



# BASIC BIOSAFETY

BIOSAFETY OFFICE, MARYLAND DEPARTMENT OF HEALTH LABS ADMINISTRATION



# COURSE OUTLINE

1. Introduction
2. Biosafety Levels
3. PPE requirements
4. Using a Biosafety Cabinet
5. Hazardous Waste Management at the MDH Labs
6. Emergency Response Procedures



# WHAT IS BIOSAFETY?

According to the WHO (World Health Organization), biosafety is the use of containment principles, technologies, and best practices to prevent unintentional exposure to pathogens and toxins, or their accidental release

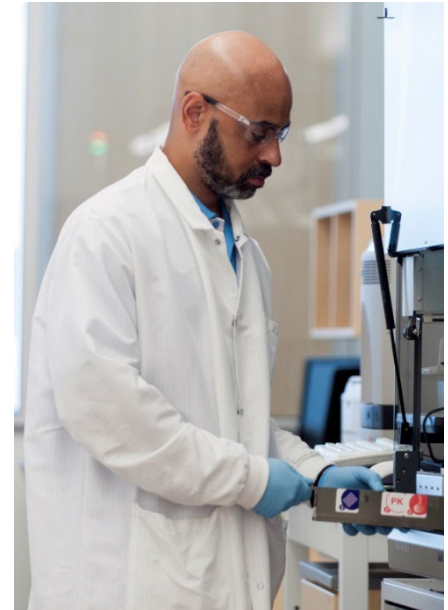
Biosafety is a **PRACTICE**: Biosafety practices are used in the proper handling of biohazardous organisms. Human, animal and plant materials may harbor biohazardous organisms or agents and such materials must be handled accordingly

Biohazardous organisms are microorganisms with an infectious potential for man, animals, and plants in the environment. These microorganisms include prokaryotic and eukaryotic microbes, viruses, sub-viral infectious agents and recombinant organisms with any potential for survival in the environment or in living materials and can cause a health risk



# WHAT IS THE PURPOSE OF THIS COURSE?

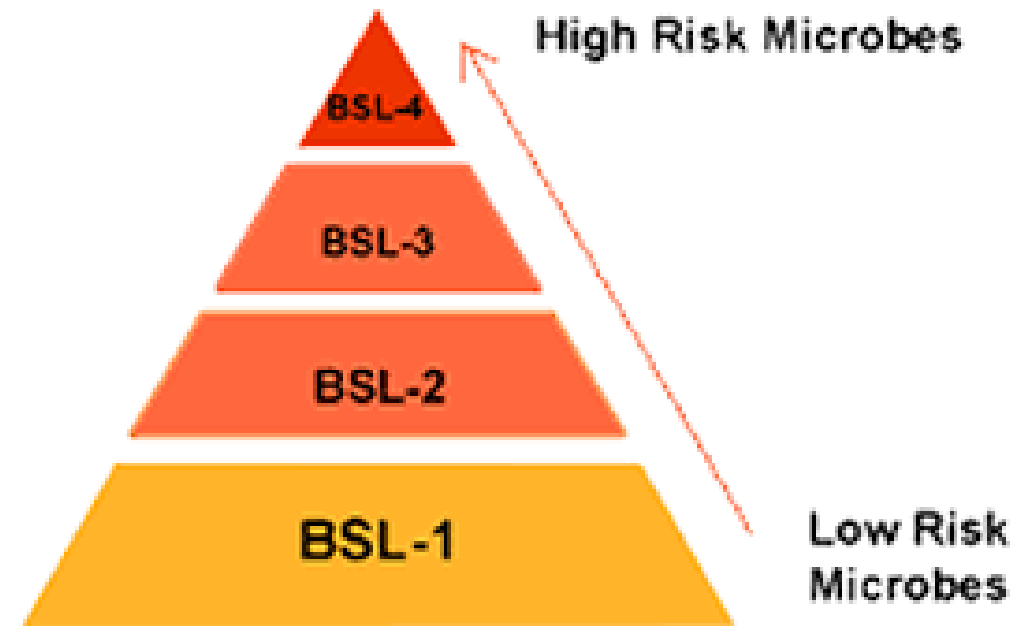
- To provide a basis for the implementation of a BIOSAFETY CULTURE at the MDH Laboratories Administration
- To ensure awareness of proper PPE, best practices, and MDH guidelines for Laboratories Administration workers
- To provide new employees with a basic knowledge of biosafety and provide refresher training for current employees



# BIOSAFETY LEVELS

**BSL-1:** Organisms that typically do not cause disease in healthy adults and pose minimal risk outside the laboratory environment (e.g. *Saccharomyces cerevisiae*, non-disease causing *E. coli*) – can be handled at BSL-1 laboratories

- Access limited to necessary personnel, no eating/drinking, etc. inside laboratory, manipulations of organisms can occur safely on benchtop



## BIOSAFETY LEVELS, CONT.

**BSL-2:** Organisms that pose a moderate risk to employees, may cause mild disease in healthy adults. These organisms pose a low aerosol risk and must be handled at BSL-2 laboratories.

- Manipulations of organisms may be performed on bench top, but any procedure likely to cause aerosols (e.g. vortex, pipette, culture plates, etc.) should be performed inside a BSC
- Additional access controls, medical surveillance for staff, are advised for BSL-2 Labs
- Personal Protective Equipment (PPE) requirements are lab coat or gown or safety goggles and or face mask

Note: Most of the work done at MDH Labs is performed within the BSL-2 laboratory. Consult with supervisor or Division Chief for specific requirements.

## BIOSAFETY LEVELS, CONT.

**BSL-3:** Organisms known to cause serious or fatal disease in humans and pose a severe risk to the environment – must be handled in BSL-3 laboratories. These organisms can be transmitted via inhalation and are not readily treatable or preventable with vaccination

- Manipulation of organisms must be performed in a secure BSL-3 laboratory and in a Biosafety Cabinet (BSC). Additional PPE is required for all work inside a BSL-3 Lab
- MDH Labs provides separate training for employees working in BSL-3 labs. Access to BSL-3 labs at MDH is restricted to those who have completed proper training

Note: Highest level is BSL-4 but this level is not in use at MDH Labs



# PPE (PERSONAL PROTECTIVE EQUIPMENT)

## Universal Precautions

- States that: All biological material is to be treated as infectious material
- Blood and Other Potentially Infectious Materials (OPIM)
  - Includes: blood, urine, sera, CSF, etc.
- Details are covered as a part of Bloodborne Pathogen training
- PPE signage is posted on all lab entry and exit doors



# PPE REQUIREMENTS

**BSL-2:** Minimum requirements in open and closed labs are lab coats and eye protection

- Gloves are required for specific tasks and testing based on unit SOPs
- Other requirements can include the use of aprons, sleeves and double-gloves while working with specific materials/samples
- Full-face shields may also be used for specific tasks

**BSL-3:** Respiratory protection (N-95 respirator or PAPR), Tyvek suit (including shoe protection), apron, sleeves, double gloves, and safety goggles and hair cover (if using N-95)



# ADDITIONAL INFORMATION FOR MDH LABS

All lab coats are to be kept inside the laboratory or lab corridor

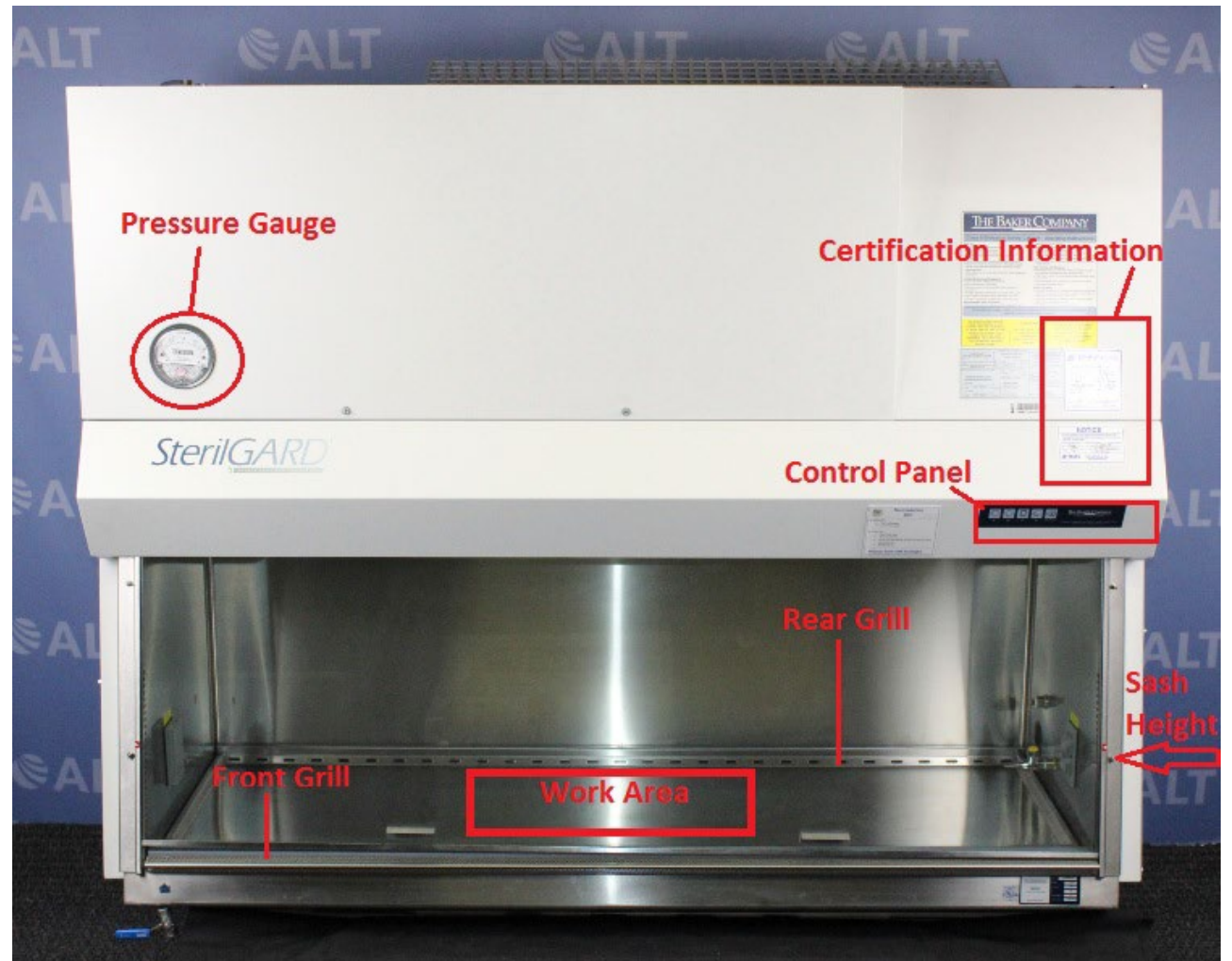
- Observe all signs for where lab coats are allowed to be worn (e.g. No lab coats in the carpeted areas in the offices, etc.)
- Launder lab coats as needed
- Additional disposable lab coats are available in every unit as needed

Wash hands prior to exiting lab. Sinks are located near each exit door for ease of access

Consult with supervisor, division chief, or Biosafety Office for other information as needed

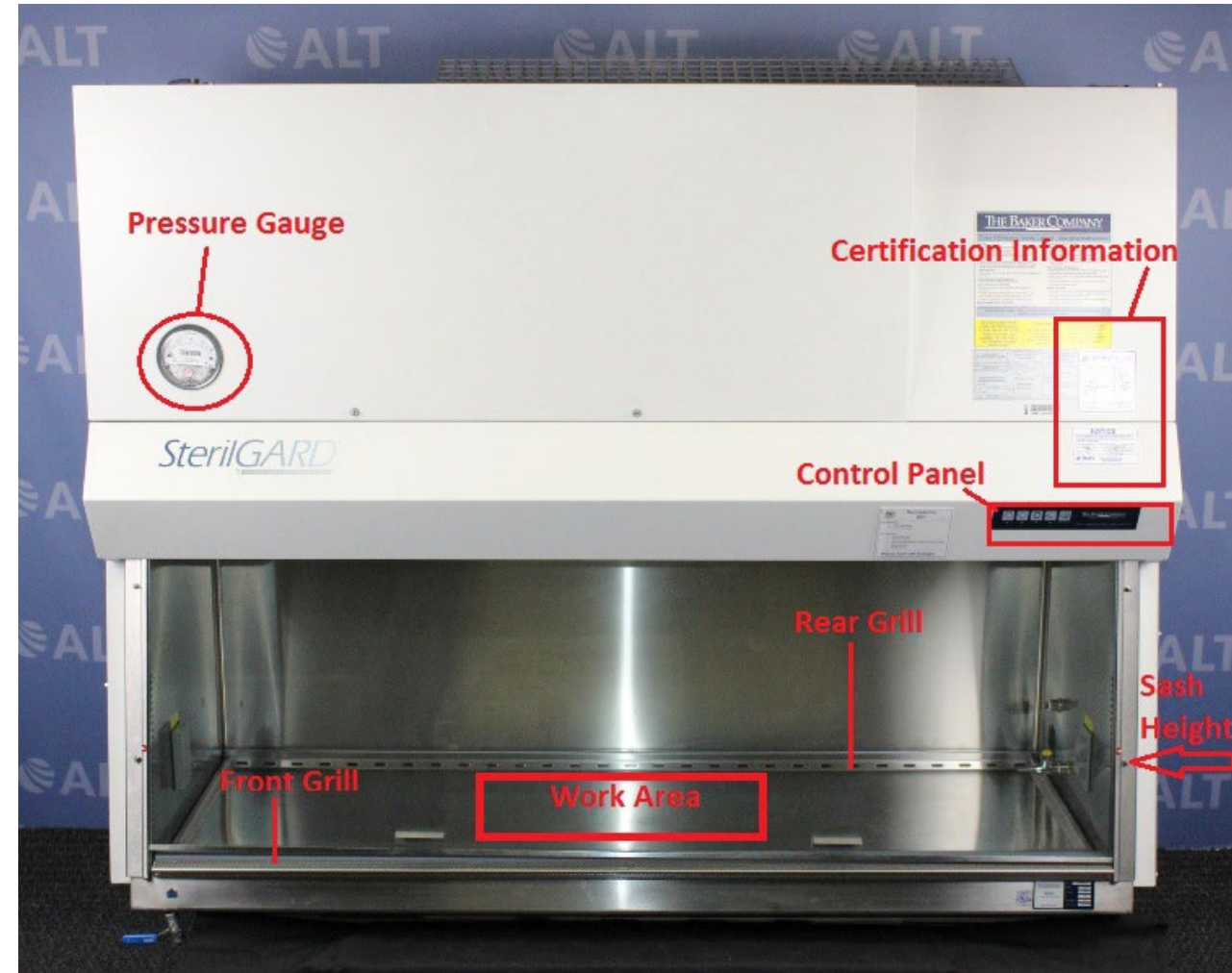
# PREPARING TO USE A BIOSAFETY CABINET (BSC)

- Ensure that the BSC is within its **certification period**
- Lift **sash** to height denoted on the side of the cabinet and turn on the blower
- Allow blower to re-circulate air and equilibrate for a minimum of 3 min, as per manufacturer's recommendation
- Check the air flow on the **pressure gauge (should be above 0.2 psi)**
- Disinfect all surfaces inside BSC with appropriate disinfectant (e.g. 10% bleach or 70% Alcohol) prior to use, if needed



# WORKING INSIDE A BSC

- Do not clutter the **work area**. Too many materials will inhibit the air flow
- Do not block the **front grill** or the **rear grill** to allow for proper circulation
- Place whatever supplies are needed into the BSC prior to beginning work. Minimize movement in and out of the hood as it disrupts the air flow
- When moving in or out of the BSC, move slowly and perpendicular to the cabinet
- Try to work towards the center of the **work area**



# FINISHING WORK IN THE BSC

- Place all waste materials inside biohazard waste container
- Upon completion of work, decontaminate materials to be removed from cabinet, if necessary, using appropriate disinfectant
- Empty biohazard waste container, if necessary
- Wipe down ALL internal surfaces with appropriate disinfectant
- Close sash and turn off blower
- Turn on UV light (if present) and fill out the daily maintenance log for BSC

**In the event of an emergency or power failure, secure the specimen/sample, then close the sash prior to leaving the area.**



## BSC Demonstration Video

Note: Video above is for demonstration purposes. MDH Labs recommendations for use are listed on previous slides.

# ADDITIONAL RESOURCES

- This video is recommended for a more detailed demonstration:

[Biosafety Cabinet Training](#)

- This includes information about the different types of safety cabinets used, such as fume hoods and laminar flow hoods, as well as the different types of BSCs

# HAZARDOUS WASTE MANAGEMENT

## Types of Hazardous Waste:

- Biological- any material that is biological in nature and may contain blood or other potentially infectious materials
- Chemical- examples include strong acids and bases, flammable materials, or anything potentially toxic or harmful
- Radiological- any material that contains radioactive isotopes
  - Note: Radiation Waste is collected and handled by the Radiation Safety Officer

Any questions about waste management practices can be directed to the Safety and Security Officer (SSO) or Biosafety Office (BSO)



# HAZARDOUS WASTE MANAGEMENT

## Biohazard Waste- Solid

- Any solid waste materials (e.g. used PPE, pipets tips, empty vials, papers, etc.) should be collected in biohazard waste bins
- All biohazard waste bins should be lined with 2 biohazard bags (double-bagged)
- Once bags are approximately 2/3 full, they should be sealed and placed in designated waste collection areas (Each floor/Division has areas for waste collection in the open lab spaces)

**NO liquid may be put into the plastic biohazard bags.**



# HAZARDOUS WASTE MANAGEMENT

## Biological Waste- Liquids/Sharps

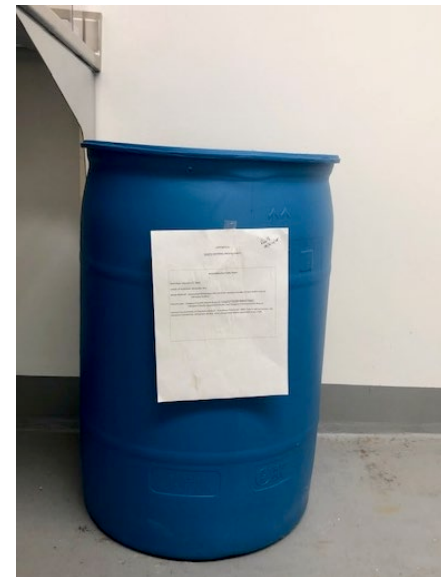
- Any potentially infectious materials that possess a sharps hazard **MUST** be placed into a hard-sided, puncture-proof container
  - Needles, broken glass etc. can be placed in regular sharps containers (top figure)
- Any potentially infectious liquids **MUST** be placed into Gasketed Sharps containers to prevent biohazardous waste leaks and spills (bottom figure)
- Any materials that contain liquid and sharps hazards must be placed in leak-proof containers (bottom figure)
  - Ex. Plastic sample cartridges, cultures, serological pipets to be disinfected, etc.
- Once containers are approx. 2/3 full, they should be properly sealed and placed in the waste collection area



# HAZARDOUS WASTE MANAGEMENT

## Chemical Waste

- No hazardous chemicals may be discarded down the drain at the MDH Laboratory Administration building
- All hazardous chemical waste generated as part of routine laboratory testing must be collected in suitable, properly labeled containers, including the date of generation
- Once containers are 2/3<sup>rd</sup> full, waste pick-up must be arranged through the Safety and Security Officer (SSO)
- Any outdated and expired chemicals must also be disposed of and arranged through the SSO



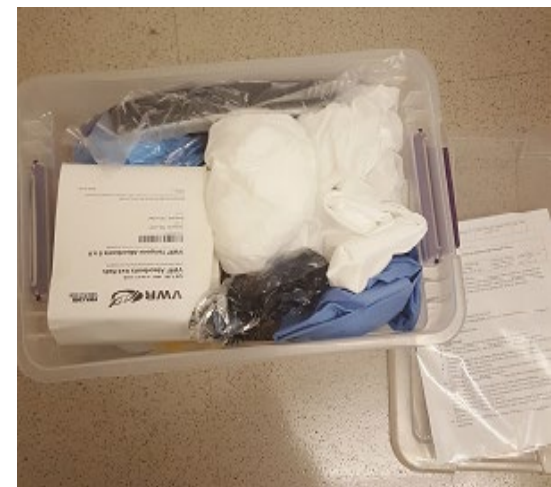
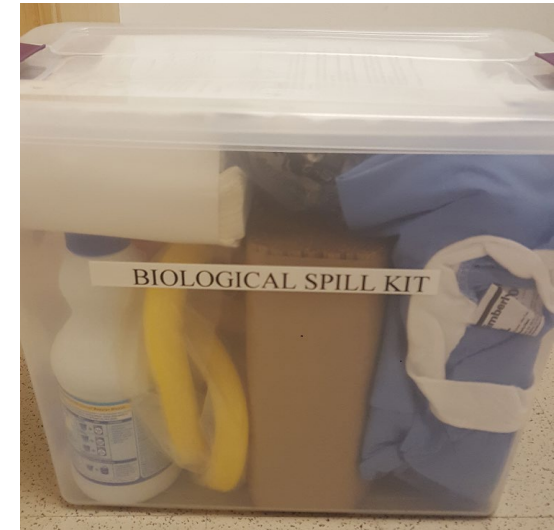
# DISINFECTION AND DECONTAMINATION

- All work surfaces should be disinfected before work is begun AND after work has been completed for the day
- Common disinfectants are:
  - 10% Bleach-prepared by mixing 1 part household bleach with 9 parts water, or by using a bleach-dilution system (Ex. Activate Bleach system)
  - Lysol-prepared according to manufacturer's instructions
  - Ethanol/Isopropanol
  - Unit-specific disinfectants (e.g. LopHene, CiDecon)
- These chemicals can also be irritants and should be handled using proper PPE (i.e. gloves)



# BIOLOGICAL SPILL CLEAN-UP

- Every Division or Unit is equipped with a Biological Spill Kit. All employees should be aware of its location within their specific unit
- The spill-kit contains the SOP and supplies required for spill clean-up. Use the Spill Clean-up SOP for detailed procedures. Hands-on training for Spill Clean-up may be recommended for each individual unit
- Any spill that occurs outside a BSC requires notification to SSO
- After use of spill kit, please replace the contents (contact SSO or BSO, if necessary)



1) Wait 30 min for aerosols to settle. Place sign on door to lab. Obtain spill kit and don new PPE, if needed.



2) Beginning from the outside, cover the spill with absorbent materials.



3) Carefully pour appropriate disinfectant on absorbent materials and wait 30 min (or recommended contact time).



4) Carefully working from edge to center, collect absorbent materials into biohazard waste container.



5) If necessary, place more absorbent materials and disinfectant for another 20 min.



6) Place all materials, including PPE, in biohazard waste bag. Place biohazard waste bag into biohazard container for disposal.



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# Spill Clean Up In Process



## Do NOT Enter

Warning Sign to use to place on door during Spill Clean Up. One sign is available in each spill kit.

# INCIDENT RESPONSE – EXPOSURE TO BIOLOGICAL PATHOGEN

- For accidents, needle sticks, etc.-
  - Remove contaminated PPE
  - Flush the exposed body area with clean water for 15-20 min
- Contact Supervisor/Director/SSO immediately
- Begin “First Report of Injury Form”
- Employee is referred to current State healthcare provider for blood sample collection and prophylaxis as needed
- Retain sample of infectious source material for further testing, as needed



# TWELVE VALUABLE RULES OF BIOSAFETY

1. SUPERVISORS MUST PROPERLY TRAIN THEIR EMPLOYEES BEFORE PERMITTING THEM TO CONDUCT BIOHAZARDOUS WORK
2. KNOW AND UNDERSTAND THE BIOLOGY AND INFECTIOUS POTENTIAL OF BIOHAZARDOUS AGENTS YOU HANDLE
3. HANDLE ALL BIOLOGICAL MATERIAL (TISSUES AND BODY FLUIDS) RECOGNIZED TO BE CAPABLE OF POTENTIALLY HARBORING BIOHAZARDOUS ORGANISMS OR AGENTS AS IF THE INFECTIOUS AGENT IS PRESENT
4. ALWAYS USE GOOD STANDARDS OF MICROBIOLOGICAL PRACTICE IN HANDLING BIOHAZARDOUS AGENTS OR MATERIALS OR ANY MICROORGANISM
5. USE THE BIOSAFETY LEVEL CONTAINMENT AND PRACTICES SPECIFIED FOR THE INFECTIOUS AGENT BY THE CENTERS FOR DISEASE CONTROL AND PREVENTION, ATLANTA, GEORGIA
6. DO NOT WORK WITH A MICROORGANISM OR AGENT IF THE REQUIRED LEVEL OF PHYSICAL CONTAINMENT DESIGNATED FOR THE BIOHAZARDOUS MATERIAL BEING USED IS NOT AVAILABLE

# TWELVE VALUABLE RULES OF BIOSAFETY

7. EACH WORKER HANDLING BIOHAZARDOUS MATERIAL IS RESPONSIBLE FOR FOLLOWING SAFETY RULES TO PREVENT INJURY TO SELF AND OTHERS
8. VIGILANCE AND MONITORING OF BIOSAFETY PRACTICES ARE ESSENTIAL IN ANY BIOSAFETY PROGRAM
9. ASSUME THAT ACCIDENTS WILL OCCUR AND PLAN FOR SAFELY MANAGING THOSE EVENTS WHEN HANDLING BIOHAZARDOUS MATERIALS AND AGENTS
10. REPORT ALL ACCIDENTS OR INCIDENTS TO YOUR SUPERVISOR IMMEDIATELY
11. USE DISINFECTANTS OR STERILANTS WITH PROVEN EFFICACY AGAINST THE SPECIFIC BIOHAZARDOUS AGENT(S) YOU ARE USING
12. NEVER PERMIT BIOHAZARDOUS MATERIALS TO LEAVE THE LABORATORY UNSTERILIZED UNLESS BEING TRANSPORTED TO ANOTHER LABORATORY FOR ADDITIONAL WORK AND PACKAGED ACCORDING TO APPROPRIATE REGULATIONS

# QUIZ

Link to Knowledge Assessment Quiz:

[https://www.surveymonkey.com/r/BiosafetyTraining\\_2022](https://www.surveymonkey.com/r/BiosafetyTraining_2022)

# CONTACT INFO

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# REFERENCES

- Biosafety in Microbiological and Biomedical Laboratories, current edition, <https://www.cdc.gov/biosafety/publications/bmbl5/>
- Principles of Biosafety Fact Sheet, Association for Biosafety and Biosecurity
- BSC Training video from National Institutes of Health (NIHOD)