



Biosecurity Risk Assessment

SNL Biosecurity Team

Principles of Laboratory Biosecurity Course

ABSA Summer Seminar Series

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,
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Risk Management

- **Establishes which assets should be protected against which threats**
 - **Assets include items that are:**
 - Dangerous
 - Hard to replace
 - Rare
 - Critical to operations

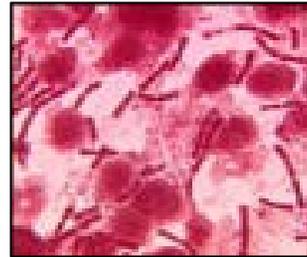
- **Ensures that the amount of protection provided to a specific asset, and the cost for that protection, is proportional to the risk of the theft or destruction of that asset**

- **Begins with a risk assessment**
- **Proceeds with risk mitigation**
- **Continuously improves with monitoring and adjustment**



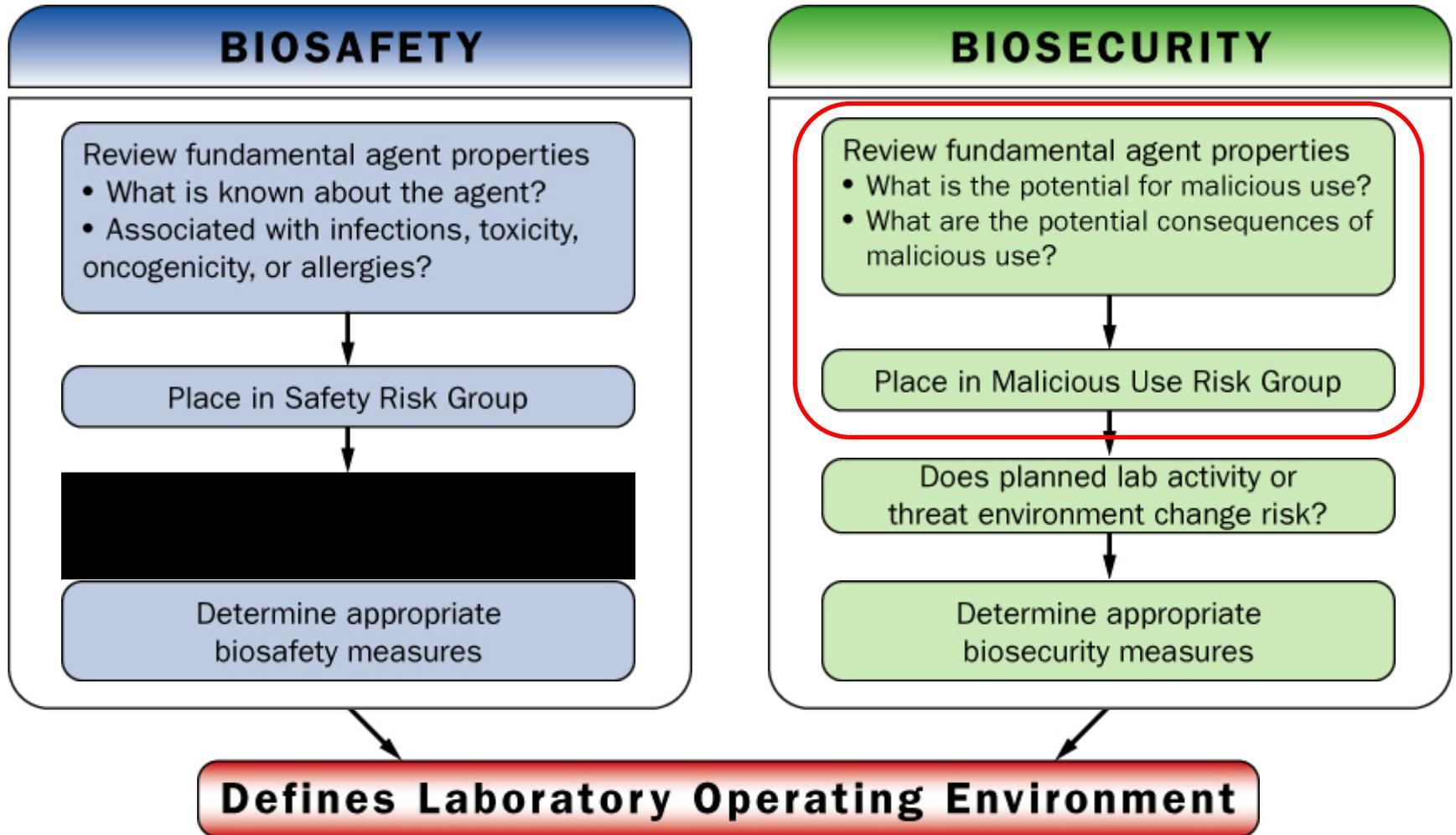
Biosecurity Risk Assessment

- 1. Evaluate assets**
- 2. Evaluate threat**
- 3. Evaluate risk**





Integrated Biosafety and Biosecurity





Malicious Use Risk Group Evaluation

- **Assess value of the agents from an adversary's perspective**
 - **Consequences**
 - Contagiousness
 - Medical effects (morbidity and mortality)
 - Potential to become endemic
 - Economic impact
 - **Weaponization potential**
 - Acquisition
 - Production
 - Ease of growth
 - Ease of processing
 - Ease of storage
 - Dissemination
 - Modes (e.g. Aerosol, Oral)
 - Environmental hardiness

REPORTS

Chemical Synthesis of Poliovirus cDNA: Generation of Infectious Virus in the Absence of Natural Template

Jeronimo Cello, Aniko V. Paul, Eckard Wimmer*

9 AUGUST 2002 VOL 297 SCIENCE www.sciencemag.org

Journal of Virology, Feb. 2001, p. 1205-1210
0022-5307/01/504-01+0 DOI: 10.1128/JVI.75.3.1205-1210.2001
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Expression of Mouse Interleukin-4 by a Recombinant Ectromelia Virus Suppresses Cytolytic Lymphocyte Responses and Overcomes Genetic Resistance to Mousepox

RONALD J. JACKSON,^{1,2*} ALSTAIR J. RAMSAY,^{2†} CARENA D. CHRISTENSEN,² SANDRA BEATON,² DUANA F. HALL,^{1‡} and IAN A. RAMSHAW²

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Malicious Use Risk Groups

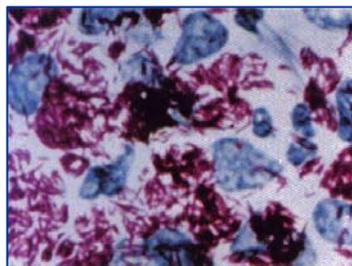
- **Nonpathogenic**
 - Malicious use would have insignificant or no consequences
- **Low Malicious Use Risk (LMUR)**
 - Difficult to deploy, and/or
 - Malicious use would have few consequences
- **Moderate Malicious Use Risk (MMUR)**
 - Relatively difficult to deploy, and
 - Malicious use would have localized consequences with low to moderate casualties and/or economic damage
- **High Malicious Use Risk (HMUR)**
 - Not particularly difficult to deploy, and
 - Malicious use could have national or international consequences, causing moderate to high casualties and/or economic damage
- **Extreme Malicious Use Risk (EMUR)**
 - Would normally be classified as HMUR, except that they are not found in nature (eradicated)
 - Could include genetically engineered agents, if they were suspected of being a HMUR





LMUR Agent Example: *Mycobacterium leprae*

- **Consequences**
 - **Leprosy**
 - Not highly virulent, most exposed people do not develop leprosy
 - Not highly contagious
 - Completely curable – majority recover without treatment
- **Weaponization potential**
 - Production is a significant challenge
 - Not environmentally hardy
- **Assessment: low consequences and low weaponization potential**

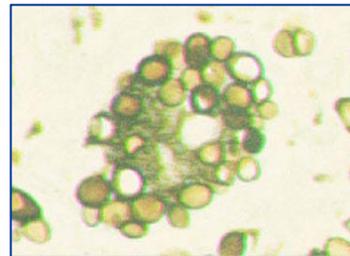


Mycobacterium leprae



MMUR Agent Example: *Coccidioides immitis*

- **Consequences**
 - **Coccidioidomycosis (Valley fever)**
 - Usually asymptomatic, 30-40% of infected become ill
 - Not contagious
 - 5-10 out of every 1000 infected develop life-threatening infection
- **Weaponization potential**
 - Requires technical skills to handle
 - Easy to procure virulent strain (wide endemic area)
 - Easy to grow colonies and produce spores
- **Assessment: low to moderate consequences and moderate weaponization potential**

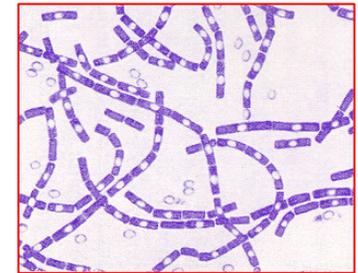


Coccidioides immitis



HMUR Agent Example: *Bacillus anthracis*

- **Consequences**
 - **Pulmonary anthrax (via aerosolized anthrax)**
 - High fatality rate
 - Not contagious, relatively high infectious dose required
 - Early diagnosis is difficult
- **Weaponization potential**
 - History of weaponization and terrorist use
 - Wide endemic area but many less virulent strains
 - Easy to grow colonies and produce spores
 - Very stable in environment and storage
- **Assessment: moderate to high consequences and relatively high weaponization potential**

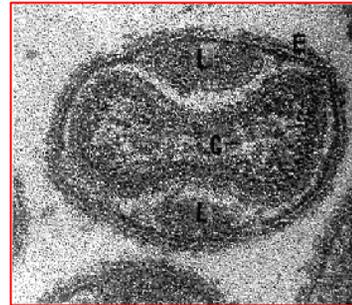


Bacillus anthracis



EMUR Agent Example: Variola major virus

- **Consequences**
 - **Smallpox**
 - High fatality rate
 - Contagious
 - Very few people vaccinated
- **Weaponization potential**
 - History of weaponization
 - Very stable in aerosol
 - Extremely difficult to obtain
- **Assessment: high consequences and moderate weaponization potential**



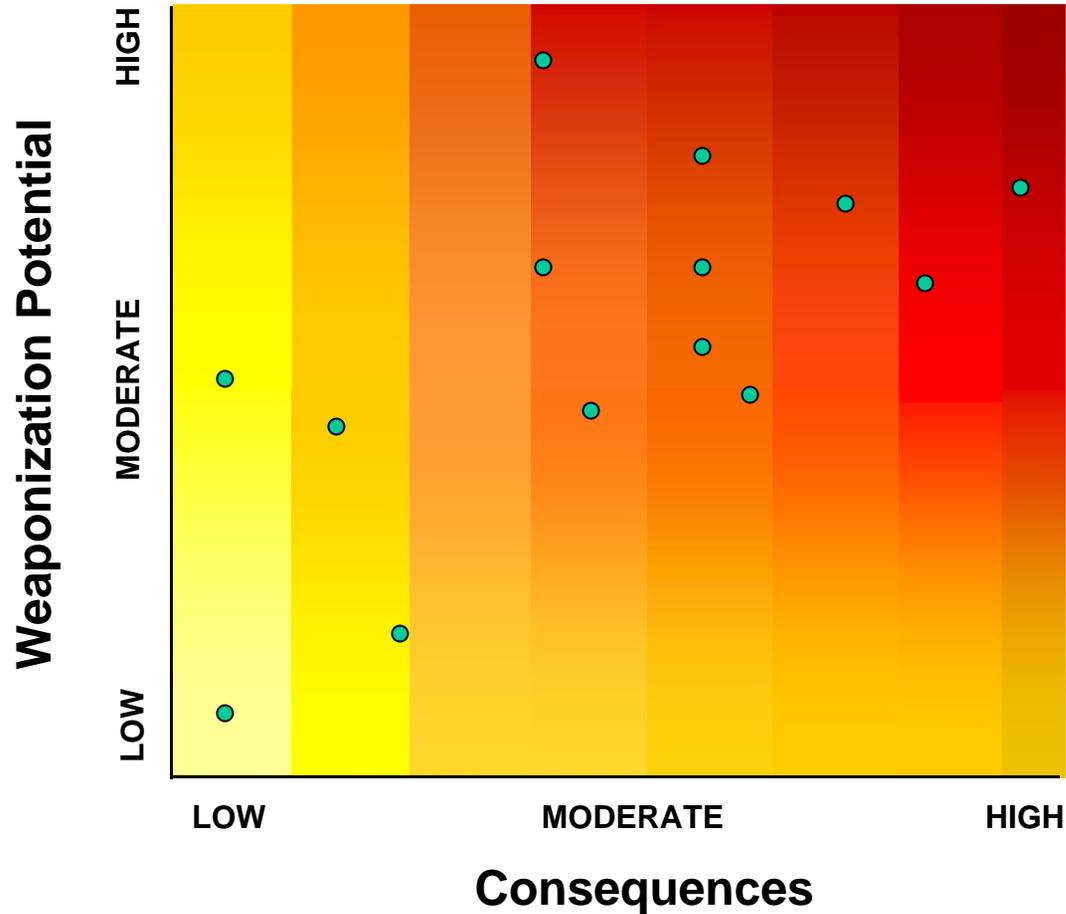
Variola major



Patient's leg covered in smallpox



Results of Malicious Use Risk Group Evaluation





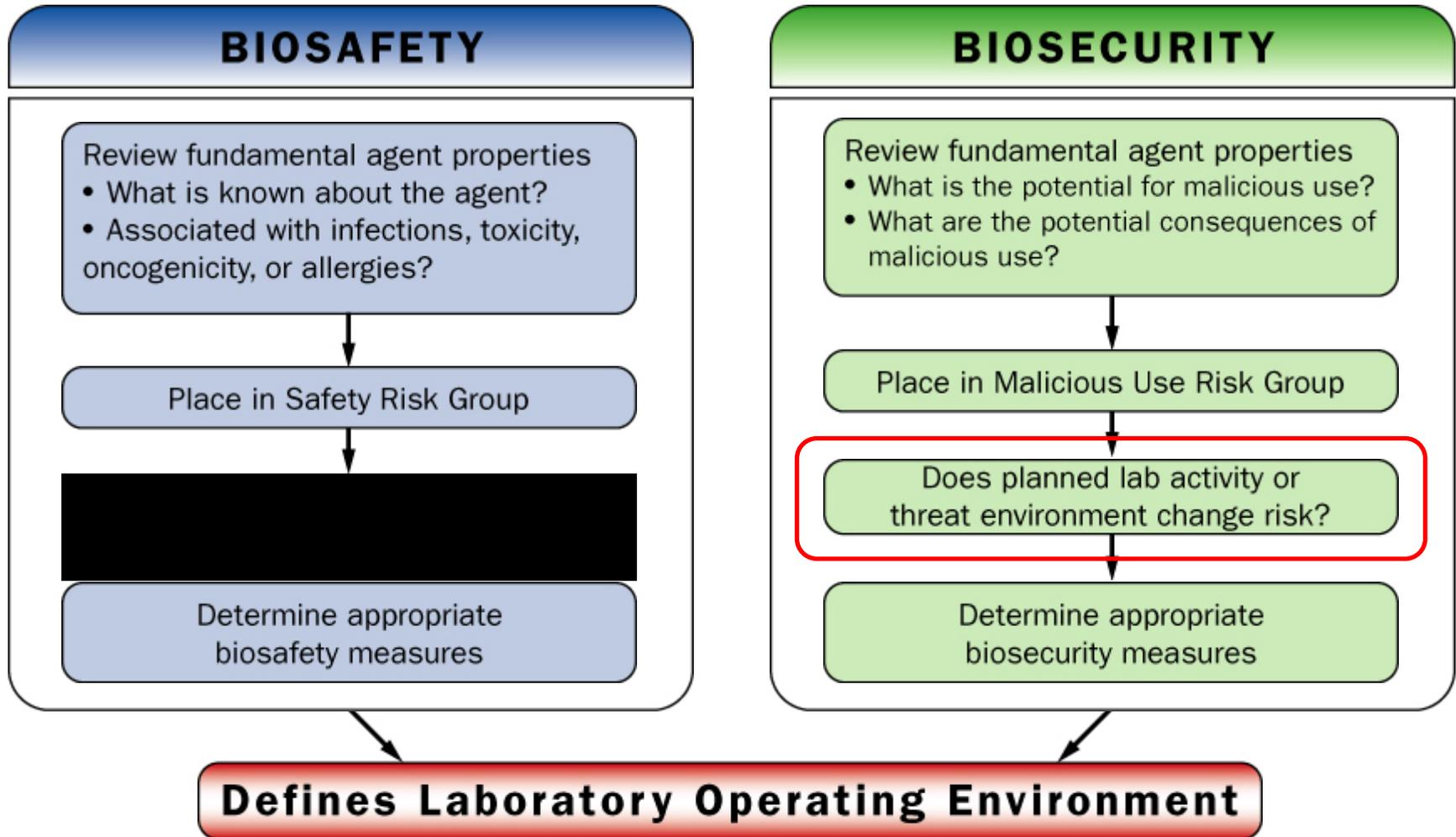
Other Assets at Biological Facilities

- **Security Information or Systems**
 - May be targeted to facilitate gaining access to dangerous biological materials

- **Other Facility Assets**
 - May be targeted by political extremists, disgruntled employees, etc.
 - May include:
 - High containment laboratories
 - Animals



Integrated Biosafety and Biosecurity





Elements That May Modify Risk

- **Consider lab experiment**
 - **Does planned experiment produce an agent with higher weaponization potential or higher potential consequences?**





Threat Environment

- **Adversary Classes**

- Terrorist
- Extremist
- Psychotic
- Criminal

- **Insiders**

- Authorized access to the facility, dangerous pathogens, and/or restricted information
- Distinguish Insiders by level of authorized access
 - Site
 - Building
 - Asset
- Facility management, site security, and local law enforcement interviews

- **Outsiders**

- No authorized access
- Local law enforcement, site security, and intelligence community interviews





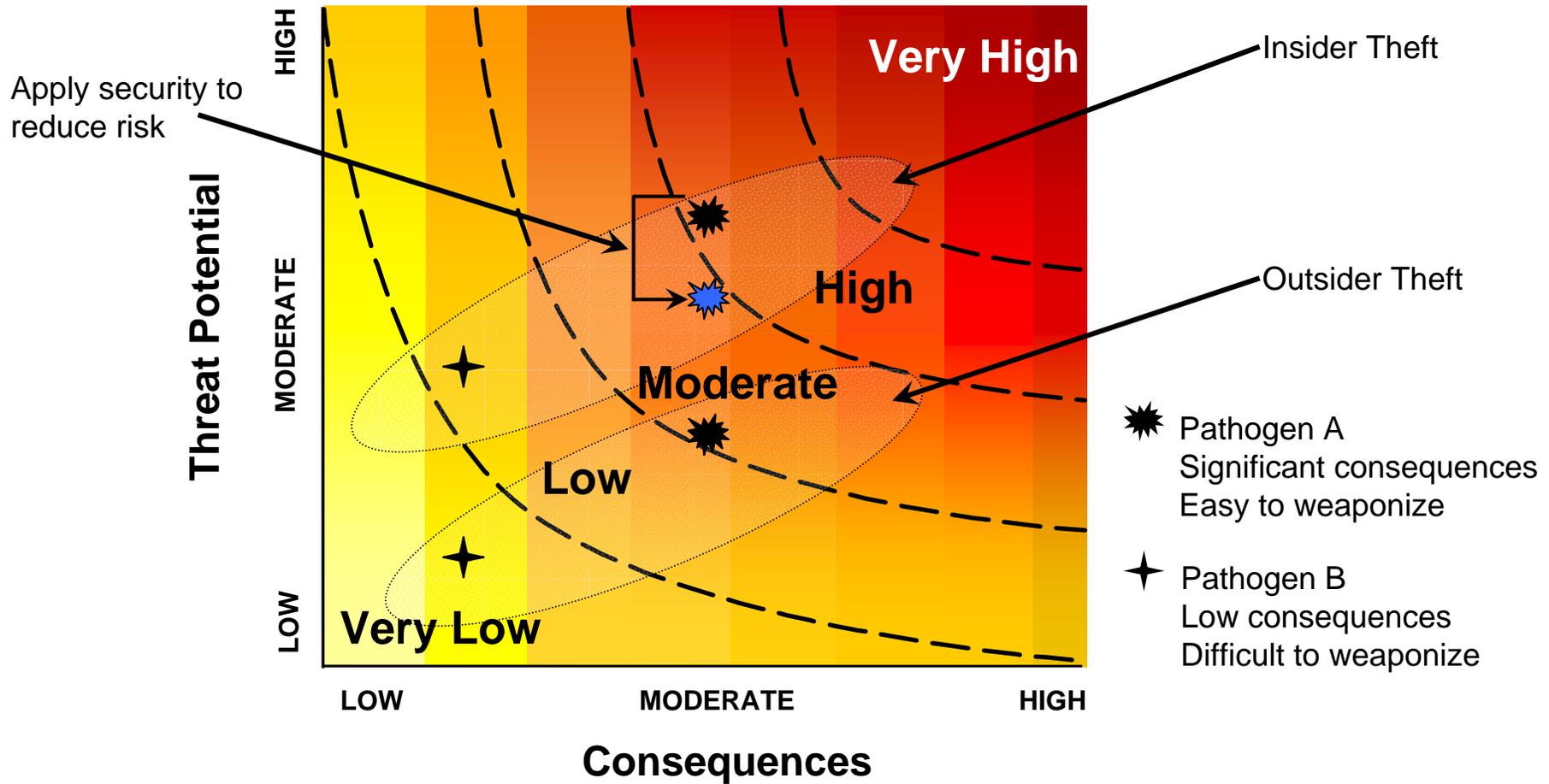
Threat Potential

Evaluate threat potential of possible adversaries:

- **Motive**
 - **Asset Attractiveness**
 - How well does the acquisition or sabotage of the asset achieve the adversary's objective, or lead to achieving the adversary's objective?
- **Means**
 - **Capability**
 - Does the adversary have the skills, knowledge, and tools necessary to conduct the attack/meet the objective?
- **Opportunity**
 - **Environment**
 - Is the adversary active in the area?
 - How recently have they acted in ways that may be threatening?
 - Has there been any indication of targeting?

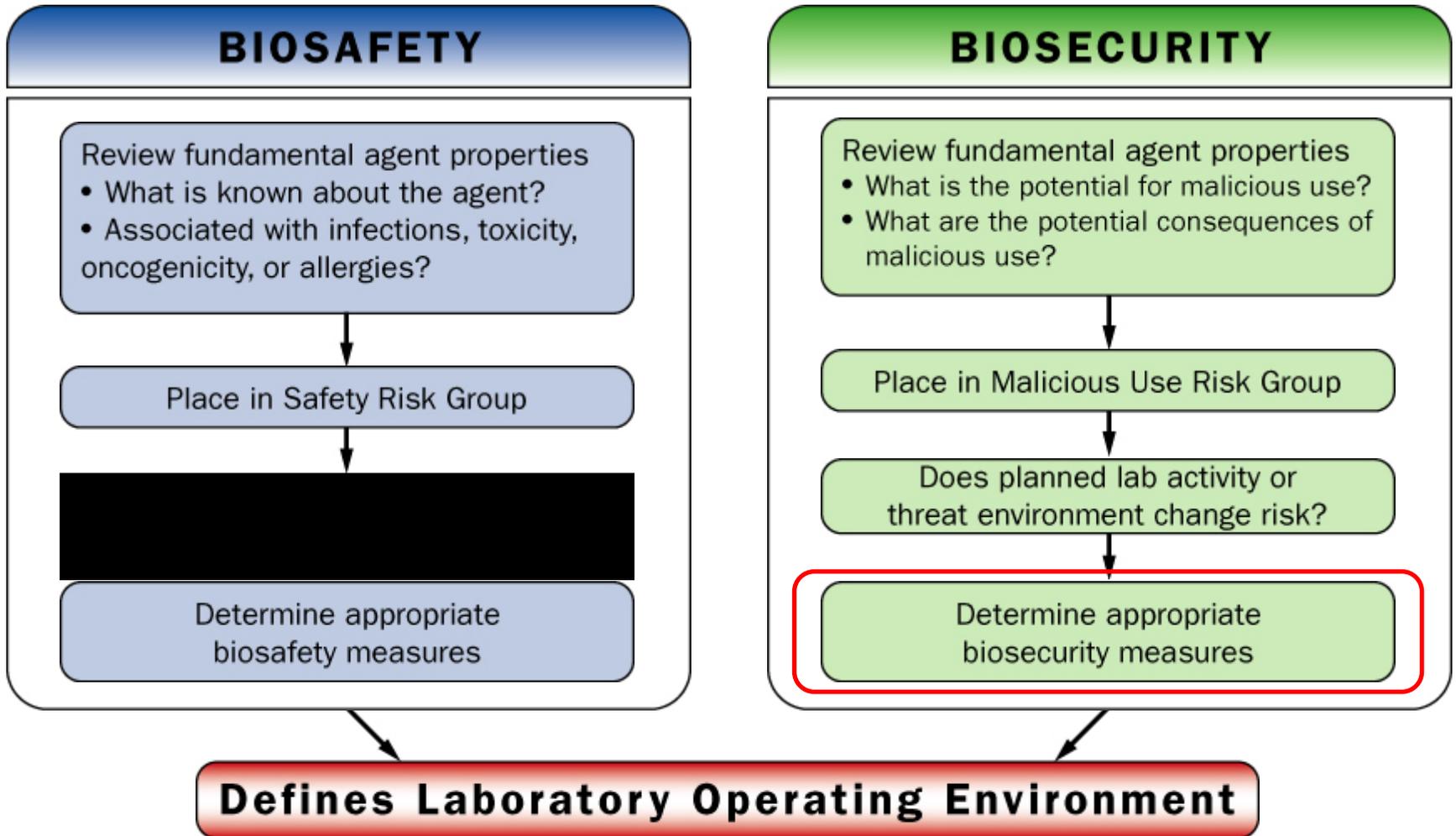


Biosecurity Risk: Insider vs. Outsider Threat





Integrated Biosafety and Biosecurity





Conclusions

- **Need to integrate biosafety and biosecurity considerations into decisions about laboratory operations**
- **Biological facility risk assessment provides an opportunity to concentrate resources on the highest risks**
 - **Tiered system of protection based on risk assessment and risk management methodologies**
- **Parallels exist between safety and security risk assessment processes**