

Fundamental terminology in biosafety & biosecurity

A comprehensive guide to biological agents, biohazards, biosafety, and laboratory safety practices.

Lact.1



Biological Agents

What Are Biological Agents?

Biological agents are microorganisms

- *Bacteria*
- *Viruses*
- *fungi and toxins*

that can cause infections, allergies, or toxicity in humans, animals, or plants.

Health Effects

They have the ability to adversely affect human health in a variety of ways, ranging from relatively mild, allergic reactions to serious medical conditions—even death. Some organisms, including various types of mold and Legionella bacteria, are found readily in the natural and built environment.

The Effects of Biological Agents

As they are usually invisible, it is often difficult to appreciate the risks they present. As a worker you may be harmed by:



Infection

Being infected by a biological agent

Toxin Exposure

Being exposed to toxins produced by the biological agent



Allergic Reaction

Having an allergic reaction to the biological agent or substances it produces, for example, enzymes



Key Definitions

Hazard

A source, situation, or act with a potential for causing danger.

Biohazard

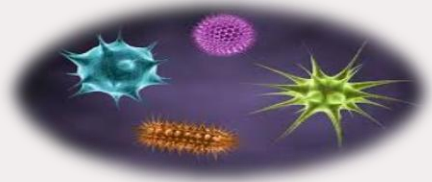
Any biological material—including pathogens, bodily fluids, blood, or laboratory samples—that poses a significant risk to health, often marked with the official symbol.

Zoonotic Disease

Infectious disease (zoonosis) that is naturally transmitted from animals to humans and vice versa.

What Is a Biohazard?

A biological agent or a condition that constitutes a threat to humans, especially in biological work, research, or experimentation — and the potential danger, risk, or harm from exposure to such an agent or condition.



Microorganisms

Viruses, bacteria, fungi, and parasites and their toxins.

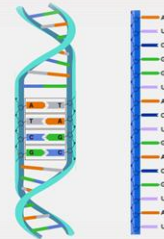


Biological Fluids

Blood and body fluids, as well as tissues from humans and animals.

Cell Lines & Nucleic Acids

Transformed cell lines and certain types of nucleic acids.



Environmental Threat

A potential hazard to humans, animals or the environment caused by a biological organism, or by material produced by such an organism.

Biological Agents vs. Biohazards

□ Biological Agents

Biological agents are living organisms (bacteria, viruses, fungi) or toxins that can cause disease.

Biological agents are the source of harm.

☢ □ Biohazards

Biohazards (biological hazards) are the broader, situational risks posed by these agents, including contaminated materials, medical waste, or animal/human samples.

Biohazard defines the threat level.

□ **Key Distinction:** *Biological agents are the source of harm, and biohazard defines the threat level.*

Risk & Risk Assessment

1

Risk

*A measure of the potential loss of a specific biologic agent of concern, based on the **probability of occurrence** of an adversary event, **effectiveness of protection**, and **consequence of loss**.*

2

Risk Assessment

An analysis of the probability and the consequences of loss, theft and potential misuse of pathogens and toxins.



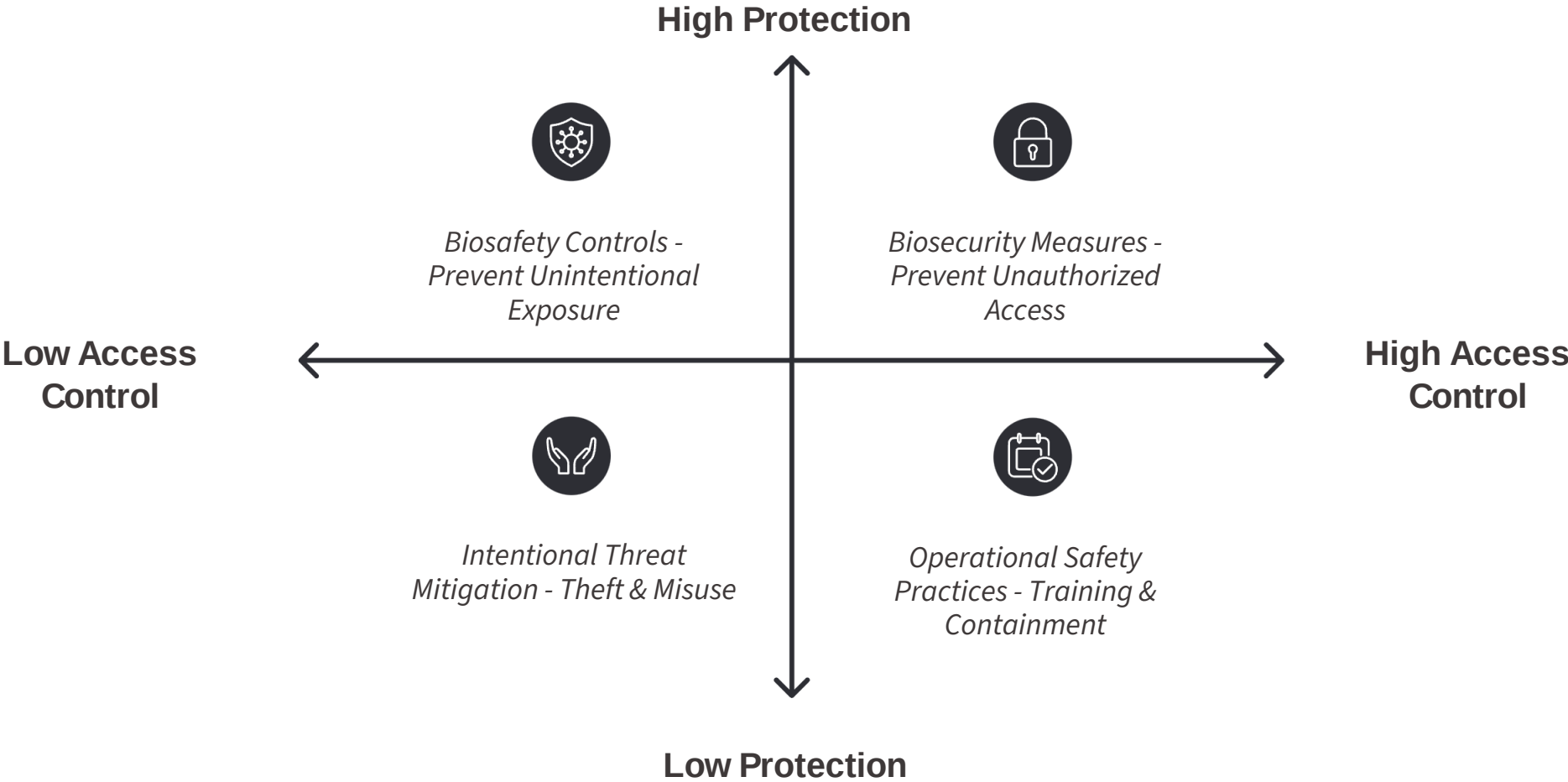
Biosafety vs. Biosecurity

 Laboratory Biosafety

Containment principles, technologies, and practices implemented to prevent unintentional exposure to pathogens and toxins, or their unintentional release.

 Laboratory Biosecurity

Protection, control, and accountability for valuable biological materials within laboratories, in order to prevent their unauthorized access, loss, theft, misuse, diversion, or intentional release.



Exposure, Contamination & Infection



Exposure

The initial, direct contact with a potentially hazardous agent or pathogen, such as through a needle stick or respiratory droplet.



Contamination

The unintended presence of infectious materials on surfaces, instruments, or in the environment.



Infection

The successful invasion and multiplication of microorganisms in body tissues, which may or may not cause symptoms.

Containment, Decontamination & Sterilization

□ Containment

*Describes safe methods for managing infectious agents in the laboratory environment where they are being handled or maintained. The purpose of containment is to reduce or eliminate exposure of laboratory workers, other people, and the outside environment to potentially hazardous agents. The three elements of containment include **laboratory practice and technique, safety equipment, and facility design.***

□ Decontamination

Free of contamination, the destruction of microorganisms to a lower level such that it removes danger of infection to individuals.

🔥 Sterilization

The complete destruction of all viable microorganisms.

□ Disinfection

Use of agents (physical or chemical) to destroy harmful organisms on inanimate objects (not necessarily all organisms).



Bioethics

Bioethics is the study of the ethical and moral implications of biological discoveries, biomedical advances, and their applications as in the fields of genetic engineering and drug research.

- ❏ **Important:** Bioethics is one of the **three components** that contribute to a successful **biorisk management culture**.

Genetic Engineering

Ethical implications of modifying genetic material in research and medicine.

Drug Research

Moral considerations in biomedical advances and pharmaceutical development.

Biorisk Management

Bioethics as a core pillar of a successful biorisk management culture.



Accidents vs. Incidents

☀ Accident

An unplanned, undesired event that results in injury, illness, damage, or loss.

⚡ Incident

A broader term that refers to any unplanned event that could have caused — or did cause — injury, damage, or disruption.

📄 *Key Relationship: All accidents are incidents, but not all incidents are accidents.*

Biological Safety Officer

Biological Safety Officer or Biosafety Responsible Official: Individual responsible for developing and implementing biological hazard monitoring and controlling programs in the workplace.



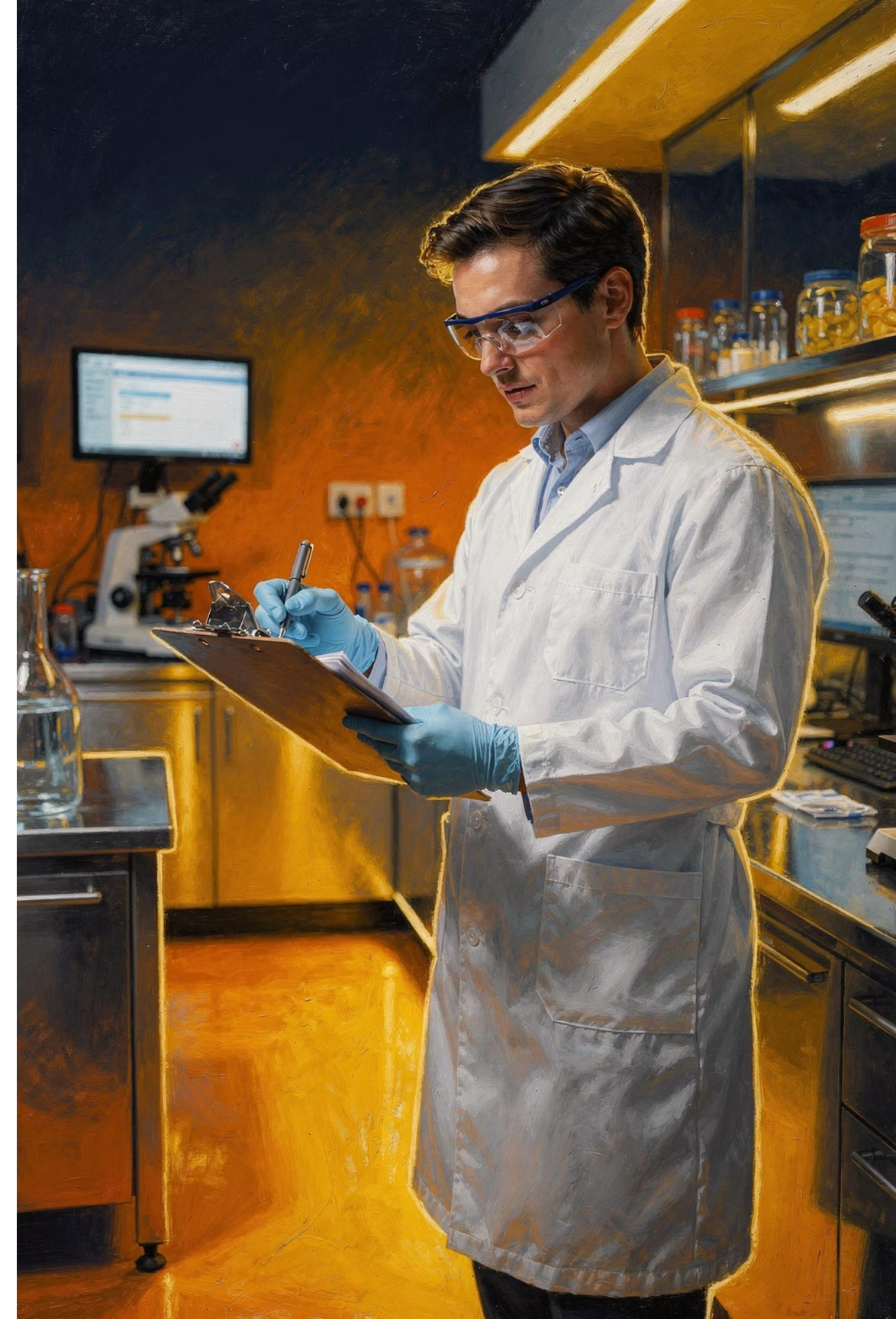
Regulatory Liaison

Serves as liaison with state and federal regulatory agencies, campus health services, and public safety.



Emergency Response

Provides assistance and emergency response for incidents involving biological and chemical hazardous materials and regulated medical waste.



Institutional Biosafety Committee

1 Policy Development

It develops institutional biosafety policies and codes of practice.

2 Protocol Review

It also reviews research protocols for work involving infectious agents, animal use, recombinant DNA, and genetically modified materials.

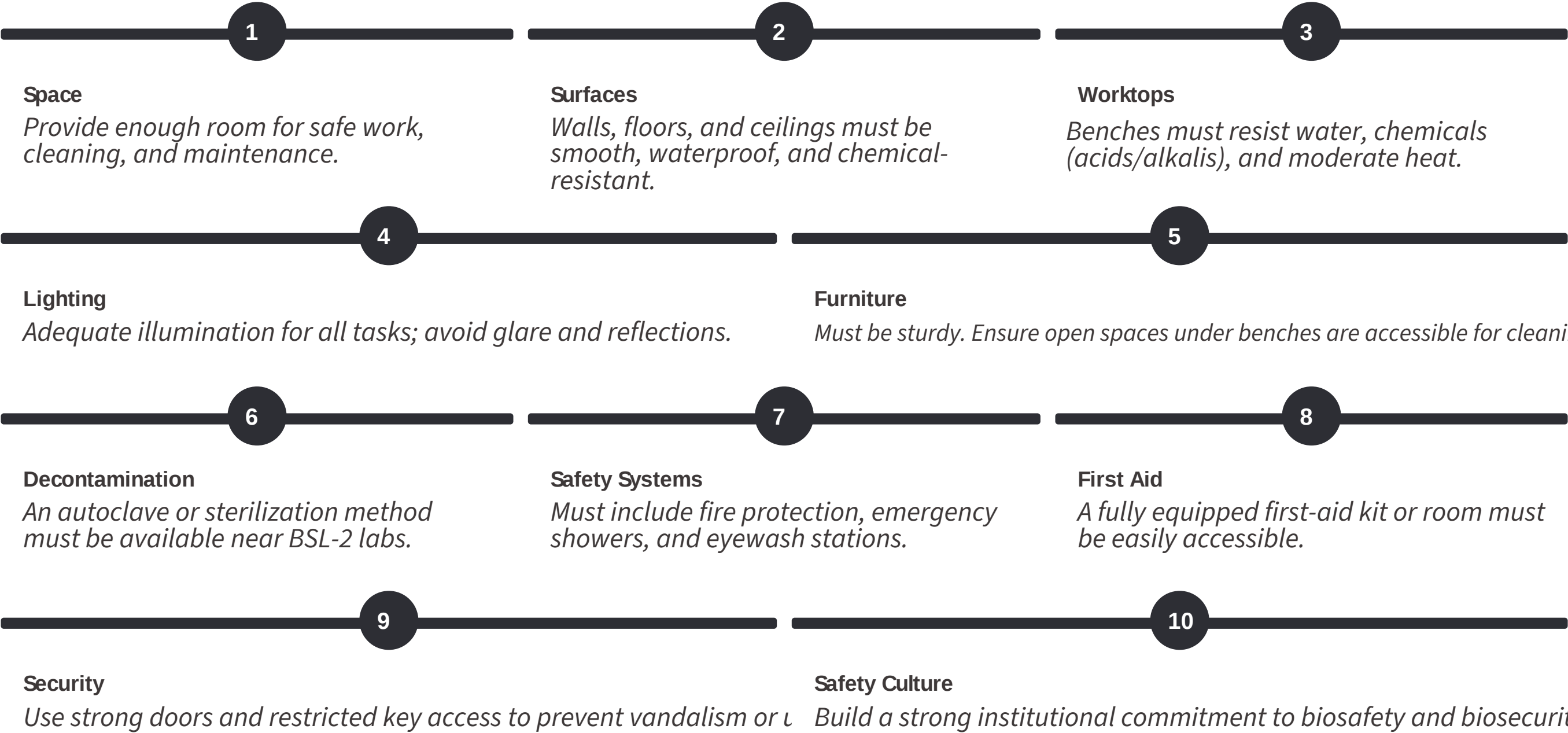
3 Additional Functions

Other functions of the committee may include risk assessments, formulation of new safety policies and arbitration in disputes over safety matters.

4 Diverse Membership

The membership of the biosafety committee should reflect the diverse occupational areas of the organization as well as its scientific expertise.

Laboratory Facility Requirements (Part 1)



Laboratory Facility Requirements (Part 2)



11. Storage

Provide enough space for daily supplies to prevent clutter on benches.



12. Hazards

Dedicated facilities for safe handling of solvents and compressed gases.



13. Break Areas

*Eating, drinking, and resting must be done **outside** the lab work area.*



14. Hygiene

Hand-washing sinks with running water must be in every room, near the exit.



15. Doors

Should have vision panels, fire ratings, and be self-closing.



16. Ventilation

Use mechanical systems with inward airflow (no recirculation) or screened windows.



17. Water Safety

*High-quality water supply with **backflow prevention** to protect public water.*



18. Power

*Reliable electricity with emergency lighting and a **backup generator** for essential equipment.*



19. Gas

Reliable and adequate gas supply with mandatory regular maintenance.



Lab Safety Begins Before You Go to the Lab!

 *Use this space to list two things you should do before going to the lab.*

Before You Enter

Review the lab protocol, safety procedures, and any relevant hazard information before entering the laboratory.

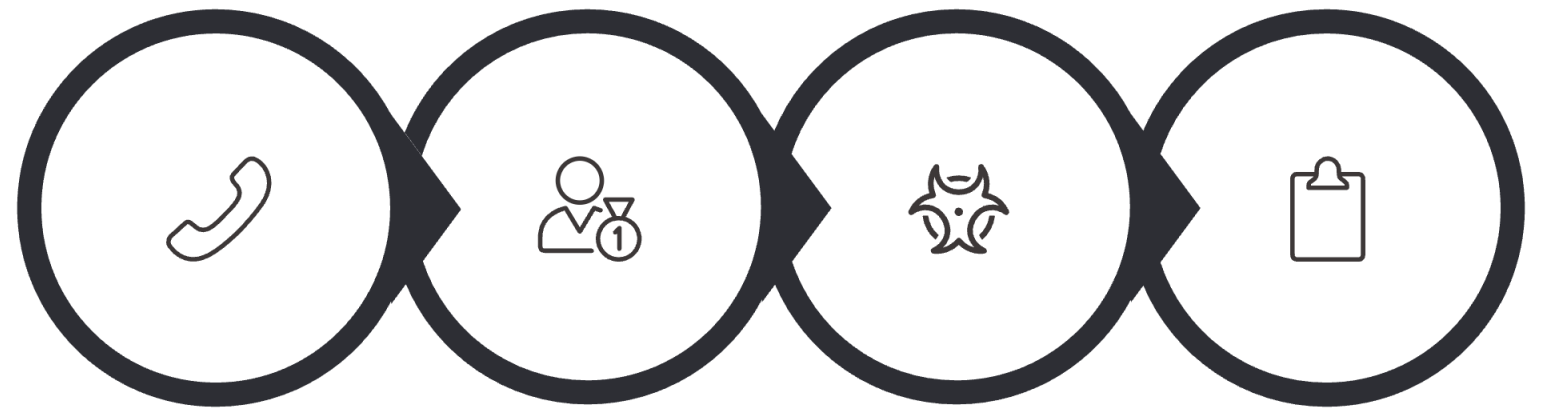
Personal Protective Equipment

Ensure you have all required personal protective equipment (PPE) ready and properly fitted before beginning any lab work.



In the Event of a Lab Accident...

☐ Use this space to discuss procedures to follow in the event of a lab accident.



Report

First Aid

Contain

Document

Following proper emergency procedures ensures the safety of all lab personnel and helps prevent further harm or contamination.



At the End of Your Lab Time...

☐ *Use this space to discuss what should be done at the end of your lab time.*

Clean & Decontaminate

Wipe down all work surfaces with appropriate disinfectant and dispose of biological waste properly.

Secure Materials

Store all specimens, reagents, and biological materials in their designated secure locations.

Remove PPE & Wash Hands

Remove all personal protective equipment safely and wash hands thoroughly before leaving the lab.

Document & Report

Record all activities, observations, and any incidents in the lab notebook or reporting system.

Remember... Safety First!

(Enter your own creative tag line above)

Protect Yourself

Always wear appropriate PPE and follow all safety protocols.

Protect Others

Your safety practices protect your colleagues and the wider community.

Protect the Environment

Proper containment and disposal safeguard our shared environment.

