Biological hazards, Ways to control

BY

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Second stage

Introduction

Bacteria, **viruses**, **blood**, **tissue**, and/or **bodily fluids** in the lab can lead to potential biological hazards. These materials can all carry disease or hazardous allergens which could put the lab team at risk. The effects of the diseases and allergens can be immediate or take significant time to manifest, demonstrating the importance that all members of the lab team are given sufficient protection, even if the dangers are not yet known.

Diseases carried by humans and animals used in research can be transmitted by the team, who then may become carriers. This means that biological hazards could prove to be a massive risk for not only the lab professionals working with the materials, but anyone they come into contact with outside of work. Sometimes incredibly infectious, biological hazards (biohazards) can be amongst the biggest risks of the modern research lab, so every consideration must be made to ensure the team and the wider public are protected against contagious materials.

Proper storage and protection are key to preventing a biological emergency in the lab. Wearing appropriate protective clothing and keeping biological agents contained in the correct areas is essential for minimizing exposure to risk. Systems and procedures for safe use, handling, storage, and transport of biological hazards should all be in place. Disinfecting work surfaces and properly disposing of waste are also vital for minimizing biological risk.

Sources of biological hazards: Bacteria, viruses, fungi, parasite, laboratory animals (experimental animals), recombinant DNA and artificial gene transfers, infectious agents and, toxins.

- All these sources can lead to **different diseases** such as:-

1. Bacterial diseases, such as tuberculosis, tetanus, food poisoning, and blood poisoning.
2. Fungal diseases, such as ringworm and thrush.
3. Viral diseases, such as mumps, hepatitis, German measles, West Nile Virus.
4. Parasitic worms that enter the body when their eggs are ingested.

Biosafety Levels

These levels, which are ranked from one to four, are selected based on the agents or organisms that are being researched or worked on in any given laboratory setting. For example, a basic lab setting specializing in the research of nonlethal agents that pose a minimal potential threat to lab workers and the environment is generally considered BSL-1, **the lowest biosafety lab level**.

A specialized research laboratory that deals with potentially deadly infectious agents like Ebola would be designated as BSL-4., **the highest and most stringent level**.

The Centers for Disease Control and Prevention (CDC) sets BSL lab levels as a way of exhibiting specific controls for the containment of microbes and biological agents. **Each BSL lab level builds upon the previous level—thereby creating layer upon layer of constraints and barriers**.

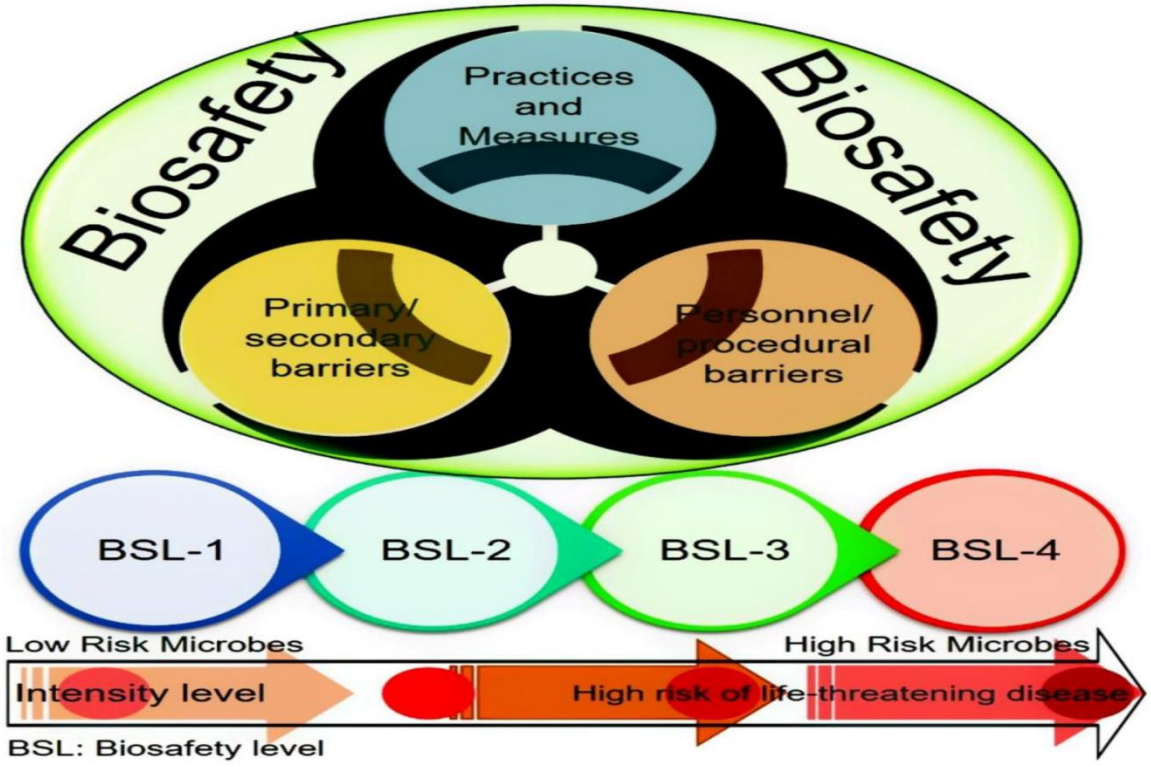
There are four levels to biosafety divided according to **hazardous of material** (severity) that found in laboratories:-

1. Biosafety Level 1 (BSL-1)
2. Biosafety Level 2 (BSL-2)
3. Biosafety Level 3 (BSL-3)
4. Biosafety Level 4 (BSL-4)

These lab levels are determined by the following

1. Risks related to containment.
2. Severity of infection.
3. Transmissibility.
4. Nature of the work conducted.
5. Origin of the microbe.
6. Agent in question.
7. Route of exposure.

The **reason** biosafety levels are so important is that they **dictate the type of work practices** that are **allowed to take place in a lab setting**. They also **heavily influence the overall design of the facility in question**, as well as the **type of specialized safety equipment used within it**.

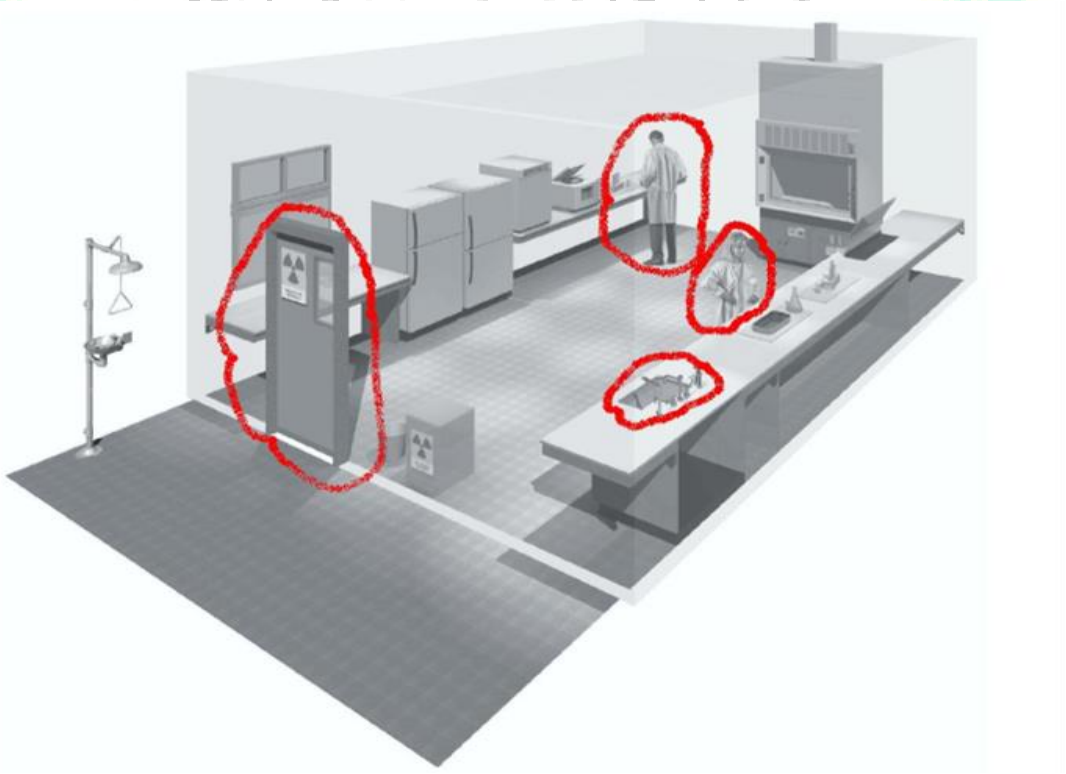


Biosafety Level 1 (BSL-1)

BSL-1 labs are used to study infectious agents or toxins not known to consistently cause disease in healthy adults. Follow basic safety procedures, called Standard Microbiological Practices, and require no special equipment or design features. Standard engineering controls in BSL-1 laboratories include easily cleaned surfaces that are able to withstand the basic chemicals used in the laboratory.

Risk agents

- No or low individual and community risk.
- A microorganism unlikely to cause human or animal disease.



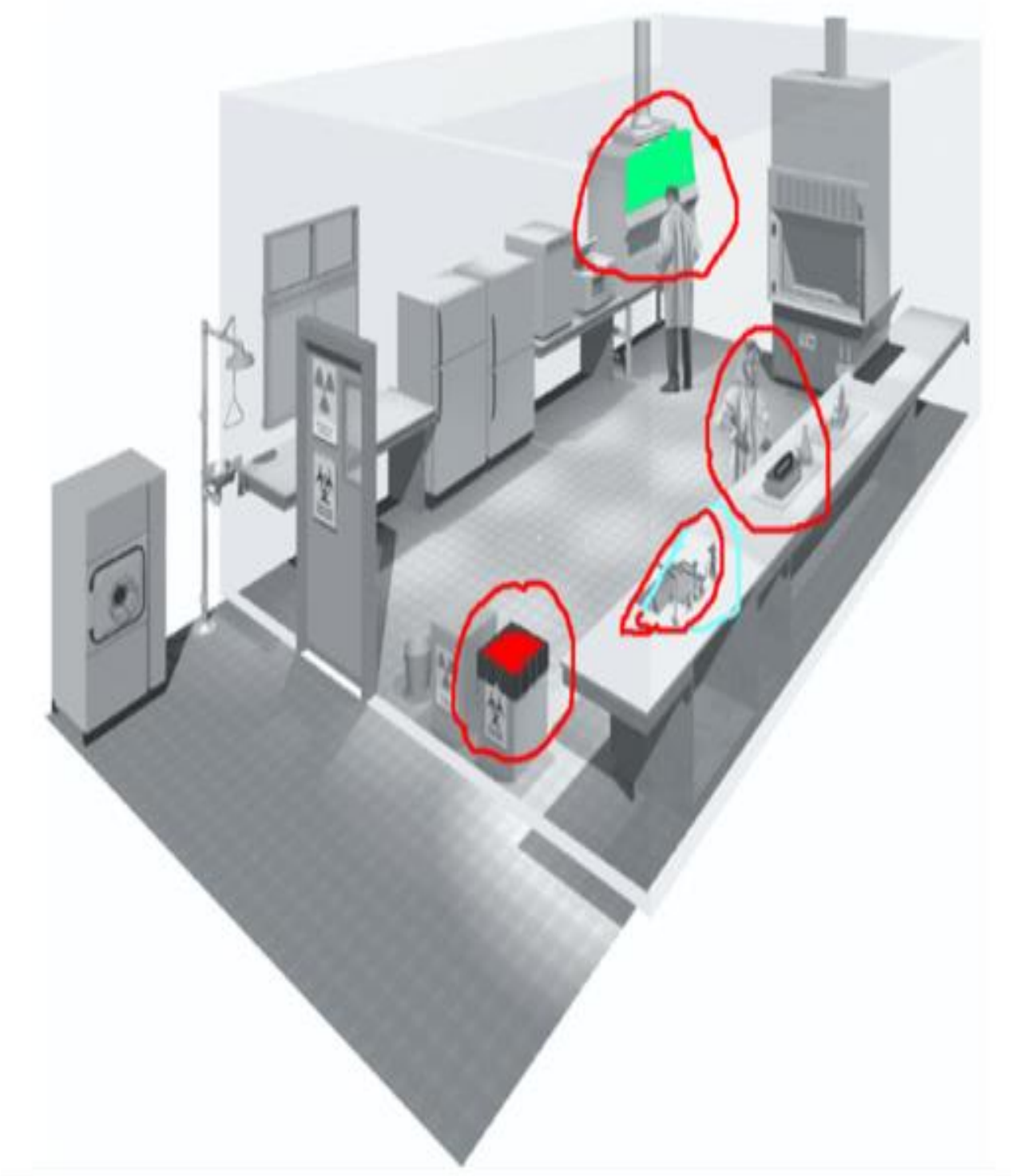
Biosafety Level 2 (BSL-2)

BSL-2 laboratories are used to study moderate-risk infectious agents or toxins that pose a risk if accidentally inhaled, swallowed, or exposed to the skin.

Design requirements for BSL-2 laboratories include hand washing sinks, eye washing stations in case of accidents, and doors that close automatically and lock. BSL-2 labs must also have access to equipment that can decontaminate laboratory waste, including an incinerator, an autoclave, and/or another method, depending on the biological risk assessment.

Risk agents

- Moderate individuals risk, low community risk
- Pathogen causes human or animal disease but is unlikely to be a serious hazard to laboratory workers, the community, livestock or the environment.
- May cause serious infection but effective treatments and preventive measures are available.
- Risk of spread is limited.



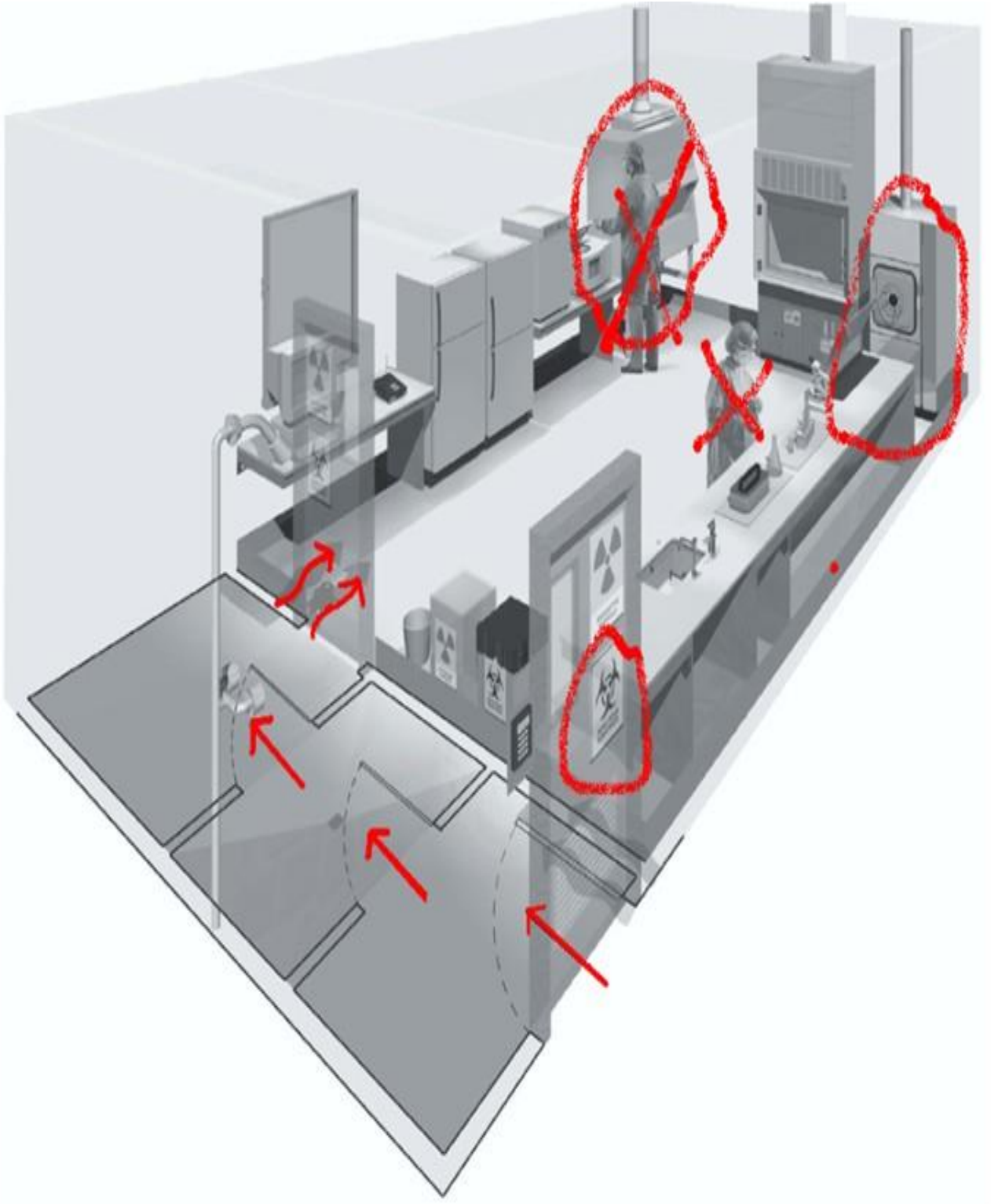
Biosafety Level 3 (BSL-3)

BSL-3 laboratories are used to study infectious agents or toxins that may be transmitted through the air and cause potentially lethal infection through inhalation exposure. Researchers perform all experiments in biosafety cabinets that use carefully controlled air flow or sealed enclosures to prevent infection. BSL-3 laboratories are designed to be easily decontaminated. These laboratories must use controlled, or "directional," air flow to ensure that air flows from non-laboratory areas (such as the hallway) into laboratory areas as an additional safety measure.

Other engineered safety features include the use of two self-closing, or interlocked, doors, sealed windows and wall surfaces, and filtered ventilation systems. BSL-3 labs must also have access to equipment that can decontaminate laboratory waste, including an incinerator, an autoclave, and/or another method, depending on the biological risk assessment.

Risk agents

- High individual risk, low community risk
- Pathogen usually causes serious human or animal disease but dos not ordinarily spread to others.
- Effective treatment and preventive measures are available.



Biosafety Level 4 (BSL-4)

BSL-4 laboratories are used to study infectious agents or toxins that pose a high risk of aerosol-transmitted laboratory infections and life-threatening disease for which no vaccine or therapy is available. The laboratories incorporate all BSL 3 features and occupy safe, isolated zones within a larger building or may be housed in a separate, dedicated building. Access to BSL-4 laboratories is carefully controlled and requires significant training.

There are two types of BSL-4 laboratories:

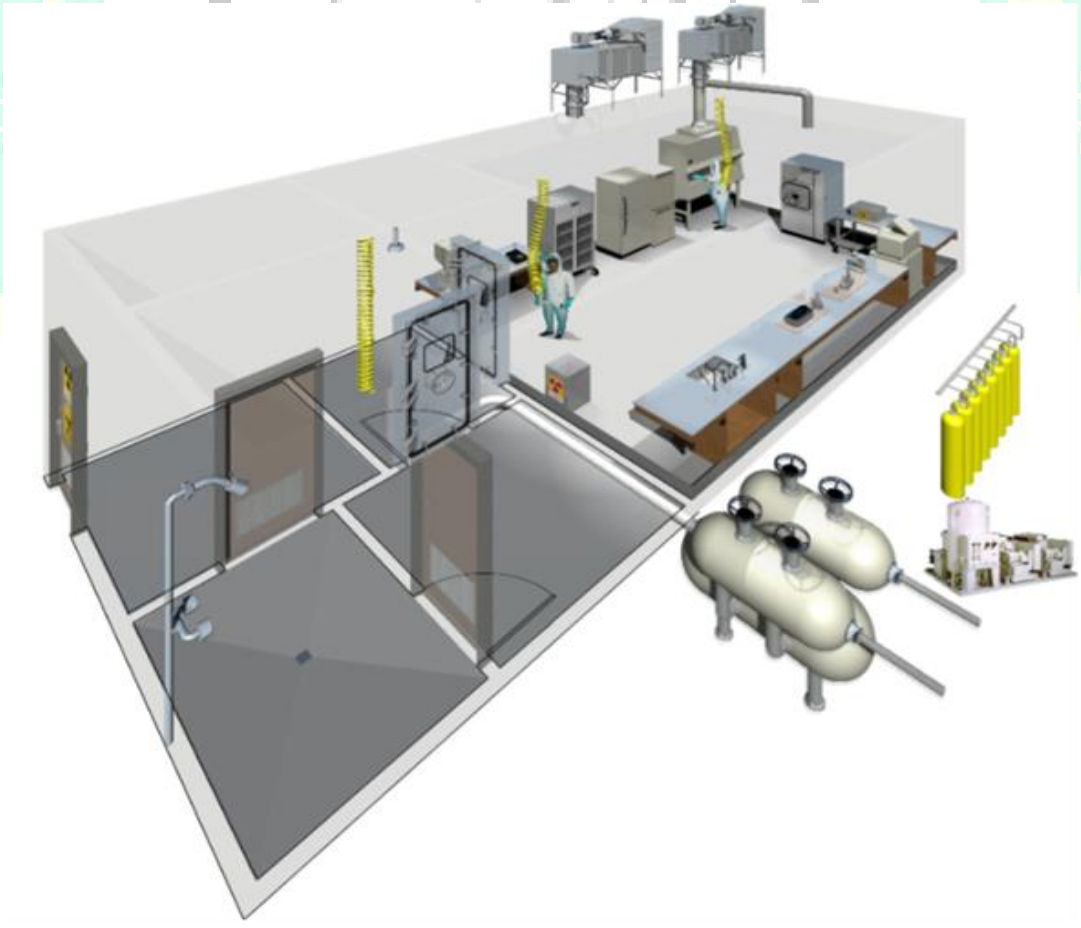
- Cabinet laboratory – all work with infectious agents or toxins is done in a Class III Biosafety Cabinet with very carefully designed procedures to contain any potential contamination. In addition, the laboratory space is designed to also prevent contamination of other spaces.

- Suit laboratory – Laboratory personnel are required to wear full-body, air-supplied suits, which are the most sophisticated type of personal protective equipment. All personnel shower before exiting the laboratory and go through a series of procedures designed to fully decontaminate them before leaving.

The engineering controls required are different for BSL-4 cabinet and suit laboratories. For either type, they are extensive and supplemented by carefully designed procedures and practices.

Risk agents

- High individual and high community.
- A pathogen causes serious human or animal disease, readily transmitted from one individual to another.
- Effective treatment and preventive measures are usually not available.



According to the levels of bio-safety, at what level can we consider the laboratories that deal with these viruses (Ebola, Zika, SARS, and Corona)? Why?

(H.W 2)