BIOSAFETY

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EIAR
Definitions

- **Biosafety**: Development of protective policies and procedures to ensure safe environment when working with hazardous organisms.

- **Biocontaminants**: Are biological agents that can potentially cause disease to human.

- **Biosecurity**: Precaution taken to minimize the risk of introducing an infectious disease into an animal population.
Major components of Biosafety program

- Good lab work practice
  - Laboratory practice and techniques
    - Regular training
- Safety equipments and facilities
  - Laminar air flow cabinet
- Personal protective equipments
  - Glove, eye and mouth mask
- Administrative controls
  - Access control
  - Security clearance
Biosafety Levels (BSL)

- BSL1
- BSL2
- BSL3 / BSL3-ag
- BSL4
BSL 1
- Involve working with agents not known to cause disease
- Minimal hazard to human and the environment
- Work is generally conducted on open bench tops using standard microbiological practices
- Examples of organisms handled
  - Non pathogenic *Escherichia coli*
  - *Canine hepatitis*
  - non-infectious bacteria
BSL 2

- Involving agents of moderate hazard to personnel and minimal to environment
- Includes various bacteria and viruses that cause only mild disease to humans
  - Examples:
    - Hepatitis A, B and C
    - Measles virus
    - Orthopoxviruses (other than smallpox)
    - *Mycobacterium fortuitum*
    - *Influenza A*
    - Measles

BSL 3

- Work with dangerous and exotic agents that pose a high individual and moderate environmental risk

- Examples
  - *Mycobacterium tuberculosis*
  - *Francisella tularensis*
  - *Leishmania donovani*
  - SARS
  - Several species of *Brucella* and yellow fever
Laboratory personnel should have specific training in handling pathogenic

- supervised by competent scientists

- All procedures should conducted within biological safety cabinets

- double-door access zone and sealed penetrations

- Respiratory protection

- Two pair of gloves, one taped
BSL 4

- work with dangerous and exotic agents that pose a high individual and environmental risk
- Examples
  - Ebola virus
  - Lassa virus
  - Marburg virus
- use of positive pressure personal suit, with a segregated air supply, is mandatory
- will contain
  - multiple showers
  - a vacuum room
  - an ultraviolet light room
- All air and water service going to and coming from the lab should undergo similar decontamination
- The facility is either in a separate building or in a controlled area within a building
- Double glove
- Boots
- Filtered air supply

http://labsq.org/2012Biosafety.pdf
BSL 1

Graphics by CUH2A, Princeton, NJ
BSL 3

Graphics by CUH2A, Princeton, NJ
BSL 4

Graphics by CUH2A, Princeton, NJ
There is also Animal Biosafety levels (ABSL)

- **ABSL-1**: Animal infected with agents not known to cause disease
- **ABSL-2**: Animals infected with agents associated with human disease via mucous membrane, oral
- **ABSL-3**: Animal infected with indigenous/exotic agents associated with human disease and potential for aerosol transmission
- **ABSL-4**: Animals infected with dangerous/exotic agents of life threatening nature
BSL Vs ABSL

- Used interchangeably/incorrect
- Comparable but animals themselves pose additional risks/hazards
- BSL 1-4 works can be done in most ABSL 1-4 facilities but not necessarily vice versa based on agents, lab design, animal species etc
HORSES IN BIOCONTAINMENT (MOCK ABSL-3 DRILL)

http://labsg.org/2012Biosafety.pdf
Biological safety cabinet (BSC)

- Personal protection
- Product protection
  - Contamination free
- Environmental protection

http://labsg.org/2012Biosafety.pdf
BSC Type

- Class I
- Class II
- Class III
Class I BSC

- Personal and environmental protection
- No production protection
  - Inward airflow protects worker
  - Exhaust to outside
  - With/without HEPA filters

http://labsq.org/2012Biosafety.pdf
Class II BSC

- Worker, product and environment protected
- Sterile working area
- Use to work with aerosol
- Use for tissue culture and virology
- Designed for working with BSL 1-3
Class III BSC

- Total exhaust cabinet
- No re-circulated air
- Provide biological and chemical containment
  - Totally enclosed, ventilated, air-tight
  - Suitable for work with BSL3/4 agents

http://labsq.org/2012Biosafety.pdf
- HEAP filter
  - “High efficiency particulate air” filter
  - Traps particulates 0.3 µm, 99.97% efficiency
Summary
<table>
<thead>
<tr>
<th></th>
<th>BSL1</th>
<th>BSL2</th>
<th>BSL3</th>
<th>BSL4</th>
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</thead>
<tbody>
<tr>
<td><strong>Hazard Level</strong></td>
<td>Low risk</td>
<td>Low to moderate risk</td>
<td>Moderate to high risk</td>
<td>High risk</td>
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<tr>
<td><strong>Public access</strong></td>
<td>Not recommended</td>
<td>Limited access to certain parts</td>
<td>Restricted</td>
<td>Not permitted</td>
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<tr>
<td><strong>Decontamination</strong></td>
<td>Daily; following any spill</td>
<td>Daily; following any spill</td>
<td>Daily; immediately after working with biohazard; following any spill</td>
<td>Daily; immediately after working with biohazard; following any spill</td>
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<tr>
<td><strong>Eating and drinking</strong></td>
<td>Permitted only in designated clean areas</td>
<td>Permitted only in designated clean areas</td>
<td>Not permitted</td>
<td>Not permitted</td>
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<tr>
<td><strong>Lab coats</strong></td>
<td>Recommended</td>
<td>Required</td>
<td>Wraparound disposable clothing required for all workers</td>
<td>Wraparound disposable clothing required for all workers</td>
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<td>BSL1</td>
<td>BSL2</td>
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<tr>
<td><strong>Biological Safety</strong></td>
<td>Not mandatory</td>
<td>Class II A/B3 or Class II B2 required (aerosol generating processes)</td>
<td>Class II / III required (biohazardous agents)</td>
<td>Class II / III required for all work.</td>
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<tr>
<td><strong>Cabinet (BSC)</strong></td>
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<td><strong>BSC work surface</strong></td>
<td>Required daily; following any spill.</td>
<td>Required after each use</td>
<td>Required after each use</td>
<td>Required after each use</td>
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<td><strong>decontamination</strong></td>
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<tr>
<td><strong>Bench-top work</strong></td>
<td>Permitted.</td>
<td>Permitted only for low-risk</td>
<td>Not permitted (biohazardous materials)</td>
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<td><strong>Open-able windows</strong></td>
<td>Permitted with fly screens</td>
<td>Permitted with fly screens</td>
<td>Not permitted</td>
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<td><strong>Laboratory</strong></td>
<td>Not required</td>
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<td>Restricted Access Only</td>
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<td>separated from</td>
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<td><strong>general public</strong></td>
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<td><strong>Medical surveillance</strong></td>
<td>Required (individual reaction)</td>
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Important References


- José Vázquez (2007). Biosafety Overview and New Developments. University of Central Florida/Environmental Health & Safety

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- Biosafety in Microbiological and Biomedical Laboratories, 5th Edition. 2007.

Thank you