




Biocontainment Facility Features

Student Guide








Introductions

- Instructors
- Students
 - Your name?
 - Where are you from?



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Action Plan

By the end of this lesson, I would like to:

KNOW		FEEL		BE ABLE TO DO	
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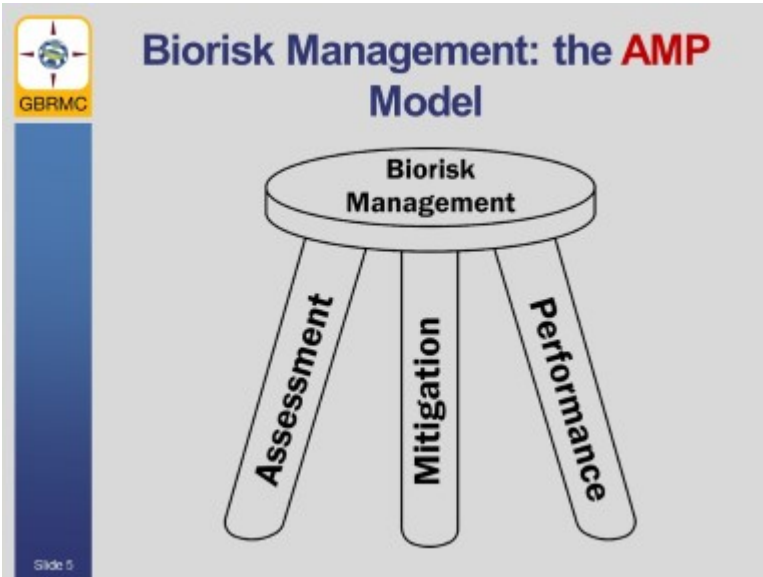
Use space on back, if needed



Key Messages

- Appropriate facility features for biocontainment are chosen based on the identified biorisk.
- Facility features are often grouped into "Biosafety Levels."
- Every facility feature grouped into a specified biosafety level may not be required to mitigate risk; however, any justification for not using a specified facility feature must be based on the risk involved and appropriate strategies to mitigate that risk.
- At times, biorisk may be mitigated using non-facility based strategies; however, the absence or unavailability of specified facility features must be justified relative to the risk involved and other available and effective biorisk mitigation strategies.

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Key Components of Biorisk Management

- **Biorisk Assessment**
 - Process of identifying the hazards and evaluating the risks associated with biological agents and toxins, taking into account the adequacy of any existing controls, and deciding whether or not the risks are acceptable

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Key Components of Biorisk Management

- **Biorisk Mitigation**
 - Actions and control measures that are put into place to reduce or eliminate the risks associated with biological agents and toxins



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Key Components of Biorisk Management

- **Biorisk Performance**
 - Improving biorisk management by recording, measuring, and evaluating organizational actions and outcomes to reduce biorisk.





Mitigation Control Measures

There are five major categories of measures for controlling biological risks in the laboratory.

1. **Elimination or Substitution**
2. **Engineering Controls**
3. **Administrative Controls**
4. **Practices and Procedures**
5. **Personal Protective Equipment**

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Containment Barriers

- **Primary Containment**
 - Protects the worker
- **Secondary Containment**
 - Protects the community & environment

Questions:

In this case: Who is the **Worker**? What is the **Community**? What is the **Environment**?

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Containment Barriers

Group Exercise – Step 1:


Your group has a set of cards with one biorisk mitigation strategy per card. Divide these between your members.

- Place your card(s) on the diagram:
 - on the primary containment boundary OR
 - on the secondary containment boundary
- If you feel your card provides both primary and secondary containment (or neither), hold on to it.
- Be prepared to discuss your results with the class.



You have **15 minutes** for this activity


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Containment Barriers

Group Exercise – Step 2:

- After reaching a consensus with the class, pick up all the biorisk mitigation cards that are **not facility features**.
- At which level of containment do most of the cards that are facility features remain? Primary or Secondary?



Primary Containment

(protects worker)

Secondary Containment

(protects community & environment)

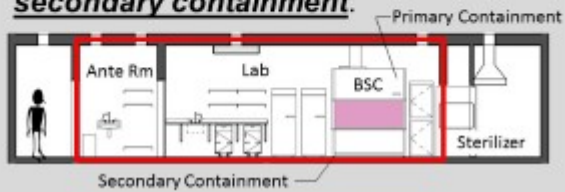
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Containment Barriers

For Example:

- BSCs and animal isolators offer **Primary containment equipment** for infectious work..
- A building's containment barriers provide **secondary containment**.



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Facility Feature Categories

Group Exercise:

Discuss the **purpose and function** of three of these categories (assigned by instructor) and how these features contribute to **secondary (and primary) containment**:

- **Access Points** (doors, anterooms, locks, windows)
- **Surfaces** (cleanable, sealed, chemical resistant walls, floors, ceilings, benches)
- **Air flow and quality** (HVAC, HEPA, etc.)
- **Monitors & alarms** (airflow, power, intrusion)
- **Redundant systems** (back-up fans, generators)
- **Decontamination** (sinks, showers, autoclaves, etc.)

Take **15 minutes**

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Facility Features based on Risk

Group Exercise:

Question:

What would you want your facility to include to provide appropriate containment?

In your groups, please take **10 minutes** to choose the facility features cards that are appropriate for your group's risk assessment scenario. Remember to consider both **biosafety** (protecting the workers, community, and environment) and **biosecurity** (protecting the pathogen).

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Scenario 1

- Pathogen
 - *Lactobacillus* sp.
- Risk Assessment (if not mitigated)
 - Worker = **low**
 - Community = **low**
 - Environment = **low**
- Procedures
 - Food science laboratory
 - Studying methods to maximize *L. acidophilus* cultures for pro-biotic foods.
 - Amplifying and maintaining large volumes of bacteria; culturing live bacteria from dairy products.



Scenario 2

- Pathogen
 - *Shigella* sp.
- Risk Assessment (if not mitigated)
 - Worker = **moderate** (oral route)
 - Community = **low to moderate** (contaminated surfaces, etc.)
 - Environment = **low to moderate** (release of modified *Shigella*)
- Procedures
 - Research in antibiotic susceptibility of differing species and strains of *Shigella*
 - Small quantity amplification & manipulations
 - Limited centrifugation



Scenario 3

- Pathogen
 - *Mycobacterium tuberculosis*
- Risk Assessment (if not mitigated)
 - Worker = **moderate to high** – infectious aerosols are likely
 - Community = **moderate to high** (lab); **moderate** beyond lab walls
 - Environment = **low to moderate** from materials released from waste
- Procedures
 - Confirming the presence of *M. tb* in sputum samples from patients suspected of having tuberculosis; drug resistance determinations



Scenario 4

- Pathogen
 - Cercopithecinae herpes virus 1 (CHV-1)
- Risk Assessment (if not mitigated)
 - Worker = **high**, through unprotected contact with infected materials
 - Community = **high** (lab), through unprotected contact with infected materials; **moderate** beyond lab walls due to contact with waste materials
 - Environment = **low to moderate** due to limited host range
- Procedures
 - Determining if blood samples collected from macaque monkeys who bit or scratched a worker show evidence of infection by CHV-1

Biocontainment Facility Features

Containment Facility Features



Facility Features of BSL-1 and -2

- Closeable doors
- Windows with insect-proof screens
- Surfaces (floors, walls, ceilings, bench tops) that are easily cleaned, liquid impermeable, and chemical and moderate heat resistant
- Adequate illumination
- Sturdy, cleanable lab furniture
- Hand washing basin (with running water, if possible)
- Reliable and adequate electricity and natural gas
- Locks (keyed)
- Emergency lighting and stand-by generator
- BSL-2: autoclave

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Facility Features of BSL-3

- **BSL-1 and -2, plus:**
- Isolation from high traffic areas
- Anteroom (double-door access)
- Self-closing doors
- Locks (keyed at a minimum)
- Sealed openings in walls, floors, and ceilings
- Closed, sealed, break-resistant windows
- Hand washing basin with hands-free controls
- Directional airflow INTO BSL-3 lab
- Visual monitor for airflow
- No recirculation of air
- Dispersed exhaust air (with consideration of HEPA filtration)
- Audible or visible alarms for system failures
- Design verified by testing

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Facility Features of BSL-4

- **BSL-3, plus:**
- Personnel shower (in and out); changing rooms
- Pass-through autoclave, fumigation chamber, or dip tank for materials in or out
- Double HEPA-filtered exhaust
- HEPA-filtered supply
- Air supply for suits with alarms for failures (suit lab)
- Redundant exhaust fans
- Effluent decontamination system
- Airlock entry points
- Dedicated power supply and emergency power
- Containment drains

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“Other” BSLs

- **Animal BSL-X**
 - Features specific to animal handling.
- **BSL-X+ or BSL-enhanced**
 - Components are added on to existing containment levels; you **MUST** specify what the “plus” or “enhanced” include.
- **BSL-X Ag**
 - Used with large animals; the facility becomes the primary barrier.

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Facility Features and BSLs

Group Exercise

Consider your group's risk assessment scenario.

In your groups, spend **5 minutes** to discuss the following questions:

- Which BSL's facility features match the closest with the features your group selected?
- Does this align with your understanding of how to best mitigate risk for your scenario's pathogen and procedures? Why or why not?

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Facility Features and BSLs

Group Exercise

Consider the **BSL** most appropriate to your risk assessment scenario.

In your groups, spend **5 minutes** to look at the list of **facility features** needed for that BSL. Discuss the following questions:

- Are all of the facility features necessary, in your opinion, to mitigate the risk of your scenario?
- Are there other features from other BSL listings needed to mitigate the risk?
- How do the previous questions influence the decision to assign a biosafety level?

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Maintenance of Facility Features

Group Exercise

Consider at least **3 of the facility features** selected by your group.

In your groups, spend **5 minutes** to discuss the following questions about your facility features:

- Does it need to be maintained?
- What is required to maintain it?
- Who is required to maintain it?
- How does maintenance impact the time and resources required to conduct the procedures with the pathogen?

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Non-ideal Facilities

Group Exercise

The instructor will remove **2 or 3 of your facility features**.

In your groups, take **5 minutes** to discuss the following questions:

- How does the lack of those features impact the risk in that laboratory?
- Are there other risk mitigation strategies available that can overcome the lack of these features? Why or why not?

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Review of Biocontainment Facility Features

To wrap-up, let's discuss what we learned about using **biocontainment facility features**.

What did we learn?

What does it mean?

Where do we go from here?

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