**Appendix C: Laboratory Safety**

Faculty have primary responsibility for ensuring student safety and properly training all enrolled students, visitors, and employees in their labs, or courses. Faculty will be expected to comply with the IBC Handbook guidelines and practices. Any failure to comply with the guidelines for laboratory safety guidelines may pose an unwarranted to risk to students, staff, and faculty. The following forms have been created to document compliance:

* Lab Safety Statements
* Laboratory Inspection Checklists

 In addition to forms, this appendix serves as a resource and provides critical information on lab safety, material handling, material disposal, and provides an overview of NIH defined risk levels and risk assessment practices.

Academic Department Chairpersons or Program Directors are responsible for

* Ensuring that proper lab safety training instruction is provided to all staff, faculty, and students and that, where appropriate, advanced training occurs (i.e., BBP)
* Regular, preferably annual, safety inspections of all research facilities assigned to faculty and/or labs and classroom where students engage in learning activities
* Forward a comprehensive list of all live material being used, to the IBC Chair, annually and no later than September 1; when appropriate, the list should be amended throughout the year

 **Laboratory Procedures and Work Practices**

Laboratory personnel should seek to utilize laboratory practices that are the most effective, but limit exposure to potentially infectious material. Consider the availability of safer, alternative procedures or non-infectious or less infectious organisms that could be substituted, and yet provide the desired outcome. While there is a wealth of acceptable procedures that have been performed in the laboratory for many years, the inherent safety of an activity is not always implied from its long-term usage. Consider the example of mouth pipetting, commonly used for many years, which is now considered a high-risk practice.

**Generally Acceptable Laboratory Practices**

* Outer street clothing (coats, hats, etc.) should be kept in an area where accidental contamination with infectious or other hazardous materials is unlikely to occur.
* Long hair, beards, and loose-flapping clothing are potentially dangerous when working near biohazardous materials that could be inadvertently spilled, or moving laboratory equipment. Tying back hair or employment of hairnets should be encouraged in all laboratories.
* Keep jewelry to a minimum. Do not wear dangling jewelry in the lab.
* Consideration must be given to whether a person should be permitted to work alone on a biohazardous laboratory operation. Emergency situations often necessitate actions by others if someone is contaminated in the incident, such as a spill, in order to prevent injury and avoid additional contamination away from the spill site. The Faculty or lab supervisor must evaluate and establish lab guidelines in this regard.
* Protection of the eyes is a matter which should be given high priority in every laboratory. Signs indicating "Eye Protection Required" should be prominently displayed in all areas where a hazardous exposure may exist. Infection can occur through the eyes if a pathogenic microorganism is splattered into the eye, and many chemicals commonly employed in the laboratory can cause serious damage if similarly deposited. Safety glasses, goggles, or a face shield should be worn when necessary.
* Every laboratory that uses materials that are irritating to the eyes must have an eyewash fountain. These eyewash fountains must be ANSI approved.
* Laboratory bench tops must be impervious to water and chemically and thermally resistant. Laboratory chairs must be covered with non-porous material that facilitates cleaning and decontamination with an appropriate disinfectant. Substitute plastic ware for glassware wherever possible.

**Standard Microbiological Work Practices**

The overall use of standard microbiological practices can minimize and even prevent exposure to biohazardous materials. Standard practices are based on the primary need to protect the worker, coworkers, community and environment while assuring product integrity. Faculty or laboratory supervisor should limit or restrict access to the laboratory when experiments that involve infectious agents or biohazardous materials are conducted. Additionally, special entry requirements, such as personal protective equipment or immunizations might be required.

**Standard practices should include:**

* Wash hands with soap and water after exposure to potentially infectious materials, after removing gloves and other personal protective equipment, after completion of any procedure in which biohazardous material is used, and before you leave the laboratory. If a sink with water and soap is not available or accessible, alcohol-based hand sanitizers (e.g., gels or foams) can be substituted.
* DO NOT eat, drink, smoke, apply cosmetics or lip balm, brush teeth, or handle contact lenses in work areas where biohazardous materials are stored or used.
* Storage of food in refrigerators or freezers used for infectious materials or chemical carcinogens is strictly forbidden.
* Use mechanical devices when pipetting. Mouth pipetting is expressly forbidden.
* Policies for the safe handling of sharps such as:
	+ Securing unused hypodermic syringes and needles, and log their distribution
	+ Utilizing one sharps item at a time. Do not leave sharps unattended
	+ Having readily accessible sharps disposal containers close to work area
	+ Incorporating engineered sharps injury protection systems (e.g., safer needles) when practical
	+ Use sharps only when no other alternatives are available
* Activities that are likely to produce aerosols, splashing, or splattering of infectious or biohazardous materials (e.g., procedures such as vortexing, grinding, blending, sonicating, centrifuging, and cutting or slicing of infectious or biohazardous materials) should be performed in a certified Biological Safety Cabinet (Class II)
	+ A Biological Safety Cabinet will be used when necessary to provide worker protection during aerosol generating procedures with human blood and OPIM (including human cells, tissue cultures, and blood products and blood components).
	+ Class II Biological Safety Cabinet is recommended for manipulations of infectious agents that are likely to create aerosols (e.g., aspirating with a syringe, removing caps from tubes after centrifugation, vortexing of open tubes, sonication).
	+ Class II Biological Safety Cabinets, while providing laminar airflow to protect research material, are designed with inward flow to protect personnel, and filtered exhaust air for environmental protection. HEPA filters (High Efficiency Particulate Air) inside the cabinet remove 99.97% of airborne particles that are 0.3um, and higher efficiencies(99.99%) with particles above and below 0.3um.   Some laminar flow hoods direct HEPA filtered air horizontally across the work surface towards the operator and the open laboratory environment. These hoods are not safety devices and must never be used with infectious, toxic, or sensitizing materials.
	+ Biological safety cabinets must be routinely inspected and certified by an independent contractor who is trained to National Sanitation Foundation Standard No. 49.
* Decontaminate work surfaces at least once a day and after any spill of infectious or biohazardous materials with a disinfectant that has been proven to be effective against the agent/ material used. Appropriate disinfectants include:
	+ Chlorine bleach (5.25% sodium hypochlorite or household bleach, in a 1:10 dilution). At these concentrations, sodium hypochlorite exhibits broad-spectrum activity against vegetative bacteria, fungi, lipid, and non-lipid viruses. Higher concentrations and extended contact time can be used to inactivate bacterial spores. The efficacy of hypochlorite as a disinfectant is reduced in the presence of organic materials, high pH, and exposure to light. Solutions should be prepared weekly.
	+ Ethyl and isopropyl alcohols, in concentrations of about 60% to 95%, which are effective against vegetative forms of bacteria, fungi, and lipid-containing viruses. Alcohols are less effective against non-lipid viruses, and completely ineffective against bacterial spores and Mycobacterium tuberculosis (TB).
	+ Chlorine dioxide gas effectively kills pathogenic microorganisms such as fungi, bacteria and viruses. It also prevents and removes biofilms. Chlorine dioxide is efficacious against protozoan parasites (Giardia) and spore forming bacteria.
	+ Formalin (37% solution of formaldehyde) diluted to 5% is effective against vegetative bacteria, spores, and viruses. Formaldehyde should not be used since it is a human carcinogen and creates respiratory problems at low levels of concentration.
	+ Glutaraldehyde (2-5%) displays a broad spectrum of activity, but because it is toxic and damaging to the eyes it should not be used
	+ Hydrogen peroxide exhibits bactericidal, virucidal, tuberculocidal, sporicidal, and fungicidal properties.
	+ Iodophors show a wide spectrum of antimicrobial and antiviral activity. hey have variable effect on hepatitis B virus, and do not inactivate bacterial spores.
	+ Phenol and Phenol derivatives (in concentrations of 0.5-5%) inactivate vegetative bacteria including Mycobacterium tuberculosis, fungi, and lipid-containing viruses, but are not active against bacterial spores or non-lipid viruses.
	+ Quaternary ammonium compounds (0.5-1.5%) are effective against many bacteria and lipid-containing viruses, but are not active against bacterial spores, non-lipid-containing viruses (e.g., hepatitis B), and Mycobacterium tuberculosis. Organic materials and salts found in water can inactivate quaternary ammonium compounds.
* Segregate biohazardous waste in red biohazard bags or sharp disposal containers, and dispose as regulated medical waste (see **Appendix D: Guidelines for** **Disposal** **of** **Infectious Waste** for more specific information).
	+ Biohazardous waste (whether autoclaved or not) should not under any circumstances go into the regular trash.
	+ Red bags with Biohazard symbols do not go into regular trash under any circumstances. Placing these bags in the regular trash puts both Bellarmine University and the regular trash removal contractor in violation.
* Biohazardous waste that imposes minimum risk (e.g., risk group 1 organisms, recombinant DNA materials) generated in the laboratory should be autoclaved in **clear autoclave bags** before disposal as regular solid waste.
	+ Only bacterial cultures of non-pathogenic, environmental (soil or plant) organisms, lab strains of genetically-modified organism which are non-pathogenic and specifically engineered to limit survival, and cell lies of non-human origin (which have been described in the literature as being free of association with any zoonoses, and have been treated with bleach to eliminate any transmission of viruses) may be autoclaved for regular trash disposal.
	+ Environmental bacterial waste autoclaved for regular trash disposal should NOT be placed in a biohazard bag – it should go in a clear bag.
	+ If such waste is autoclaved, spore-containing sterility controls should be periodically used. Records of those sterility controls should be maintained and should be available for periodic review by the personnel on the Biosafety Committee responsible for biohazardous waste disposal. Chemical or physical indicators can be routinely used to ensure that the correct temperature has been achieved and maintained for the specified amount of time needed to ensure sterilization. For example, chemical indicators, such as those used in autoclave tape, use a color change to indicate that the appropriate temperature and pressure have been reached.
	+ Any waste that is autoclaved would need to be retained until the sterility controls are checked.
	+ Even acceptable non-hazardous cultures, that are autoclaved properly for disposal, should be placed in trash containers in existing secured labs and not in public or unsecured spaces (i.e., hallways).
* Use the universal biohazard warning symbol to indicate areas and equipment where infectious agents and biohazardous materials are handled and stored.
* Report any insect/ rodent problems to Facilities Management.
* Persons working with infectious material should avoid touching the face, eyes or nose with gloved or unwashed hands. The use of Kleenex rather than cloth handkerchiefs is recommended for personal hygiene in laboratories handling infectious materials.
* Gloves must be worn when working with an infectious agent. Gloves must also be worn when one anticipates hand contact with blood, potentially infectious materials, mucous membranes, or non-intact skin. Vinyl, latex, and nitrile single-use, disposable gloves should be replaced as soon as possible if contaminated, torn, punctured or damaged in any way. Never wash or decontaminate gloves for reuse. Faculty and lab supervisors should be aware of the possibility that employees may have allergies to latex. When chemical hazards are also present more extensive consideration of the many available types of glove materials is necessary.
* Laboratory clothing should be routinely laundered at work. When clothing is overtly contaminated with infectious materials decontaminate by steam sterilization (autoclaving) or other proven effective means (e.g., soak in bleach solution) before laundering. Avoid laundering at home unless the clothing can first be decontaminated. Disposable clothing (coats, gowns, etc.) must be decontaminated by steam sterilization before discarding. In exceptional circumstances, the Institutional Biosafety Committee may recommend alternative treatment of laboratory clothing worn in certain BSL-2 facilities prior to laundering.
* All biohazardous materials must be placed in rigid, leak proof containers labeled with a biohazard symbol for intra-campus transport between buildings or from one laboratory to another located in the same building. The primary container must be a sealed non-breaking container and must be enclosed in a non-breakable, sealable, secondary container. Both containers must be decontaminated prior to removal from the laboratory. Containers of viable materials may be opened only in facilities having an equivalent or higher than the biosafety level than the biosafety level of the laboratory of origin.

**Biological Risk Assessment**

To ensure overall lab safety and OSHA compliance, all lab instructors are encouraged to complete a “Biological Risk Assessment” for their courses and/or research activities. The IBC suggests using the CDC generic example for the purpose of assessing risk. The worksheet is located at:

<http://www.cdc.gov/biosafety/publications/BiologicalRiskAssessmentWorksheet.pdf>

An effective risk assessment process adequately identifies characteristics of microorganisms as well as host and environmental factors that influence the potential for exposure and balances this against expensive or burdensome safeguards that may prove ineffective. An effective initial risk assessment will identify hazards; determine how to manage laboratory hazards; determine the appropriate biosafety level and select additional relevant precautions; evaluate integrity of equipment and the proficiencies of staff work practices; and review risk assessments with a representative of the Institutional Biosafety Committee

Faculty and laboratory supervisors are encouraged to consult with the IBC to ensure that the laboratory is in compliance with established guidelines, regulations, and the proper work practices and containment requirements for work with biohazardous materials as applies to individual laboratories.

Microorganisms are assigned to one of four risk groups. The NIH Guidelines contain a comprehensive list of risk group 2-4 agents. However, those agents not listed in Risk Groups 2, 3, and 4 are not automatically or implicitly classified in Risk Group 1; a risk assessment must be performed on the known and potential properties of the agent, and consider the relationship to agents on the list. The risk group classification and the types of laboratory activities being conducted are used as a starting point to estimate the appropriate containment for working with a biohazardous agent and assignment to one of four biosafety levels (BSL1-4). The assigned biosafety level takes into consideration characteristics of the agent such as its infectivity, severity of any associated disease, transmissibility and the nature of the work being conducted. Generally, organisms of a particular risk group are handled at the corresponding biosafety level (e.g., RG2 at BSL2). The fundamental principle of biological safety is containment. A thorough understanding of containment includes knowledge of acceptable practices and techniques, components of primary barriers, protective clothing, mechanical devices, and secondary facility design.

The risk assessment for the use of recombinant organisms should include the following considerations: the properties of the organism derived by recombinant DNA (rDNA) techniques, either through deliberate or accidental means; the potential for deliberate release or accidental escape of some of these microorganisms in the workplace and/or into the environment; the subsequent multiplication, genetic reconstruction, growth, transport, modification and die-off of these micro-organisms in the environment, including possible transfer of genetic material to other microorganisms; the establishment of these microorganisms within an ecosystem niche, including possible colonization of humans; and the subsequent occurrence of human or ecological effects due to interaction of the organism with some host or environmental factor.

See <http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5_sect_II.pdf> for —Biological Risk Assessment help.

**Research/Teaching requiring IBC approval**

1. Recombinant or Synthetic Nucleic Acid molecules activities as required by the NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules

1. Infectious Microorganisms – Excluding those considered low risk to health humans hat are contained at Biosafety Level 1

The following charts from CDC Biosafety in Microbiological and Biomedical Laboratories (BMBL) will assess the risk level and biosafety level of the agent(s) with which you are working

**Classification of Infectious Microorganisms By Risk Group (Risk Groups correlate with but do not equate to biosafety levels)**

| **RISK GROUP CLASSIFICATION** | **NIH GUIDELINES FOR RESEARCH INVOLVING RECOMBINANT DNA MOLECULES 2013** | **WORLD HEALTH ORGANIZATION LABORATORY BIOSAFETY MANUAL 3RD EDITION 2004** |
| --- | --- | --- |
| Risk Group 1 | Agents that are not associated with disease in healthy adult humans. | (No or low individual and community risk) A microorganism that is unlikely to cause human or animal disease. |
| Risk Group 2 | Agents that are associated with human disease which is rarely serious and for which preventive or therapeutic interventions are often available. | (Moderate individual risk; low community risk) A pathogen that can cause human or animal disease but is unlikely to be a serious hazard to laboratory workers, the community, livestock or the environment. Laboratory exposures may cause serious infection, but effective treatment and preventive measures are available and the risk of spread of infection is limited. |
| Risk Group 3 | Agents that are associated with serious or lethal human disease for which preventive or therapeutic interventions may be available (high individual risk but low community risk). | (High individual risk; low community risk) A pathogen that usually causes serious human or animal disease but does not ordinarily spread from one infected individual to another. Effective treatment and preventive measures are available. |
| Risk Group 4 | Agents that are likely to cause serious or lethal human disease for which preventive or therapeutic interventions are not usually available (high individual risk and high community risk). | (High individual and community risk) A pathogen that usually causes serious human or animal disease and that can be readily transmitted from one individual to another, directly or indirectly. Effective treatment and preventive measures are not usually available.3 |

**Summary of Recommended Biosafety Levels for Microorganisms (Note: BSL (Biological Safety Level) in BMBL is equivalent to BL (Biosafety Level) in the NIH recombinant DNA Guidelines)**

| **BSL** | **AGENTS** | **PRACTICES** | **PRIMARY BARRIERS AND SAFETY EQUIPMENT** | **FACILITIES SECONDARY BARRIERS** |
| --- | --- | --- | --- | --- |
| 1 | Not known to consistently cause diseases in healthy adults | Standard Microbiological Practices | None required | Open bench and sink required |
| 2 | * Agents associated with human disease
* Routes of transmission include percutaneous injury, ingestion, mucous membrane exposure
 | BSL-1 practice plus:* Limited access
* Biohazard warning signs
* "Sharps" precautions
* Biosafety manual defining any needed waste decontamination or medical surveillance policies
 | Primary barriers:* Class I or II BSCs or other physical containment devices used for all manipulations of agents that cause splashes or aerosols of infectious materials PPEs \*:
	+ Laboratory coats; gloves; face protection as needed
 | BSL-1 plus:* Autoclave available
 |
| 3 | * Indigenous or exotic agents with potential for aerosol transmission
* Disease may have serious or lethal consequences
 | BSL-2 practice plus:* Controlled access
* Decontamination of all waste
* Decontamination of laboratory clothing before laundering
* Baseline serum
 | Primary barriers:* Class I or II BSCs or other physical containment devices used for all open manipulation of agents PPEs:
	+ Protective laboratory clothing; gloves; respiratory protection as needed
 | BSL-2 plus:* Physical separation from access corridors
* Self-closing, double-door access
* Exhaust air not recirculated
* Negative airflow into laboratory
 |
| 4 | * Dangerous/exotic agents which pose high risk of life-threatening disease
* Aerosol-transmitted laboratory infections have occurred; or related agents with unknown risk of transmission
 | BSL-3 practices plus:* Clothing change before entering
* Shower on exit
* All material decontaminated on exit from facility
 | Primary barriers:* All procedures conducted in Class III BSCs or Class I or II BSCs in combination with full- body, air-supplied, positive pressure personnel suit
 | BSL-3 plus:* Separate building or isolated zone
* Dedicated supply and exhaust, vacuum, and decontamination systems
* Other requirements outlined in the text
 |

**LABORATORY SAFETY STATEMENT**

***COURSE NAME AND NUMBER – INSTRUCTOR NAME***

The following rules must be observed at all times to prevent accidental injury to and infection of yourself and others and to minimize contamination of the lab environment:

1. **Never place books, backpacks, purses, etc., on bench tops.** Always place these in the assigned cubicles. Keep manuals and pens on pull-out desks.
2. **Electronic devices should not be brought into the lab**. This includes, but is not limited to iPods, iPads, MP3 players, radios and cell phones.
3. **Clean your work area** with dilute bleach solution at the beginning **AND** end of each lab.
4. **Wash your hands** with soap and dry with paper towels when entering and leaving the lab.
5. Wear a **lab coat** at all times while working in the lab to prevent contamination or accidental staining of your clothing.
	1. **Closed-toe shoes** (no sandals) are to be worn in the lab.
	2. **Long hair must be tied back** to prevent exposure to flame and contamination of cultures.
	3. **Gloves** should be worn when staining microbes and handling hazardous chemicals.
6. **Do not place anything in your mouth or eyes while in the lab.** This includes pencils, food, and fingers. Keep your hands away from your mouth and eyes.
	1. Eating and drinking are **prohibited** in the lab at all times.
	2. This includes gum, cough drops, and candy.
	3. Do not apply cosmetics in the lab. This includes Chapstick and Blistex.
	4. **Never pipet by mouth.** Use a mechanical pipetting device.
7. **Do not remove media, chemicals, equipment, or bacterial cultures from the laboratory.** This is absolutely prohibited and unnecessary.
8. Do not place contaminated instruments such as inoculating loops, needles, and pipettes on bench tops. Loops and needles should be sterilized by incineration, and pipettes should be disposed of in designated receptacles of bleach solution.
9. Carry cultures in a test tube rack when moving around the lab or when keeping cultures on bench tops for use. This prevents accidents and contamination of your person or belongings.
10. **Immediately cover spilled cultures or broken culture tubes with paper towels and then saturate them with disinfectant solution.** Notify your instructor that there has been a spill. After 15 minutes, dispose of the towels and broken items as indicated by your instructor.
11. **Report accidental cuts or burns to the instructor immediately**.
12. At the end of each lab session, place all materials in the proper disposal area.
13. If you are immune-compromised (including those who are pregnant or may become pregnant) and students living with or caring for an immune-compromised individual are advised to consult with your physician to determine the appropriate level of participation in the lab. Should your physician determine that you should not participate in this lab, please have him or her write a note stating the concerns. Alternative accommodations may be indicated.

**OSHA INFORMATION**

**Material Safety Data Sheets (MSDS)** are located

**The first aid kit** is located

**The eyewash station** is located

**The shower** is located

**The fire extinguisher** is located

**AGREEMENT ON LABORATORY SAFETY**

I have read the Laboratory Safety Statement and I understand its content. I agree to abide by all laboratory rules set forth by the instructor. I understand that my safety is entirely my own responsibility and that I may be putting myself and others in danger if I do not abide by all the rules set forth by the instructor.

**COURSE:**

**NAME OF FACULTY/STUDENT (PRINT):**

**SIGNATURE OF FACULTY/STUDENT:**

**DATE:**

**BSL-2 Biosafety Guidelines for Instructional & Laboratory Spaces**

**[NOTE: This Document must be posted in all labs, readily visible, and distributed to all students, researchers, & Instructors]**

**I. Authority for Microbiology Lab and Prep Room Regulations**

Labs will follow the guidelines posted by the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, and National Institutes of Health. These guidelines describe acceptable biosafety practices in biomedical and microbiological laboratories and can be found at: [**http://www.cdc.gov/biosafety/publications/bmbl5/index.htm**](http://www.cdc.gov/biosafety/publications/bmbl5/index.htm) **.**

BSL1 precautions will be followed during routine media prep, autoclaving, and sub-culturing. Whenever a BSL2 agent is in use, biohazard signs will be posted on the doors and the entire room will follow BSL2 practices.

**II. Regulations**

**A. Access, Training and Responsibilities**

1. Access is limited to individuals involved directly in media prep, clean up, lab prep, and research.

2. The lab and prep room doors will be closed when a BSL2 agent is in use.

3. All staff and students are required to read, understand, and follow these regulations before working in this facility.

4. All staff and students will receive training from the coordinating instructor or lab director concerning use of the equipment. Staff or students who have not received training from either a BU instructor or lab director must not operate any laboratory equipment.

5. The coordinating instructor or lab director will train staff and students on aseptic techniques appropriate for handling pathogenic agents. This will include the potential hazards associated with the work involved, the necessary precautions to prevent exposures, and the exposure evaluation procedures.

6. Personnel receive annual updates or additional training as necessary.

7. Personnel are advised of special hazards and are required to read and follow instructions on practices and procedures.

8. Any staff or students found in violation of the regulations may have their access to this facility terminated.

9. The coordinating instructor or lab director is responsible for seeing that the consequences of student or staff actions are rectified, including correction of damages and violations and take-down of experiments.

**B. Apparel**

1. Personnel entering lab will be required to wear closed-toe shoes and have long hair tied back.

2. Personnel working in this facility at BSL2 must wear lab coats at all times. This protective clothing is removed and left in the laboratory before leaving for non-laboratory areas (e.g., restroom, cafeteria, library, or administrative offices). All protective clothing is either autoclaved or laundered with bleach by the institution before being returned to personnel.

3. Gloves are worn when handling microorganisms or hazardous chemicals. Gloves are disposed of when contaminated, and removed when work with infectious materials is completed or when the integrity of the glove is compromised. Gloves are placed in a biohazard bag and autoclaved prior to disposal. Disposable gloves are not washed, reused, or used for touching “clean” surfaces (keyboards, telephones, etc.), and they should not be worn outside the lab. Hands are washed following removal of gloves.

4. In a BSL2 lab, safety goggles, safety glasses, or face shields are worn for normal lab procedures involving liquid cultures that do not generate a splash hazard (e.g., proper pipetting, spread plates, etc.). Safety goggles and face shields or safety goggles and masks are worn when performing procedures that may create a splash hazard.

5. When working in a biosafety cabinet, only lab coats and gloves are needed for personal protection.

**C. Standard Microbiological Practices**

1. Eating, drinking, smoking, handling contact lenses, and applying cosmetics are not permitted in the lab. Food for human consumption is never stored the lab.

2. An orange biohazard sign must be posted on the entrance to the laboratory when etiologic agents are in use. Information to be posted includes the agent(s) in use, biohazard symbol, biosafety level 2, the investigator's name and telephone number, any personal protective equipment that must be worn in the laboratory, and any procedures required for exiting the laboratory.

3. Persons wash their hands upon entering the lab, after they finish working in the lab, after removing gloves, and before leaving the laboratory.

4. Work surfaces are decontaminated prior to beginning any work in these rooms, on completion of work or at the end of the day with 10% bleach solution. Any spill or splash of viable material should be decontaminated with 25% bleach solution.

5. All procedures are performed carefully to minimize the creation of splashes or aerosols. Any procedure that would potentially create aerosols will be performed within the biosafety cabinet.

6. Mouth pipetting is prohibited; mechanical pipetting devices are used.

7. A limited number of needles and syringes are used for reconstituting reagents. After use, these materials are placed in a puncture-proof red sharps container. Do not recap needles.

8. All biohazardous cultures, swabs, and waste containers are decontaminated before disposal by autoclaving. Materials to be decontaminated outside of the immediate laboratory are placed in a durable, leak-proof container for transport from the laboratory.

**D. Special Practices**

1. Access to the laboratory is limited or restricted by the laboratory director when work with infectious agents is in progress. Persons who are at increased risk of acquiring infection – e.g., those who are immunocompromised or immunosuppressed – or for whom infection may have serious consequences, should consult with their physician to determine the appropriate level of participation in the lab.

**E. Transfer of materials**

1. Cultures, tissues, specimens of body fluids, or potentially infectious wastes are placed in a container that prevents leakage during collection, handling, processing, storage, and transport.

**F. Disposal of Materials and Decontamination**

1. Laboratory equipment and work surfaces should be decontaminated with 10% bleach on a routine basis and after work with infectious materials is finished. Overt spills, splashes, or other contamination by infectious materials should be decontaminated with 25% bleach.

2. Spills and accidents that result in overt exposures to infectious materials are immediately reported to the laboratory director. Medical evaluation, surveillance, and treatment are provided as appropriate and written records are maintained.

3. Broken glassware that does not contain live cultures should be swept up with the broom and dust pan and discarded in the glass disposal box.

4. Broken glassware that contains live cultures should be saturated with bleach solution. After 15 minutes, the debris should be “swept” up into an autoclave bin using a plastic beaker and/or paper towels. After being autoclaved, the glassware can go into the glass disposal box and the paper towels can go into the regular trash.

**G. Hygiene and Housekeeping**

1. Bench tops are impervious to water and are resistant to moderate heat and the organic solvents, acids, alkalis, and bleach used to decontaminate the work surfaces.

2. Laboratory furniture is capable of supporting anticipated loading and uses. Spaces between benches, cabinets, and equipment are accessible for cleaning. Chairs used in laboratory work should be covered with a nonporous material that can be easily decontaminated.

3. **Material Safety Data Sheets (MSDS)** are located

4. **First aid kits** are located

5. **Eyewash stations** are located

6. **The shower** is located

7. **Fire extinguishers** are mounted on the wall

**Checklist for Biosafety Level 1 Laboratory Operations**

Department Building Room #

Faculty e-mail Phone #

Contact (if different) e-mail Phone #

IBC Member(s) Date Completed

The following statements are based primarily on the Biosafety Level 1 section of *Biosafety in Microbiological and Biomedical Laboratories*, 5th edition, 2007, (<http://www.cdc.gov/biosafety/publications/BMBL_5th_Edition.pdf> ). Check the appropriate box for each statement. Please provide comments or an explanation for “No” or “NA” (Not Applicable) responses. This checklist is to be used for individual laboratory assessment and as part of a review completed by the Institutional Biosafety Committee. Contact the Institutional Biosafety Committee (dgolemboski@bellarmine.edu ) if you have any questions or require assistance.

|  |  |  |  |
| --- | --- | --- | --- |
| 1. **Standard Microbiological Practices**
 |  |  |  |
|  | **Yes** | **No** | **N/A** |
| 1. Access to the laboratory is limited or restricted at the discretion of the Instructor or laboratory supervisor when experiments are in progress.
 | ❒ | ❒ | ❒ |
| 1. Personnel wash their hands after they handle viable materials and animals, after removing gloves, and before leaving the laboratory.
 | ❒ | ❒ | ❒ |
| 1. Eating, drinking, handling contact lenses, and applying cosmetics are not permitted in the laboratory. Persons who wear contact lenses in laboratories should also wear safety glasses, goggles or face shield. Food is stored outside the laboratory in cabinets or refrigerators designated for this purpose only.
 | ❒ | ❒ | ❒ |
| 1. Mouth pipetting is prohibited; mechanical pipetting devices are used.
 | ❒ | ❒ | ❒ |
| 1. All procedures are performed carefully to minimize the creation of splashes or aerosols.
 | ❒ | ❒ | ❒ |
| 1. Work surfaces are decontaminated at least once a day and after any spill of viable material with a disinfectant effective against the agents of concern.
 | ❒ | ❒ | ❒ |
| 1. Cultures, stocks, contaminated plastic ware, and other non-sharps wastes are autoclaved prior to disposal. Consult specific University disposal requirements (e.g., clear autoclave bags, red biohazard bags).
 | ❒ | ❒ | ❒ |
| 1. 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:
 | ❒ | ❒ | ❒ |
| 1. 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.
 | ❒ | ❒ | ❒ |
| 1. Used disposable needles and syringes must be carefully placed in conveniently located puncture-resistant containers used for sharps disposal.
 | ❒ | ❒ | ❒ |
| 1. Non-disposable sharps must be placed in a hard walled sharps disposal container used for sharps disposal.
 | ❒ | ❒ | ❒ |
| 1. Broken glassware must not be handled directly. Instead, it must be removed using a brush and dustpan, tongs, or forceps. Plastic ware should be substituted for glassware whenever possible.
 | ❒ | ❒ | ❒ |
| 1. Culture fluids and other contaminated liquid wastes are autoclaved or decontaminated with a suitable disinfectant before disposal down the sanitary drain.
 | ❒ | ❒ | ❒ |
| 1. Materials to be decontaminated outside of the immediate laboratory are placed in a durable, leak-proof container and closed for transport from the laboratory.
 | ❒ | ❒ | ❒ |
| Comments/Explanations for Standard Microbiological Practices |  |  |  |
| 1. **Special Practices**
 |  |  |  |
|  |  |  |  |
| 1. Hypodermic syringes and needles, when not in use, are secured (i.e., locking cabinet, drawer) against unauthorized access. A log of stock materials and their distribution is maintained.
 | ❒ | ❒ | ❒ |
| Comments/Explanations for Special Practices |  |  |  |
| 1. **Safety Equipment (Primary Barriers)**
 |  |  |  |
|  |  |  |  |
| 1. Special containment devices or equipment such as a biological safety cabinet is generally not required for manipulations of agents assigned to Biosafety Level 1.
 | ❒ | ❒ | ❒ |
| 1. If used, biological safety cabinets are certified annually, when cabinets are moved, or when HEPA filters are changed.
 | ❒ | ❒ | ❒ |
| 1. Protective eyewear should be worn for conduct of procedures in which splashes of microorganisms or other hazardous materials is anticipated.
 | ❒ | ❒ | ❒ |
| 1. Laboratory coats, gowns, or uniforms are worn to prevent contamination or soiling of street clothes. This protective clothing is removed and left in the laboratory before leaving for or travel through non-laboratory areas (e.g., cafeteria, library, administrative offices, and public corridors). All protective clothing is disposed of in the laboratory, laundered by the institution, or autoclaved and laundered at home by personnel.
 | ❒ | ❒ | ❒ |
| 1. Gloves must be worn to protect hands from exposure to hazardous materials. Glove selection should be based on an appropriate risk assessment. Gloves are disposed of when contaminated, removed when work is completed, and are not worn outside the laboratory. Disposable gloves are not washed or reused. Hands are washed after glove use.
 | ❒ | ❒ | ❒ |
| Comments/Explanations for Safety Equipment |  |  |  |
| 1. **Laboratory Facilities (Secondary Barriers)**
 |  |  |  |
|  |  |  |  |
| 1. Each laboratory contains a sink for hand washing.
 | ❒ | ❒ | ❒ |
| 1. The laboratory is designed so that it can be easily cleaned and decontaminated. Carpets, rugs, and cloth furniture are not appropriate.
 | ❒ | ❒ | ❒ |
| 1. Bench tops are impervious to water and resistant to moderate heat, acids, alkalis, organic solvents, and chemicals used to decontaminate the work surface.
 | ❒ | ❒ | ❒ |
| 1. Laboratory furniture is sturdy and capable of supporting anticipated loads and uses. Spaces between benches, cabinets, and equipment are accessible for cleaning.
 | ❒ | ❒ | ❒ |
| 1. If the laboratory has windows that open, they are fitted with fly screens.
 | ❒ | ❒ | ❒ |
| 1. An autoclave for pre-treatment of laboratory wastes is available.
 | ❒ | ❒ | ❒ |
| 1. An eyewash facility is readily available within the laboratory.
 | ❒ | ❒ | ❒ |
| Comments/Explanations for Laboratory Facilities |  |  |  |

**Checklist for Biosafety Level 2 Laboratory Operations**

Department Building Room #

Faculty e-mail Phone #

Contact (if different) e-mail Phone #

IBC Member(s) Date Completed

The following statements are based primarily on the Biosafety Level 2 section of *Biosafety in Microbiological and Biomedical Laboratories*, 5th edition, 2007, (<http://www.cdc.gov/biosafety/publications/BMBL_5th_Edition.pdf> ). Check the appropriate box for each statement. Please provide comments or an explanation for “No” or “NA” (Not Applicable) responses. This checklist is to be used for individual laboratory assessment and as part of a review completed by the Institutional Biosafety Committee. Contact the Institutional Biosafety Committee (dgolemboski@bellarmine.edu ) if you have any questions or require assistance.

|  |  |  |  |
| --- | --- | --- | --- |
| 1. **Standard Microbiological Practices**
 |  |  |  |
|  | **Yes** | **No** | **N/A** |
| 1. Access to the laboratory is limited or restricted at the discretion of the Instructor or laboratory supervisor when experiments are in progress.
 | ❒ | ❒ | ❒ |
| 1. Personnel wash their hands after they handle viable materials and animals, after removing gloves, and before leaving the laboratory.
 | ❒ | ❒ | ❒ |
| 1. Eating, drinking, handling contact lenses, and applying cosmetics are not permitted in the laboratory. Persons who wear contact lenses in laboratories should also wear safety glasses, goggles or face shield. Food is stored outside the laboratory in cabinets or refrigerators designated for this purpose only.
 | ❒ | ❒ | ❒ |
| 1. Mouth pipetting is prohibited; mechanical pipetting devices are used.
 | ❒ | ❒ | ❒ |
| 1. All procedures are performed carefully to minimize the creation of splashes or aerosols.
 | ❒ | ❒ | ❒ |
| 1. Decontaminate work surfaces and laboratory equipment routinely after completion of work, and after any spill or splash of potentially infections material with a disinfectant effective against the agents of concern. Contaminated equipment is decontaminated before removal from the facility, sent for repair or maintenance, or packaged for transport.
 | ❒ | ❒ | ❒ |
| 1. Cultures, stocks, contaminated plastic ware, and other regulated non-sharps wastes are discarded in red biohazard bags and treated as infectious medical wastes
 | ❒ | ❒ | ❒ |
| 1. 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:
 | ❒ | ❒ | ❒ |
| 1. 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.
 | ❒ | ❒ | ❒ |
| 1. Used disposable needles and syringes must be carefully placed in conveniently located puncture-resistant containers used for sharps disposal.
 | ❒ | ❒ | ❒ |
| 1. Reusable sharps, being disposed of, must be placed in a hard walled sharps disposal container used for sharps disposal.
 | ❒ | ❒ | ❒ |
| 1. Broken glassware must not be handled directly. Instead, it must be removed using a brush and dustpan, tongs, or forceps. Plastic ware should be substituted for glassware whenever possible.
 | ❒ | ❒ | ❒ |
| 1. Culture fluids and other contaminated liquid wastes are autoclaved or decontaminated with a suitable disinfectant before disposal down the sanitary drain.
 | ❒ | ❒ | ❒ |
| 1. Materials to be decontaminated outside of the immediate laboratory are placed in a durable, leak-proof container and closed for transport from the laboratory.
 | ❒ | ❒ | ❒ |
| 1. An effective integrated pest management program is required.
 | ❒ | ❒ | ❒ |
| 1. 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.
 | ❒ | ❒ | ❒ |
| 1. The laboratory supervisor must ensure that laboratory personnel receive appropriate training regarding their duties, the potential hazards associated with the work involved, the necessary precautions to prevent exposures, and exposure evaluation procedures (e.g., symptoms of a disease). Personnel must receive regular updates or additional training as necessary. Training is documented. Since personal health status may impact an individual’s susceptibility to infection, ability to receive immunizations or prophylactic interventions, all laboratory personnel and particularly women of child-bearing age should be provided with information regarding immune competence and conditions (e.g., chronic disease, medications) that may predispose them to infection.
 | ❒ | ❒ | ❒ |
| Comments/Explanations for Standard Microbiological Practices |  |  |  |
| 1. **Special Practices**
 |  |  |  |
|  |  |  |  |
| 1. All persons entering the laboratory must be advised of the potential hazards and meet specific entry/exit requirements.
 | ❒ | ❒ | ❒ |
| 1. Laboratory personnel must be provided medical surveillance and offered appropriate immunizations for agents handled or potentially present in the laboratory.
 | ❒ | ❒ | ❒ |
| 1. A laboratory-specific biosafety manual, standard operating procedures must be prepared and adopted as policy. The biosafety manual must be available and accessible.
 | ❒ | ❒ | ❒ |
| 1. The laboratory supervisor must ensure that laboratory personnel demonstrate proficiency in standard and special microbiological practices before working with infectious agents.
 | ❒ | ❒ | ❒ |
| 1. Potentially infectious materials must be placed in a durable, leak proof container during collection, handling, processing, storage, or transport within a facility.
 | ❒ | ❒ | ❒ |
| 1. 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 and documented via the University reporting. Medical evaluation, surveillance, and treatment should be provided by Bellarmine Health Services or personal physician and appropriate records maintained.
 | ❒ | ❒ | ❒ |
| 1. Projects that utilize biohazardous and/or recombinant DNA materials are registered with the Institutional Biosafety Committee.
 | ❒ | ❒ | ❒ |
| 1. Animals and plants not associated with the work being performed must not be permitted in the laboratory.
 | ❒ | ❒ | ❒ |
| 1. All procedures involving the manipulation of infectious materials that may generate an aerosol should be conducted within a biosafety cabinet (BSC) or other physical containment devices.
 | ❒ | ❒ | ❒ |
| 1. On campus transport (between laboratories, buildings) of cultures, tissues, or specimens is conducted in closed, leak proof, break resistant containers, lined with absorbent material and labeled with the biohazard sign and contact information. Off campus transport must comply with domestic (US DOT) and/or international regulations (ICAO), including required training.
 | ❒ | ❒ | ❒ |
| 1. Stock cultures of infectious agents are secured against unauthorized access (e.g., locked freezers, secured laboratories).
 | ❒ | ❒ | ❒ |
| 1. Hypodermic syringes and needles, when not in use, are secured (i.e., locking cabinet, drawer) against unauthorized access. A log of stock materials and their distribution is maintained.
 | ❒ | ❒ | ❒ |
| Comments/Explanations for Special Practices |  |  |  |
| 1. **Safety Equipment (Primary Barriers)**
 |  |  |  |
|  |  |  |  |
| 1. Properly maintained biological safety cabinets, preferably Class II, or other appropriate physical containment devices must be used whenever:
 | ❒ | ❒ | ❒ |
| 1. Procedures with a potential for creating infectious aerosols or splashes are conducted. These may include pipetting, centrifuging, grinding, blending, shaking or mixing, sonic disruption, opening containers of infectious materials whose internal pressures may be different from ambient pressures.
 | ❒ | ❒ | ❒ |
| 1. High concentrations or large volumes of infectious agents are used. Such materials may be centrifuged in the open laboratory if sealed rotor heads, centrifuge safety cups, or gasket-containing centrifuge tubes are used. These rotors, safety cups, or tubes are packaged and opened only in a biological safety cabinet.
 | ❒ | ❒ | ❒ |
| 1. Biological safety cabinets are certified annually, when cabinets are moved, or when HEPA filters are changed.
 | ❒ | ❒ | ❒ |
| 1. Face protection (goggles, mask, face shield or other platter guards) is used for anticipated splashes or sprays of infectious or other hazardous materials to the face, when the microorganisms must be manipulated outside the biological safety cabinet.
 | ❒ | ❒ | ❒ |
| 1. 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., 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.
 | ❒ | ❒ | ❒ |
| 1. 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:
 | ❒ | ❒ | ❒ |
| 1. Change gloves when contaminated, integrity has been compromised, or when otherwise necessary. Wear two pairs of gloves when appropriate.
 | ❒ | ❒ | ❒ |
| 1. Remove gloves and wash hands when work with hazardous materials has been completed and before leaving the laboratory.
 | ❒ | ❒ | ❒ |
| 1. Do not wash or reuse disposable gloves. Dispose of used gloves with other contaminated laboratory waste. Hand washing protocols must be rigorously followed.
 | ❒ | ❒ | ❒ |
| 1. 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.
 | ❒ | ❒ | ❒ |
| Comments/Explanations for Safety Equipment |  |  |  |
| 1. **Laboratory Facilities (Secondary Barriers)**
 |  |  |  |
|  |  |  |  |
| 1. Each laboratory 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.
 | ❒ | ❒ | ❒ |
| 1. Laboratory doors should be self-closing and have locks in accordance with the institutional policies.
 | ❒ | ❒ | ❒ |
| 1. The laboratory is designed so that it can be easily cleaned and decontaminated. Carpets and rugs are not permitted.
 | ❒ | ❒ | ❒ |
| 1. Laboratory furniture must be sturdy and capable of supporting anticipated loads and uses. Spaces between benches, cabinets, and equipment are accessible for cleaning.
 | ❒ | ❒ | ❒ |
| 1. Bench tops are impervious to water and resistant to moderate heat, acids, alkalis, organic solvents, and chemicals used to decontaminate the work surface.
 | ❒ | ❒ | ❒ |
| 1. Chairs used in laboratory work must be covered with a non-porous material that can be easily cleaned and decontaminated with appropriate disinfectant.
 | ❒ | ❒ | ❒ |
| 1. 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, supply and exhaust vents, and other possible airflow disruptions.
 | ❒ | ❒ | ❒ |
| 1. Vacuum lines should be protected with High Efficiency Particulate Air (HEPA) or their equivalent. Liquid disinfectant traps may be required. Portable vacuum pumps may also be used (also properly protected with traps or filters).
 | ❒ | ❒ | ❒ |
| 1. 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.
 | ❒ | ❒ | ❒ |
| 1. Laboratory doors are kept closed whenever work with biohazardous materials is conducted.
 | ❒ | ❒ | ❒ |
| 1. An autoclave for pre-treatment of laboratory wastes is available.
 | ❒ | ❒ | ❒ |
| 1. An eyewash facility is readily available within the laboratory.
 | ❒ | ❒ | ❒ |
| Comments/Explanations for Laboratory Facilities |  |  |  |