UMass Lowell employee, you have the option to receive the HepB at no cost to you. Please print your name and indicate your interest in receiving HepB by checking one of the options below.

Sign and date this form and return it to the Training Instructor or send it by interoffice mail to:  
EHS/Biosafety, University Crossing, 220 Pawtucket Street, Suite 140 Lowell, MA 01854

I, (name) \_\_\_\_\_ Date \_\_\_\_\_

Job Department \_\_\_\_\_ Supervisor \_\_\_\_\_

Building/Room # \_\_\_\_\_ E-mail \_\_\_\_\_

- \_\_\_\_\_ N/A - My job does not involve contact with blood or other human body fluids
- \_\_\_\_\_ Yes, I want to receive the HepB vaccination
- \_\_\_\_\_ I have already received the HepB vaccination
- \_\_\_\_\_ No, I am not interested in receiving the Hep B vaccination. I understand that due to my occupational exposure to blood or other infectious materials that I may be at risk of acquiring Hepatitis B virus infection. I have been given the opportunity to be vaccinated with the Hepatitis B vaccine at no charge to myself. However, I decline the Hepatitis B vaccination at this time. I understand that by declining this vaccine, I continue to be at risk of acquiring Hepatitis B, a serious disease. If in the future I continue to have occupational exposure to blood or other potentially infectious materials and I want the Hepatitis B vaccine, I can receive the vaccine series at no charge to me 29 CFR 1910.1030(f)(2)(iv)

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Note: EHS personnel will coordinate HepB Vaccination for employees covered by the UMass Lowell-Bloodborne Pathogens Program. If you have any questions, contact the Biosafety Officer at [biosafety@uml.edu](mailto:biosafety@uml.edu) or 978-934-2618.





## APPENDIX C

### Characteristics of Containment BL-1, BL-2 and BL-3\*

Containment Or Biosafety Level	Agents	Practices	Safety Equipment (Primary barriers and PPE)	Facilities (Secondary Barriers)
<b>BL-1</b>	Not known to consistently cause disease in healthy adults	Standard Microbiological Practices	No primary barriers required <b>PPE:</b> labcoat; gloves, safety	Open bench top, sink required
<b>BL-2</b>	Agents are associated with human disease, hazard Route of exposure: ➤ Percutaneous injury or broken skin, ➤ ingestion, ➤ mucous membranes (eyes, mouth, nose)	<b>BL-1</b> practice plus: Limited access, Biohazard warning signs, Sharps precautions, Decontamination, Waste management, Medical surveillance policies, Biosafety Manual	<b>Primary barriers</b> Class or II BSC or other physical containment devices used for all manipulations that cause splashes or aerosols of infectious materials;  <b>PPE:</b> labcoat; gloves; safety glasses, and face protection as needed	<b>B+L-1</b> plus: autoclave available
<b>BL-3**</b>	Agents are indigenous or exotic with potential for aerosol transmission; Disease may have serious or lethal consequences	<b>BL-2</b> practice plus: Controlled access Decontamination of all waste Decontamination of lab clothing before laundering Baseline serum	<b>Primary barriers</b> Class I or II BSC or other physical containment devices used for all open manipulations of agents; <b>PPE</b> protective lab clothing; gloves; respiratory protection as needed	<b>BL-2</b> plus: Physical separation from access corridors, Self-closing double door access, Exhausted air not recirculated, Negative airflow into laboratory

\* (BMBL-6<sup>th</sup> edition, 2009)

\*\* No BSL-3 Laboratories at UMass Lowell, PPE: personal protective equipment



## APPENDIX D

### REFERENCES, RESOURCES AND WEBSITE LINKS FOR SUPPORTING INFORMATION

1. The OSHA Bloodborne Pathogen Standard 29CFR 1910.1030  
<https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1030>
2. CDC/NIH, “*Biosafety in Microbiological and Biomedical Laboratories*” (BMBL), Fifth Edition. December 2009  
[https://www.cdc.gov/labs/pdf/SF\\_19\\_308133-A\\_BMBL6\\_00-BOOK-WEB-final-3.pdf](https://www.cdc.gov/labs/pdf/SF_19_308133-A_BMBL6_00-BOOK-WEB-final-3.pdf)
3. CDC HIV  
<https://www.cdc.gov/hiv/index.html>
4. NIH Guidelines for Research Involving Recombinant DNA Molecules  
<http://osp.od.nih.gov/office-biotechnology-activities/biosafety/nih-guidelines>
5. 105 CMR 480.00 “*Storage and Disposal of Infectious or Biological Wastes: State Sanitary Code*” Chapter VIII  
<http://www.mass.gov/eohhs/docs/dph/regs/105cmr480.pdf>
6. Public Health Agency of Canada  
This site contains Pathogens Safety Data Sheet (PSDS), the equivalent of SDS for microorganisms.  
<http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/index-eng.php>
7. EPA Approved Disinfectants  
<https://www.epa.gov/pesticide-registration/selected-epa-registered-disinfectants>
8. UML Environmental Emergency Management – Environmental Health and Safety  
<https://www.uml.edu/EEM/EHS/default.aspx>

9. UML EHS-Biosafety Program  
<https://www.uml.edu/EEM/EHS/Biosafety/default.aspx>
10. UML-Office of Research Integrity (ORI)  
<https://www.uml.edu/research/integrity/>
11. UML Institutional Biosafety Committee (IBC)  
<https://www.uml.edu/research/integrity/biological-safety/>
12. EHS Lab Coat Program  
<https://www.uml.edu/eem/ehs/hazardous-materials/lab-coats/>
13. EHS BBP/Biosafety and Lab Safety Training  
<https://www.uml.edu/eem/ehs/biosafety/#Agent-training>  
<https://www.uml.edu/eem/ehs/lab-safety/#training>