

**Security Risk Assessment of  
*M. tuberculosis***

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*Risk Assessment for Laboratory  
Biosecurity and Biosafety  
Nashville, TN  
6 October 2007*

[www.biosecurity.sandia.gov](http://www.biosecurity.sandia.gov)

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**Hazard vs. Risk**

- **Hazard: The way in which an object or a situation may cause harm**
  - A hazard exists where an object (or substance) or situation has an inherent ability to cause an adverse effect
- **Risk: The chance that harm will actually occur**
  - Risk is the chance that such effects will occur
  - The risk can be high or negligible
- **Risk is a function of probability AND consequences**





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**Assessment Methodology**

- **Characterize agents (pathogens and toxins) and threats**
  - Evaluate the pathogens and toxins at the facility
  - Evaluate the adversaries who might attempt to steal those pathogens or toxins
- **Evaluate scenarios**
  - Create scenarios
    - Example: a specific adversary attempting to steal and misuse a specific biological agent
  - Determine how the various scenarios could be perpetrated
- **Characterize the risk**
  - Evaluate threat potential and consequences of each scenario
  - Assist in determining acceptable and unacceptable risks, and in developing risk statement or definition
- **The problem should be defined in terms or criteria that are relevant to the problem, understandable, measurable, and non-redundant.**






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**Characterize agents and threats**

- **Evaluate the pathogens and toxins at the facility**
  - Assess the biochemical properties of the pathogens and toxins to determine how easy or difficult it would be to successfully use them maliciously
  - Assess the potential consequences of malicious use of those pathogens and toxins
- **Evaluating the adversaries who might attempt to steal those pathogens or toxins**






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**Agent Assessment**

- **Consequences**
  - Population Impact
    - Transmission
    - Mortality
    - Morbidity
    - Pre and Post Exposure Countermeasures
  - Economic Impact
  - Psychological Impact
- **Task Complexity**
  - Difficulty of acquiring the agent
  - Difficulty of processing the agent into a suitable quantity in a suitable form for most appropriate dissemination pathway
  - Difficulty of disseminating the agent to cause harm




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**Agent Assessment *M. Tuberculosis***

- **Consequences**
  - Population Impact
    - There would be a small population impact for a malicious attack using TB
    - Tuberculosis is spread through the air by sputum with a low infection dose
    - The mortality rate is high for untreated TB (50% to 90%), low for treated TB
    - The mobility is moderate (less than 50% would require hospitalization, more than 50% would require outpatient care)
  - There is little direct economic impact, an outbreak may have indirect economic impacts due to the limitations of the public health system
  - In areas where TB is endemic, a malicious attack using TB would not have a significant impact
- **Task Complexity**
  - Acquisition
    - TB is easily acquired
    - There is no regulation
    - TB is globally distributed
  - Production
    - TB is difficult to grow
    - TB is very stable
  - Dissemination
    - TB is environmentally hardy but vulnerable to UV and heat
    - TB can be disseminated via aerosol





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## Threat Assessment

- **Adversary Motive**
  - Motive characterizes why an adversary would steal a pathogen or toxin.
- **Adversary Means**
  - Means is a characterization of the adversary's technical skills, operational knowledge, and necessary tools required to conduct the scenario
- **Adversary Opportunity**
  - Opportunity characterizes whether an adversary could steal the biological agent covertly or must steal it overtly. This is based on the degree of the adversary's access to the asset.




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## Threat Environment

- **Aspects which might increase the overall threat to the facility:**
  - High incidence of crime in area
  - Activist groups
  - Local or national political instability
  - Internal discontentment among laboratory staff




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## Creation and Evaluation of Scenarios

- **Create Scenarios**
  - Specific pathogen or toxin
  - An individual or group of individuals who wish to steal a pathogen or toxin from a bioscience laboratory
  - The theft of a pathogen or toxin
- **Screen Agents and Adversaries**
  - Remove assets and adversaries which do not pose a significant threat

EMUR – Extreme Malicious Risk Group

HMUR – High Malicious Risk Group

MMUR – Moderate Malicious Risk Group

Asset	Adversary	Action
EMUR	Insider	Theft of the pathogen or toxin
EMUR	Terrorist Group	Theft of the pathogen or toxin
EMUR	Coaching Terrorist Group	Theft of the pathogen or toxin
HMUR	Insider	Theft of the pathogen or toxin
HMUR	Terrorist Group	Theft of the pathogen or toxin
HMUR	Coaching Terrorist Group	Theft of the pathogen or toxin
MMUR	Single Terrorist	Theft of the pathogen or toxin
MMUR	Insider	Theft of the pathogen or toxin
MMUR	Single Terrorist	Theft of the pathogen or toxin

Table 3. Scenarios in a Full Bioscience Risk Assessment




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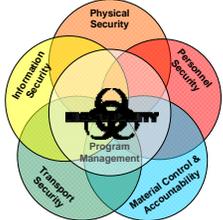
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## Vulnerability Assessment

- In the context of a biosecurity risk assessment, this vulnerability assessment entails reviewing the existing implementation of the biosecurity components:
  - Physical security
  - Personnel security
  - MC&A
  - Transport security
  - Information security
  - Program management



**International**  
BIOLOGICAL THREAT REDUCTION

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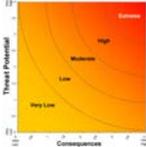
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## Characterize the Risk

- Evaluate threat potential and consequences of each scenario
  - Agent task complexity
  - Adversary attributes
  - Site vulnerability
- Assist in determining which scenarios represent acceptable risks and which represent unacceptable risks
- Assist in developing a definition to articulate the objectives of the biosecurity system
  - Deny
  - Contain
  - Deter



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BIOLOGICAL THREAT REDUCTION

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## Evaluate Threat Potential and Consequences of Scenarios

$$\text{Biosecurity Risk} = (\text{Threat Potential}) \cdot (\text{Consequences})$$

**Threat Potential** = Site Vulnerability, Agent Task Complexity, Adversary Attributes  
**Consequences** = Population, Economic, Psychological, Operational  
**Adversary Attributes** = Motive, Means, Opportunity  
**Agent Task Complexity** = Acquisition, Development, Dissemination  
**Site Vulnerability** = Physical Security, Personnel Security, MC&A, Information Security, Transport Security, Program Management

Reference: Laboratory Biosecurity Handbook, by Reynolds M. Salerno, Jennifer Gaudioso CRC; 1 edition (June 20, 2007) ISBN-10: 0849364752

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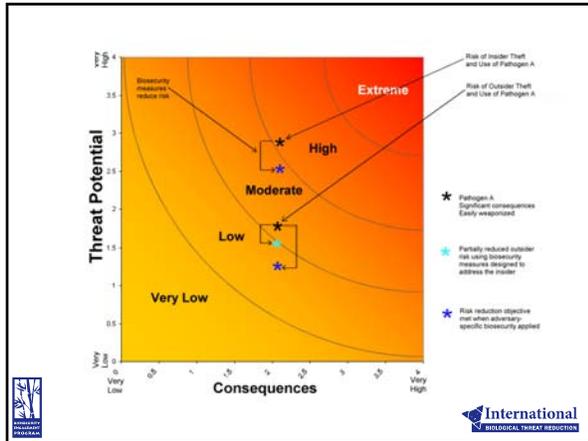
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