

Laboratory and Field Biosecurity

Student Guide





Laboratory Biosecurity

Welcome & Introductions



Welcome to Laboratory Biosecurity



Introductions

- Instructors
- Students
 - What is your name?
 - Where are you from?
 - Something fun about yourself.

Slide 2



Notes:



Action Plan

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

KNOW	FEEL	BE ABLE TO DO

Your learning doesn't stop with this lesson. Use this space to think about what else you need to do or learn to put the information from this lesson into practice.

What more do I need to know or do?	How will I acquire the knowledge or skills?	How will I know that I've succeeded?	How will I use this new learning in my job?



Key Messages

- A proper biosecurity risk assessment is necessary before implementing an efficient and effective biosecurity program.
- Securing pathogens and toxins can be very different from securing other kinds of materials.
- Physical security is only one component of a successful laboratory biosecurity program.
- Material Control and Accountability, Transport Security, and Information Security complement other security components.
- Security awareness is crucial in laboratory biosecurity.

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Key Messages

- Field work with pathogens and toxins is very different from laboratory work – security is also different in the field versus the laboratory.
- Many laboratory biosecurity measures can be modified and adapted to field work.
- The same frameworks for approaching risk management in laboratories can be utilized in the field.
- Biosecurity risk mitigation in the field places special emphasis material control and accountability as well as personnel reliability.
- Security awareness is crucial in field biosecurity.

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Laboratory Biosecurity

Biorisk Management

Biorisk Management: the **AMP** Model



Biorisk Management =
Asessment, **M**itigation, **P**erformance

Record refresher notes on the AMP model and biorisk management.

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



Slide 6

Define Biorisk Assessment:

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



Define Biorisk Mitigation:



Laboratory Biosecurity

Biorisk Management

Key Components of Biorisk Management

Define Performance:



Laboratory Biosecurity

Laboratory Biosecurity

Laboratory Biosecurity

What is Laboratory Biosecurity?

What are some things that come to mind when thinking about laboratory biosecurity?



Laboratory Biosecurity

Laboratory Biosecurity

Biosecurity Threats

Notes:



Laboratory Biosecurity

Unique Challenges

Unique Challenges

Discussion: What are some **unique challenges to securing biological materials in a laboratory, as opposed to securing:**

- Money
- Dangerous Chemicals
- Nuclear Material
- Electronic Information?

What makes biological materials different?

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Biological materials pose some challenges with regard to security. How is security for biological materials different than securing:

Money

Dangerous Chemicals

Nuclear Material

Electronic Information



Laboratory Biosecurity

Unique Challenges

Unique Challenges

- Viruses and Bacteria can **multiply**, making them difficult to count (and thus, keep track of) in the laboratory.
- Potentially, one need only steal a **small amount**... more can always be grown from that seed stock.
- Detection of theft is almost impossible. Vials are small. Biological agents do not give off energy (unlike radiological materials), making stand-off **detection difficult**.

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What other complications do biological materials present?



Laboratory Biosecurity

Unique Challenges

Unique Challenges

Question: Where can you **find biological materials** in the laboratory?

What should we protect?

- 1) Only vials with well-characterized strains? Closely related strains? Aliquots?
- 2) Genetic materials? Reagents? Vectors?
- 3) Waste?
- 4) Experimental Results? Sequence Information?
- 5) Animals?

How should we protect?

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Where can you find biological materials in the laboratory?

What should we protect?

How should we protect?



Laboratory Biosecurity

Unique Challenges

Unique Challenges

Laboratories, unlike banks or nuclear repositories, **do not often think of themselves as needing to be secure** – this often requires a **cultural change** toward security.

- 1) For most **laboratory workers**, the idea that their biological materials could be desired for intentional misuse is foreign.
- 2) In **academic** settings, openness is valued.
- 3) In a **clinical** setting, security does not typically consider biological materials.

A proper **Risk Assessment** can help determine security needs



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What would be involved in creating a cultural shift toward biosecurity in the laboratory?

Unique Challenges

Group Activity:

A goal of a laboratory is to operate safety and securely, but at times these goals may be at odds with each other.

What are some examples? How do you choose between Safety and Security?

In your group, please spend **10 minutes** to answer the above questions. Put your examples on sticky-notes and place them on your flip chart.

Be prepared to report your answers to the class.

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What are some examples when the goals of biosafety and biosecurity might be different?

What are some examples?

How do you choose between Safety and Security?



Laboratory Biosecurity

Unique Challenges

Unique Challenges Summary

Securing biological materials in the laboratory can be challenging because they can **replicate**, are **hard to detect**, are **found everywhere** and the idea of security in the laboratory setting often requires a **cultural change** as well as good **communication about potential risks**.



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Field Biosecurity

Comparing Lab and Field Biosecurity

Lab and Field Biosecurity

Group Activity:

What are some **differences** between biological work in the **field** and biological work in the **lab**?

In your small groups, spend **10 minutes** listing as many differences as possible. Write each difference on a sticky note and place them on your flip chart.

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BEP

What are some differences between biological work in the field and biological work in the lab?

Are the conditions more mutable in the lab or the field?

Which of these unpredictable conditions might concern you?

How may this present a challenge to Biosecurity?

Lab and Field Biosecurity

In the field...

- Organisms may or may not be well-characterized
- The work area may not have a well-defined perimeter
- Work procedures must be flexible to conform to very different and rapidly changing situations
- There may not be buildings or fixed equipment

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Lab and Field Biosecurity

In the field...

- Work may be short-term, fast-paced, and disorganized
- There may be a higher likelihood of interactions with persons and animals unaccustomed to biological work
- Work (and samples) must be easily mobile

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Lab and Field Biosecurity

What is unique about field Biosecurity?

Lab and Field Biosecurity

What is unique about field Biosecurity?



Laboratory Biosecurity

Unique Challenges

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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Field Biosecurity

Comparing Lab and Field Biosecurity

Biosecurity Risk Mitigation

There are five pillars of Biosecurity Risk Mitigation

- 1) Physical Security
- 2) Personnel Management
- 3) Material Control & Accountability
- 4) Transport Security
- 5) Information Security

Question: How would you apply these elements in the field?

As we work through each pillar, make notes in your workbook. Then afterward, you will work in your **small group**, to present one of the pillars to the class with examples of how to apply the pillar **in the field**.

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Biosecurity Risk Mitigation – Field Examples

	Physical Security	Personnel Management	Material Control & Accountability	Transport Security	Information Security
Definition					
Examples					

Biosecurity Risk Mitigation

There are five pillars of Biosecurity Risk Mitigation

- 1) Physical Security
- 2) Personnel Management
- 3) Material Control & Accountability
- 4) Transport Security
- 5) Information Security

What makes biological materials different?



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Physical Security

The first “pillar” is **Physical Security**

Physical Security is the assurance of safety from physical intrusion

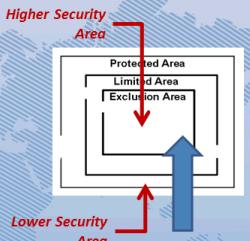


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Physical Security

An important concept in **Physical Security** is the concept of **Graded Protection**. This is based on the idea that different areas of a facility will have **different levels of security** based on risk.

Graded Protection is manifested in concentric rings of increasing security spanning **from outside to inside** the facility.



What are some examples of graded protection?

Physical Security

Graded Protection

Property Protection Areas (Low risk assets)

- Grounds
- Public access offices
- Warehouses

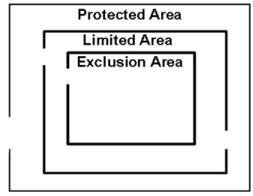
Limited Areas (Moderate risk assets)

- Laboratories
- Sensitive or administration offices
- Hallways surrounding Exclusion Areas

Exclusion Areas (High risk assets)

- High containment laboratories
- Computer network hubs

Concentric Layers of Security



Question:
Why is concentric good?

BEP

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Why is concentric good?

Physical Security

3 Principles of Physical Security:

- **Detection**
- **Delay**
- **Response**

We will also cover **Access Control**, which is another important, overall, aspect of physical security.



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Physical Security

Principle 1) **Detection**

Intrusion **Detection** is the process of determining whether an unauthorized action has occurred or is occurring

Detection includes sensing the action, communicating the alarm, and assessing the alarm



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Physical Security

Principle 1) **Detection**

For Example:

Intrusion **Detection** can be as complicated as a **closed-circuit television system**, infrared and **motion sensors**, and **guards** patrolling throughout the facility.

Or, it could be as simple as good **training** of laboratory staff and a procedure to call someone in case a suspicious person is noticed in the laboratory.



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Physical Security

Principle 2) **Delay**

Delay is simply the act of slowing down an intruder's progress in your facility long enough so that the adversary may be detected, assessed and responded to.

There are many ways of delaying an intruder

- Guards
- Perimeter Fencing
- Solid doors with locks
- Bars on windows
- Magnetic switches on doors



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Physical Security

Principle 3) Response

Response is the act of alerting, transporting, and staging a security force to interrupt and neutralize an adversary.

Response is tied to the overall system objective

Deny: To prevent an adversary from reaching the target/objective

Contain: To 'catch' an adversary before they leave with the target or before they accomplish the objective



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Physical Security

Principle 3) Response

For Example:

Based on your **Risk Assessment** and **scenario analysis**, **Response** can range from implementing a **guard force** in your facility to establishing a line of **communication** with your local **police force**.



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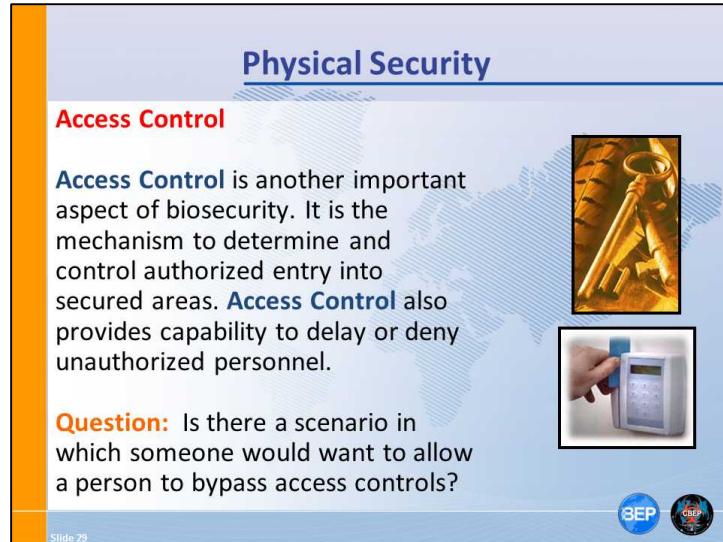
Physical Security

Access Control

Access Control is another important aspect of biosecurity. It is the mechanism to determine and control authorized entry into secured areas. **Access Control** also provides capability to delay or deny unauthorized personnel.

Question: Is there a scenario in which someone would want to allow a person to bypass access controls?

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Is there a scenario in which someone would want to allow a person to bypass access controls?

Physical Security

Access Control

For Example, access granted based on:

Something you have

Key

Card (Credential)

Something you know

Personal Identification Number (PIN)

Password

Something you are

Biometric feature (i.e., fingerprints)



Notes

Physical Security Activity

Group Activity:

A facility is working with large quantities of cultured *Yersinia pestis* in a laboratory area accessed by approximately 30 people. After a risk assessment, the laboratory director fears terror groups may try to access these cultures.

In your group, please spend **15 minutes** to design a physical security system for this facility. Please discuss how you would detect, delay and respond to potential intruders, and how you would control access.

Use your flip charts to design your physical security system and be prepared to report to the class.

Plan out your physical security system:



Laboratory Biosecurity

Physical Security

Physical Security

Discussion:



What do you do in your laboratories at home to prevent people from entering areas they are not supposed to?

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Biosecurity Risk Mitigation

There are five pillars of Biosecurity Risk Mitigation

- 1) Physical Security
- 2) **Personnel Management**
- 3) Material Control & Accountability
- 4) Transport Security
- 5) Information Security

*What makes
biological
materials
different?*

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Personnel Management

The second “pillar” is **Personnel Management**

Personnel Management in the context of biosecurity, it is the assurance that the people that are given access to sensitive biological materials **should** have that access.



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Personnel Management

The Objectives of a Personnel Management Program are to:

Understand that human factors can significantly impact the success of biorisk management.

- To reduce the risk of theft and fraud
- To reduce the risk of scientific misconduct
- Etc..

To support the procedural and administrative access control requirements

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Personnel Management

For Example: These are some factors that can influence **Human Performance**

- **Job**
 - Setting
 - Values
- **Individual**
 - Personalities
 - Values
- **Organization**
 - Expectations
 - Assessments



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Laboratory Biosecurity

Personnel Management

Personnel Management

Notes:



Laboratory Biosecurity

Personnel Management

Personnel Management

Question:
What are some factors to consider when assessing the **risk of insider** versus **outsider** threat?

An **insider** is a person who has authorized access to a facility, its units (such as laboratories), and its assets.

An **outsider** is a person who does not have authorized access.

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What are some factors to consider when assessing the risk of insider versus outsider threat?

Insider

Outsider



Laboratory Biosecurity

Personnel Management

Personnel Management

Notes:

Biosecurity Risk Mitigation

There are five pillars of Biosecurity Risk Mitigation

- 1) Physical Security
- 2) Personnel Management
- 3) **Material Control & Accountability**
- 4) Transport Security
- 5) Information Security

*What makes
biological
materials
different?*

We will also discuss a sixth topic:

- 6) Security Awareness

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Material Control & Accountability

The third “pillar” is **Material Control & Accountability**

Material Control & Accountability is the assurance that there is an awareness of what exists in the field, where it is, and who is responsible for it.



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Material Control & Accountability

The Objective of MC&A is to:

- Ensure the complete and timely knowledge of:
 - What materials exist
 - Where the materials are
 - Who is accountable for them
- Objective is NOT to detect whether something is missing. This could be impossible. The objective is to create an environment that discourages theft and misuse by establishing oversight.

Question: Why might MC&A be *particularly* important for field biosecurity?

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Material Control & Accountability

Key Issues in MC&A

- What materials are subject to MC&A measures?
- What operating procedures are associated with the materials?
 - Where can they be stored and used?
 - How are they identified?
 - How is inventory maintained?
- What records need to be kept for those materials? What timeliness requirements are necessary for those records?
- What does accountability mean?
- What documentation and reporting requirements?



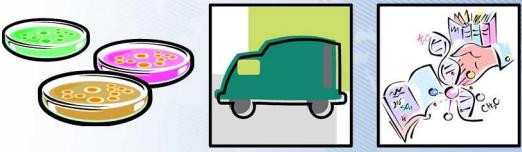
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Material Control & Accountability

Material Control & Accountability



Question: What Material should we keep track of in the Field?

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BEP

Material Control & Accountability

Material Control & Accountability

- Control is either...
 - Engineered / Physical (Locks)
 - Administrative (Chain of Custody)
- Containment is part of material control
 - Containment During Transport / Freezer / Ampoule
- Procedures are essential for material control
 - For both normal and abnormal conditions



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Material Control & Accountability

Material Control & Accountability

All material should have an associated “accountable person” who is ultimately responsible for the material.

- The person best in a position to answer questions about the associated material
- Not someone to blame!
- Ensure that no material is “orphaned”



Material Control & Accountability

Scenario:

Your team of 3 researchers and 12 assistants is in the field collecting fleas, ticks and dead rodents at the site of a suspected outbreak of *Yersinia pestis*.

You are working in a remote region, where petty crime is endemic and there has been some civil unrest involving separatist groups with ties to international terrorist organizations. However, your work site is located in an isolated wooded area. Your work area is very large and you have several vehicles and tents in one clearing where you will keep your equipment and plan to store samples. You expect to be in the field 5 days.



MC&A Scenario

Group Activity:

In your groups, please spend **15 minutes** to develop a **Biosecurity MC&A Plan** for this scenario.

Be sure to identify the **Material** you will be protecting, how you will **Control** the material and how **Accountability** will be used as a risk mitigation measure.

Outline your MC&A Plan on your flip-chart and be prepared to report to the class.

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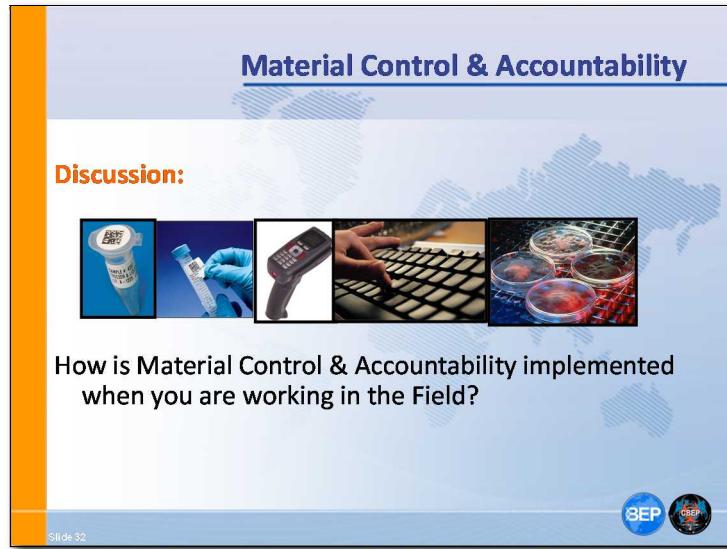
BEP

Biosecurity MC&A Outline:

Material:

Control:

Accountability:



Notes:

Biosecurity Risk Mitigation

There are five pillars of Biosecurity Risk Mitigation

- 1) Physical Security
- 2) Personnel Management
- 3) Material Control & Accountability
- 4) Transport Security**
- 5) Information Security

What makes biological materials different?

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Transport Security

The fourth “pillar” is **Transport Security**

Field Transport Security is the assurance that risk mitigation controls and processes are in place to protect biological materials during transport from the field to the laboratory.



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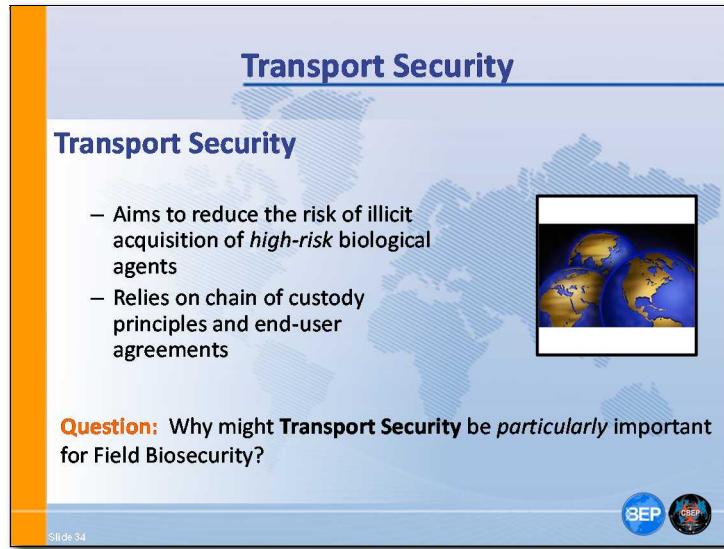
Transport Security

Transport Security

- Aims to reduce the risk of illicit acquisition of *high-risk* biological agents
- Relies on chain of custody principles and end-user agreements

Question: Why might Transport Security be *particularly* important for Field Biosecurity?

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BEP OIEP

Transport Security

Chain of Custody (CoC)

Aims to protect sample by documenting...

- All individuals who have control of sample
- Secure receipt of material at appropriate location

Chain of custody documentation includes...

- Description of material being moved
- Contact information for a responsible person
- Time/date signatures of every person who assumes control



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BEP QEP

Transport Security

External Carrier

If using an external carrier, the same procedures used for securing materials for transport out of a laboratory should be employed in the field, whenever possible.

Field Personnel

If field personnel will be transporting samples, internal guidelines for doing so, in many ways similar to the requirements for MC&A in the field, should be developed to ensure samples are moved securely.



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BEP QEP

Transport Security

So, we want to keep our high-risk samples secure during transport. What should you do?

- Require a responsible authority to pre-approve all transport
- Advise eligible receiving party of transport
- Document transport in lab records
- Ensure only trustworthy people handle the samples
- Physically secure samples in transit with special packaging and/or locks
- Control movements and document in delivery records
- Use timely shipping methods
- Maintain a Chain of Custody
- Request notification of receipt

Other ideas?



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Transport Security

For Example: When Transporting..

Moderate risk agents...

- Internal transport personnel screened
- Recipient screened for legitimacy
- Safe receipt notification

High risk agents...

- Moderate plus
 - Chain of custody
 - Physical controls on storage containers



A proper **Risk Assessment** can help determine transport security needs

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Field Biosecurity

Field Biosecurity Risk Mitigation Strategies

Transport Security

Group Activity:

Your team must send 10 sample vials suspected of containing infectious *Burkholderia mallei* to the area's state diagnostic laboratory

Spend **15 minutes** to **Develop a Procedure** for securing the sample during transport (including documentation). Then act it out with the receiving lab. (Remember, you'll be receiving samples too!)

Consider how might you apply **Physical Security, Personnel Management, and Material Control & Accountability** to a sample of valuable biological material on the move?

BEP

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Transport Procedure:

Standard Operating Procedure Pattern

Conditions	Who should use the SOP?	When should it be used?	Why should the SOP be used?	Where should it be used?								
Context												
Input(s):												
Output:												
Preparation:												



Field Biosecurity

Field Biosecurity Risk Mitigation Strategies

Transport Security

Discussion:



How do you secure biological materials in the field during transport?

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Biosecurity Risk Mitigation

There are five pillars of Biosecurity Risk Mitigation

- 1) Physical Security
- 2) Personnel Management
- 3) Material Control & Accountability
- 4) Transport Security
- 5) **Information Security**

What makes biological materials different?

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The fifth “pillar” is **Information Security**

Information Security is the assurance that the **sensitive** and **valuable** information stored in a laboratory is protected from theft or diversion.

Question: What kind of information do you think this might include?
Work for **5 minutes** with your group and share your ideas with the class.

What are some examples of information security?



Information Security

Information Security may not be the most obvious area of biosecurity, but a failure here could have very severe consequences in terms of securing pathogens and toxins.

Document control and **computer security** is necessary to reduce risks in a facility. However, these can also be intrusive. Any policies implemented should be based on a **robust risk assessment**.



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Information Security

The Objective of **Information Security** is to:

Protect information that is too sensitive for public distribution

- Label information as restricted
- Limit distribution
- Restrict methods of communication
- Implement network and desktop security



Biosecurity-related sensitive information

- Security of dangerous pathogens and toxins
 - Risk assessments
 - Security system design
- Access authorizations



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Information Security

Identification, Control, and Marking

Identification

- Designated sensitivity level
- A review and approval process aids in the identification of sensitivities
 - Critical prior to public release of information

Control

- Individual responsible for control of sensitive information
 - Physical security
 - Communication security
- In the US, in order to refuse public access upon request, information must be exempt from the Freedom of Information Act

Marking

- Sensitivity level designation
 - Top and bottom of each page / cover sheet
- Marking and control methods should be well understood by those working with information



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Information Security

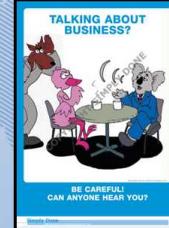
Communication and Network Security

Communication Security

- Mail, email, or fax security is required
- Limited discussions in open areas
- Information should only be reproduced when needed and each copy must be controlled as the original

Network Security

- Firewalls
- User authentication
- Virus protection
- Layered network access
- Desktop security
- Remote and wireless access controls
 - Encryption
 - Authentication



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Information Security

Security Considerations for Network Systems

Administrators have full control

- The ultimate insider

Protect the system using procedures

- Two person control
- Configuration management
- Password control

Restrict operator privileges

Provide physical protection for equipment

Backup equipment and procedures must be provided to maintain security

Emergency power and uninterruptible power supply required for computers



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How is network access assigned?



Information Security

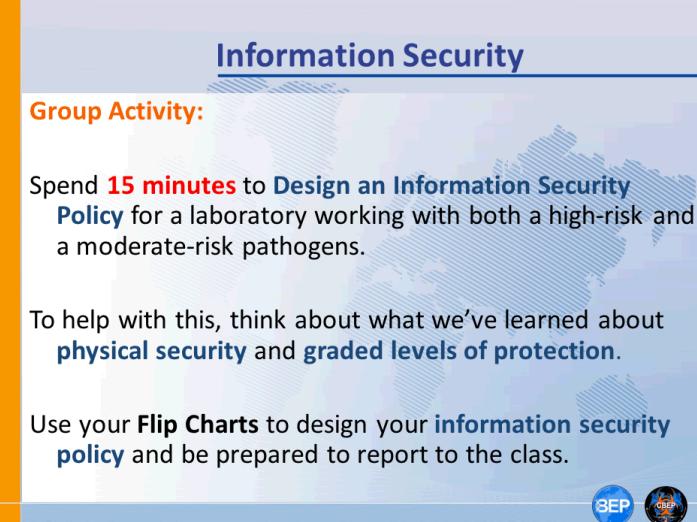
Group Activity:

Spend **15 minutes** to **Design an Information Security Policy** for a laboratory working with both a high-risk and a moderate-risk pathogens.

To help with this, think about what we've learned about **physical security** and **graded levels of protection**.

Use your **Flip Charts** to design your **information security policy** and be prepared to report to the class.

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Your Information Security Policy:

High risk pathogens:

Low risk pathogens:



Laboratory Biosecurity

Information Security

Information Security

Notes:



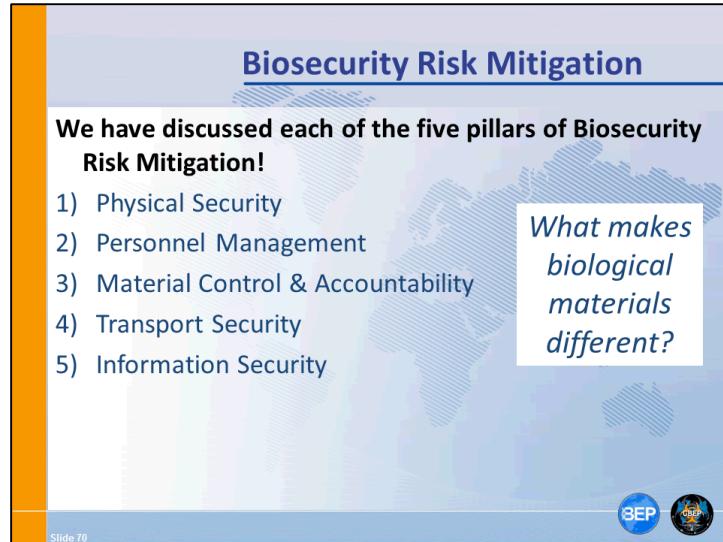
Biosecurity Risk Mitigation

We have discussed each of the five pillars of Biosecurity Risk Mitigation!

- 1) Physical Security
- 2) Personnel Management
- 3) Material Control & Accountability
- 4) Transport Security
- 5) Information Security

What makes biological materials different?

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Field Biosecurity

Field Biosecurity Risk Mitigation Strategies

Biosecurity Risk Mitigation

There are five pillars of Biosecurity Risk Mitigation

- 1) Physical Security
- 2) Personnel Management
- 3) Material Control & Accountability
- 4) Transport Security
- 5) Information Security

Question: How would you apply these elements in the field?

As we work through each pillar, make notes in your workbook. Then afterward, you will work in your **small group**, to present one of the pillars to the class with examples of how to apply the pillar **in the field**.

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Security Awareness

The final topic is **Security Awareness**

Security Awareness is general awareness of the proper security posture in your laboratory, where the risks are, and what should be done.



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BEP  

Security Awareness

For Example: Security Awareness

Most bioscience facilities are not accustomed to worrying too much about security, so appropriate security awareness may require a very difficult **cultural shift**.

Security Awareness will be easier to achieve if personnel in your laboratory trust that a **biosecurity risk assessment** is accurate and robust.



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Security Awareness

If the people in your facility are **aware** of the **true biosecurity risks** they face, they will be more likely to:

- 1) Report if someone strange is walking around
- 2) Keep an eye on sample storage areas and assign security responsibilities to each other
- 3) Keep sensitive information safe
- 4) Provide suggestions for improving security
- 5) Take training more seriously
- 6) Etc...



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Laboratory Biosecurity

Security Awareness

Security Awareness

How does security awareness tie in to the other pillars?



Laboratory Biosecurity

Security Awareness

Security Awareness

Notes:

Final Review

Review

For **10 minutes**, let's discuss what we have learned about **Laboratory Biosecurity**.

What did we learn? What does it mean? Where do we go from here?

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Key Messages

- A proper biosecurity risk assessment is necessary before implementing an efficient and effective biosecurity program.
- Securing pathogens and toxins can be very different from securing other kinds of materials.
- Physical security is only one component of a successful laboratory biosecurity program.
- Material Control and Accountability, Transport Security, and Information Security complement other security components.
- Security awareness is crucial in laboratory biosecurity.

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Key Messages

- Field work with pathogens and toxins is very different from laboratory work – security is also different in the field versus the laboratory.
- Many laboratory biosecurity measures can be modified and adapted to field work.
- The same frameworks for approaching risk management in laboratories can be utilized in the field.
- Biosecurity risk mitigation in the field places special emphasis material control and accountability as well as personnel reliability.
- Security awareness is crucial in field biosecurity.

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