

Biosafety Precautions in Laboratory Animal House

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Introduction

Biosafety in animal laboratory facilities is a critical aspect of maintaining safe and efficient environments for scientific research. These facilities handle biological agents that pose risks to human health, animal welfare, and the environment. Adopting robust biosafety measures minimizes hazards and ensures compliance with international standards.

1. Key Biosafety Concepts

Animal Biosafety Levels (ABSL): Classification of containment measures based on risk levels:

- **ABSL-1:** Minimal hazard; work with well-characterized agents not known to cause disease in humans.
- **ABSL-2:** Moderate risk; agents associated with human diseases transmissible via ingestion or mucous membrane exposure.
- **ABSL-3:** High risk; indigenous or exotic agents causing serious disease via aerosol transmission.
- **ABSL-4:** Extreme risk; life-threatening agents with high aerosol transmissibility or unknown risks.

2. Risk Assessment in Animal Laboratories:

Hazards Identified:

- **Zoonotic Risks:** Transmission of pathogens like Hantavirus or Influenza.
- **Allergens:** Exposure to animal dander, bedding, or hair causing allergic reactions and asthma.
- **Experimental Hazards:** Risks posed by genetically modified organisms, prions, or infectious agents.
- **Physical Risks:** Bites, scratches, and needle-stick injuries during handling.

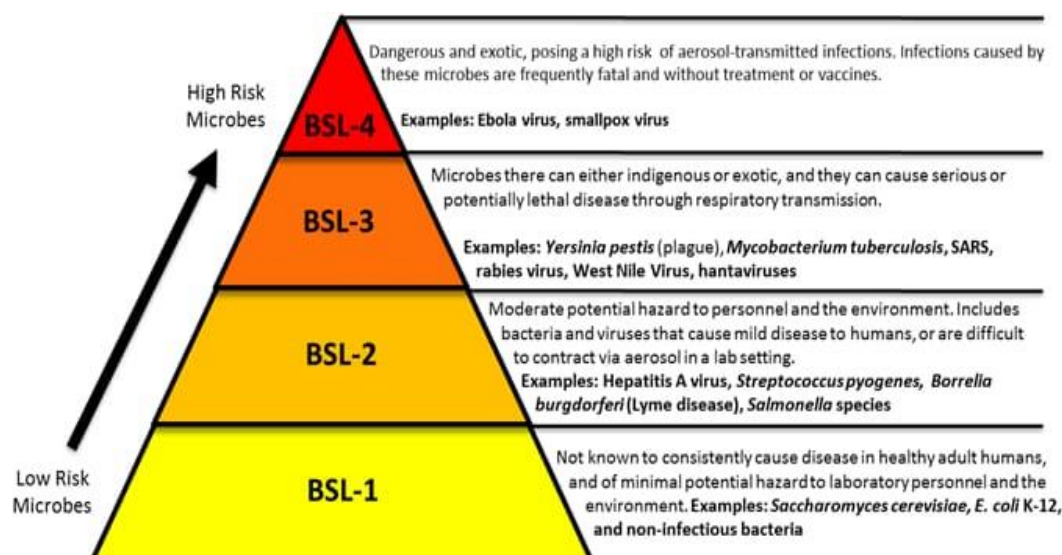
Risk Categorization:

- **Zoonotic agents:** Direct risk to humans.
- **Non-zoonotic pathogens:** Risk to the environment and other animals.

3. Facility Design for Biosafety:

General Design:

- Controlled access with secured entrances, airlocks, and electronic monitoring.



- Separation of clean and contaminated zones with unidirectional traffic patterns.

-Structural Features:

- Smooth, non-porous, and disinfectant-resistant walls, floors, and ceilings.
- Self-closing, inward-opening doors with locks.
- Ventilation systems ensuring directional airflow and HEPA filtration in containment areas.

Specialized Areas:

- Dedicated zones for animal housing, cage cleaning, and necropsy.
- Imaging facilities with pathogen barriers for immunocompromised animals.

4. Animal Housing and Containment:

Primary Containment Options:

- Open Cages: Basic housing for non-infected animals.
- Filter-Top Cages: Control allergens but provide limited pathogen containment.
- Individually Ventilated Cages (IVCs): Enhanced microenvironment with HEPA filtration.
- Isolators: Absolute containment for high-risk pathogens.

Labeling and Monitoring:

- Clear labeling of enclosures with biological agent details and emergency contact information.
- Regular health monitoring to detect asymptomatic infections in animals.

5. Personal Protective Equipment (PPE):

Essential PPE:

- Laboratory coats, gloves, goggles, face masks, and head covers.
- Respiratory protection (e.g., FFP3 masks) for aerosol exposure risks.

Training:

- Personnel are trained in PPE usage, respiratory fit testing, and hygiene practices.
- Emphasis on mitigating allergen exposure and preventing cross-contamination.

6. Biosafety Equipment:

Key Tools:

- Biosafety Cabinets (BSCs): Used for aerosol-generating tasks like necropsies and inoculations.
- Animal Workstations: Protect personnel from allergens during cage handling.
- Autoclaves: For sterilizing waste, bedding, and cages.

Advanced Containment Systems:

- Rapid Transfer Ports (RTPs) for safe material transfer in isolators.
- HEPA-filtered animal containment units for high-risk procedures.

7. Waste Management and Decontamination:

Decontamination:

- Use of chemical agents like hydrogen peroxide vapor (HPV) for facility-wide sterilization.
- Validated processes for fumigating high-containment areas.

Waste Management:

- Segregation of hazardous and non-hazardous waste.
- Inactivation of hazardous waste through autoclaving, incineration, or chemical treatment.
- Special treatment systems for liquid and solid biological waste, ensuring environmental safety.

8. Emergency Preparedness:

Disaster Planning:

- Development of detailed protocols for containment breaches or facility emergencies.
- Regular drills and clear communication of emergency contacts and procedures.

Incident Response:

- Immediate isolation and decontamination of affected areas.
- Reporting mechanisms for accidents involving personnel or animals.

9. Biosecurity Measures:

Access Control:

- Restricted entry to animal laboratories with electronic or biometric systems.
- Zoned access to segregate containment levels.

Surveillance and Accountability:

- Use of CCTV monitoring and logging systems for traceability.
- Secure storage and tracking of biological agents to prevent unauthorized access or misuse.

Conclusion

Biosafety in animal laboratory facilities is an integral aspect of research involving biological agents. By adhering to stringent design principles, employing advanced containment systems, and ensuring comprehensive training, these facilities can minimize risks to personnel, animals, and the environment. A strong focus on biosafety safeguards the integrity of scientific research while promoting health and safety standards globally