



United States Army Medical Research Institute of Infectious Diseases

USAMRIID's New Aerobiology Suite Illustrates Advanced and Enhanced Features for Animal Biosafety Level (ABSL)-3

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Objectives

- Present design features of new BSL-3 and ABSL-3 aerobiology laboratory
- Designed for high-throughput animal bioaerosol efficacy studies with select agents
- Test new candidate biodefense vaccines, drugs, and diagnostics
- Testing conducted IAW FDA "Animal Rule" 21 CFR parts 314 and 601
- Provide six unique design objectives and solutions
- Review "lessons learned" during the project

USAMRIID Mission

- **USAMRIID** conducts basic and applied research on biological threats resulting in medical solutions to protect the warfighter.
- **USAMRIID Center of Aerobiological Sciences** conducts and supports research on pathogenesis, prophylaxis, and therapy of disease and intoxications caused by exposure through the respiratory tract to aerosols of biological threat agents.



Project Scope

- Demolish existing, inefficient BSL-2 laboratory space
- Construct BSL-3 and ABSL-3 aerobiology laboratory
- Replace mechanical and electrical utilities
- Replace air-handling unit
- Install redundant HEPA filtration, exhaust fan and ductwork

Concurrent Projects to Enhance Aerobiology Laboratory

- Upgrade building steam capacity
- Install reverse osmosis water purification system
- Install clean steam generator for humidification
- Replace fire alarm system
- Install physical and electronic security upgrades



Six Unique Design Objectives

1. Ensure safe, humane movement of animals
2. Optimize aerosol productivity and efficiency
3. Incorporate hands-free door operations
4. Stabilize laboratory ambient temperature
5. Shorten soiled-cage sterilization time
6. Provide flexibility for future changes in mission

Safe, Humane Movement of Animals

- Mobile class III BSC animal transporters
- Provide HEPA-filtered ventilated containment
- Equipped with direct current rechargeable power packs to operate blowers
- Mobile transporters dock to stationary class III BSCs via rapid transfer ports
- Mobile transporters dock to ABSL-3 holding room doors through unique ports









Optimal Aerosol Productivity and Efficiency

- Open-laboratory concept with directional airflow
- Fully accessible, free-standing stationary Class III BSCs
- BSCs have ergonomic design features
- Aerosol equipment preparation alcoves
- BSL-3 cell culture rooms with dedicated equipment
- ABSL-3 holding rooms
- Secure storage of select agents and toxins





Hands-free Operated Doors

- Facilitate movement of animals, people, and materials
- Remote controls to open doors
- Sensors to close doors automatically
- Sliding doors to cell culture rooms require less floor space than conventional swinging doors
- Sliding doors to cell culture rooms disrupt directional airflow less than swinging doors



Heat Load Reduction and Temperature Control in the Laboratory

- Eliminate double-door autoclaves from class III BSCs to minimize temperature fluctuations and reduce laboratory total heat load
- Maintain uniform ambient temperature inside the stationary class III BSCs to enhance animal comfort and optimize automated bioaerosol system operation
- Install ventilation hood above ultra low-temperature freezers to exhaust excess heat
- Locate bulk autoclave in hallway outside of laboratory to reduce total heat load

Shorten Soiled-Cage Sterilization Time

- Install bulk autoclave sized to sterilize two-over-two nonhuman primate cage racks
- Steam sterilization cycle in bulk autoclave with chemical indicator validation is 3 hours
- Gaseous fumigation process in airlock with biological indicator validation is 3 days



Flexibility for Changing Requirements in the Future

- Install removable flanges on stationary class III BSCs to accommodate future double-door autoclaves
- Cap off steam lines above class III BSCs to accommodate future double-door autoclaves
- Install decontamination ports on class III BSCs to use a choice of vaporized sterilants
- Provide quick clamp connections to join class III BSCs to piped utilities
- Design stationary class III BSCs to be portable so they can be relocated





Safety Lessons Learned

- Establish one-way traffic flow of people, animals, and materials
- Install hands-free, hand-wash sink at exit
- Balance laboratory variable flow damper system with building constant flow damper system to maintain negative air flow gradient
- Install “dump” valves to deflate airlock APR door pneumatic gaskets for emergency egress





Conclusions

- Concerted team effort of architect, builder, vendors, and customer to complete the project
- Final product is an innovative, operational aerobiology laboratory
- Conduct safe, efficient testing of medical countermeasures to support critical biodefense mission

Disclaimer

Opinions, interpretations, conclusions, and recommendations are those of the author and are not necessarily endorsed by the U.S. Army.

Laboratory Animal Usage

- Research is conducted in compliance with the Animal Welfare Act and other federal statutes and regulations relating to animals and experiments involving animals and adheres to principles stated in the Guide for the Care and Use of Laboratory Animals, National Research Council, 1996.
- The facility where this research is conducted is fully accredited by the Association for Assessment and Accreditation of Laboratory Animal Care International.

Definitions

ABSL	Animal biosafety level
APR	Air-pressure resistant
BSC	Biological safety cabinet
BSL	Biosafety level
CFR	Code of Federal Regulations
FDA	Food and Drug Administration
HEPA	High-efficiency particulate air
IAW	In accordance with

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