

**Harvard Institutes of Medicine/  
New Research Building**

**Biosafety  
Manual**



**HIM/NRB Environmental Health and Safety Office  
77 Avenue Louis Pasteur  
Boston, MA 02115**

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### LIST OF ABBREVIATIONS AND ACRONYMS

BBP	bloodborne pathogens
BMBL	Biosafety in Microbiological and Biomedical Laboratories
BSC	biological safety cabinet
BL	biosafety level
BSO	biosafety officer
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
CMR	Code of Massachusetts Regulations
COMS	Harvard Committee on Microbiological Safety
DNA	deoxyribonucleic acid
DOT	U.S. Department of Transportation
DFCI	Dana Farber Cancer Institute
ECP	Exposure Control Plan
EH&S	Environmental Health and Safety
EPA	U.S. Environmental Protection Agency
ESD	Environmental Services Department
FDA	U.S. Food and Drug Administration
ft/min	feet per minute
GMO	Genetically Modified Organism
GMMO	Genetically Modified Microorganism
HCCM	Harvard Center for Comparative Medicine
HBV	hepatitis B virus
HCV	hepatitis C virus
HEPA	high efficiency particle air
HIM	Harvard Institutes of Medicine
HIV	human immunodeficiency virus
IACUC	Institutional Animal Care and Use Committee
IATA	International Air Transport Association
IBC	Institutional Biosafety Committee
LAA	laboratory animal allergies
LCM	lymphocytic choriomeningitis virus
NIH	National Institutes of Health
NRB	New Research Building
NRC	Nuclear Regulatory Commission
NSF	National Sanitation Foundation
OSHA	U.S. Occupational Safety and Health Administration
PHS	U.S. Public Health Service
PI	principal investigator
PIM	potentially infectious material
PPE	personal protective equipment
rDNA	recombinant DNA
TB	Tuberculosis
USDA	U.S. Department of Agriculture
°C	degrees Celsius

## CONTACT INFORMATION AND USEFUL WEBSITES

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Rebecca Caruso, Associate Director, Office of Biological Safety (COMS)	617-432-4897	COMS@hms.harvard.edu
Ted Myatt, Sc.D., Director of the Partners Institutional Biosafety Committee	617-732-8330	PIBC@partners.org

### WEBSITES

Department	Contact For
HIM/NRB Biological Safety Services	<a href="http://www.himnrbehs.com/himnrbehs/biosafety.asp">http://www.himnrbehs.com/himnrbehs/biosafety.asp</a>
Harvard Center for Comparative Medicine (HCCM)	<a href="https://arcm.med.harvard.edu/">https://arcm.med.harvard.edu/</a>
Harvard Committee on Microbiological Safety (COMS)	<a href="http://www.hms.harvard.edu/orsp/coms">http://www.hms.harvard.edu/orsp/coms</a>
National Institutes of Health (NIH) Guidelines for Research Involving Recombinant DNA Molecules (NIH Guidelines)	<a href="http://oba.od.nih.gov/rdna/nih_guidelines_oba.html">http://oba.od.nih.gov/rdna/nih_guidelines_oba.html</a>
NIH/ Centers for Disease Control and Prevention (CDC) Biosafety in Microbiological and Biomedical Laboratories (BMBL)	<a href="http://www.cdc.gov/biosafety/publications/bmbl5/index.htm">http://www.cdc.gov/biosafety/publications/bmbl5/index.htm</a>
OSHA Bloodborne Pathogen Standard	<a href="http://www.osha.gov/SLTC/bloodbornepathogens/index.html">http://www.osha.gov/SLTC/bloodbornepathogens/index.html</a>

## 1.0 INTRODUCTION TO BIOSAFETY

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### 1.1 BACKGROUND

Work with tissues, cells, microorganisms, and animals comprise a wide variety of routine activities in many biomedical research and biotechnology laboratories. These activities include many current and expanding technologies, such as development of new products from cells and tissues for therapeutic use, isolation and identification of genes, and genetic manipulation of cells, tissues, microorganisms, plants, and animals. However, these routine activities can present underestimated health hazards for laboratory staff by placing them at increased risk for infections from bacteria, fungi, viruses, viral vectors, recombinant deoxyribonucleic acid (rDNA), and biological organisms containing rDNA.

Biosafety can be simply defined as a group of practices and procedures designed to provide a safe working environment for individuals who work with potentially hazardous biological materials. The primary goal of biosafety is to reduce or eliminate exposures to these materials through the use of containment. The term containment refers to safe methods for managing potentially infectious materials in laboratory environments. Containment includes not only good microbiological techniques and safety equipment (primary containment), but also the design and operation of the laboratory facility (secondary containment).

Biosafety guidelines have been developed by two government agencies, the National Institutes of Health (NIH) and the Centers for Disease Control and Prevention (CDC). These guidelines provide the foundation for this manual. They are designed to protect laboratory personnel and individuals in the surrounding community, and are described in two publications. The first is the *National Institutes of Health Guidelines for Research Involving Recombinant DNA Molecules* (NIH Guidelines) ([http://oba.od.nih.gov/rdna/nih\\_guidelines\\_oba.html](http://oba.od.nih.gov/rdna/nih_guidelines_oba.html)). The second is *Biosafety in Microbiological and Biomedical Laboratories* (BMBL), which is published jointly by the CDC and the NIH (<http://www.cdc.gov/biosafety/publications/bmbl5/index.htm>); the most recent edition was published in 2009.

These two publications classify work with biological agents into four distinct biosafety levels (BLs). Each of these levels is matched with progressively restrictive practices and laboratory design features that have been developed to reduce health risks from exposures to potentially hazardous biological agents. These levels are further discussed in Section 3.

## **1.2 REGULATIONS**

Federal, state, and local agencies have developed regulations for protecting laboratory workers and the general public from potential health hazards associated with the use of biological agents in laboratories. Some of these regulations, such as those from the U.S. Occupational Safety and Health Administration (OSHA), have the force of law while those from NIH and CDC are recommended guidelines. As part of the grant application process, many federal and private granting agencies require applicants to certify that they adhere to both the suggested federal guidelines and the federally mandated requirements.

### **1.2.1 Federal**

Laboratory workers who come in contact with human blood or other human bodily fluids are at increased risk for exposures to and infections from certain bloodborne pathogens (BBP), such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV). The OSHA Bloodborne Pathogens Standard (29 Code of Federal Regulations [CFR] 1910.1030) was designed to eliminate or minimize occupational exposures to blood and other bodily fluids and the risks for developing the infectious diseases associated with them. All laboratories that work with human cells, human blood, human tissues, and certain, specific human body fluids must adhere to the OSHA BBP Standard (<http://www.osha.gov/SLTC/bloodbornepathogens/standards.html>)

The use of Universal Precautions is a key element of a BBP program and must be followed at all times in the BL2 laboratories. Universal Precautions involves treating all samples as potentially infectious. For example, blood from any source, even HIV-seronegative control donors, should be handled as potentially infectious. Training in Universal Precautions techniques is given at the time of orientation and on an annual

basis. This training is offered through the Harvard Institutes of Medicine (HIM)/New Research Building (NRB) Environmental Health and Safety (EH&S) Office. For more information, refer to <http://www.himnrbehs.com/himnrbehs/training.asp> or call 617-432-2762.

Safe practices for studies involving the use of rDNA are governed by the NIH Guidelines ([http://oba.od.nih.gov/rdna/nih\\_guidelines\\_oba.html](http://oba.od.nih.gov/rdna/nih_guidelines_oba.html)). It is HIM/NRB policy that all laboratories comply with these Guidelines, which are law in the City of Boston.

### **1.2.2 Commonwealth of Massachusetts**

Regulations from the Commonwealth of Massachusetts (105 Code of Massachusetts Regulations [CMR] 480.000—Storage and Disposal of Infectious or Physically Dangerous Medical or Biological Waste State Sanitary Code Chapter VIII, <http://www.mass.gov/eohhs/docs/dph/regs/105cmr480.pdf> primarily focus on the management of laboratory waste. The principal issues deal with what constitutes biological waste and how to dispose of it properly. Overall, the State statutes agree with the NIH and CDC definition of biological waste.

### **1.2.3 City of Boston**

All rDNA work conducted in the City of Boston must be approved by the institution's Institutional Biosafety Committee (IBC) and be registered with the City of Boston (<http://www.hms.harvard.edu/orsp/coms/Government/BostonRegulations.htm>). In general, the City of Boston rules agree with NIH and CDC guidelines.

### **1.2.4 Harvard Institutes of Medicine/New Research Building Regulations**

HIM/NRB have adopted the regulations from NIH, CDC, and OSHA as institutional policy. The NIH places the responsibility for implementing its guidelines in the hands of an Institutional Biosafety Committee (IBC). The Harvard Committee on Microbiological Safety (COMS) serves as the IBC for researchers affiliated with Harvard University, including Harvard Medical School, Harvard School of Public Health, and Harvard's Faculty of Arts and Sciences. The Partners Institutional Biosafety Committee (PIBC) serves as the IBC for researchers affiliated with Partners Health Services, including

Brigham and Women's Hospital and Massachusetts General Hospital. The Dana Farber Cancer Institute (DFCI) Biohazard Control Committee (BCC) serves as the IBC for researchers affiliated with DFCI. All research conducted by researchers involving the use of rDNA and infectious microorganisms, including BBP, must be registered with their appropriate IBC (COMS, PIBC, or the BCC).

### **1.3 INSTITUTIONAL BIOSAFETY COMMITTEES (IBC)**

The primary responsibilities of IBCs are to:

- Promote the best practices for the safe handling and disposal of potentially hazardous and infectious biological materials.
- Ensure compliance with all relevant federal, state, and local regulations for work with biohazardous materials.

The functions of IBCs are as follows:

- Recommend appropriate biosafety-related policies and procedures for management of potentially hazardous biological materials.
- Serve as a resource for technical information for biological risk assessment and reduction of exposures to biohazards.
- Keep current on regulations pertaining to the use of potentially biohazardous materials.
- Assist investigators in identifying technical resources and relevant information related to biosafety.

#### **1.3.1 The Harvard Committee on Microbiological Safety (COMS)**

Harvard University has adopted the regulations from NIH, CDC, and OSHA as University policy. The NIH places the responsibility for implementing its Guidelines in the hands of an IBC; COMS serves as the IBC for Harvard University. In compliance with the NIH Guidelines, COMS includes representatives from the general public as part of its Committee membership. All research involving the use of rDNA and infectious microorganisms, including bloodborne pathogens, must be registered with COMS. Additional information can be found on the Harvard COMS website (<http://www.hms.harvard.edu/orsp/coms>).

### 1.3.1.1 *Registering Research Projects with COMS*

Each project, study, or experiment using potentially hazardous biological materials must be registered with COMS. Examples of such materials include rDNA, organisms containing rDNA, unfixed human tissues, immortalized human cell lines, pathogens, and toxins. Clinical trials involving human gene therapy, vaccine development, and xenotransplantation must also be registered with COMS. The principal investigator (PI) is responsible for completing the appropriate project registration forms.

The COMS registration forms for HIM and NRB can be downloaded from the COMS website at <http://www.hms.harvard.edu/orsp/coms/forms.htm>. If you have questions about completing the forms, please contact the HIM/NRB Biosafety Officer (BSO), Jessica Healey, at 800-825-5343 or [jhealey@eheinc.com](mailto:jhealey@eheinc.com).

Each registration form will be reviewed by the BSO to verify its completeness and then submitted to COMS for final approval. The PI will receive an approval letter signed by the COMS Chair that contains specific information about biosafety procedures and containment for the project. A copy of this approval letter should be kept by the PI or a designate. Copies of the registration will also be maintained in the HIM/NRB EH&S office.

### 1.3.1.2 *Helpful Hints for COMS Registrations*

In order to expedite the review of your COMS application, please review the following "Helpful Hints." By providing appropriate information in the application, the review process by the BSO and IBC will be completed in as timely a manner as possible.

- On the front page, be sure to give an accurate mailing address. Once your application has been approved, COMS will use this mailing address for all written correspondence.
- Read the *Memorandum of Understanding and Agreement* section carefully. The signatory agrees that they will provide biosafety training, maintain a safe work

environment, and notify COMS immediately of accidental exposures or if a staff member develops symptoms related to the agents used in the laboratory.

- In the “Describe the Experiment in Detail” section, provide a detailed, but brief description of the experiment. Include information on how all biological agents will be used. This should include each agent’s purpose in the experiment, route of administration (if applicable), and how the agent will be maintained and manipulated throughout the experiment. **Do not cut and paste information from other documents** such as animal protocols or grants into this section, as these documents contain information that is not relevant to the biological safety of the project.
- If you include citations or reference scientific papers in your application, please provide a copy of the full publication, if possible.
- List the specific strain and source (i.e., the name of the commercial company or research laboratory) of all biological agents and transgenic animals.
- If the project involves the use of animals, provide a copy of the animal protocol (IACUC form) even if the animal application is pending the biosafety approval.
- In the “Describe the Biohazard Potential of These Experiments” section, list procedures where exposures might occur and the biosafety levels of agents in use, if known. **Leaving this section blank or stating “none” is not acceptable.** If you are using viral vectors to insert or knockout genes address the following issues in the Biosafety Section:
  - Identify any oncogenes, tumor suppressor genes, toxin producing genes, or other genes with the potential to cause harm if expressed or knocked out.
  - Indicate if the inserted gene has the potential for altering the cell cycle.
  - Indicate if the viral DNA can integrate into the host genome.
  - Discuss the probability of generating replication-competent viruses including methods to reduce this probability such as multiple plasmid systems and self-inactivation.
  - Discuss the expected consequences of a human exposure to the vector.

### 1.3.2 Partners Institutional Biosafety Committee (PIBC)

The Partners Institutional Biosafety Committee (PIBC) serves as the IBC for the Partners Healthcare System (PHS) member institutions engaged in biological research. These institutions include Massachusetts General Hospital, Brigham and Women's Hospital, and McLean Hospital. The PIBC conducts specific review and oversight of biological research activities in compliance with the following guidelines and regulations:

- NIH—[NIH Guideline for Research Involving Recombinant DNA Molecules \(NIH Guidelines\)](#)
- Occupational Safety and Health Administration—[OSHA Bloodborne Pathogen Standard 1910.1030](#)
- Massachusetts Department of Public Health—[Medical Waste Regulation](#)
- Boston Public Health Commission—[Biological Safety / Laboratory Safety Regulations](#)
- Cambridge Public Health Department—[Laboratory Biosafety Regulations](#)
- Town of Belmont—[Regulation for the Use of Recombinant DNA Molecule Technology and Non-Recombinant Infectious Agents](#)

Additional information on the responsibilities of the PIBC can be found on their website ([http://resadmin.partners.org/RM\\_Home/Research\\_Support\\_Depts/Research\\_Oversight/PIBC/PartnersPIBC.aspx](http://resadmin.partners.org/RM_Home/Research_Support_Depts/Research_Oversight/PIBC/PartnersPIBC.aspx) ).

#### 1.3.2.1 Registering Research Projects with PIBC

Every project, study, or experiment involving biological research needs to be registered with the PIBC. Biological Research is defined as any activity that is either laboratory research involving rDNA, biological agents, human or nonhuman primate materials, or biological toxins or human subject research involving rDNA, biological agents, or xenotransplant

An investigator does not need to file a separate registration for every project performed or funded in the laboratory if the projects involve similar biological research activities. In the case of laboratories working only with human or nonhuman primate materials, only one registration is required.

Projects will be registered using the Insight Research Portal eIBC Module (<http://insight.partners.org/login/login.asp?CTAuthMode=BASIC>). To get access to this system, email the PIBC office at [PIBC@partners.org](mailto:PIBC@partners.org). The eIBC system can be used to submit New Applications, Amendments, Annual Reviews or Five-Year Renewals. After completing the forms on eIBC, the BSO conducts a preliminary review of the registration and may request additional information or clarification from the submitter and/or PI. Once the BSO review is complete, the submission is sent to the PIBC office where it will be reviewed to determine if the research can be administratively approved. If the research falls under Sections III-A through III-D of the NIH Guidelines, it must be reviewed at a convened meeting of the PIBC. Additionally, research with biological agents is typically reviewed at a convened meeting. For additional details on the review process, please reference the PIBC website.

### **1.3.3 Dana Farber Cancer Institute (DFCI) Biohazard Control Committee (BCC)**

The DFCI Biohazard Control Committee (BCC) serves as the IBC for DFCI. In compliance with the NIH Guidelines, the IBC includes representatives from the general public as part of its Committee membership. All research involving the use of rDNA and infectious microorganisms, including BBP, must be registered with the BCC.

#### *1.3.3.1 Registering Research Projects with BCC*

If you have questions regarding registration with the BCC, please contact Karen Byers by e-mail at [karen\\_byers@dfci.harvard.edu](mailto:karen_byers@dfci.harvard.edu) or by phone at 617-632-3890.

## **1.4 RESPONSIBILITIES**

The following section outlines the specific responsibilities associated with the HIM/NRB biosafety program.

### **1.4.1 Principal Investigator**

PIs are responsible for implementation of the applicable biosafety procedures and practices in their laboratories. They must ensure that the appropriate equipment and facilities are available for laboratory staff members and that they are used properly. They

must also arrange for appropriate employee training regarding the safe use of potentially hazardous biological agents and require that individuals handling BBPs receive the annual training mandated by OSHA. Each principal investigator must be aware of the potential adverse health effects of the biological materials used in his or her laboratory, the appropriate biosafety level, and any other pertinent factors that will ensure the safety of laboratory staff members and the surrounding community.

In addition to the responsibilities of the PI above, when research involves the use of rDNA, the PI agrees to abide by the NIH Guidelines. Under the NIH Guidelines, the PI has a number of specific responsibilities. In particular, the Principal Investigator must (among other tasks):

- Ensure that no research is conducted with biological materials prior to approval by the institution's IBC.
- Report any significant problems, violations of the NIH Guidelines, or any research-related accidents, illnesses, or potential exposures to the HIM/NRB Biosafety Officer and the institution's IBC.
- Instruct and train laboratory staff in: (i) the practices and techniques required to ensure safety, and (ii) the procedures for dealing with accidents. This instruction should be specific to the agents and materials used in the research project.
- Make available to all laboratory staff protocols that describe the potential biohazards and the precautions to be taken with the agents to be used.

Additional responsibilities of the PI when working with rDNA are located in the NIH Guidelines ([http://oba.od.nih.gov/rdna/nih\\_guidelines\\_oba.html](http://oba.od.nih.gov/rdna/nih_guidelines_oba.html)) Failure to comply with the NIH Guidelines by one PI could affect all NIH-funded projects at HIM/NRB; therefore, compliance is absolutely mandatory.

### **1.4.2 Laboratory Staff Responsibilities**

Laboratory staff members are responsible for following the HIM/NRB health and safety policies and the procedures and instructions from their PIs and the BSOs. They need to comply with the NIH, CDC and OSHA regulations, use safe laboratory practices, and inform the PI, laboratory supervisor, or BSO regarding any potentially hazardous situations or conditions.

### **1.4.3 Biosafety Officer**

Per your institution's IBC Policies and Procedures, the BSO is the primary intermediary between investigators and the IBC. For DFCI researchers, the HIM/NRB BSO acts in concert with the DFCI BSO. The BSO responsibilities include:

- Managing the biosafety program and implementation of COMS, PIBC, and BCC policies and procedures at HIM/NRB.
- Assisting laboratories in conforming to pertinent regulatory guidelines and COMS, PIBC, and BCC policies by providing training, facility inspection, and communication of program requirements.
- Making annual inspections of laboratory containment, procedures, records, and equipment for laboratories using biosafety level (BL) 1, 1N, 2, 2N, and 2 with stipulations (a.k.a. BL2+) practices and procedures, and select agents.
- Screening research protocols proposed by PIs and submitting to COMS and PIBC for approval. The BSO will determine whether more information is necessary and, if so, will communicate this need to the PI. Once the revised application is complete, the BSO will facilitate the approval process, corresponding with the appropriate IBC and/or PI as needed.
- Reporting to COMS and PIBC on the program status.

- Assisting the DFCI BSO, when needed, in addressing biosafety-related issues with DFCI researchers.

In addition, the BSO is responsible for:

- Preparing Biosafety Officer Memorandum to Principal Investigators explaining the requirements associated with their COMS recommendations.
- Conducting a Hazard Analysis/Risk Assessment when a PI proposes to work with a biological material that does not have COMS or PIBC precedents. Refer to Section 2 for more information.
- Providing advice on safe methods for new procedures.
- Recommending emergency response procedures in the event of an infectious spill or an exposure to a biological material.
- Summarizing the results of the biosafety inspections of laboratories in biosafety reports.
- Distributing biosafety report results to the laboratory biosafety contact and PI.
- Acting as the liaison between the IBC, the Institutional Animal Care and Use Committee (IACUC), and researchers.

## **2.0 HAZARD ANALYSIS/RISK ASSESSMENT**

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In order to determine which practices and procedures are required when working with biological materials, a risk assessment should be conducted. At a minimum, the risk assessment should include the following:

- Pathogenicity of the biological material and infectious dose
- Consideration of the outcome of an exposure
- Natural route of exposure
- Other routes of exposure (parenteral, airborne, ingestion, etc.)
- Stability of biological material in the environment
- Concentration of biological material and amount to be manipulated
- Presence of a suitable host
- Information available from animal studies and reports of laboratory-acquired infections or clinical reports
- How the biological material will be used (concentration, sonication, aerosolization, centrifugation, etc.)
- Any genetic manipulation of the organism that may extend the host range of the agent or alter the agent's sensitivity to known, effective treatment regimens
- Local availability of effective prophylaxis or therapeutic interventions

### **2.1 LIMITED INFORMATION**

There are situations when the information is insufficient to perform a risk assessment. For these situations, the following conservative approach should be used:

- Universal precautions should always be followed, and barrier protections applied (Gloves, gowns, eye protection), regardless of the origin of the samples.
- Biosafety level 2 should be the minimum requirement for the handling of specimens.

### **2.2 BIOLOGICAL EXPRESSION SYSTEMS**

Since biological expression systems consist of vectors and host cells, the BSO should consider the following:

- The expression of the DNA sequences derived from pathogenic organisms may increase the virulence of the genetically modified organism (GMO).
- Inserted DNA sequences are not well characterized, e.g., during the preparation of the genomic DNA libraries from pathogenic microorganisms
- Gene products have potential pharmacological activity
- Gene products code for toxins

### **2.3 GENETICALLY MODIFIED MICROORGANISMS**

When a PI is proposing to work with genetically modified microorganisms (GMMO), the BSO should consider the characteristics of donor and recipient/host organisms. In addition, s/he should consider the hazards:

- Arising directly from the inserted gene (donor organism):
  - Toxins
  - Cytokines
  - Hormones
  - Gene expression regulators
  - Virulence factors or enhancers
  - Oncogenic gene sequences
  - Antibiotic resistance
  - Allergens
- Associated with the recipient/host
  - Susceptibility of the host
  - Pathogenicity of the host strain, including virulence, infectivity, and toxin production
  - Modification of the host range
  - Recipient immune status
  - Consequences of exposure
- Arising from the alteration of existing pathogenic traits
  - Is there an increase in infectivity or pathogenicity?

- Could any disabling mutation within the recipient be overcome as a result of the insertion of the foreign gene?
- Does the foreign gene encode a pathogenicity determinant from another organism?
- If the foreign DNA does include a pathogenicity determinant, is it foreseeable that this gene could contribute to the pathogenicity of the GMMO?
- Is treatment available?
- Will the susceptibility of the GMMO to antibiotics or other forms of therapy be affected as a consequence of the genetic modification?
- Is eradication of the GMMO achievable?

### 3.0 PRINCIPLES OF BIOSAFETY

The BMBL classifies work with biological agents into four distinct BLs that have increasingly restrictive practices and facilities. Each BL designation is based on the potential health risks for individuals handling the biological materials. The four BLs and the associated risks for individuals and community members, including the Harvard designation BL2 with stipulations (a.k.a. BL2+) that has been established by COMS, are summarized in Table 3.1. These biosafety levels are also used by the PIBC.

<b>Biosafety Level</b>	<b>Risk Group</b>	<b>Examples</b>
BL1	Individual risk: LOW Community risk: LOW	<i>Escherichia coli</i> Adeno-associated viruses
BL2	Individual risk: MODERATE Community risk: LOW	<i>Streptococcus</i> <i>Staphylococcus</i> Hepatitis B and C viruses Adenoviruses Most retroviruses and lentiviruses
BL2+ <sup>1</sup>	Individual risk: MODERATE Community risk: LOW	Some retroviruses and lentiviruses Prions
BL3	Individual risk: HIGH Community risk: MODERATE	Tuberculosis West Nile virus
BL4	Individual risk: HIGH Community risk: HIGH	Ebola virus
<sup>1</sup> This classification has been established by the Committee on Microbiological Safety and is not included in the <i>Biosafety in Microbiological and Biomedical Laboratories</i> .		

Appendix A contains specific information drawn from the BMBL concerning BL1, BL2, and BL3, which applies to BL2+ (also referred to as BL2 with Stipulations).

#### 3.1 BIOSAFETY LEVELS 1 AND 2

The majority of laboratory work at HIM/NRB is conducted using BL1 and BL2 containment and procedures. BL1 is applicable to work involving well-characterized agents not known to consistently cause disease in healthy adult humans; these agents present minimal potential health hazards to laboratory personnel and the surrounding community. BL2 is recommended for work involving agents that present moderate potential health hazards to laboratory personnel and the surrounding community. BL2

includes all of the practices and procedures of BL1 and then builds upon these guidelines. Table 3.2 provides a brief summary of the biosafety level criteria for BL1 and BL2.

<b>Table 3.2</b> Summary of Biosafety Level Criteria for BL1 and BL2				
<b>Biosafety Level</b>	<b>Agents</b>	<b>Practices</b>	<b>Safety Equipment (Primary Barriers)</b>	<b>Facilities (Secondary Barriers)</b>
BL1	Not known to consistently cause disease in healthy adults	Standard Microbiological Practices	Personal Protective Equipment (PPE) includes laboratory coats; gloves; eye protection as needed	Open bench top sink required
BL2	Associated with human disease. Potential hazards from percutaneous injury, ingestion, and mucous membrane exposure.	BL1 practices plus: <ul style="list-style-type: none"> <li>• Limited access</li> <li>• Biohazard signs</li> <li>• PPE</li> <li>• Sharps precautions</li> <li>• Biosafety manual that defines any biological waste decontamination policies</li> </ul>	<ul style="list-style-type: none"> <li>• Primary barriers include Class I or II biosafety cabinets or other physical containment devices for all manipulations of agents that cause splashes or aerosols of infectious materials.</li> <li>• PPE includes laboratory coats; gloves; face protection as needed</li> </ul>	BL1 plus: <ul style="list-style-type: none"> <li>• Autoclave available</li> </ul>

### **3.2 BIOSAFETY LEVEL 2+ (BL2 WITH STIPULATIONS)**

BL2 with stipulations (a.k.a. BL2+) work is performed in a BL2 facility used in conjunction with BL3 procedures and work practices with the appropriate safety equipment (safety centrifuge cups, biosafety cabinets, disposable labware, etc.). This BL2+ containment level affords a greater margin of safety for personnel for instances when BL3 containment is not necessary.

BL2+ involves infectious agents that do not have a documented aerosol route of exposure. This containment level is also suitable for activity with agents where there is insufficient information available about the agents in question and/or about worker safety when using these agents.

The most common example of biological agents that require BL2+ conditions are certain lentiviral and retroviral vectors expressing harmful gene products. These conditions are defined as the use of BL2 practices plus the following practices:

- The BL2+ laboratory must be self-contained. If a centrifuge cannot be located in the laboratory, then rotors and centrifuge cups must be opened inside a biosafety cabinet within the laboratory.
- Strict needle and sharps precautions must be observed.
- All work must be done in a biosafety cabinet.
- Vacuum lines must be protected with filters.
- Gloves must be worn for handling cultures.
- Before beginning *in vitro* work with replication incompetent vectors, the PI must provide the COMS or PIBC with a protocol for testing the viral vector preparations for replication competence. The sensitivity of the assay must be indicated.
- Vector preparations must be tested for the presence of replication-competent virus. Testing result records must be maintained and will be subject to periodic evaluation.
- Before beginning your animal experiments under this registration, you must provide the COMS or PIBC with a protocol for testing whether virus is shed from treated animals.
- Treated animals must be tested for viral shedding.
- Waste materials may be required to be autoclaved prior to disposal depending on the risk assessment conducted by BSO.

### **3.3 BIOSAFETY LEVEL 2 (VIRAL VECTOR)**

For DFCI researchers, the DFCI BCC utilizes a designation of BL2 (Viral Vector) for research involving lentiviral vectors. For information on procedures related to this destination, refer to the DFCI Biosafety Manual (<http://dfcionline.org/departments/environmentalhealthsafety/default.aspx>). **This is a Partners intranet link (i.e., you need to be on a Partners computer or have VPN access to connect to it).**

## **4.0 LABORATORY PRACTICES**

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### **4.1 PERSONAL PROTECTIVE EQUIPMENT**

Personal protective equipment (PPE) is an essential element laboratory safety, and must be provided to all staff members by their respective institutions free of charge. PPE provided to staff members includes, but is not limited to:

- Gloves
- Laboratory coats (impervious)
- Side shields (for glasses)
- Face shields/masks
- Safety glasses
- Prescription safety glasses
- Goggles
- Hoods
- Shoe covers
- Respiratory protection
- Other site-specific personal protective equipment

At a minimum, laboratory personnel shall wear gloves and a laboratory coat whenever handling biological agents, cells and tissues. Safety glasses with side shields, goggles, or face shield shall be worn when these materials could potentially be splashed in the face. Laboratory personnel should wear other personal protective equipment (apron, face shield, mask, etc.) as needed or required to prevent potentially infectious materials from reaching their clothes, skin, eyes, mouth, or other mucous membranes. PPE must be removed prior to leaving the work area and placed in designated areas. PPE must be treated as medical waste when discarded. If PPE is not disposable, PPE shall be cleaned with disinfectant before and after use.

### **4.2 BIOLOGICAL SAFETY CABINETS**

Biological safety cabinets (BSCs) provide a primary level of containment for working safely with potentially hazardous biological materials. When combined with good

microbiological practices, BSCs can protect both laboratory personnel and the environment. Although many may think that the principle function of BSCs is to protect cells and cultures from contamination by bacteria and fungi, **their primary purpose should be to protect the laboratory workers from exposures to potentially infectious agents.**

BSCs are designated as Class I, II, or III based on specific airflow patterns within the BSC and on the locations of high efficiency particulate air (HEPA) filters within the unit (Table 4.1). HEPA filters are usually composed of a pleated sheet of borosilicate fiber material that has been treated with a wet-strength water-repellant binder. These filters are specifically designed to remove particles equal and greater than 0.3 microns with an efficiency of 99.97%. This filtration level will capture a majority of bacteria, spores, and viruses from the filtered air. Figure 4.1 illustrates typical airflow patterns in a BSC.

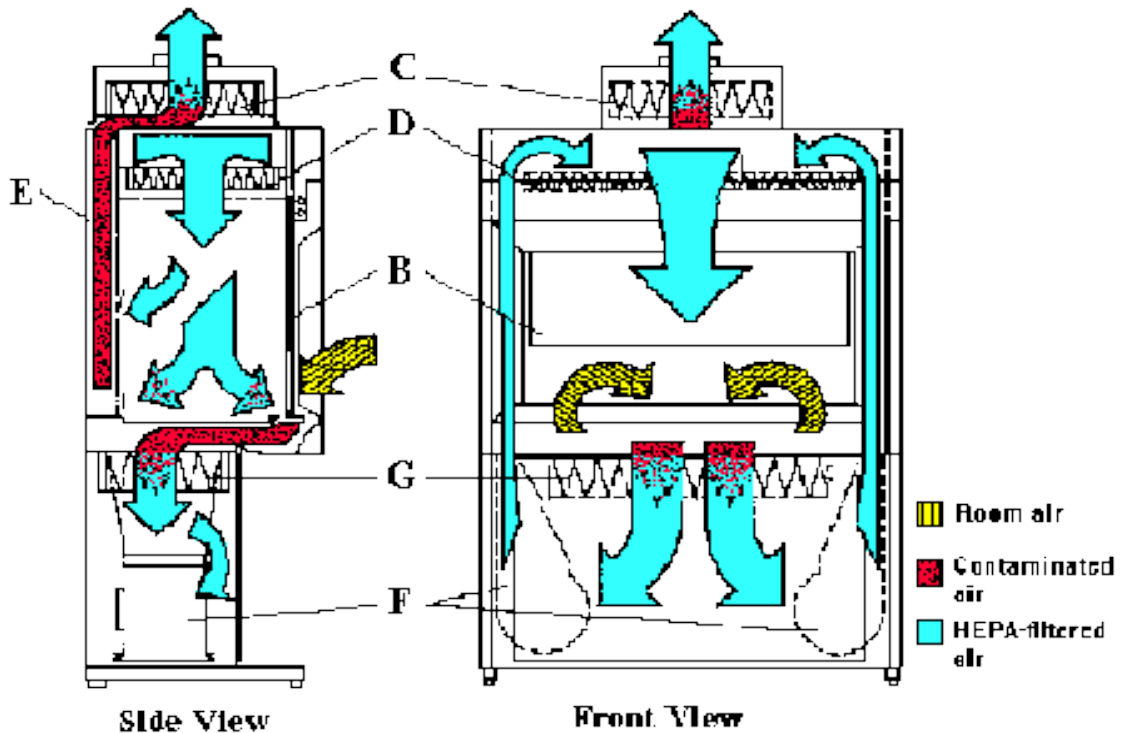
<b>Table 4.1</b> Biological Safety Cabinet Characteristics <sup>1</sup>				
<b>New NSF Class and Type</b>	<b>Previous NSF Class and Type</b>	<b>Face Velocity (linear ft./min.)</b>	<b>Airflow Pattern</b>	<b>Use of Volatile Toxic Chemicals and Radionuclides</b>
A1	II, A	75	70% of intake air recirculated; 30% exhausted from a common plenum to the room. Plenum contaminated with biological materials under positive pressure	No
A2	II, A/B3	100	70% of intake air recirculated; 30% exhausted from a common plenum to the room. Plenum contaminated with biological materials under negative pressure or surrounded by negative pressure	Yes (small amounts <sup>2</sup> )
A2	II, B3	100	70% of intake air recirculated; 30% exhausted from a common plenum to the room. Plenum contaminated with biological materials under negative pressure or surrounded by negative pressure.	Yes (small amounts)
B1	II, B1	100	40% of intake air recirculated; 60% exhausted from cabinet; exhaust air pulled through dedicated exhaust duct into facility exhaust system. All plenums contaminated with biological materials are negative to the room or surrounded by negative pressure plenums.	Yes (small amounts <sup>2</sup> )
B2	II, B2	100	No intake air recirculated; 100% exhausted from cabinet. Exhaust air pulled through dedicated exhaust duct into facility exhaust system. All ducts and plenums are under negative pressure; all ducts contaminated with biological materials are under negative pressure or surrounded by directly exhausted negative pressure ducts or plenums.	Yes (small amounts <sup>2</sup> )

**Table 4.1** Continued

NSF National Sanitation Foundation  
ft/min. feet per minute

<sup>1</sup> Information from Baker Labs.

<sup>2</sup> Under no circumstances should the chemical concentration approach the lower explosion limits of the compound.



(Figure from *Biosafety in Microbiological and Biomedical Laboratories*, 4<sup>th</sup> Edition, 1999.)

**Figure 4.1** Class II, Type B1 Biological Safety Cabinet (classic design). B—sash, C—exhaust HEPA filter, D—supply HEPA filter, E—negative pressure exhaust plenum, F—blower, G—additional HEPA filter for supply air. Note: The cabinet's exhaust needs to be connected to the building exhaust system.

Implementation of the following procedures will ensure optimal operation of a BSC:

- Front and rear grills should be free of clutter to allow proper air intake
- Sash should not be raised above the specified level
- Bunsen burner use should be avoided to prevent airflow disruptions and damage to the HEPA filter.
- Certification must be performed annually.

BSCs are required to be tested and certified annually by technicians accredited by the National Sanitation Foundation (NSF). Additionally, BSCs will be certified when they are first installed and whenever they are moved, even to a nearby laboratory, because the HEPA filters may be dislodged from their proper fitting during these moves. Please contact the HIM/NRB EH&S office at 617-432-2762 for additional assistance with BSC certifications.

## 4.3 DISPOSAL OF BIOLOGICAL WASTE

### 4.3.1 Biological Waste

Biological waste may be disposed of in three ways: designated biological waste box, chemical disinfection, and steam sterilization/autoclave. Appropriate disinfection procedures will be chosen and utilized in accordance with both the PI and the BSO in order to ensure adequate decontamination of biological wastes.

- Infectious and potentially infectious waste and waste containing rDNA may only be disposed of in designated gray plastic reusable biological waste containers. Each box is labeled with the universal biohazard symbol (Figure 4.2) and is lined with one red plastic bag. When a biological waste box is between two-thirds (2/3) and three-quarters (3/4) full, the bag should be hand tied closed and the lids on the container should be closed. Do not overfill the containers. Boxes that leak any liquid or that exceed 55 pounds will not be moved or removed for disposal. Once the container is closed, it should be placed in the hallway for collection by the Harvard Custodial Department.



**Figure 4.2** Universal Biohazard Symbol

Liquid biological waste and rDNA waste must be rendered non-infectious by steam sterilization or chemical disinfection prior to sink disposal. If chemical disinfection is

selected, full-strength household chlorine bleach may be added to the waste container, such as an aspiration flask, so that the **final** solution concentration of bleach will be 10%. Contact time should be at least 30 minutes prior to sink disposal for bleach.

**Note:** If bleach is not an adequate disinfectant for the biological agent in use, an U.S. Environmental Protection Agency (EPA) approved disinfectant must be used. Ensure the proper contact time prior to disposal.

Before disposing of the treated solution down the sink, check the pH to ensure it is within the permissible pH range under the Massachusetts Water Resources Authority (MWRA) discharge permit (5.5 – 12.0 standard units). If it is within the permissible range, then disposal of the treated solution in the sink should be done with running tap water to minimize possible plumbing damage due to the corrosive effects of the disinfectants. Autoclaving solutions containing bleach is **not permitted** due to the potential for production of toxic chlorine gas.

#### **4.3.2 Biological/Radionuclide Waste**

There are three steps in dealing with radioactive waste disposal:

- Disinfect.
- Check radioactivity.
- If it is radioactive, discard as radioactive.

Harvard Radiation Safety is responsible for the disposal of radioactive waste and ensuring compliance with the Nuclear Regulatory Commission (NRC) regulations. If you have any questions regarding radioactive waste, please contact them at 617-495-2060.

There are several problems that should be considered before the disinfection. First, autoclaving radioactive material is forbidden. Second, using chlorine bleach for disinfection on material labeled with  $I^{125}$  can release radioactivity, gases, and iodine. Do not disinfect iodinated compounds or cells with chlorine bleach.

- **Solid Radioactive Biological Waste:** All radioactive solid waste should be rinsed (glass or plastic) or sprayed (paper) with a suitable disinfectant. Allow at least 30 minutes of contact to ensure adequate inactivation of the biological hazard. After chemical disinfection, contact Harvard Radiation Safety for additional guidance at 617-495-2060.
- **Liquid Radioactive Biological Waste:** Treating liquid radioactive biowaste with a 1:10 dilution of household bleach for at least 30 minutes can inactivate most biological hazards. Add the concentrated bleach to the final waste until a final dilution of 1:10 is achieved. Evaluate the liquid waste for presence of radioactivity. If the levels are within NRC sink disposal limits, it may be possible to dispose of the isotope in a designated sink. Record the disposal. If the radioactivity exceeds the permissible sink disposal limits, place the liquid waste in an unbreakable container filled with absorbent, and dispose of as radioactive waste.

#### **4.3.3 Biological/Chemical Waste**

The approach for managing biological waste containing hazardous or potentially hazardous chemicals is similar to radioactive biological waste. Disinfect the infectious material with chemical disinfectant and dispose of as chemical waste. Select chemical disinfectants carefully because some disinfectants can react with chemicals. Check with the HIM/NRB EH&S office at 617-432-2762 if you have any questions.

#### **4.4 SHARPS MANAGEMENT**

Some of the most serious accidents in biological laboratories are those caused by puncture wounds through skin (percutaneous exposures). All objects that can puncture skin are designated as sharps and require special disposal treatment. Examples of sharps include hypodermic needles, glass Pasteur pipettes, razor blades, broken glass, and suture needles. Massachusetts regulations classify any item that may cause punctures or cuts as a sharp

Federal regulations concerning sharps primarily focus on work with human bodily fluids. Research work conducted with animals only is not required to utilize engineered sharps;

however, it is recommended that engineered devices be used whenever practical. Because the majority of laboratory biohazard injuries are due to hypodermic needles, special attention has focused on their use and disposal. Some guidelines include:

- Minimize use of needles and syringes.
- Do not bend, shear, or break needles.
- Do not recap needles.
- Do not remove needles from syringes.
- Throw away the entire syringe-needle combination.
- Be careful during cleanup; some sharp items may be hidden in the waste materials.
- If you do stick yourself, encourage the wound to bleed for a few minutes, wash the area, and then get medical attention immediately.

In 2001, in response to the *Needlestick Safety and Prevention Act*, OSHA revised the BBP Standard 29 CFR 1910.1030. The revised standard clarifies the need for employers to select safer needle devices and to involve employees in identifying and choosing these devices. The updated standard also requires employers to maintain a log of injuries from contaminated sharps. Further information can be found at <http://www.cdc.gov/niosh/stopsticks/safersharpdevices.html> HIM/NRB laboratories are required to evaluate the use of safety needles whenever possible, and if feasible, select safety needles for use. Please refer to the HIM/NRB Exposure Control Plan in Appendix C for details.

#### **4.4.1 Sharps Disposal**

To protect yourself and others from injury from sharps, place all needles, Pasteur pipettes, syringes, suture needles, scalpels, and razor blades into standard sharps containers. Large volumetric/serological pipettes or other items that can puncture the biological waste red bags should be disposed of in Sharps Boxes. Sharps containers must be red, fluorescent orange or orange-red leak proof, rigid, puncture-resistant, shatterproof containers that are marked prominently with the universal biohazard warning symbol and the word “Biohazard” in a contrasting color. Place sharps containers in convenient locations near work areas so they will be used. **Do not overfill the sharps**

**containers.** Containers should be sealed when they are three-quarters (3/4) full. Filled reusable sharps containers are routinely picked up and replaced by Stericycle.



**Figure 4.3** Sharps Container

Any filled **disposable** sharps containers should be placed into a larger reusable sharps container.

#### **4.4.2 Broken Glassware Disposal**

Place clean broken glassware into the standard recycling boxes for glassware. Contaminated broken test tubes or other glass items may be placed directly into sharps containers. For questions about glassware disposal and what is considered clean glass contact the HIM/NRB EH&S office at [himnrbehs@eheinc.com](mailto:himnrbehs@eheinc.com) or 617-432-2762.

#### **4.4.3 Pasteur Pipettes Disposal**

Pasteur pipettes are a special case because Massachusetts law requires that they be considered as a sharps waste no matter what their previous use. Discard glass Pasteur pipettes directly into sharps containers; **do not** use broken glassware boxes. Plastic pipettes and serological pipettes that could puncture the red waste bags should also be disposed of in sharps containers.

## 4.5 DISINFECTION AND DECONTAMINATION

Disinfection and decontamination are terms that are often used interchangeably, but they each have specific definitions. Disinfection is a chemical or physical treatment that destroys most biological agents, except spores. Decontamination refers to a chemical or physical treatment that destroys most biological agents to a low level, but not necessarily zero. A number of disinfectants are commonly used in laboratory settings, particularly to wipe down surfaces to remove infectious agents. Types of disinfectants and their uses are summarized in Table 4.2.

<b>Table 4.2</b> Summary of Disinfectants and Their Uses			
<b>Disinfectant</b>	<b>Final Concentration</b>	<b>Effective On</b>	<b>Ineffective On</b>
Sodium Hypochlorite Bleaches: e.g., Clorox™*	1:10	Bacteria, some spores, viruses, TB,** HIV	Some spores
Chlorine Dioxide: e.g., Clidox®-S*	1:3:1 or 1:18:1~	Bacteria, spores, viruses, TB	
Alcohols (ethanol, isopropanol)	70%	Bacteria, most viruses	Spores, TB
Quaternary Ammonium Compounds: e.g., Quatricide®*	Follow manufacturers' directions for dilutions	Bacteria, spores, viruses, TB	
TB      tuberculosis HIV     human immunodeficiency virus  *      The use of brand names does not imply a recommendation. **     Use 1/5 dilution ~      Please check the manufacturers' directions for specific dilutions			

## 4.6 AUTOCLAVING PROCEDURES

Autoclaves work by denaturing biological molecules with superheated steam; dry heat is not nearly as effective. For example, it takes 12 minutes to kill most spores with steam at 121 degrees Celsius (°C), while 6 hours are required with dry heat at the same temperature. It is the steam that kills.

As a result, anything that does not come in contact with steam inside the autoclave may not be adequately decontaminated. The potential for inadequate decontamination becomes a greater concern when sealed biohazard bags are placed in an autoclave.

There are two simple solutions: 1) cut open the bag, or 2) place about 200 milliliters of water in the bag before sealing.

Typically, bags (24" x 36") of solid plastic waste take from 45 minutes to 1 hour to reach sterilizing temperatures throughout its contents.

Massachusetts regulations 105 CMR 480 requires that if you use an autoclave for the treatment of infectious waste, each load must be logged with the date of the treatment, the quantity of the waste treated, the type of waste, process parameters (e.g., pressure temperature) and the signature of the operator. Examples of log-sheets are located at the Massachusetts Department of Public Health website:

<http://www.mass.gov/eohhs/docs/dph/environmental/sanitation/105cmr480-medical-waste-on-site-log.pdf>

#### 4.6.1 Autoclave Testing and Validation

Autoclaves should be tested quarterly and validated to insure that they are operating properly and killing the biological organisms in each autoclave load. The preferred method to check your autoclave is to test it with a commercial spore test system. This system uses ampoules containing a bacterial species called *Bacillus stearothermophilus* that is tolerant to high temperatures and a color indicator solution. The ampoules are autoclaved under realistic conditions, such as in the middle of a bag of waste, and then incubated for two days at 56°C. If the spores grow, a color change will occur, indicating inadequate sterilization in the autoclave. If there is no growth, no color change occurs and the autoclaving procedure is adequate. Frequent validation is not necessary, unless required by regulatory authorities in special circumstances. Using an established autoclave test procedure, quarterly to yearly checks with a biological indicator are usually adequate to assure proper autoclave function and to detect gradual deterioration of operation. It is important to note that autoclave tape indicates only that a critical temperature was reached; it **does not** indicate the length of time at the desired temperature or whether steam was present.

In the research laboratory setting, the target organisms to be killed are usually known and they are usually heat sensitive. In practice, the same autoclave is used for sterilizing

laboratory materials and waste. If sterilized materials are subsequently determined to be contaminated, it is an indication that the autoclave is not working properly.

The following tips will help prevent injury and property damage when using the autoclave.

- Do not overfill containers. Leave the top third as empty expansion space.
- Use only vented closures.
- Place contaminated materials in autoclave bags. Place bags inside plastic or metal trays when autoclaving.
- Use only containers designed for sterilization. Use plastic or metal trays.

Bottles should be cool to the touch before attempting to remove them. Do not place hot bottles directly on a room temperature or cool surface. Tighten screw caps when the liquid is completely cooled.

Massachusetts regulation 105 CMR 480 requires that if you use an autoclave for the treatment of infectious waste, efficiency testing, maintenance, and parametric monitor calibration must be completed on a quarterly basis.

The following paragraphs are the specific requirements as stated in 105 CMR 480.150:

(B) The methods which rely on heat shall be evaluated for each load or cycle by using a recording thermometer, thermocouple, parametric monitoring device, thermal indicator strip, or by an equivalent method approved in writing by the Department.

(C) For any wastes that are rendered noninfectious by chemical disinfection, the chemical used shall be of demonstrated efficacy, as determined by the Department, against the challenge testing target or indicator organism and registered with:

- (1) The U.S. Environmental Protection Agency, Office of Pesticide Programs pursuant to the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA); and
- (2) The Massachusetts Department of Agricultural Resources, Pesticide Bureau.

(D) All parametric monitoring equipment utilized in conjunction with any approved disinfection methods, including autoclaves, shall be calibrated at a minimum annually, by an individual who has received training from the manufacturer in the operations and maintenance of the equipment.

(E) Quarterly qualitative (growth/no growth) biological challenge testing shall be conducted during standard operations for all approved disinfection methods including autoclaves, but not incineration. Specifically:

(1) Testing shall consist of spore strips or a retrievable alternative medium approved by the Department, which contain a  $1.0 \times 10^4$  minimum challenge population of a bacterial indicator organism that is most resistant to any aspect of the treatment technology as outlined in the most recent medical waste treatment technology guidelines established by The State and Territorial Association on Alternative Treatment Technologies (STAATT) or its successor The International Society of Analytical Analysis of Treatment Technologies (IStAATT);

(2) Testing methodologies including the number, type and locations shall be in accordance with manufacturer's guidelines and procedures approved by the Department;

(3) Analytical testing results (growth/no growth) should demonstrate a minimum bacterial spore reduction of 4 log 10;

(4) When a 4 log 10 bacterial spore reduction has not been demonstrated (results indicate bacterial growth), an operations and mechanical systems assessment shall be conducted by a qualified individual who has received training from the manufacturer in the operations and maintenance of the equipment. Appropriate corrective actions shall be implemented, when warranted, including but not limited to mechanical adjustments and when applicable, recalibration of all parametric monitoring devices followed by re-treatment of the waste and additional challenge testing to confirm the effectiveness of any implemented corrective action;

(5) In accordance with 105 CMR 480.500(B)(1)(f), the analytical test results shall be documented on the required record-keeping log form for medical or biological waste treated on site in conjunction with the date and all applicable corresponding process parameter results.

(6) When implemented, corrective actions pursuant to 105 CMR 480.150(E)(4) shall be documented in detail, including the date, name of the individual implementing the corrective actions and a description of the work performed, on the back of the applicable record-keeping log form for medical or biological waste treated on-site.

(7) All analytical test results shall be retained in the required record-keeping log for a

period of three years.

#### 4.7 SPILL MANAGEMENT

The following procedures are recommended for the management of small spills of blood, bodily fluids, or other potentially infectious materials. If a large volume of a biological material spills or if equipment (centrifuge/homogenizer/biosafety cabinet) malfunctions while processing biological materials, call the HIM/NRB EH&S office for immediate consultation to implement appropriate measures to contain the spill.

- **Wear gloves and proper protective clothing.** Heavyweight, puncture-resistant, utility gloves are recommended to be worn over disposable latex or nitrile gloves. If the spill contains broken glass or other objects, these should be removed and discarded without contact with the hands. Rigid sheets of cardboard used as a "pusher" and "receiver" may be used to handle such objects and should be discarded with the objects into an appropriate biohazard container. If the spill is large and/or there is a potential of contaminating the worker's shoes, water-impermeable shoe covers should be worn.
- **Absorb the spill.** Because most disinfectants are less active, or even ineffective in the presence of high concentrations of protein that are found in blood and serum, the bulk of the spilled liquid should be absorbed prior to disinfection. Absorb the spilled material with disposable absorbent material (e.g., paper towels, gauze pads, or tissue paper wipes). If the spill is large, granular absorbent material may be used to absorb the liquid. Absorbent granular material, such as an Isolyzer, containing a chemical that releases chlorine upon wetting is commercially available. The efficacy of such material for disinfection is not known and, therefore, should not be relied upon to disinfect a spill. After absorption of the liquid, all contaminated materials should be discarded as biological waste.
- **Clean the spill site** of all visible spilled material using an aqueous detergent solution. Any household detergent may be used. The intent is to dilute the spilled material, lyse red blood cells, and further remove proteins from the contaminated

area. Absorb the bulk of liquid prior to disinfection to prevent dilution of the disinfectant. The use of a disinfectant detergent is not necessary.

- **Disinfect the spill site** using an appropriate intermediate to high-level hospital disinfectant, such as a dilution of household bleach (see Table 4.2). If you are adding disinfectant to a liquid spill, make sure the final concentration is correct. Flood the spill site or wipe down the spill site with disposable towels soaked in disinfectant to make the site "glistening wet."

**Note:** If bleach does not disinfect the material, then you are required to use an EPA approved disinfectant. Ensure the proper contact time prior to disposal.

- **Rinse the spill site** with water to remove any noxious chemicals or odors. Dry the spill site to prevent slipping.
- **Dispose** all disposable materials used to decontaminate the spill into a biological waste container. Handle the material in the same manner as other infectious waste.

#### 4.7.1 Management of Small Spills

The following procedures are recommended for the management of small spills of blood, body fluids, or other potentially infectious materials in the laboratory or in a biosafety cabinet. Small spills are defined as spills <10 ml or that can be absorbed using two paper towels.

- Put on protective clothing (laboratory coat, gloves, face and eye protection, and shoe covers) and assemble clean-up materials (disinfectant, autoclavable container or bag, forceps, and paper towels).
- If the spill has occurred in a biosafety cabinet, keep the cabinet turned on.
- Spray the affected area with a disinfectant, such as a fresh 10% bleach solution.
- Pick up any broken glass with forceps and dispose it in a sharps container.
- Let disinfectant sit for 30 minutes.
- Soak up the disinfectant and spill with paper towels.
- Discard all clean-up materials in a biological waste box. Autoclave any reusable items, such as laboratory coats.

- Wash hands and exposed skin areas thoroughly with soap and water.

#### **4.7.2 Management of Large Spills**

The following procedures are recommended for a large volume biological spill (defined as spills >10 ml) in the laboratory area, in a BSC, or if equipment malfunctions while processing biological materials:

- If the spill occurs in a BSC, close the sash and leave the BSC running.
- Keep people out of the area to prevent spread of the contamination. Put up a warning sign.
- Remove any contaminated clothing and put it into a biohazard bag for decontamination later.
- Wash hands and exposed skin thoroughly with soap and water.
- Contact the HIM/NRB EH&S office at 617-432-2762.
- Complete an incident report form (Appendix D).

## **5.0 IMMUNIZATIONS AND MEDICAL RESTRICTIONS**

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Certain biological materials require personnel working with them to receive immunizations and/or have medical restrictions.

### **5.1 VACCINIA**

Vaccination against Vaccinia virus is **not mandatory**, due to its contraindications under many circumstances. Individuals who have any of the following conditions or who live with someone who does should NOT get the smallpox vaccine unless they have been exposed to the smallpox virus:

- Eczema or atopic dermatitis (this is true even if the condition is not currently active, is mild, or was experienced as a child).
- Skin conditions such as burns, chickenpox, shingles, impetigo, herpes, severe acne, or psoriasis (people with any of these conditions should not get the vaccine until they have completely healed).
- Weakened immune system (cancer treatment, an organ transplant, HIV, Primary Immune Deficiency disorders, some severe autoimmune disorders and medications to treat autoimmune disorders, and other illnesses can weaken the immune system).
- Pregnancy or plans to become pregnant within one month of vaccination.

Employees who work with Vaccinia constructs and who want to be vaccinated, should contact their department of Occupational Health and Safety.

### **5.2 HEPATITIS B VACCINE**

Under the OSHA BBP Standard, a hepatitis B vaccine is recommended for all employees working with human blood, body fluids, tissues, or other potentially infectious materials. Those employees declining vaccination will be asked to sign the OSHA waiver

indicating that hepatitis B vaccine has been offered and refused. Any questions should be directed to Occupational Health and Safety.

### **5.3 PREGNANCY**

Several infectious agents are known to affect embryonic development. Women of childbearing age should be aware of the risks associated with studies using these agents. Men or women living with women of childbearing age should also know of the risks and should be especially careful not to bring infectious agents home on clothing or other laboratory materials.

For an infectious agent to affect embryonic development, the infectious agent must be transmitted to the child. In some cases, transmission is via the blood through the placenta. The following is a partial list of infectious organisms known to have some adverse effects on human embryo and fetal development:

- Rubella virus
- Herpes simplex virus
- Varicella virus
- HIV

This list is not all-inclusive. Please contact the HIM/NRB EH&S Office for further information.

Infections caused by the following biological agents can cause birth defects in animals, but have not yet been shown to be teratogenic in humans:

- Influenza virus
- Mumps virus
- Parainfluenza type 2

This list is not all-inclusive. Please contact the HIM/NRB EH&S Office for further information.

Should you become or wish to become pregnant, it is wise to inform your obstetrician and gynecologist of any infectious agents and any chemicals you may encounter in your work. Women who are pregnant or become pregnant are encouraged to inform their supervisors or principal investigators and discuss exposure issues regarding associated risks of research being conducted and pregnancy, including infectious agents and chemical exposures and encounters.

- Radiation exposure can also cause fetal damage. If concerned about radiation exposure, contact the Harvard Radiation Safety Office.
- Women who wish to become pregnant, or who become pregnant while working in the BL2+ laboratories, are encouraged to inform their supervisors or PIs and the HIM/NRB EH&S Office. Such employees are urged to discuss exposure issues relating to fetal infection and radiation exposure with their supervisors or PIs. The BSO is available to give advice about precautions, which might be necessary to protect the fetus and mother against exposure to infectious materials. Contact the HIM/NRB EH&S office for precautions when working with hazardous chemicals and Harvard Radiation Safety when working with radioisotopes during pregnancy.

#### **5.4 OTHER MEDICAL RESTRICTIONS**

Restrictions or recommendations will be made on an individual basis after discussion with either an occupational medicine practitioner or your personal physician.

Examples of some conditions that might warrant special precautions are HIV infection, immunosuppressive conditions, or drug therapy that suppresses the immune system.

Therefore, if you are suffering from any of the above-mentioned conditions, you must inform your personal physician and your Occupational Health and Safety department about any issues that prevent you from being able to work in a BL2+ laboratory.

## **6.0 LABORATORY SAFETY TRAINING INFORMATION**

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General laboratory safety information, including biological safety training is provided for all HIM/NRB laboratory staff by the HIM/NRB EH&S office. Laboratory staff including PIs, are required to take this training annually. Lack of compliance with the training requirement will prevent new research from being approved by the IBC. Currently, the HIM/NRB EH&S office offers the training in both an online format and frequently scheduled in-person trainings. The HIM/NRB EH&S office will also conduct training to specific groups upon request.

## **7.0 SHIPPING AND RECEIVING PROCEDURES FOR BIOLOGICAL SPECIMENS**

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Import, export, and interstate transport of biological materials are subject to requirements and laws from several federal agencies. The U.S. Public Health Service (PHS), U.S. Department of Transportation (DOT), U.S. Department of Agriculture (USDA), and U.S. Postal Service, regulate transport of hazardous materials by rail, air, vessel, and public highway. The guidelines and regulations of the International Air Transport Association (IATA) and International Civil Aviation Organization also apply when shipping substances by air. Import/Export Permit requirements are regulated by the Bureau of Customs; the Department of Commerce, CDC, and USDA require permits for certain agents.

The PHS defines etiological agents as viable microorganisms that cause disease in humans; infectious substances are those substances that contain etiologic agents. This terminology is used by the DOT and IATA. Diagnostic specimens are anything that the shipper reasonably believes to contain an infectious substance. Diagnostic and infectious specimens are regulated by the USDA, U.S. Food and Drug Administration (FDA), PHS, and IATA. Biological product means a product prepared in accordance with regulations that govern the manufacture of vaccines, reagents, or all viruses, serums, toxins, etc. intended for use in the diagnosis, treatment, or prevention of diseases in humans or animals. Biological products are regulated by the USDA, FDA, PHS, DOT, and IATA.

Laboratory staff may receive awareness level training from the HIM/NRB EH&S office for the shipment of hazardous materials. Individuals packaging specimens/hazardous materials for shipment must also receive function-specific training. The training is required every two years or when there is change in the regulations. For assistance regarding training and other requirements necessary for the legal shipping of hazardous materials, please contact the HIM/NRB EH&S office. Go to the HIM/NRB EH&S website at <http://www.himnrbehs.com/himnrbehs/training.asp> for a list of upcoming training dates.

The required type of packaging, labeling, and documentation depend on the biohazardous material being shipped, how it is being shipped, and where it is being shipped. Specific packaging requirements for various biological agents should be reviewed by the principal investigator to ensure compliance with all regulatory requirements. Please be aware that anyone who ships restricted items improperly and without authorization may be subjected to fines and/or incarceration.

For more information of DOT Research and Special Programs Administration Office of Hazardous Materials Safety regulation (49 CFR Part 171 et. al.), please see <http://hazmat.dot.gov/67fr-53118.pdf>. For more information about shipping packaging materials, go to Saf-T-Pak® website <http://www.saftpak.com>.

## **8.0 GENERAL LABORATORY SAFETY AND BIOLOGICAL SAFETY INSPECTIONS**

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Various federal, state, and local regulations require that laboratory inspections are conducted on an annual basis for all BL2 laboratories and higher and once every two years for BL1 laboratories. Copies of the inspections forms can be found in Appendix B or by visiting the HIM/NRB EH&S webpage at <http://www.himnrbehs.com/himnrbehs/biosafety.asp>.

Laboratory inspections are typically scheduled beforehand to ensure the visit to the laboratory does not create a disruption; however, the HIM/NRB EH&S office reserves the right to perform unannounced inspections. The surveyor will review any non-compliant conditions observed, and make recommendations for improvement. An unannounced site visit may occur anytime after 30 days to make certain that all conditions are corrected.

## **9.0 BLOODBORNE PATHOGENS AND THE EXPOSURE CONTROL PLAN**

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### **9.1 BACKGROUND**

Laboratory workers who come in contact with human blood or other human bodily fluids are at increased risk for exposures to and infections from certain BBP, such as HIV, HBV, and HCV. Exposures to BBP can occur in a variety of ways. The most common route of exposure is a needle stick injury, but transmission may also occur through contact with mucous membranes or through cuts in the skin.

In response to these health concerns, the federal government issued the OSHA BBP Standard (29 CFR 1910.1030) in December 1991. The primary purpose of the BBP Standard is to eliminate or minimize occupational exposures to blood and other bodily fluids, as well as the risks for developing the infectious diseases associated with them. In addition to HIV and the hepatitis viruses, the BBP Standard covers a wide variety of bloodborne infectious agents that can cause disease. Some of the included agents are simian immunodeficiency virus and the biological agents that cause syphilis, malaria, babesiosis, brucellosis, leptospirosis, relapsing fever, arboviral infections, Creutzfeldt-Jacob disease, and viral hemorrhagic fevers.

Sources of potential exposures to BBP include human blood and a variety of potentially infectious materials (PIMs). The OSHA definition of human blood includes whole blood, blood products, and blood components. PIMs include body fluids, such as saliva, semen, vaginal, cerebrospinal, synovial, pleural, peritoneal, pericardial, amniotic fluids, any body fluid in which visible blood is present, and any unfixed tissue or organ from a human either living or dead. Cell or tissue cultures, organ cultures, or media containing HIV, HBV, or HCV are also included.

OSHA requires using “Universal Precautions” as the approach for controlling against infections from BBP. The concept is that all human blood and certain body fluids are treated as if they contain HIV, HBV, or other BBP. In the laboratory environment, BL2 practices and containment are required for activities involving BBP. BL2 practices are also recommended for work with human cell lines, including those that have been maintained in culture for decades, such as HeLa cells. Experienced researchers may

argue that they have worked with these cells for years without incident. However, even though the potential risks are low, current molecular biology manipulations may unknowingly depress proviral forms of viruses embedded in the DNA of these human cell lines. Therefore, BL2 practices should be implemented to reduce the potential for infections from such agents in these cell lines.

## **9.2 PURPOSE OF THE EXPOSURE CONTROL PLAN**

The BBP Standard requires that an Exposure Control Plan (ECP) be written and implemented and that a copy of the ECP be available to employees. The ECP includes several required elements, policies, and procedures that are designed to eliminate or minimize BBP exposures. The purposes of the plan are to:

- Protect HIM/NRB staff members from the health hazards associated with BBP.
- Coordinate appropriate treatment and counseling should an employee be exposed to BBP.

## **9.3 EXPOSURE CONTROL PLAN PROGRAM MANAGEMENT**

Responsibilities for implementation of the ECP are as follows:

- **Department Heads:** Department heads are responsible for ensuring that proper work practices, such as universal precautions and use of PPE, are followed on a day-to-day basis.
- **HIM/NRB Staff Members:** All individuals working at HIM/NRB are responsible for attending the annual training sessions, participating in the orientation program, knowing what tasks they perform that have potential occupational exposures to BBP and employing safe work practices in the performance of their duties.

## 9.4 EXPOSURE DETERMINATION

The following procedures have been implemented to identify employees that have occupational exposures to BBP. Each staff member is classified as either exposed or unexposed and is informed of their classification by respective supervisors.

1. Job classifications have been identified in which:
  - a. All employees have occupational exposure to BBP.
  - b. Some employees have occupational exposure to BBP.

These classifications are based on the individual's potential for coming in contact with any potentially infectious material and/or their duties as they relate to work in the laboratory. Employees with no exposure are also identified. Department managers or supervisors are responsible for reviewing and modifying their employee's classification as exposed or unexposed based on detailed knowledge of the employee's work responsibilities.

2. Lists of tasks and procedures during which occupational exposure may occur are maintained for employees identified above in 1b.

## 9.5 METHODS OF COMPLIANCE

PIs are responsible for ensuring the effectiveness of and compliance with the following controls and practices.

### 9.5.1 Universal Precautions

Universal precautions are implemented by HIM/NRB staff members to minimize or prevent contact with PIMs. **REMINDER**—This means that all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV, and other BBPs.

### 9.5.2 Engineering Controls

One of the key aspects of the HIM/NRB ECP is the use of engineering controls to minimize or eliminate BBP exposures. Staff members use equipment such as hand

washing facilities, sharps disposal containers, leak-proof containers for human blood and tissue samples, and biological safety cabinets, as appropriate. New engineering controls will be evaluated and implemented as they become available.

### **9.5.3 Work Practice Controls**

In addition to engineering controls, HIM/NRB policies require a number of work practice controls to help eliminate or minimize employee exposure to BBP. New work practice controls will be evaluated and implemented as they become available.

- Employees must wash their hands immediately with soap and water, or as soon as feasible, after the removal of gloves or other personal protective equipment.
- Following any contact of body areas with blood or any other infectious materials, employees must wash their hands and any other exposed skin with soap and water as soon as possible. They also must flush exposed mucous membranes with water.
- Contaminated needles and other contaminated sharps are not bent, recapped, or removed unless:
  - It can be demonstrated that no feasible alternative is available.
  - The action is required by specific research procedure.
  - In the two situations above, the recapping or needle removal is accomplished through the use of a medical device or a one-handed technique.
- Contaminated reusable sharps are placed in appropriate containers immediately, or as soon as possible, after use.
- Mouth pipetting/suctioning of blood or other PIMs is prohibited.
- Use procedures that minimize splashing, spraying, or other actions generating droplets when working with blood or other PIMs.

- Specimens of blood or PIMs are handled and stored in designated leak-proof containers that have been labeled appropriately.

#### **9.5.4 Personal Protective Equipment**

PPE, as described in Section 3.1, is a primary line of defense against BBP exposures. HIM/NRB staff members must be trained regarding the use of the appropriate PPE for their job classifications and for the activities they perform with BBP. Additional training will be provided by PIs or their designees, e.g., when an employee takes a new position or new job functions are added. BBP training is a component of the safety training provided by the HIM/NRB EH&S office. BBP training is an annual requirement for laboratory employees working with BBP.

The following procedures are implemented during the handling of BBP:

- A laboratory coat is worn whenever potential exposure is anticipated.
- If any garments are penetrated by blood or other infectious materials, they are removed immediately, or as soon as is feasible.
- All PPE is removed prior to leaving a work area.
- Gloves are worn in the following circumstances:
  - Whenever employees anticipate hand contact with PIMs.
  - When handling or touching contaminated items or surfaces.
- Disposable gloves are replaced as soon as practical after contamination or if they are torn, punctured, or otherwise lose their ability to function as an exposure barrier.
- Utility gloves are decontaminated for reuse unless they are cracked, peeling, torn, or exhibit other signs of deterioration.
- Full-face protection, such as facemasks, face shields, and eye protection, is used whenever splashes or sprays may generate droplets of infectious materials.
- Head covers/hoods and/or shoe covers/boots are used in any instances where gross contamination is anticipated, such as perfusion activities.

### **9.5.5 Housekeeping**

All laboratory surfaces are cleaned with an EPA approved germicidal disinfectant. The disinfectant solution is applied in accordance with the manufacturer's recommendations. Laboratory personnel must clean contaminated equipment and surfaces after contact with blood or other potentially infectious materials after the completion of procedures, immediately (or as soon as feasible) when surfaces are overtly contaminated, after any large spill of blood or infectious materials, or at the end of the work shift if the surface may have been contaminated during that shift.

## **9.6 VACCINATION PROGRAM AND POST-EXPOSURE EVALUATION AND FOLLOW-UP**

Staff members must contact their respective Occupation Health and Safety Departments for information regarding vaccinations and post-exposure evaluation and follow up, and to obtain information about the HBV vaccination program.

### **9.6.1 Vaccination Program**

The HBV vaccination program is available, at no cost, to all staff members who have occupational exposures to BBP. Those who decline to take part in the vaccination program must sign the "Vaccination Declination Form" and will have the opportunity to be vaccinated at a later date.

### **9.6.2 Post-Exposure Evaluation and Follow-Up**

If you are exposed to blood or other PIMs, employees must perform the following immediately:

1. Remove contaminated clothing
2. Wash and flush the affected area vigorously for 15 minutes
3. Report to your Occupational Health Department or the Emergency Department for treatment immediately.
4. Notify the HIM/NRB EH&S Office.
5. Be certain to complete an incident report.

### 9.6.3 Investigation of Circumstances Surrounding Exposure Incidents

You are responsible for reporting exposure incidents to your laboratory manager or supervisor. The investigation is initiated as soon as possible after the incident is reported and involves gathering the following information:

- When the incident occurred.
  - Date and time.
  
- Where the incident occurred.
  - Location within the facility.
  
- What potentially infectious materials were involved in the incident.
  - Type of material (blood, specific infectious agent, etc.).
  
- Source of the material.
  
- Under what circumstances the incident occurred.
  - Type of work being performed.
  
- How the incident was caused.
  - Accident.
  - Unusual circumstances, such as equipment malfunction.
  
- PPE being used at the time of the incident.
  
- Actions taken as a result of the incident.
  - Employee decontamination.
  - Clean up.
  - Notifications to supervisors.

After this information is gathered and evaluated, a written summary of the incident and its causes is prepared and recommendations are made for avoiding similar incidents in the future.

The Sharps Injury Log is maintained by OHS.

## **9.7 TRAINING AND RECORD KEEPING**

Staff members with potential occupational exposures to BBP must receive annual training in accordance with the BBP Standard. This training is offered through the HIM/NRB EH&S Office on a frequent basis, and is also offered as part of an on-line training program. PIs and laboratory supervisors are responsible for ensuring that all employees with potential occupational exposures to BBP participate in this training.

## 10.0 WORKING WITH LABORATORY ANIMALS

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### 10.1 INTRODUCTION

Working with animals in a laboratory setting can present risks from infections and injuries to all personnel. Those personnel working with laboratory animals must be aware of the potential risks and implement measures to prevent injury or illnesses related to laboratory animal use. The purpose of this section is to communicate the risks involved with and protective procedures in place at HIM/NRB regarding laboratory animal use.

All use and handling of animals at HIM/NRB must be conducted safely, humanely, and in compliance with all institutional and federal regulations. The Harvard Center for Comparative Medicine (HCCM) Policy and Procedure manual (<http://arcm.med.harvard.edu/>) provides details for the required training and the procedures that must be followed when working with laboratory animals at HIM/NRB. When working with hazardous agents in and around animals, please refer to the applicable Sections in the HCCM Policy and Procedure Manual for specific guidance.

Any unsafe or hazardous behavior or work conditions regarding the use of animals needs to be reported to the Animal Resources Manager, Attending Veterinarian/Director, or the IACUC.

Prior to commencing any work **IN ANIMALS** that utilize BL2 pathogens, it is **mandatory** that all Investigators contact HCCM to report the pathogen name(s) and the animal facility requested for such use. All Investigators must contact the HCCM Office of the Director at 617-432-1289 and speak directly to Dr. Arthur Lage or Linda Janse.

### 10.2 ALLERGIES

Allergic reactions to animals are among the most common conditions that adversely affect the health of workers involved in the care and use of animals in biomedical

research<sup>1,2</sup>. The development of laboratory animal allergies (LAA) commonly begins with the inhalation of animal allergens, such as dander and urinary proteins. Skin and eye contact with allergens can also result in symptoms. Although most animal allergens are found in urine, dander, hair, serum, and saliva, coexisting allergies and tobacco smoking can exacerbate the development of LAA. All possible measures or controls must be implemented to decrease or eliminate the exposure of personnel to allergens when working with laboratory animals.

Symptoms of LAA can range from minor to life threatening. Rhinitis (runny noses), conjunctivitis, asthma or other breathing difficulties, fever, skin rashes or bumps (atopic dermatitis), and gastrointestinal disorders can all be the result of LAA. Be aware that symptoms can be delayed up to 12 hours after animal exposure.<sup>3</sup> Promptly report any suspicious clinical symptoms to your Occupational Health Department.

Guidelines for working with animals are summarized below.

- Wear required PPE at all times when working with animals.
- Do not wear PPE outside of the animal facility.
- Wear gloves at all times when handling animals.
- Do not distribute animal bedding in your immediate work environment. All cage cleaning procedures should be performed in a manner that prevents bedding debris from entering the work environment. Change bedding in a BSC or fume hood.
- Ensure that animal cages are properly fitted into ventilated racks and that static microisolator cage lids properly fit.
- Do not overpopulate animal cages.
- Work with your animals in a ventilated hood or BSC when required and whenever possible.

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<sup>1</sup> Wolfle TL and Bush RK. 2001. The Science and Pervasiveness of Laboratory Animal Allergy. *ILAR Journal* 42:1 – 3.

<sup>2</sup> National Research Council. 1997. *Occupational Health and Safety in the Care and Use of Research Animals*. Washington, D.C: National Academy Press.

<sup>3</sup> Bush RK. 2001. Assessment and Treatment of Laboratory Animal Allergy. *ILAR Journal*, 42:55 – 64.

- Work with animals in well ventilated areas when you are not working under a hood/cabinet.
- Clean and disinfect all equipment after use.
- Wash your hands with soap and water frequently and always after handling animals (even when wearing gloves).
- Avoid touching your face when working with animals.
- Keep your work area clean.
- Keep animal cages and transport containers properly covered at all times.
- Do not handle common items (i.e., door knobs) with gloved hands that have had animal contact.
- Do not house any animals overnight in any research laboratory.

### **10.3 ZOONOSES**

Zoonoses are diseases that are communicable from lower animals (i.e., rats and mice) to humans under natural conditions.

#### **10.3.1 Mice**

No known risk of zoonotic diseases are known to be caused by usual animal care and handling exposures to the microbial flora of laboratory-reared mice. Two diseases of concern when working with mice are lymphocytic choriomeningitis virus (LCM) and hantavirus. Animals brought into the Animal Resource Centers are known to be free from these diseases and the Animal Health Monitoring program evaluates for these agents on a regular basis.

#### **10.3.2 Rats**

No known risk of zoonotic diseases results from typical exposure to the microbial flora of laboratory-reared rats. All rats at HIM/NRB have been raised commercially and have a non-pathogenic, well-defined microbial flora. Two diseases of concern when working with rats are hantavirus and rat-bite fever. Animals brought into the Animal Resource

Centers are known to be free from hantavirus and the Animal Health Monitoring program evaluates for the virus on a regular basis.

Rat-bite fever is caused by two bacteria, *Streptobacillus moniliformis* and *Spirillum minor*. These bacteria are present in the upper respiratory tract and mouths of rats. Rats are asymptomatic as the bacteria do not cause disease in them. Commercial vendors have virtually eliminated this bacterium from their animals.<sup>4</sup>

## **10.4 BITES AND SCRATCHES**

Bites and scratches are hazards associated with all laboratory animals. A thorough understanding of species-specific rodent behaviors and habits is the best preventative measure against bites and scratches. All personnel handling animals are required to go through species-specific training according to the requirements set forth by the IACUC and the Animal Facility's Policies and Procedures.

Injured and sick animals and certain strains of mice and rats may display unusually high levels of aggression towards one another and towards humans; even experienced animal handlers must exercise caution. Diseases such as rat-bite fever are transmitted through bites and scratches. All bite wounds and scratches should receive immediate first aid; an evaluation for more extensive medical care may be needed. Please report all bites and scratches, and seek proper medical care through your respective occupational health services department.

## **10.5 RESPONSIBILITIES**

### **10.5.1 Institutional Animal Care and Use Committee**

The Harvard IACUC will review all animal care and use protocols to ensure a safe working environment for laboratory personnel. The IACUC will work with ARCM staff to ensure that the animal care and use program complies with current regulations and standards. The IACUC also requires on-line training for occupational health and safety for all Animal Resource Center users.

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<sup>4</sup> National Research Council. 1997.

### **10.5.2 Principal Investigator**

The PI is responsible for ensuring that research is conducted in accordance with HIM/NRB policies and safe laboratory practices. The PI is responsible for completing all appropriate hazardous agent protocols (radiation, chemical and biological hazards) and the IACUC protocol prior to the start of the research. The PI and/or a designee is responsible for obtaining necessary safety equipment and maintaining awareness of safety policies and procedures. The HCCM or the HIM/NRB EH&S office can be contacted for assistance.

### **10.5.3 Laboratory Staff**

Laboratory staff members are responsible for conducting all animal work in a safe and humane manner in accordance with HIM/NRB and HCCM policies and safe laboratory practices. Staff members are responsible for informing the PI, animal facility management, laboratory supervisor, IACUC, or BSO regarding any potentially hazardous situations or conditions. Staff members are also responsible for reporting any work-related injuries or incidents in accordance with HIM/NRB policies.

**APPENDIX A**  
**LABORATORY BIOSAFETY LEVEL CRITERIA**

## Section IV

### *Laboratory Biosafety Level Criteria*

The essential elements of the four biosafety levels for activities involving infectious microorganisms and laboratory animals are summarized in Table 1 of this section and discussed in Section 2. The levels are designated in ascending order, by degree of protection provided to personnel, the environment, and the community. Standard microbiological practices are common to all laboratories. Special microbiological practices enhance worker safety, environmental protection, and address the risk of handling agents requiring increasing levels of containment.

### **Biosafety Level 1**

**Biosafety Level 1** is suitable for work involving well-characterized agents not known to consistently cause disease in immunocompetent adult humans, and present minimal potential hazard to laboratory personnel and the environment. BSL-1 laboratories are not necessarily separated from the general traffic patterns in the building. Work is typically conducted on open bench tops using standard microbiological practices. Special containment equipment or facility design is not required, but may be used as determined by appropriate risk assessment. Laboratory personnel must have specific training in the procedures conducted in the laboratory and must be supervised by a scientist with training in microbiology or a related science.

The following standard practices, safety equipment, and facility requirements apply to BSL-1:

#### ***A. Standard Microbiological Practices***

1. The laboratory supervisor must enforce the institutional policies that control access to the laboratory.
2. Persons must wash their hands after working with potentially hazardous materials and before leaving the laboratory.
3. Eating, drinking, smoking, handling contact lenses, applying cosmetics, and storing food for human consumption must not be permitted in laboratory areas. Food must be stored outside the laboratory area in cabinets or refrigerators designated and used for this purpose.
4. Mouth pipetting is prohibited; mechanical pipetting devices must be used.
5. Policies for the safe handling of sharps, such as needles, scalpels, pipettes, and broken glassware must be developed and implemented. Whenever practical,

## Laboratory Biosafety Level Criteria – Biosafety Level 1

laboratory supervisors should adopt improved engineering and work practice controls that reduce risk of sharps injuries.

Precautions, including those listed below, must always be taken with sharp items. These include:

- a. Careful management of needles and other sharps are of primary importance. Needles must not be bent, sheared, broken, recapped, removed from disposable syringes, or otherwise manipulated by hand before disposal.
  - b. Used disposable needles and syringes must be carefully placed in conveniently located puncture-resistant containers used for sharps disposal.
  - c. Non disposable sharps must be placed in a hard walled container for transport to a processing area for decontamination, preferably by autoclaving.
  - d. Broken glassware must not be handled directly. Instead, it must be removed using a brush and dustpan, tongs, or forceps. Plasticware should be substituted for glassware whenever possible.
6. Perform all procedures to minimize the creation of splashes and/or aerosols.
  7. Decontaminate work surfaces after completion of work and after any spill or splash of potentially infectious material with appropriate disinfectant.
  8. Decontaminate all cultures, stocks, and other potentially infectious materials before disposal using an effective method. Depending on where the decontamination will be performed, the following methods should be used prior to transport:
    - a. Materials to be decontaminated outside of the immediate laboratory must be placed in a durable, leak proof container and secured for transport.
    - b. Materials to be removed from the facility for decontamination must be packed in accordance with applicable local, state, and federal regulations.
  9. A sign incorporating the universal biohazard symbol must be posted at the entrance to the laboratory when infectious agents are present. The sign may include the name of the agent(s) in use, and the name and phone number of the laboratory supervisor or other responsible personnel. Agent information should be posted in accordance with the institutional policy.

## Laboratory Biosafety Level Criteria – Biosafety Level 1

10. An effective integrated pest management program is required. See Appendix G.
11. The laboratory supervisor must ensure that laboratory personnel receive appropriate training regarding their duties, the necessary precautions to prevent exposures, and exposure evaluation procedures. Personnel must receive annual updates or additional training when procedural or policy changes occur. Personal health status may impact an individual's susceptibility to infection, ability to receive immunizations or prophylactic interventions. Therefore, all laboratory personnel and particularly women of child-bearing age should be provided with information regarding immune competence and conditions that may predispose them to infection. Individuals having these conditions should be encouraged to self-identify to the institution's healthcare provider for appropriate counseling and guidance.

### ***B. Special Practices***

None required.

### ***C. Safety Equipment (Primary Barriers and Personal Protective Equipment)***

1. Special containment devices or equipment, such as BSCs, are not generally required.
2. Protective laboratory coats, gowns, or uniforms are recommended to prevent contamination of personal clothing.
3. Wear protective eyewear when conducting procedures that have the potential to create splashes of microorganisms or other hazardous materials. Persons who wear contact lenses in laboratories should also wear eye protection.
4. Gloves must be worn to protect hands from exposure to hazardous materials. Glove selection should be based on an appropriate risk assessment. Alternatives to latex gloves should be available. Wash hands prior to leaving the laboratory. In addition, BSL-1 workers should:
  - a. Change gloves when contaminated, integrity has been compromised, or when otherwise necessary.
  - b. Remove gloves and wash hands when work with hazardous materials has been completed and before leaving the laboratory.
  - c. Do not wash or reuse disposable gloves. Dispose of used gloves with other contaminated laboratory waste. Hand washing protocols must be rigorously followed.

## Laboratory Biosafety Level Criteria – Biosafety Level 1

### **D. Laboratory Facilities (Secondary Barriers)**

1. Laboratories should have doors for access control.
2. Laboratories must have a sink for hand washing.
3. The laboratory should be designed so that it can be easily cleaned. Carpets and rugs in laboratories are not appropriate.
4. Laboratory furniture must be capable of supporting anticipated loads and uses. Spaces between benches, cabinets, and equipment should be accessible for cleaning.
  - a. Bench tops must be impervious to water and resistant to heat, organic solvents, acids, alkalis, and other chemicals.
  - b. Chairs used in laboratory work must be covered with a non-porous material that can be easily cleaned and decontaminated with appropriate disinfectant.
5. Laboratories windows that open to the exterior should be fitted with screens.

## **Biosafety Level 2**

**Biosafety Level 2** builds upon BSL-1. BSL-2 is suitable for work involving agents that pose moderate hazards to personnel and the environment. It differs from BSL-1 in that 1) laboratory personnel have specific training in handling pathogenic agents and are supervised by scientists competent in handling infectious agents and associated procedures; 2) access to the laboratory is restricted when work is being conducted; and 3) all procedures in which infectious aerosols or splashes may be created are conducted in BSCs or other physical containment equipment.

The following standard and special practices, safety equipment, and facility requirements apply to BSL-2:

### **A. Standard Microbiological Practices**

1. The laboratory supervisor must enforce the institutional policies that control access to the laboratory.
2. Persons must wash their hands after working with potentially hazardous materials and before leaving the laboratory.
3. Eating, drinking, smoking, handling contact lenses, applying cosmetics, and storing food for human consumption must not be permitted in laboratory

## Laboratory Biosafety Level Criteria – Biosafety Level 2

areas. Food must be stored outside the laboratory area in cabinets or refrigerators designated and used for this purpose.

4. Mouth pipetting is prohibited; mechanical pipetting devices must be used.
5. Policies for the safe handling of sharps, such as needles, scalpels, pipettes, and broken glassware must be developed and implemented. Whenever practical, laboratory supervisors should adopt improved engineering and work practice controls that reduce risk of sharps injuries.

Precautions, including those listed below, must always be taken with sharp items. These include:

- a. Careful management of needles and other sharps are of primary importance. Needles must not be bent, sheared, broken, recapped, removed from disposable syringes, or otherwise manipulated by hand before disposal.
  - b. Used disposable needles and syringes must be carefully placed in conveniently located puncture-resistant containers used for sharps disposal.
  - c. Non-disposable sharps must be placed in a hard walled container for transport to a processing area for decontamination, preferably by autoclaving.
  - d. Broken glassware must not be handled directly. Instead, it must be removed using a brush and dustpan, tongs, or forceps. Plasticware should be substituted for glassware whenever possible.
6. Perform all procedures to minimize the creation of splashes and/or aerosols.
  7. Decontaminate work surfaces after completion of work and after any spill or splash of potentially infectious material with appropriate disinfectant.
  8. Decontaminate all cultures, stocks, and other potentially infectious materials before disposal using an effective method. Depending on where the decontamination will be performed, the following methods should be used prior to transport:
    - a. Materials to be decontaminated outside of the immediate laboratory must be placed in a durable, leak proof container and secured for transport.

## Laboratory Biosafety Level Criteria – Biosafety Level 2

- b. Materials to be removed from the facility for decontamination must be packed in accordance with applicable local, state, and federal regulations.
9. A sign incorporating the universal biohazard symbol must be posted at the entrance to the laboratory when infectious agents are present. Posted information must include: the laboratory's biosafety level, the supervisor's name (or other responsible personnel), telephone number, and required procedures for entering and exiting the laboratory. Agent information should be posted in accordance with the institutional policy.
10. An effective integrated pest management program is required. See Appendix G.
11. The laboratory supervisor must ensure that laboratory personnel receive appropriate training regarding their duties, the necessary precautions to prevent exposures, and exposure evaluation procedures. Personnel must receive annual updates or additional training when procedural or policy changes occur. Personal health status may impact an individual's susceptibility to infection, ability to receive immunizations or prophylactic interventions. Therefore, all laboratory personnel and particularly women of child-bearing age should be provided with information regarding immune competence and conditions that may predispose them to infection. Individuals having these conditions should be encouraged to self-identify to the institution's healthcare provider for appropriate counseling and guidance.

### ***B. Special Practices***

1. All persons entering the laboratory must be advised of the potential hazards and meet specific entry/exit requirements.
2. Laboratory personnel must be provided medical surveillance and offered appropriate immunizations for agents handled or potentially present in the laboratory.
3. When appropriate, a baseline serum sample should be stored.
4. A laboratory-specific biosafety manual must be prepared and adopted as policy. The biosafety manual must be available and accessible.
5. The laboratory supervisor must ensure that laboratory personnel demonstrate proficiency in standard and special microbiological practices before working with BSL-2 agents.

## Laboratory Biosafety Level Criteria – Biosafety Level 2

6. Potentially infectious materials must be placed in a durable, leak proof container during collection, handling, processing, storage, or transport within a facility.
7. Laboratory equipment should be routinely decontaminated, as well as, after spills, splashes, or other potential contamination.
  - a. Spills involving infectious materials must be contained, decontaminated, and cleaned up by staff properly trained and equipped to work with infectious material.
  - b. Equipment must be decontaminated before repair, maintenance, or removal from the laboratory.
8. Incidents that may result in exposure to infectious materials must be immediately evaluated and treated according to procedures described in the laboratory biosafety safety manual. All such incidents must be reported to the laboratory supervisor. Medical evaluation, surveillance, and treatment should be provided and appropriate records maintained.
9. Animals and plants not associated with the work being performed must not be permitted in the laboratory.
10. All procedures involving the manipulation of infectious materials that may generate an aerosol should be conducted within a BSC or other physical containment devices.

### ***C. Safety Equipment (Primary Barriers and Personal Protective Equipment)***

1. Properly maintained BSCs (preferably Class II), other appropriate personal protective equipment, or other physical containment devices must be used whenever:
  - a. Procedures with a potential for creating infectious aerosols or splashes are conducted. These may include pipetting, centrifuging, grinding, blending, shaking, mixing, sonicating, opening containers of infectious materials, inoculating animals intranasally, and harvesting infected tissues from animals or eggs.
  - b. High concentrations or large volumes of infectious agents are used. Such materials may be centrifuged in the open laboratory using sealed rotor heads or centrifuge safety cups.
2. Protective laboratory coats, gowns, smocks, or uniforms designated for laboratory use must be worn while working with hazardous materials. Remove protective clothing before leaving for non-laboratory areas (e.g.,

## Laboratory Biosafety Level Criteria – Biosafety Level 2

cafeteria, library, administrative offices). Dispose of protective clothing appropriately, or deposit it for laundering by the institution. It is recommended that laboratory clothing not be taken home.

3. Eye and face protection (goggles, mask, face shield or other splatter guard) is used for anticipated splashes or sprays of infectious or other hazardous materials when the microorganisms must be handled outside the BSC or containment device. Eye and face protection must be disposed of with other contaminated laboratory waste or decontaminated before reuse. Persons who wear contact lenses in laboratories should also wear eye protection.
4. Gloves must be worn to protect hands from exposure to hazardous materials. Glove selection should be based on an appropriate risk assessment. Alternatives to latex gloves should be available. Gloves must not be worn outside the laboratory. In addition, BSL-2 laboratory workers should:
  - a. Change gloves when contaminated, integrity has been compromised, or when otherwise necessary. Wear two pairs of gloves when appropriate.
  - b. Remove gloves and wash hands when work with hazardous materials has been completed and before leaving the laboratory.
  - c. Do not wash or reuse disposable gloves. Dispose of used gloves with other contaminated laboratory waste. Hand washing protocols must be rigorously followed.
5. Eye, face and respiratory protection should be used in rooms containing infected animals as determined by the risk assessment.

### ***D. Laboratory Facilities (Secondary Barriers)***

1. Laboratory doors should be self-closing and have locks in accordance with the institutional policies.
2. Laboratories must have a sink for hand washing. The sink may be manually, hands-free, or automatically operated. It should be located near the exit door.
3. The laboratory should be designed so that it can be easily cleaned and decontaminated. Carpets and rugs in laboratories are not permitted.
4. Laboratory furniture must be capable of supporting anticipated loads and uses. Spaces between benches, cabinets, and equipment should be accessible for cleaning.
  - a. Bench tops must be impervious to water and resistant to heat, organic solvents, acids, alkalis, and other chemicals.

## Laboratory Biosafety Level Criteria – Biosafety Level 2

- b. Chairs used in laboratory work must be covered with a non-porous material that can be easily cleaned and decontaminated with appropriate disinfectant.
5. Laboratory windows that open to the exterior are not recommended. However, if a laboratory does have windows that open to the exterior, they must be fitted with screens.
6. BSCs must be installed so that fluctuations of the room air supply and exhaust do not interfere with proper operations. BSCs should be located away from doors, windows that can be opened, heavily traveled laboratory areas, and other possible airflow disruptions.
7. Vacuum lines should be protected with High Efficiency Particulate Air (HEPA) filters, or their equivalent. Filters must be replaced as needed. Liquid disinfectant traps may be required.
8. An eyewash station must be readily available.
9. There are no specific requirements on ventilation systems. However, planning of new facilities should consider mechanical ventilation systems that provide an inward flow of air without recirculation to spaces outside of the laboratory.
10. HEPA filtered exhaust air from a Class II BSC can be safely re-circulated back into the laboratory environment if the cabinet is tested and certified at least annually and operated according to manufacturer's recommendations. BSCs can also be connected to the laboratory exhaust system by either a thimble (canopy) connection or a direct (hard) connection. Provisions to assure proper safety cabinet performance and air system operation must be verified.
11. A method for decontaminating all laboratory wastes should be available in the facility (e.g., autoclave, chemical disinfection, incineration, or other validated decontamination method).

## Biosafety Level 3

**Biosafety Level 3** is applicable to clinical, diagnostic, teaching, research, or production facilities where work is performed with indigenous or exotic agents that may cause serious or potentially lethal disease through inhalation route exposure. Laboratory personnel must receive specific training in handling pathogenic and potentially lethal agents, and must be supervised by scientists competent in handling infectious agents and associated procedures.

## Laboratory Biosafety Level Criteria – Biosafety Level 3

All procedures involving the manipulation of infectious materials must be conducted within BSCs, other physical containment devices, or by personnel wearing appropriate personal protective equipment.

A BSL-3 laboratory has special engineering and design features.

The following standard and special safety practices, equipment, and facility requirements apply to BSL-3:

### ***A. Standard Microbiological Practices***

1. The laboratory supervisor must enforce the institutional policies that control access to the laboratory.
2. Persons must wash their hands after working with potentially hazardous materials and before leaving the laboratory.
3. Eating, drinking, smoking, handling contact lenses, applying cosmetics, and storing food for human consumption must not be permitted in laboratory areas. Food must be stored outside the laboratory area in cabinets or refrigerators designated and used for this purpose.
4. Mouth pipetting is prohibited; mechanical pipetting devices must be used.
5. Policies for the safe handling of sharps, such as needles, scalpels, pipettes, and broken glassware must be developed and implemented. Whenever practical, laboratory supervisors should adopt improved engineering and work practice controls that reduce risk of sharps injuries.

Precautions, including those listed below, must always be taken with sharp items. These include:

- a. Careful management of needles and other sharps are of primary importance. Needles must not be bent, sheared, broken, recapped, removed from disposable syringes, or otherwise manipulated by hand before disposal.
- b. Used disposable needles and syringes must be carefully placed in conveniently located puncture-resistant containers used for sharps disposal.
- c. Non-disposable sharps must be placed in a hard walled container for transport to a processing area for decontamination, preferably by autoclaving.

### Laboratory Biosafety Level Criteria – Biosafety Level 3

- d. Broken glassware must not be handled directly. Instead, it must be removed using a brush and dustpan, tongs, or forceps. Plasticware should be substituted for glassware whenever possible.
6. Perform all procedures to minimize the creation of splashes and/or aerosols.
7. Decontaminate work surfaces after completion of work and after any spill or splash of potentially infectious material with appropriate disinfectant.
8. Decontaminate all cultures, stocks, and other potentially infectious materials before disposal using an effective method. A method for decontaminating all laboratory wastes should be available in the facility, preferably within the laboratory (e.g., autoclave, chemical disinfection, incineration, or other validated decontamination method). Depending on where the decontamination will be performed, the following methods should be used prior to transport:
  - a. Materials to be decontaminated outside of the immediate laboratory must be placed in a durable, leak proof container and secured for transport.
  - b. Materials to be removed from the facility for decontamination must be packed in accordance with applicable local, state, and federal regulations.
9. A sign incorporating the universal biohazard symbol must be posted at the entrance to the laboratory when infectious agents are present. Posted information must include the laboratory's biosafety level, the supervisor's name (or other responsible personnel), telephone number, and required procedures for entering and exiting the laboratory. Agent information should be posted in accordance with the institutional policy.
10. An effective integrated pest management program is required. See Appendix G.
11. The laboratory supervisor must ensure that laboratory personnel receive appropriate training regarding their duties, the necessary precautions to prevent exposures, and exposure evaluation procedures. Personnel must receive annual updates or additional training when procedural or policy changes occur. Personal health status may impact an individual's susceptibility to infection, ability to receive immunizations or prophylactic interventions. Therefore, all laboratory personnel and particularly women of child-bearing age should be provided with information regarding immune competence and conditions that may predispose them to infection. Individuals having these conditions should be encouraged to self-identify to the institution's healthcare provider for appropriate counseling and guidance.

## Laboratory Biosafety Level Criteria – Biosafety Level 3

### **B. *Special Practices***

1. All persons entering the laboratory must be advised of the potential hazards and meet specific entry/exit requirements.
2. Laboratory personnel must be provided medical surveillance and offered appropriate immunizations for agents handled or potentially present in the laboratory.
3. Each institution should consider the need for collection and storage of serum samples from at-risk personnel.
4. A laboratory-specific biosafety manual must be prepared and adopted as policy. The biosafety manual must be available and accessible.
5. The laboratory supervisor must ensure that laboratory personnel demonstrate proficiency in standard and special microbiological practices before working with BSL-3 agents.
6. Potentially infectious materials must be placed in a durable, leak proof container during collection, handling, processing, storage, or transport within a facility.
7. Laboratory equipment should be routinely decontaminated, as well as, after spills, splashes, or other potential contamination.
  - a. Spills involving infectious materials must be contained, decontaminated, and cleaned up by staff properly trained and equipped to work with infectious material.
  - b. Equipment must be decontaminated before repair, maintenance, or removal from the laboratory.
8. Incidents that may result in exposure to infectious materials must be immediately evaluated and treated according to procedures described in the laboratory biosafety safety manual. All such incidents must be reported to the laboratory supervisor. Medical evaluation, surveillance, and treatment should be provided and appropriate records maintained.
9. Animals and plants not associated with the work being performed must not be permitted in the laboratory.
10. All procedures involving the manipulation of infectious materials must be conducted within a BSC, or other physical containment devices. No work with open vessels is conducted on the bench. When a procedure cannot be performed within a BSC, a combination of personal protective equipment and

## Laboratory Biosafety Level Criteria – Biosafety Level 3

other containment devices, such as a centrifuge safety cup or sealed rotor, must be used.

### **C. Safety Equipment (Primary Barriers and Personal Protective Equipment)**

1. All procedures involving the manipulation of infectious materials must be conducted within a BSC (preferably Class II or Class III), or other physical containment devices.
2. Protective laboratory clothing with a solid-front such as tie-back or wrap-around gowns, scrub suits, or coveralls are worn by workers when in the laboratory. Protective clothing is not worn outside of the laboratory. Reusable clothing is decontaminated with appropriate disinfectant before being laundered. Clothing is changed when contaminated.
3. Eye and face protection (goggles, mask, face shield or other splatter guard) is used for anticipated splashes or sprays of infectious or other hazardous materials. Eye and face protection must be disposed of with other contaminated laboratory waste or decontaminated before reuse. Persons who wear contact lenses in laboratories must also wear eye protection.
4. Gloves must be worn to protect hands from exposure to hazardous materials. Glove selection should be based on an appropriate risk assessment. Alternatives to latex gloves should be available. Gloves must not be worn outside the laboratory. In addition, BSL-3 laboratory workers should:
  - a. Change gloves when contaminated, integrity has been compromised, or when otherwise necessary. Wear two pairs of gloves when appropriate.
  - b. Remove gloves and wash hands when work with hazardous materials has been completed and before leaving the laboratory.
  - c. Do not wash or reuse disposable gloves. Dispose of used gloves with other contaminated laboratory waste. Hand washing protocols must be rigorously followed.
5. Eye, face, and respiratory protection must be used in rooms containing infected animals.

### **D. Laboratory Facilities (Secondary Barriers)**

1. Laboratory doors must be self closing and have locks in accordance with the institutional policies.

### Laboratory Biosafety Level Criteria – Biosafety Level 3

The laboratory must be separated from areas that are open to unrestricted traffic flow within the building.

Access to the laboratory is restricted to entry by a series of two self-closing doors.

A clothing change room (anteroom) may be included in the passageway between the two self-closing doors.

2. Laboratories must have a sink for hand washing. The sink must be hands-free or automatically operated. It should be located near the exit door.

If the laboratory is segregated into different laboratories, a sink must also be available for hand washing in each zone.

Additional sinks may be required as determined by the risk assessment.

3. The laboratory must be designed so that it can be easily cleaned and decontaminated. Carpets and rugs are not permitted. Seams, floors, walls, and ceiling surfaces should be sealed. Spaces around doors and ventilation openings should be capable of being sealed to facilitate space decontamination.
  - a. Floors must be slip resistant, impervious to liquids, and resistant to chemicals. Consideration should be given to the installation of seamless, sealed, resilient or poured floors, with integral cove bases.
  - b. Walls should be constructed to produce a sealed smooth finish that can be easily cleaned and decontaminated.
  - c. Ceilings should be constructed, sealed, and finished in the same general manner as walls.

Decontamination of the entire laboratory should be considered when there has been gross contamination of the space, significant changes in laboratory usage, for major renovations, or maintenance shut downs. Selection of the appropriate materials and methods used to decontaminate the laboratory must be based on the risk assessment of the biological agents in use.

4. Laboratory furniture must be capable of supporting anticipated loads and uses. Spaces between benches, cabinets, and equipment must be accessible for cleaning.
  - a. Bench tops must be impervious to water and resistant to heat, organic solvents, acids, alkalis, and other chemicals.

### Laboratory Biosafety Level Criteria – Biosafety Level 3

- b. Chairs used in laboratory work must be covered with a non-porous material that can be easily cleaned and decontaminated with appropriate disinfectant.
5. All windows in the laboratory must be sealed.
6. BSCs must be installed so that fluctuations of the room air supply and exhaust do not interfere with proper operations. BSCs should be located away from doors, heavily traveled laboratory areas, and other possible airflow disruptions.
7. Vacuum lines must be protected with HEPA filters, or their equivalent. Filters must be replaced as needed. Liquid disinfectant traps may be required.
8. An eyewash station must be readily available in the laboratory.
9. A ducted air ventilation system is required. This system must provide sustained directional airflow by drawing air into the laboratory from “clean” areas toward “potentially contaminated” areas. The laboratory shall be designed such that under failure conditions the airflow will not be reversed.
  - a. Laboratory personnel must be able to verify directional air flow. A visual monitoring device which confirms directional air flow must be provided at the laboratory entry. Audible alarms should be considered to notify personnel of air flow disruption.
  - b. The laboratory exhaust air must not re-circulate to any other area of the building.
  - c. The laboratory building exhaust air should be dispersed away from occupied areas and from building air intake locations or the exhaust air must be HEPA filtered.
10. HEPA filtered exhaust air from a Class II BSC can be safely re-circulated into the laboratory environment if the cabinet is tested and certified at least annually and operated according to manufacturer’s recommendations. BSCs can also be connected to the laboratory exhaust system by either a thimble (canopy) connection or a direct (hard) connection. Provisions to assure proper safety cabinet performance and air system operation must be verified. BSCs should be certified at least annually to assure correct performance. Class III BSCs must be directly (hard) connected up through the second exhaust HEPA filter of the cabinet. Supply air must be provided in such a manner that prevents positive pressurization of the cabinet.

### Laboratory Biosafety Level Criteria – Biosafety Level 3

11. A method for decontaminating all laboratory wastes should be available in the facility, preferably within the laboratory (e.g., autoclave, chemical disinfection, incineration, or other validated decontamination method).
12. Equipment that may produce infectious aerosols must be contained in devices that exhaust air through HEPA filtration or other equivalent technology before being discharged into the laboratory. These HEPA filters should be tested and/or replaced at least annually.
13. Facility design consideration should be given to means of decontaminating large pieces of equipment before removal from the laboratory.
14. Enhanced environmental and personal protection may be required by the agent summary statement, risk assessment, or applicable local, state, or federal regulations. These laboratory enhancements may include, for example, one or more of the following; an anteroom for clean storage of equipment and supplies with dress-in, shower-out capabilities; gas tight dampers to facilitate laboratory isolation; final HEPA filtration of the laboratory exhaust air; laboratory effluent decontamination; and advanced access control devices such as biometrics. HEPA filter housings should have gas-tight isolation dampers; decontamination ports; and/or bag-in/bag-out (with appropriate decontamination procedures) capability. The HEPA filter housing should allow for leak testing of each filter and assembly. The filters and the housing should be certified at least annually.
15. The BSL-3 facility design, operational parameters, and procedures must be verified and documented prior to operation. Facilities must be re-verified and documented at least annually.

**APPENDIX B**  
**INSPECTION FORMS**

## Laboratory Occupational Safety & Health Survey - General BioSafety

Inspection Date _____	Bldg: _____	Rooms: _____	Number of Deficiencies = _____
Local Contact _____	Phone: _____	Email: _____	
Safety Contact _____	Phone: _____	Email: _____	
Researcher: _____	Phone: _____	Email: _____	

### PPE/Protective Clothing

N/A   Yes   No   Comment

If working with hazardous chemicals, or biohazardous/potentially infectious materials, laboratory personnel are wearing the appropriate PPE, which at a minimum includes chemical compatible gloves, safety glasses, closed-toed shoes, and laboratory coats?

Inform staff of appropriate PPE usage. Latex gloves do not protect against all hazardous chemicals.

        \_\_\_\_\_

*OSHA 29 CFR 1910.132(a)*

If any respirator is worn in the lab, including N95 masks, the individuals wearing the respirators have been medically cleared and fit tested.

Lab members who need to be fit-tested should contact their Occupational Health Department or the EHS office. (29 CFR 1910.134)

        \_\_\_\_\_

Eye, face, and respiratory protection is used in rooms containing infected animals.

(CDC/NIH BMBL, 5th Ed., 2007)

        \_\_\_\_\_

### Harvard Committee on Microbiological Safety (COMS)

N/A   Yes   No   Comment

A risk assessment was conducted for the work being conducted in your work area by the biosafety officer (BSO).

Contact your BSO to perform a risk assessment (CDC/NIH BMBL, 5th Ed., 2007)

        \_\_\_\_\_

Are all research projects registered with COMS?

(NIH Guidelines, April 2002.)

        \_\_\_\_\_

Is COMS registration information, including personnel, accurate?

If COMS registration information needs to be amended or updated, contact the biosafety officer. (NIH Guidelines, April 2002.)

        \_\_\_\_\_

### Training and Recordkeeping

N/A   Yes   No   Comment

# Laboratory Occupational Safety & Health Survey - General BioSafety

Inspection Date \_\_\_\_\_ Bldg: \_\_\_\_\_ Rooms: \_\_\_\_\_

**Training and Recordkeeping**

N/A   Yes   No   Comment

All staff who work with biohazardous/potentially infectious materials are trained for handling, decontamination, and spill management procedures.

Ensure staff are aware of the required actions necessary to safely handle biohazardous/potentially infectious materials, to decontaminate work areas, and to clean spills. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)

\_\_\_\_\_

All staff have received additional training for handling specific biohazardous/potentially infectious materials.

(29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)

\_\_\_\_\_

All staff who work with Bloodborne Pathogens (BBP) have received annual/refresher training.

BBP training is available for review during the annual laboratory EH&S training. (29 CFR 1910.1030)

\_\_\_\_\_

**Bloodborne Pathogens (BBP)**

N/A   Yes   No   Comment

If using BBP or other potentially infectious materials an Exposure Control Plan is available.

The Exposure Control Plan is located on the HIM/NRB EH&S webpage. (29 CFR 1910.1030)

\_\_\_\_\_

Laboratory personnel have been offered the hepatitis B vaccine.

If someone has refused to have the Hepatitis B vaccine, s(he) must sign an Occupational Exposure to Bloodborne Pathogens Form. (29 CFR 1910.1030)

\_\_\_\_\_

**General Laboratory Conditions**

N/A   Yes   No   Comment

Biosafety levels posted on laboratory doors are correct.

Biosafety levels should correspond to those recommended by COMS. Contact the EH&S office (432-2762) for new signs. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)

\_\_\_\_\_

Laboratory doors are kept closed.

Doors to areas that are designated BL2 or higher must be kept closed. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)

\_\_\_\_\_

All equipment used for work with potentially infectious materials is labeled with the biohazard symbol.

Equipment may include refrigerators, freezers, incubators and centrifuges. Labels can be obtained from the EH&S office (432-2762). (29 CFR 1910.1030)

\_\_\_\_\_

Laboratory personnel wash their hands after each glove removal and before leaving the laboratory.

Laboratory personnel should wash their hands and remove gloves prior to leaving laboratory. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)

\_\_\_\_\_

# Laboratory Occupational Safety & Health Survey - General BioSafety

Inspection Date \_\_\_\_\_ Bldg: \_\_\_\_\_ Rooms: \_\_\_\_\_

**General Laboratory Conditions**

N/A    Yes    No    Comment

All equipment used for work with biohazardous/potentially infectious materials is clean and in good working order.      Clean equipment, i.e. plate counters, lyophilizers, and centrifuges, after each use. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)                  \_\_\_\_\_

A sink for handwashing is available in the tissue culture room.      (CDC/NIH BMBL 5th Ed., 2007)                  \_\_\_\_\_

Surfaces and furniture should be easily cleanable and made of non-porous materials.      Replace non-compliant lab furniture. No carpet or rugs are allowed in BL2+ tissue culture rooms. (CDC/NIH BMBL, 5th Ed., 2007)                  \_\_\_\_\_

Eyewash station(s) are readily available.      Ensure that eyewash stations have correct signage, are clear of any obstructions, and are inspected periodically. (CDC/NIH BMBL, 5th Ed., 2007)                  \_\_\_\_\_

There is no indication of food, drink, tobacco products, cosmetics, handling of contact lenses, etc.      (29 CFR 1910.141(g); 29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed., 2007)                  \_\_\_\_\_

Animals and plants not associated with research are not permitted in laboratory.      (CDC/NIH BMBL, 5th Ed., 2007)                  \_\_\_\_\_

**Biosafety Cabinets (BSCs)**

N/A    Yes    No    Comment

Biosafety cabinets are certified annually.      Contact the EH&S office (432-2762) for information on how to get a biosafety cabinet certified. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)                  \_\_\_\_\_

Correct sash height is indicated and used, BSC is clean and work surface is uncluttered.      To maintain proper airflow, always work with BSC at recommended sash height and ensure that air intakes are not blocked. (CDC/NIH BMBL 5th Ed., 2007)                  \_\_\_\_\_

BSC is disinfected both before and after use.      Refer to the Biosafety Manual for disinfection procedures. UV light is not an acceptable disinfectant. (CDC/NIH BMBL 5th Ed., 2007)                  \_\_\_\_\_

Valve on vacuum lines is not in bypass position.      Valve should not be in the bypass position (BMP)                  \_\_\_\_\_

In-line hydrophobic filters are used for all aspiration flasks.      Order hydrophobic filters to place in line with aspirating bottles. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)                  \_\_\_\_\_

# Laboratory Occupational Safety & Health Survey - General BioSafety

Inspection Date \_\_\_\_\_ Bldg: \_\_\_\_\_ Rooms: \_\_\_\_\_

## Biosafety Cabinets (BSCs)

		N/A	Yes	No	Comment
Aspiration flasks located on the floor are in secondary containers.	If stored on floor, secondary containers must be large enough to contain spill. (BMP)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
No Bunsen burners are used inside BSCs.	Electric incinerators, disposable inoculating loops, etc. are recommended. (BMP)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
BSCs are installed so that fluctuations of room air supply and exhaust do not interfere with proper operation.	BSCs should not be located in areas where high traffic or opening/shutting doors could interfere with the airflow in the cabinet. (CDC/NIH BMBL 5th Ed., 2009)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
All work with potentially infectious materials that could potentially generate aerosols is performed in a BSC.	No work with open vessels containing potentially infectious materials should be performed on an open bench.(CDC/NIH BMBL 5th Ed., 2007)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

## Disinfection and Spill Management Procedures

		N/A	Yes	No	Comment
Bleach solutions for aspiration flasks are prepared and disposed of weekly.	To ensure effective disinfection, prepare bleach solutions at a minimum on a weekly basis. (BMP)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Laboratory personnel know where the Biohazard Spill Kits and how to use them.	Biohazard spill kits should be clearly labeled, readily available and fully stocked. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

## Sharps

		N/A	Yes	No	Comment
The use of safer medical devices has been evaluated.	If syringes/needles are used in the laboratory, safety needle products should be used if possible. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Safe practices for handling, storage, and disposal of sharps are in use.	Store needles/syringes in a secure location and dispose of sharps immediately after use. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Leak-proof and puncture resistant sharps containers are accessible.	Containers must be red, fluorescent orange or orange-red, leakproof, puncture-resistant, marked with the biohazard symbol, and as close to the point of use as possible.(105 CMR 480; 29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed, 2007)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Sharps containers are not filled more than 2/3 full.	Do not overfill sharps containers .(BMP)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

## Biohazardous Waste Management

N/A Yes No Comment

# Laboratory Occupational Safety & Health Survey - General BioSafety

Inspection Date \_\_\_\_\_

Bldg: \_\_\_\_\_

Rooms: \_\_\_\_\_

## Biohazardous Waste Management

N/A    Yes    No    Comment

Procedures for disposal of biohazardous waste are established and implemented.

For Biohazardous waste removal, please call the Facility Operations Center at 432-1901. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007; 105 CMR 480)

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All biohazardous waste containers are double-bagged with biohazard waste bags.

Properly line biohazardous waste containers with two red biohazard waste bags. Containers must be impervious to moisture/leakage, sealable and marked with the universal biohazard symbol. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007; 105 CMR 480)

\_\_\_\_\_

All biohazardous waste containers are closed or covered when not actively adding waste (e.g. overnight).

Ensure that all containers are closeable.(29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007; 105 CMR 480)

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Autoclaves are tested quarterly to verify proper operation.

Autoclaves used for waste disinfection should be tested quarterly. Biological indicators are available from laboratory equipment vendors and comply with 105 CMR 480.(105 CMR 480)

\_\_\_\_\_

Autoclave validation records are maintained.

Validation records for autoclaves used for waste disinfection should be maintained for at least 3 years. (105 CMR 480)

\_\_\_\_\_

## Accident/Incident Investigation and Reporting

N/A    Yes    No    Comment

Staff know symptoms associated with agents used in the lab.

Review symptoms associated with exposures to the agents used in the laboratory. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)

\_\_\_\_\_

Staff know response procedures for injuries/illnesses involving biohazardous materials/BBP.

Report all injuries and suspected exposures to your institution's occupational health department and the EH&S Office (432-2762). Go to the occupational health department or the ER for medical treatment. (29 CFR 1910.1030 ; CDC/NIH BMBL 5th Ed., 2007)

\_\_\_\_\_

Accident/illness investigation reports are maintained and submitted to the HIM/NRB EHS office and your institution's Occupational Health department.

Incident Reports must be completed for all injuries and exposures. (29 CFR 1910.1030; 29 CFR 1904; CDC/NIH BMBL 5th Ed., 2007)

\_\_\_\_\_

There have been no incidents among laboratory staff within the past 12 months.

Illnesses and accidents must be reported to your institution's occupational health department and the EH&S Office (432-2762) immediately. (29 CFR 1904, 29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)

\_\_\_\_\_

## Shipment of Dangerous Goods

N/A    Yes    No    Comment

Copies of completed shipping documents are maintained.

Ensure laboratory maintains a copy of all shipping documents that meets DOT/IATA requirements.(49 CFR 172; IATA DGR)

\_\_\_\_\_

## Laboratory Occupational Safety & Health Survey - General BioSafety

Inspection Date \_\_\_\_\_ Bldg: \_\_\_\_\_ Rooms: \_\_\_\_\_

**Shipment of Dangerous Goods**

N/A Yes No Comment

Is contact number a 24-hour emergency number?      Ensure phone number on paperwork is a 24-hour number for person responsible for material being shipped. (49 CFR 172; IATA DGR)         \_\_\_\_\_

Did a knowledgeable person sign paperwork, and was the person who prepared the paperwork trained?      Ensure person(s) preparing/signing paperwork is familiar with the hazards associated with the material and appropriately trained.(49 CFR 172; IATA DGR)         \_\_\_\_\_

Is training updated every two years, or when the regulations change?      Call the EH&S Office (432-2762) for Training Information. (49 CFR 172; IATA DGR)         \_\_\_\_\_

**Select Agents**

N/A Yes No Comment

Are all select agents registered with COMS?      If the laboratoy uses select agents, ensure someone from the laboratory has signed the Select Agent Form available on the COMS webpage. (42 CFR 73; 7 CFR 331/9CFR 121; CDC; APHIS Select Agent Regs)         \_\_\_\_\_

There are no select agents being used/stored in the lab.      If the laboratoy does not use select agents, the PI must sign the HIM/NRB EHS form indicating such.(42 CFR 73; 7 CFR 331/9CFR 121; CDC; APHIS Select Agent Regs)         \_\_\_\_\_

**Other Comments**

**For questions please contact Harvard Institutes of Medicine/New Research Building (HIM/NRB) Environmental Health and Safety (EH&S) Office at 617-432-2762.**

Laboratory Contact at Time of Survey	
Name:	Signature:

## Laboratory Occupational Safety & Health Survey - Research - BL2+

Inspection Date _____	Bldg: _____	Rooms: _____	Number of Deficiencies = _____
Local Contact _____	Phone: _____	Email: _____	
Safety Contact _____	Phone: _____	Email: _____	
Researcher: _____	Phone: _____	Email: _____	

### PPE/Protective Clothing

		N/A	Yes	No	Comment
Eye, face, and respiratory protection is used in rooms containing infected animals.	(CDC/NIH BMBL, 5th Ed., 2007)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Personal protective equipment consists of disposable solid front gown, two pairs of disposable latex or nitrile gloves, safety glasses, and safety goggles/a face shield when splashes are possible.	(29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed, 2007)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
PPE is not worn outside of the BL2+ laboratory.	(29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed, 2007)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Contaminated PPE is removed and disposed of or cleaned and disinfected.	CDC/NIH BMBL, 5th Ed., 2007	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
All cuts and abrasions are covered with a bandage before donning disposable gloves.	(29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed, 2007)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

### Harvard Committee on Microbiological Safety (COMS)

		N/A	Yes	No	Comment
A risk assessment was conducted for the work being conducted in your work area by the biosafety officer (BSO).	Contact your BSO to perform a risk assessment (CDC/NIH BMBL, 5th Ed., 2007)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Are all research projects registered with COMS?	(NIH Guidelines, April 2002.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Is COMS registration information, including personnel, accurate?	If COMS registration information needs to be amended or updated, contact the biosafety officer. (NIH Guidelines, April 2002.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

### Training and Recordkeeping

N/A   Yes   No   Comment

# Laboratory Occupational Safety & Health Survey - Research - BL2+

Inspection Date \_\_\_\_\_ Bldg: \_\_\_\_\_ Rooms: \_\_\_\_\_

## Training and Recordkeeping

N/A Yes No Comment

All laboratory personnel who work with biohazardous materials requiring BioSafety Level 2+ (BL2+) procedures are trained on the Laboratory-Specific BL2+ SOP. (29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed, 2007)

\_\_\_\_\_

All laboratory personnel working at BL2+ have received annual/refresher training specific to their project(s). (29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed, 2007)

\_\_\_\_\_

## Bloodborne Pathogens (BBP)

N/A Yes No Comment

The laboratory has an Exposure Control Plan. Plan is located on the HIM/NRB Environmental Health and Safety webpage. (29 CFR 1910.1030)

\_\_\_\_\_

Laboratory personnel have been offered the hepatitis B vaccine. If someone has refused to have the Hepatitis B vaccine, s(he) must sign an Occupational Exposure to Bloodborne Pathogens Form. (29 CFR 1910.1030)

\_\_\_\_\_

## General Laboratory Conditions

N/A Yes No Comment

All equipment used for work with potentially infectious materials is labeled with the biohazard symbol. Equipment may include refrigerators, freezers, incubators and centrifuges. Labels can be obtained from the EH&S office (432-2762).(29 CFR 1910.1030)

\_\_\_\_\_

Laboratory personnel wash their hands after each glove removal and before leaving the laboratory. Laboratory personnel should wash their hands and remove gloves prior to leaving laboratory. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)

\_\_\_\_\_

All equipment used for work with biohazardous/potentially infectious materials is clean and in good working order. Clean equipment, i.e. plate counters, lyophilizers, and centrifuges, after each use. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)

\_\_\_\_\_

Appropriate biohazard warning signs are posted on door to BL2+ areas. Information should include: universal biohazard symbol, infectious agent(s), name and telephone # of the Principal Investigator (PI) and other responsible persons, and special requirements for entering the room (such as vaccinations and PPE).

\_\_\_\_\_

Doors to the BL2+ laboratory are closed at all times. (29 CFR 1910.1030 and CDC/NIH BMBL 5th Ed., 2007)

\_\_\_\_\_

## Laboratory Occupational Safety & Health Survey - Research - BL2+

Inspection Date \_\_\_\_\_

Bldg: \_\_\_\_\_

Rooms: \_\_\_\_\_

**General Laboratory Conditions**

N/A    Yes    No    Comment

A sink for handwashing is available in the tissue culture room. (CDC/NIH BMBL 5th Ed., 2007)    \_\_\_\_\_

Surfaces and furniture should be easily cleanable and made of non-porous materials. Replace non-compliant lab furniture. No carpet or rugs are allowed in BL2+ tissue culture rooms. (CDC/NIH BMBL, 5th Ed., 2007)    \_\_\_\_\_

Eyewash station(s) are readily available. Ensure that eyewash stations have correct signage, are clear of any obstructions, and are inspected periodically. (CDC/NIH BMBL, 5th Ed., 2007)    \_\_\_\_\_

There is no indication of food, drink, tobacco products, cosmetics, handling of contact lenses, etc. (29 CFR 1910.141(g); 29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed., 2007)    \_\_\_\_\_

Animals and plants not associated with research are not permitted in laboratory. (CDC/NIH BMBL, 5th Ed., 2007)    \_\_\_\_\_

**Biosafety Cabinets (BSCs)**

N/A    Yes    No    Comment

Biosafety cabinets are certified annually. Contact the EH&S office (432-2762) for information on how to get a biosafety cabinet certified. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)    \_\_\_\_\_

Correct sash height is indicated and used, BSC is clean and work surface is uncluttered. To maintain proper airflow, always work with BSC at recommended sash height and ensure that air intakes are not blocked. (CDC/NIH BMBL 5th Ed., 2007)    \_\_\_\_\_

BSC is disinfected both before and after use. Refer to the Biosafety Manual for disinfection procedures. UV light is not an acceptable disinfectant. (CDC/NIH BMBL 5th Ed., 2007)    \_\_\_\_\_

Valve on vacuum lines is not in bypass position. Valve should not be in the bypass position (BMP)    \_\_\_\_\_

In-line hydrophobic filters are used for all aspiration flasks. Order hydrophobic filters to place in line with aspirating bottles. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)    \_\_\_\_\_

Aspiration flasks located on the floor are in secondary containers. If stored on floor, secondary containers must be large enough to contain spill. (BMP)    \_\_\_\_\_

No Bunsen burners are used inside BSCs. Electric incinerators, disposable inoculating loops, etc. are recommended. (BMP)    \_\_\_\_\_

## Laboratory Occupational Safety & Health Survey - Research - BL2+

Inspection Date \_\_\_\_\_

Bldg: \_\_\_\_\_

Rooms: \_\_\_\_\_

**Biosafety Cabinets (BSCs)**

N/A    Yes    No    Comment

BSCs are installed so that fluctuations of room air supply and exhaust do not interfere with proper operation.

BSCs should not be located in areas where high traffic or opening/shutting doors could interfere with the airflow in the cabinet. (CDC/NIH BMBL 5th Ed., 2009)

           \_\_\_\_\_

All work with potentially infectious materials that could potentially generate aerosols is performed in a BSC.

No work with open vessels containing potentially infectious materials should be performed on an open bench. (CDC/NIH BMBL 5th Ed., 2007)

           \_\_\_\_\_

**Sharps**

N/A    Yes    No    Comment

The use of safer medical devices has been evaluated.

If syringes/needles are used in the laboratory, safety needle products should be used if possible. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)

           \_\_\_\_\_

Safe practices for handling, storage, and disposal of sharps are in use.

Store needles/syringes in a secure location and dispose of sharps immediately after use. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)

           \_\_\_\_\_

Leak-proof and puncture resistant sharps containers are accessible.

Containers must be red, fluorescent orange or orange-red, leakproof, puncture-resistant, marked with the biohazard symbol, and as close to the point of use as possible. (105 CMR 480; 29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed, 2007)

           \_\_\_\_\_

Sharps containers are not filled more than 2/3 full.

Do not overfill sharps containers. (BMP)

           \_\_\_\_\_

**Biohazardous Waste Management**

N/A    Yes    No    Comment

Procedures for disposal of biohazardous waste are established and implemented.

For Biohazardous waste removal, please call the Facility Operations Center at 432-1901. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007; 105 CMR 480)

           \_\_\_\_\_

All biohazardous waste containers are double-bagged with biohazard waste bags.

Properly line biohazardous waste containers with two red biohazard waste bags. Containers must be impervious to moisture/leakage, sealable and marked with the universal biohazard symbol. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007; 105 CMR 480)

           \_\_\_\_\_

All biohazardous waste containers are closed or covered when not actively adding waste (e.g. overnight).

Ensure that all containers are closeable. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007; 105 CMR 480)

           \_\_\_\_\_

# Laboratory Occupational Safety & Health Survey - Research - BL2+

Inspection Date \_\_\_\_\_ Bldg: \_\_\_\_\_ Rooms: \_\_\_\_\_

## Biohazardous Waste Management

N/A	Yes	No	Comment
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

Biohazardous solid waste must be decontaminated, preferably within the laboratory, prior to disposal.

e.g. autoclave, chemical disinfection, incineration, or other validated method (CDC/NIH BMBL, 5th Ed, 2007; 105 CMR 480)

Autoclaves are tested quarterly to verify proper operation.

Autoclaves used for waste disinfection should be tested quarterly. Biological indicators are available from laboratory equipment vendors and comply with 105 CMR 480.(105 CMR 480)

Autoclave validation records are maintained.

Validation records for autoclaves used for waste disinfection should be maintained for at least 3 years. (105 CMR 480)

## Accident/Incident Investigation and Reporting

N/A	Yes	No	Comment
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

Staff know symptoms associated with agents used in the lab.

Review symptoms associated with exposures to the agents used in the laboratory. (29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)

Staff know response procedures for injuries/illnesses involving biohazardous materials/BBP.

Report all injuries and suspected exposures to your institution's occupational health department and the EH&S Office (432-2762). Go to the occupational health department or the ER for medical treatment. (29 CFR 1910.1030 ; CDC/NIH BMBL 5th Ed., 2007)

Accident/illness investigation reports are maintained and submitted to the HIM/NRB EHS office and your institution's Occupational Health department.

Incident Reports must be completed for all injuries and exposures. (29 CFR 1910.1030; 29 CFR 1904; CDC/NIH BMBL 5th Ed., 2007)

There have been no incidents among laboratory staff within the past 12 months.

Illnesses and accidents must be reported to your institution's occupational health department and the EH&S Office (432-2762) immediately. (29 CFR 1904, 29 CFR 1910.1030; CDC/NIH BMBL 5th Ed., 2007)

## Standard Operating Procedures

N/A	Yes	No	Comment
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

There is a specific BL2+ Standard Operating Procedure for the project on file with the EH&S office.

(29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed, 2007)

The BL2+ Standard Operating Procedure is updated on an annual basis.

(29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed, 2007)

## Laboratory Occupational Safety & Health Survey - Research - BL2+

Inspection Date \_\_\_\_\_ Bldg: \_\_\_\_\_ Rooms: \_\_\_\_\_

### Standard Operating Procedures

N/A Yes No Comment

All infectious materials for centrifugation are placed into aerosol containment canisters (opened and closed within Biosafety Cabinet). (29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed, 2007)    \_\_\_\_\_

O-rings and canisters are inspected periodically to ensure correct function. (29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed, 2007)    \_\_\_\_\_

Disposable plasticware is used instead of glassware. (29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed, 2007)    \_\_\_\_\_

Vacuum flasks, pipettes and buckets/beakers are autoclaved at 121o C for 30 minutes for liquids and 1 hour for solids or decontaminated within the laboratory using chemical disinfection or other validated method. If not using an autoclave, contact the BSO to approve proposed disinfection method(s) (29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed, 2007)    \_\_\_\_\_

### Personnel Restrictions

N/A Yes No Comment

Pregnant or immunocompromised personnel have been advised to meet with their Occupational Health Department for consultation regarding their immune status and the agents they are handling. (29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed. 2007)    \_\_\_\_\_

The Principal Investigator (PI) along with Occupational Health has determined if immunizations are required based on the agents being used. (29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed, 2007)    \_\_\_\_\_

No custodial or maintenance personnel are permitted to enter without authorization of the PI and accompanied by a staff member. (29 CFR 1910.1030; CDC/NIH BMBL, 5th Ed, 2007)    \_\_\_\_\_

## Laboratory Occupational Safety & Health Survey - Research - BL2+

Inspection Date \_\_\_\_\_ Bldg: \_\_\_\_\_ Rooms: \_\_\_\_\_

Other Comments

For questions please contact Harvard Institutes of Medicine/New Research Building (HIM/NRB) Environmental Health and Safety (EH&S) Office at 617-432-2762.

Laboratory Contact at Time of Survey	
Name:	Signature:

**APPENDIX C**  
**EXPOSURE CONTROL PLAN**

**Harvard Institutes of Medicine/  
New Research Building**

# **Exposure Control Plan**

**HIM/NRB Environmental Health and Safety Office  
77 Avenue Louis Pasteur  
Boston, MA 02115**

**October 2011**

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### **LIST OF ABBREVIATIONS AND ACRONYMS**

BBP	bloodborne pathogens
BSC	biological safety cabinet
CDC	Centers for Disease Control and Prevention
DNA	deoxyribonucleic acid
ECP	Exposure Control Plan
EH&S	Environmental Health and Safety
EPA	U.S. Environmental Protection Agency
HBV	hepatitis B virus
HCV	hepatitis C virus
HIV	human immunodeficiency virus
HIM	Harvard Institutes of Medicine
NIOSH	National Institute for Occupational Safety and Health
NRB	New Research Building
OPIM	Other potentially infectious materials
OSHA	U.S. Occupational Safety and Health Administration
PHS	U.S. Public Health Service
PI	principal investigator
PIM	potentially infectious materials
PPE	personal protective equipment
rDNA	recombinant deoxyribonucleic acid

## 1.0 INTRODUCTION

---

The primary purpose of the U.S. Occupational Health and Safety Administration (OSHA) Bloodborne Pathogens (BBP) Standard is to minimize or eliminate occupational exposures to blood and other bodily fluids and the risk of developing the infectious diseases associated with them. A copy of the BBP Standard can be found at the following webpage: <http://www.osha.gov/SLTC/bloodbornepathogens/index.html>.

As part of this standard, an Exposure Control Plan (ECP) must be written, implemented, and made available to employees. The ECP includes ways to minimize or eliminate exposures using a combination of engineering and work practice controls, personal protective equipment, training, medical surveillance, hepatitis B vaccination, signs and labels, and other provisions.

The Harvard Institutes of Medicine (HIM)/New Research Building (NRB) Environmental Health and Safety (EH&S) Office has prepared this ECP to meet this requirement. The ECP will be reviewed on an annual basis by the HIM/NRB EH&S Office.

### 1.1 RESPONSIBLE PERSONS

Responsibility for implementation of this plan is as follows:

- **EH&S:** The EH&S Office has overall responsibility for overseeing the implementation of the Exposure Control Plan and appropriate policies and practices needed to support the effective implementation of this Plan. The EH&S Office will be responsible for oversight of Department activities.
- **Principal Investigators (PIs), Department Administrators and the Facility Manager:** PIs, Department Administrators, and the Facility Manager are responsible for exposure control in their respective areas. Guidance to these individuals will be provided by EH&S.
- **Occupational/Employee Health Services:** Each individual institution's Occupational/Employee Health Services has responsibility for establishing and

implementing the vaccination program and the post-exposure incident medical evaluation and follow-up as per OSHA mandate.

- **Laboratory Managers/Supervisors:** Managers/Supervisors are responsible for ensuring proper work practices (e.g., universal precautions, use of personal protective equipment [PPE]) are followed on a day to day basis.
- **Occupants:** All individuals working at HIM/NRB are responsible for attending the annual training sessions, participating in their department's orientation program, understanding which tasks have the potential for occupational exposure and employing safe work practices in the performance of their duties.

## 2.0 DEFINITIONS

---

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

**Bloodborne Pathogens** means 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), Hepatitis C virus (HCV), and human immunodeficiency virus (HIV).

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

**Contaminated Laundry** means laundry which has been soiled with blood or other PIM or may contain sharps.

**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., sharps disposal containers, self-sheathing needles, safer medical devices, such as sharps with engineered sharps injury protections and needleless systems) that isolate or remove the bloodborne pathogens hazard from the workplace.

**Exposure Incident** means a specific instance of contact with blood or other PIM, via eye, mouth, other mucous membrane, non-intact skin, or parenteral contact, during the course of the performance of an employee'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.

**Needleless Systems** means a device that does not use needles for: (1) The collection of bodily fluids or withdrawal of body fluids after initial venous or arterial access is established; (2) The administration of medication or fluids; or (3) Any other procedure involving the potential for occupational exposure to bloodborne pathogens due to percutaneous injuries from contaminated sharps.

**Non-intact skin** includes skin with dermatitis, hangnails, cuts, abrasions, chafing, and acne.

**Occupational Exposure** means reasonably anticipated contact with blood or other PIM, via eye, mouth, other mucous membrane, non-intact skin, or parenteral contact, during the course of the performance of an employee's duties.

**Other Potentially Infectious Materials (OPIM)** means (1) 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; (2) Any unfixed tissue or organ (other than intact skin) from a human (living or dead); and (3) 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 needlesticks, human bites, cuts, and abrasions.

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

**Regulated Waste** means liquid or semi-liquid blood or OPIM; contaminated items that would release blood or OPIM in a liquid or semi-liquid state if compressed; items that are caked with dried blood or OPIM and are capable of releasing these materials during handling; contaminated sharps; and pathological and microbiological wastes containing blood or other PIM.

**Research Laboratory** means a laboratory producing or using research-laboratory-scale amounts of HIV, HBV, or HCV. Research laboratories may produce high concentrations of HIV, HBV, or HCV but not in the volume found in production facilities.

**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 that has a built-in safety feature or mechanism that effectively reduces the risk of an exposure incident.

**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, HCV, 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).

### **3.0 EXPOSURE DETERMINATION**

---

An exposure determination must be made for anyone who has a reasonable chance of encountering human blood, body fluids and OPIM while performing their normal job duties.

This exposure determination is made without regard to the use of personal protective equipment (i.e., persons are considered to be exposed even if they wear personal protective equipment) and is required to list all job classifications in which one may be expected to incur an occupational exposure. At HIM/NRB, the following job classifications are in this category:

- Laboratory Technicians/Research Assistants
- Graduate Students
- Postdoctoral Fellows
- Glassware Washers
- Students/Interns

In addition, we have identified job classifications in which some employees may have occupational exposure. Not all employees in these categories are expected to have exposure to blood or OPIM. Therefore, tasks or procedures that would cause occupational exposure are also listed to further specify which employees have occupational exposure.

Job classifications and associated tasks for these categories are as follows:

- Centrifugation of blood samples or OPIM.
- Separation of blood components or OPIM.
- Transferring blood or other body fluids between containers.
- Washing contaminated glassware.
- Disposing used needles and biohazardous waste.
- Working with human blood, body fluids, unfixed tissues and organs, and primary human cells.

- Working with cultures of HIV or virus-producing cell lines and non-human primate cells.
- Administering recombinant deoxyribonucleic acid (rDNA) molecules or infectious microbiological agents into animals or animal or human cell lines.

## 4.0 METHODS OF COMPLIANCE

---

PIs are responsible for ensuring the effectiveness of and compliance with the following controls and practices.

### 4.1 UNIVERSAL PRECAUTIONS

Universal precautions techniques developed by the Centers for Disease Control and Prevention(CDC) (<http://www.osha.gov/SLTC/etools/hospital/hazards/univprec/univ.html>) will be observed at this facility to prevent contact with blood or OPIM. **All human blood or other human source materials will be considered potentially infectious for HIV, HBV, HCV, and other bloodborne pathogens, regardless of the perceived “low risk” status of the source individual.**

### 4.2 ENGINEERING AND WORK PRACTICE CONTROLS

One of the key aspects of the HIM/NRB ECP is the use of engineering and work practice controls to minimize or eliminate BBP exposures. At this facility, the following engineering and work practice controls are used:

- Hands and any other skin will be washed with soap and water, and eyes or mucous membranes will be flushed with water immediately or as soon as feasible following contact of such body areas with blood or OPIM.
- Contaminated needles and other contaminated sharps shall not be bent, recapped, or removed from their syringe.
- After use, sharps (e.g., needles, scalpels, razor blades, Pasteur pipettes, etc.) will be placed in red, fluorescent orange or orange-red leakproof, rigid, puncture-resistant, shatterproof containers that that are marked prominently with the universal biohazard warning symbol and the word “Biohazard” in a contrasting color.
- Eating, drinking, chewing gum, smoking, applying cosmetics, and handling contact lenses is prohibited in work areas where exposure to infectious materials may occur.
- Food and drink will not be kept in refrigerators, freezers, on countertops, or in other storage areas where blood or OPIM are present.

- Procedures involving blood or OPIM will be performed carefully to minimize splashing, spraying, splattering, and producing droplets or aerosols of blood or OPIM.
- Mouth pipetting/suctioning of blood or OPIM is prohibited.
- All equipment and work surfaces will be cleaned and disinfected on a routine basis and as soon as possible following spills or other exposure to blood or OPIM.
- Leak-proof, labeled containers will be used for disposal of contaminated waste.
- Biosafety cabinets (BSCs) will be used as secondary protection (second to personal protective equipment such as laboratory coats, disposable latex or nitrile gloves, and eye or face shields).
- To help reduce needlesticks and other sharps injuries the use of safer medical devices is advised.

#### **4.3 PERSONAL PROTECTIVE EQUIPMENT**

PPE is considered the required safety equipment, or a “primary barrier” for protection against bloodborne pathogens. Each host institution is required to provide all necessary PPE to their employees free of cost. This equipment includes, but is not limited to:

- Disposable latex or nitrile gloves
- Laboratory coats
- Gowns/scrubs
- Goggles
- Safety glasses with side shields
- Prescription safety glasses
- Face shields/masks
- Hoods
- Shoe covers
- Respiratory protection
- Other site specific PPE as needed

Occupants are trained regarding the use of the appropriate PPE for their job classifications and tasks/procedures they perform. Training is provided by the HIM/NRB

EH&S Office, laboratory managers or designee, when necessary, such as when an employee takes a new position or new job functions are added to their current position.

To ensure that PPE is not contaminated and is in the appropriate condition to protect employees from potential exposure, our facility adheres to the following practices:

- PPE selection is reviewed by HIM/NRB EH&S Office or the responsible Laboratory Manager/Laboratory Safety Contact.
- Reusable PPE is properly cleaned, laundered and decontaminated, as needed.
- Single-use PPE (or equipment that cannot, for whatever reason, be decontaminated) is disposed of as biological waste.

To ensure that PPE is used as effectively as possible, occupants are trained to adhere to the following practices, which include, but are not limited to:

- Any garments penetrated by blood or other infectious materials are removed immediately or as soon as feasible.
- All PPE is removed prior to leaving a work area and is never worn in common areas of the building such as conference rooms, restrooms, and lunchrooms.
- Disposable latex or nitrile gloves are worn in the following circumstances:
  - Whenever employees anticipate hand contact with potentially infectious materials.
  - When performing vascular access procedures, with reasonable likelihood of blood exposure.
  - When handling or touching contaminated items or surfaces.
- Disposable latex or nitrile gloves are replaced as soon as practical after contamination, or if they are torn, punctured or otherwise lose their ability to function as an “exposure barrier.”
- Utility gloves are decontaminated for reuse unless they are cracked, peeling, torn or exhibit other signs of deterioration, at which time they are disposed of.
- Full-face protection, such as masks, face shields, and eye protection (goggles, etc.) are used whenever splashes or sprays may generate droplets of infectious materials.
- Protective clothing (such as gowns, scrubs and aprons) is worn whenever potential exposure is anticipated.

- Head covers/hoods and/or shoe covers/boots are used in any instances where “gross contamination” is anticipated (such as perfusion activities).

#### **4.4 HOUSEKEEPING**

It is the responsibility of everyone who works at HIM/NRB to ensure that the facility is maintained in a clean and sanitary condition. The following sections outline the procedures to ensure this level of cleanliness.

##### **4.4.1 Equipment and Working Surfaces**

Contaminated work surfaces and equipment should be cleaned with a U.S. Environmental Protection Agency (EPA) approved germicidal disinfectant (<http://www.epa.gov/oppad001/chemregindex.htm>). The disinfectant solution is applied in accordance with the manufacturer's recommendations.

Laboratory personnel must clean and decontaminated equipment and surfaces after contact with blood or other potentially infectious materials after the completion of procedures, immediately (or as soon as feasible) when surfaces are overtly contaminated, after any large spill of blood or infectious materials, or at the end of the work shift if the surface may have been contaminated during that shift.

##### **4.4.2 Contaminated Sharps Disposal**

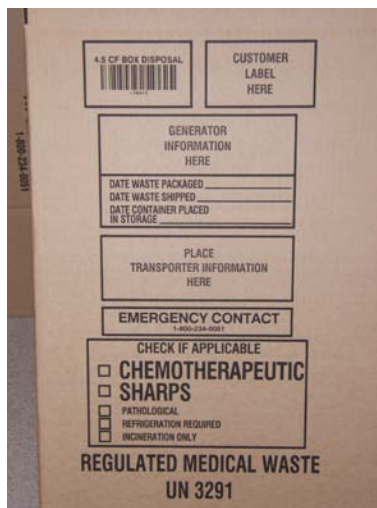
Contaminated sharps will be discarded immediately or as soon as feasible into a sharps container. Refer to Figure 4.1 for an example of a sharps container.



**Figure 4.1** Sharps Container

During use, the sharps container will be easily accessible to laboratory members and located as close as is feasible to the immediate area where sharps are used. These containers should remain upright throughout use, be replaced routinely, and not be overfilled.

When moving the sharps container from the area of use, the containers should be closed immediately prior to removal or replacement to prevent spills or protrusion of contents during handling, storage, transport, or shipping. Filled reusable sharps containers are routinely picked up and replaced by Stericycle. Any filled disposable sharps containers can be placed either into a larger reusable sharps container or into a biological waste box lined with two red biohazard waste bags. Disposable sharps containers must be sealed before being placed into cardboard biohazardous waste boxes. It is important that the SHARPS box on the outside of the biological waste box be checked to ensure the sharps are disposed of properly. See Figure 4.2.



**Figure 4.2** Side of Biological Waste Box

Call 617-432-1901 for biological waste box pick-up.

#### **4.4.3 Solid Biological Waste Disposal**

Any viable organism containing rDNA molecules must be rendered non-infectious by a validated method (e.g., steam sterilization, chemical disinfection, incineration at an

approved facility) prior to being removed off-site. Other solid materials may be placed directly in the biological waste containers lined with two red biohazard waste bags.

When the biological waste box is nearly full, close up and seal as follows:

- Close and tape or tie the inner bag.
- Close and tape or tie the outer bag.
- Place the cover on top.
- Seal with two inch wide tape across the top of the box.
- Place the floor label on each biological waste box.
- Label the top of the box with the lab room number and the PI's name.
- Inspect the sealed boxes for leakage. Leaking biological waste box will be returned to the originating lab for repacking.

The sealed boxes are removed periodically throughout the day. Call 617-432-1901 to pickup a biological waste box or deliver empty biological waste bags, boxes, and lids. Contact Harvard Custodial to obtain labels associated with the biological waste boxes.

#### **4.4.4 Contaminated Laundry**

Personnel should replace laboratory gowns or coats regularly and when they become contaminated. Contaminated laundry that can be reused should be placed in leak-proof bags labeled with the biohazard symbol or color-coded red before transporting for decontamination or cleaning.

## **5.0 HIV, HBV AND HCV RESEARCH LABORATORIES**

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This section applies to research laboratories and production facilities engaged in the culture, production, concentration, experimentation, and manipulation of HIV, HBV, HCV, or other bloodborne pathogens. It does not apply to clinical or diagnostic laboratories engaged solely in the analysis of blood, tissues, or organs.

### **5.1 SPECIAL PRECAUTIONS**

Research laboratories and production facilities are required to meet the following criteria:

- All regulated waste will either be incinerated or decontaminated by a method such as autoclaving known to effectively destroy bloodborne pathogens.
- Laboratory doors will be kept closed while work is in progress.
- Contaminated materials will be kept in closed, appropriately labeled and leakproof containers prior to removal from the laboratory. Access will be limited to authorized persons only and controlled via written policies and procedures that only allow entry to those who are aware of the potential biohazards and meet entry requirements.
- Hazard warning sign incorporating the universal biohazard symbol will be posted on access doors.
- All work with viable infectious materials shall be conducted in a biological safety cabinet or other physical containment devices. No work with viable infectious materials will be conducted on open benches.
- Appropriate protective clothing will be used in work areas, not worn outside work areas, and decontaminated before being laundered.
- Special precautions will be applied when using vacuum lines (e.g., double-flasks and an in-line filter are used to prevent contamination of the house vacuum lines).
- Hypodermic needles and syringes will be used only for parenteral injections and aspirations of fluids from animals and diaphragm bottles.
- Spills will be immediately contained and cleaned up by trained personnel.
- Incidents will be reported immediately to your immediate supervisor, the HIM/NRB EH&S Office and to your institution's Occupational Health Department.
- A biosafety manual must be available for employees. The HIM/NRB Biosafety Manual is available at <http://www.himnrbehs.com/himnrbehs/biosafety.asp>.

- A hand washing and an eye wash facility must be readily available within work area.

### **5.1.2 SPECIAL PRECAUTIONS FOR BL2 WITH STIPULATIONS (a.k.a. BL2+) LABORATORIES**

In addition to the precautions listed above, laboratories that are designated BL2+ by Harvard COMS must meet the following criteria:

- A biosafety manual containing *laboratory-specific* Standard Operating Procedures must be available for employees.
- Employees must be trained on the laboratory biosafety manual prior to beginning work with biohazardous materials.
- No regular waste basket shall be present.
- An autoclave for decontamination of regulated waste must be available.
- All PPE worn in the area should be disposable or autoclavable.

Refer to the HIM/NRB Biosafety Manual for further information about BL2+ Laboratory requirements.

## **5.2 CONTAINMENT EQUIPMENT**

Biological safety cabinets (BSCs), personal protection, and physical containment devices (e.g., centrifuge safety cups) must be used for all activities with potentially infectious materials that pose a threat of exposure to droplets, splashes, spills, or aerosols.

BSCs require certification when installed, whenever they are moved, and at least annually.

## **5.3 TRAINING REQUIREMENTS**

In addition to the requirements in Section 8.0, before employees are allowed to work with HIV, HBV, and HCV in research laboratories and production facilities the employer shall ensure that employees demonstrate proficiency in:

- Standard microbiological practices and techniques and laboratory-specific standard operating procedures, **and** either
  - Prior experience with handling human pathogens or tissues cultures, **or**
  - Successful completion of a training program which stresses learning and proficiency in necessary techniques.
- Employees may only participate in work activities that include the handling of infectious agents after they have demonstrated proficiency in standard microbiological practices and necessary techniques.

## **6.0 HEPATITIS B VACCINATION AND POST-EXPOSURE**

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Staff members must contact the Occupation Health Department for their respective home institution to obtain information about the HBV vaccination program.

### **6.1 VACCINATION PROGRAM**

The hepatitis B vaccine is offered to all employees who have occupational exposure to bloodborne pathogens, and post exposure follow-up is offered to employees who have had an exposure incident. All medical evaluations and procedures including the hepatitis B vaccine and vaccination series and post exposure follow up, including prophylaxis, are:

- Made available at no cost to the employee.
- Made available to the employee at a reasonable time and place.
- Performed by or under the supervision of a licensed physician or by or under the supervision of another licensed healthcare professional.
- Provided according to the recommendations of the U.S. Public Health Service (PHS).

All records of Hepatitis B vaccinations and test results are kept on file in the Institution's Occupational Health Department. An accredited laboratory conducts all laboratory tests.

Hepatitis B vaccination is made available to all employees who have occupational exposure within 10 working days of their initial assignment.

Participation in a pre-screening program is **not** a prerequisite for receiving hepatitis B vaccination. If an employee initially declines the hepatitis B vaccination, but decides to accept the vaccination at a later date and is still covered under the standard, the vaccination will be made available. **All employees who decline the offered hepatitis B vaccination must sign the OSHA-required waiver indicating their refusal.** If the PHS recommends a routine booster dose of hepatitis B vaccine at a future date, such booster doses will be made available, at no cost to the employee.

## 6.2 POST-EXPOSURE EVALUATION AND FOLLOW-UP

All exposure incidents are reported, investigated, and documented. When the employee is exposed to blood or other PIM, the incident is reported to the HIM/NRB EH&S Office and Occupational Health Department.

### **What to do if exposed:**

- Immediately, wash the exposed skin area, needle sticks, and/or cuts with soap and water. Flush eyes and exposed mucous membranes with large amounts of clear water. Do not use caustic agents, such as bleach.
- Next, report the exposure to your supervisor and the HIM/MRB EH&S Office immediately, so that post-exposure evaluation, counseling, and any necessary treatment can begin. Act quickly, because with some infections, treatment works best when started right away.

### **When an employee is exposed, he or she will receive a confidential medical evaluation and follow-up, including at least the following elements:**

- Documentation of the route of exposure and the circumstances, under which the exposure occurred.
- Identification and documentation of the source individual, unless it can be established that identification is infeasible or prohibited by state or local law.
- The source individual's blood shall be tested as soon as feasible and after consent is obtained in order to determine HBV, HCV, and HIV infectivity. If consent is not obtained, the treating physician establishes that legally required consent cannot be obtained. When law does not require the source individual's consent, the source individual's blood, if available, will be tested and the results documented. When the source individual is already known to be infected with HBV, HCV, or HIV, testing for the source individual's known HBV, HCV, or HIV status need not be repeated.

- Results of the source individual's testing are made available to the exposed employee, and the employee is informed of applicable laws and regulations concerning disclosure of the identity and infectious status of the source individual.

**Collection and testing of blood for HBV, HCV, and HIV serological status will comply with the following:**

- The exposed employee's blood is collected as soon as possible and tested after consent is obtained.
- The employee will be offered the option of having their blood collected for testing of the employee's HIV/HBV/HCV serological status. The blood sample will be preserved for **up to 90 days** to allow the employee to decide if the blood should be tested for HIV serological status.

**All employees who incur exposure will be offered post-exposure evaluation and follow-up according to the OSHA standard.** The employee's primary care physician may provide all post-exposure follow-ups. In some instances, if the employee saw a physician at a hospital emergency room, that physician may provide the post-exposure follow-up.

The healthcare professional responsible for the employee's hepatitis B vaccination is provided with the following:

- A description of the exposed employee's duties as they relate to the exposure incident.
- A description of the route of exposure and circumstances under which exposure occurred.
- Results of the source individuals blood testing, if available.
- All medical records relevant to the appropriate treatment of the employee including vaccination status.
- **The employee must obtain and provide the HIM/NRB EH&S Office with a copy of the evaluating healthcare professional's written opinion within 15 days of the completion of the evaluation.**

The healthcare professional's written opinion for HBV vaccination must be limited to whether HBV vaccination is indicated for an employee, and if the employee has received such vaccination. **The healthcare professional's written opinion for post-exposure follow-up is limited to the following information:**

- A statement that the employee has been informed of the results of the evaluation.
- A statement that the employee has been told about any medical conditions resulting from exposure to blood or OPIM, which require further evaluation or treatment.

**NOTE:** All other findings or diagnosis shall remain **confidential** and will not be included in the written report.

## 7.0 LABELS AND SIGNS

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### 7.1 LABELS

Containers of regulated waste, refrigerators, and freezers containing blood or OPIM; and other containers used to store, transport, or ship blood or OPIM must be labeled with the biohazard warning label. The label must incorporate the universal biohazard sign and a predominant florescent orange or orange-red background with contrasting letter and symbol. See Figure 7.1 for an example.



**BIOHAZARD**

**Figure 7.1** Universal Biohazard Symbol

Labels should be affixed to the container by string, wire, adhesive, or other method that prevents their loss or unintentional removal.

### 7.2 SIGNS

At the entrance to laboratories where tenants are working with BBP or other infectious materials, the following sign shall be posted at the entrance:



**BIOHAZARD**

(Name of Infectious Agent)

(Special requirements for entering the area)

(Name, telephone number of laboratory director or other responsible person)

**Figure 7.2** Entrance Sign

These signs must be fluorescent orange-red with lettering and symbols in a contrasting color.

## 8.0 TRAINING

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The HIM/NRB EH&S Office ensures that persons who provide Bloodborne Pathogens training are knowledgeable in the required subject matter. We make sure that employees covered by the bloodborne pathogens standard are trained at the time of initial assignment to tasks where occupational exposure may occur, and every year thereafter, on or around the anniversary of their initial training.

The following training methods may be employed:

- Training sessions conducted by a knowledgeable trainer.
- Videotape.
- Pamphlets.
- Internet-based online training.
- Access to additional materials and consultation provided by the HIM/NRB EH&S Office or their designees.

Initial bloodborne pathogens training is tailored to the education and language level of the employee, and offered during the normal work shift. During training, employees are encouraged to ask questions. The initial training is interactive and covers the following:

- The Bloodborne Pathogens Standard and its contents, and a method for obtaining a copy.
- The epidemiology and symptoms of bloodborne diseases.
- The modes of transmission of bloodborne pathogens: HIV, HBV, and HCV.
- The Exposure Control Plan and a method for obtaining a copy.
- The recognition of tasks that may involve exposure.
- The use and limitations of methods to reduce exposure, for example engineering controls, safety devices (such as self-sheathing needles), work practices and PPE.
- The types, use, location, removal, handling, decontamination, and disposal of PPE.
- The basis of selection of PPE.
- The hepatitis B vaccination, including efficacy, safety, method of administration, benefits, and that it will be offered free of charge.

- The appropriate actions to take and persons to contact in an emergency involving blood or other potentially infectious materials.
- The procedures to follow if an exposure incident occur, including the method of reporting and medical follow-up.
- The evaluation and follow-up required after an employee exposure incident.
- The signs, labels, and color-coding systems.

Additional training is provided to employees when there are any changes of tasks or procedures affecting the employee's occupational exposure. Employees who have received training on Bloodborne Pathogens in the 12 months preceding the effective date of this plan will only receive training in provisions of the plan that were not covered.

## **9.0 RECORDKEEPING**

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### **9.1 MEDICAL RECORDS**

Medical records shall be maintained in accordance with OSHA Standard 29 CFR 1910.20. These records shall be kept confidential, and must be maintained for at least the duration of employment plus 30 years.

The records generally include the following:

- The name and social security number of the employee.
- A copy of the employee's HBV vaccination status, including the dates of vaccination.
- A copy of all results of examinations, medical testing, and follow-up procedures.
- A copy of the information provided to the healthcare professional, including a description of the employee's duties as they relate to the exposure incident, and documentation of the routes of exposure and circumstances of the exposure.

Medical records are confidential and will be kept in the institution's occupational health department.

### **9.2 TRAINING RECORDS**

Training records shall be maintained for a minimum of three years from the date of training.

The following information shall be documented:

- The dates of the training sessions.
- An outline describing the material presented.
- The names and qualifications of persons conducting the training.
- The names and Department names of all persons attending the training sessions.

### **9.3 AVAILABILITY**

All employee records shall be made available to the employee in accordance with 29 CFR 1910.20. All employee records shall be made available to the Assistant Secretary

of Labor for the OSHA and the Director of the National Institute for Occupational Safety and Health (NIOSH) upon request.

#### **9.4 TRANSFER OF RECORDS**

If this facility is closed or there is no successor employer to receive and retain the records for the prescribed period, the Director of the NIOSH shall be contacted for final disposition.

**APPENDIX D**  
**INCIDENT REPORT FORM**

**HARVARD INSTITUTES OF MEDICINE/NEW RESEARCH BUILDING  
INCIDENT REPORT FORM**

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Date: \_\_\_\_\_ Time of Incident: \_\_\_\_\_ Location of Incident: \_\_\_\_\_

Institution: \_\_\_\_\_ Department: \_\_\_\_\_

Principal Investigator: \_\_\_\_\_ Phone #: \_\_\_\_\_

Safety Representative: \_\_\_\_\_ Phone #: \_\_\_\_\_

Person Initiating call to EH&S: \_\_\_\_\_ Phone #: \_\_\_\_\_

Type of Incident: \_\_\_\_\_

Brief Characterization of Incident: \_\_\_\_\_

\_\_\_\_\_

Response Summary: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Recommended Corrective/Preventive Action: \_\_\_\_\_

\_\_\_\_\_

Additional Comments: \_\_\_\_\_

\_\_\_\_\_

HIM/NRB EH&S Responder(s): \_\_\_\_\_

HIM/NRB Facility Management Responder(s): \_\_\_\_\_

Date of Resolution: \_\_\_\_\_ Time of Resolution: \_\_\_\_\_

cc: \_\_\_\_\_

**CHECK HERE IF THIS REQUIRES FURTHER ACTION BY P.I.**