ABSA International
BioRisk Evaluation Tool
Fungi
Risk Management

Identification of Hazard (Slide 2 & 3)
- Pathogen/toxin
- Personnel
- Scale
- Procedures
- Frequency
- Place

Identification of Threat (Slide 5)

Assess prevention barriers and mitigation of risk options (Slide 7)

Assess mitigation of consequences (Slide 9)

Risk Management (Prioritize)

Continuous review
<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Fungi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host range</td>
<td>Human</td>
</tr>
<tr>
<td></td>
<td>Animal</td>
</tr>
<tr>
<td>Occupational Health</td>
<td>Healthy</td>
</tr>
<tr>
<td>considerations</td>
<td>Pre-Existing conditions</td>
</tr>
<tr>
<td></td>
<td>Immunocompromised</td>
</tr>
<tr>
<td></td>
<td>Additional risks</td>
</tr>
<tr>
<td>Type of samples &amp;</td>
<td>Sample type: environmental, blood, tissue</td>
</tr>
<tr>
<td>Proposed Activities</td>
<td>Other Potentially</td>
</tr>
<tr>
<td></td>
<td>Infectious Material (OPIM)</td>
</tr>
<tr>
<td></td>
<td>Activities: culturing, using sharps,</td>
</tr>
<tr>
<td></td>
<td>centrifugation, tissue extraction,</td>
</tr>
<tr>
<td></td>
<td>vortex</td>
</tr>
<tr>
<td>Fungi-specific</td>
<td>Blastomyces dermatitidis and Blastomyces</td>
</tr>
<tr>
<td>recommendations</td>
<td>gilchristii</td>
</tr>
<tr>
<td>included in the</td>
<td>Coccidioides immitis and Coccidioides</td>
</tr>
<tr>
<td>CDC/NIH BMBL 6th 2020</td>
<td>posadasii</td>
</tr>
<tr>
<td>– Section VIII: Fungal</td>
<td>Histoplasma capsulatum</td>
</tr>
<tr>
<td>Agents</td>
<td>Sporothrix schenckii species complex</td>
</tr>
<tr>
<td></td>
<td>Candida spp.</td>
</tr>
<tr>
<td></td>
<td>Miscellaneous Yeast and mold organisms</td>
</tr>
<tr>
<td></td>
<td>causing human infection</td>
</tr>
</tbody>
</table>
## Identification of Hazard/Pathogen

<table>
<thead>
<tr>
<th>Factors</th>
<th>What is known</th>
</tr>
</thead>
</table>
| Biological Agent | - Eukaryotic  
- Exists in multiple forms such as yeast and pseudohyphal  
- Encapsulated or acellular (parasite)  
- Diploid  
- Cell wall  
- Depending on the fungi, colonies appear within 48-72 h (*Candida albicans*)                                                   |
| Disease          | - May colonize skin, nails (surface)  
- May colonize organs (systemic)  
- May be a commensal pathogen, that is, it is part of the normal flora.  
- There are genetic conditions such as chronic mucocutaneous candidiasis due to a defect in the immune response to Candida.  
- Risk factors: antibiotic therapy; administration of steroids, immunosuppressants, or chemotherapy; prior surgery; solid organ or hematopoietic stem cell transplants; diseases such as AIDS, leukemia, diabetes, and lymphoma; as well as trauma and burn patients |
| Treatment        | - Specific drugs to treat fungi  
- May be resistant to one or more of the major classes of drugs that are typically used to treat fungal infections |
| Transmission     | - Fungi may be found in soil, inanimate objects, fomite, food  
- Person to person  
- Animal to human (in the wild) |
| Host range       | Humans, animals |
| Infectious dose  | Unknown |
| Incubation time  | Unknown |
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Assess prevention barriers and mitigation of risk options (Slide 7)

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Risk Management (Prioritize)

Continuous review

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## Identification of Threat

<table>
<thead>
<tr>
<th>What is known</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air</strong></td>
<td></td>
</tr>
<tr>
<td>Fungi may be transmitted as bioaerosols or individual particles (Tang JW. 2015)</td>
<td>- Where will the samples be handled? (Air supply, Air exhaust. Air flow)</td>
</tr>
<tr>
<td></td>
<td>- Facility, engineering controls (e.g. BSC)</td>
</tr>
<tr>
<td></td>
<td>- PPE</td>
</tr>
<tr>
<td><strong>Water/soil</strong></td>
<td></td>
</tr>
<tr>
<td>Fungal infection from freshwater is rare. (Baumgardner DJ 2017)</td>
<td>- Will fresh water or soil be the source of the specimen?</td>
</tr>
<tr>
<td>Fungal infection from soil is common (Baumgardner DJ 2012)</td>
<td></td>
</tr>
<tr>
<td>Coccidioidomycosis (“valley fever”) may represent up to 29% of community acquired pneumonia cases (150,000 annually) in endemic areas.</td>
<td></td>
</tr>
<tr>
<td><strong>Personnel</strong></td>
<td></td>
</tr>
<tr>
<td>Laboratory-acquired infections have been reported for Coccidioides immitis, Histoplasma capsulatum, Blatomyces and others. Consult the ABSA LAI Database -<a href="https://my.absa.org/LAI">https://my.absa.org/LAI</a></td>
<td>• Stress, pre-existing illnesses</td>
</tr>
<tr>
<td></td>
<td>• Language barriers</td>
</tr>
<tr>
<td></td>
<td>• Knowledge, Skills, Abilities</td>
</tr>
<tr>
<td><strong>Waste</strong></td>
<td></td>
</tr>
<tr>
<td>Fungi have been identified in untreated waste collected from households (Madsen AM, 2016)</td>
<td>- What type of waste will be generated? Solid, Liquid, Mixed, Sharps</td>
</tr>
<tr>
<td><strong>Fomite</strong></td>
<td></td>
</tr>
<tr>
<td>Surfaces – Candida albicans may survive on surfaces up to 4 months; other Candida may survive shorter times (14 days) – (Kramer A. 2006)</td>
<td>- What surfaces may be potentially contaminated? Equipment used, counters, storage, door knobs</td>
</tr>
<tr>
<td><strong>Work with animals</strong></td>
<td></td>
</tr>
<tr>
<td>Some fungal diseases are zoonotic (transmission from animal to human)</td>
<td>- Size of the animal</td>
</tr>
<tr>
<td>S. Seyedmousavi (2015) – Table 1 shows Medically important fungi with the potential of zoonotic transmission to humans</td>
<td>- Allergies, Shedding, Husbandry</td>
</tr>
<tr>
<td><strong>Inactivation</strong></td>
<td></td>
</tr>
<tr>
<td>UV light has been shown to reduce fungal load, but is ineffective in killing the yeast completely (Theraud M et al 2004). Most microorganisms are also inactivated by moist heat (121°C for 15 min- 30 min) (Pflug, IJ et al 2001)</td>
<td>- Will waste be disposed of through approved vendor?</td>
</tr>
<tr>
<td></td>
<td>- Is autoclaving required based on local requirement?</td>
</tr>
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Continuous review

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**Hazard ID**
Agent, Host, Scale procedures/activity, frequency

**TOP EVENT**
[Incident]
- Loss of primary containment
- Release into environment
- Cross contamination
- Loss of control
- Breach in chain of custody

**Risk Analysis**

**PREVENTION BARRIERS/MITIGATION OF RISK**
Hierarchy of Controls

**ENGINEERING CONTROLS**
- HEPA filter
- BSC
- Monitors
- Alarms
- Unidirectional or negative air flow
- Facility design

**ADMINISTRATIVE CONTROL**
- SOPs
- Occ Health
- Process validation
- Procedures
- Alarm response
- Occ health Surveillance
- Immunizations
- Training
- Competency check

**PPE**
- Right size
- Correct type
- Competency check

**BEHAVIOR**
- Follow SOP
- Report Incidents, Accidents and Near misses
- Knowledge
- Skills
- Abilities

**AGENT**
- WATER
- PERSONNEL
- WASTE
- FOMITE
- ANIMAL
- FACILITY
- SECURITY

**THREAT**
Risk Path Category

**AIR**
- FACILITY

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Continuous review
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Hazard ID
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POST-INCIDENT/MITIGATION OF CONSEQUENCES
Recovery Barriers

POST-INCIDENT/ MITIGATION OF CONSEQUENCES

Hazard ID
Agent, Host, Scale procedures/activity, frequency

Engineering Controls
Early detection systems
Lock/disabling systems

Administrative Control
SOPs
Occ Health
Quarantine
Spill response
Emergency response
Vaccines/Prophylaxis
Crisis management
Evacuation plans

Behavior
Follow SOP
Report Incidents, Accidents and Near misses
- Ensure others follow SOP
- Report new medical conditions

Consequence

OPERATOR
Death/illness/Disease

COMMUNITY
Distrust
Outbreak

ENVIRONMENT
Contamination

INSTITUTION
Reputation
Economic loss

Risk Analysis
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BioRisk Evaluation Tool (BET)

Instructions

The BET has been designed to aid the biosafety & biosecurity professional to conduct risk evaluations.

This tool may be used to assess biohazards in various scenarios (i.e. laboratories, hospitals).

Select a hazard and use the BET to perform a systematic risk evaluation. Each slide prompts you to evaluate your hazard and conduct a thorough analysis ending in a mitigation plan to address potential consequences (accidental or intentional).

Considerations when conducting a risk evaluation:

- The outcome of the risk evaluation is as robust as the hazard identification
- Evaluate how each hazard will become a risk or threat. Determine what barriers can be put in place to prevent or mitigate the consequences.
- Identify the stakeholders associated with the hazards and risks identified.

Acknowledgments

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Resources

Mueller-Doblies, Uwe. Managing Biological Risk Concerns in the Veterinary Laboratory and Animal Facilities. 2017. 18th WAVLD, 9th June 2017, Sorrento, Italy OIE Seminar: Implementing New Biorisk Standards

Caskey, S., et. Al. SANDIA REPORT SAND2010-6487 2010 Biosafety Risk Assessment Methodology
https://www.osti.gov/servlets/purl/1325209


Centers for Disease Control and Prevention. Biological Risk Assessment: General Considerations for Laboratories.


**Definitions**

**BIORISK**: The probability or chance that a particular adverse event (in the context of this document: accidental infection or unauthorized access, loss, theft, misuse, diversion, or intentional release), possibly leading to harm, will occur.

**Hazard**: A danger or source of danger; the potential to cause harm. An operation, activity on a material with the potential to cause harm to people, property, the environment or business; or simply a potential source of harm.

**Threat**: The likelihood for an adverse event to occur, as an expression of intention to inflict evil, injury, disruption or damage. A possible initiating event that can result in a loss of control or loss of containment of the hazard (aka cause, initiating event).

**Top event/Incident**: a central event lying between a threat and a consequence corresponding to the moment when there is a loss of control or loss of containment of the hazard.

**Prevention barrier**: A barrier located on the left-side of the bow tie diagram and lies between a threat and the incident. It must have the capability on its own to completely terminate a threat sequence (aka proactive barrier).

Mitigation Barriers are employed after the top event has occurred and should help an organization prevent or reduce losses and regain control once it has been lost. The objective is possibly to stop undesired consequences.

Consequences of loss of control of the hazard