2015 Annual Conference

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Seminar 12
Biocontainment Facility Design, Commissioning and Certification Strategies

Biocontainment Ventilation:
Complex or Simple Design?

Atlanta, Georgia

Learning Objectives

- Objective 1 Describe the concept of pressure reversal, also known as air flow reversal in containment laboratories and define where the pressure reversals are not allowed, and where they are permitted.
- Objective 2 Describe the National Institutes of Health and Centers for Disease Control oversight of BSL-3 facilities.
- Objective 3 Explain differences between biocontainment facility commissioning and annual performance verification and understand the distinction of ANSI Z9.14 and "Select Agent" rules as they relate to performance verification.
- Objective 4 Understand what options are available to simplify the design of biocontainment facility HVAC to reduce costs.

Acknowledgments

- Appreciation to Ron Trower for his assistance in developing this presentation.

Outline

- Biocontainment Facts
- Design Requirements
- Operational Differences
  - Complex vs. Simple
- Failures
- Problems and Solutions
- Conclusions

Containment HVAC Design: Complex vs. Simple

- Objectives :
  - Describe the actual biocontainment design requirements
  - Understand potential problems of complex ventilation design
  - Explain the operational differences between a complex and simple HVAC design

Biocontainment Facts

- Biocontainment labs are not contaminated unless there has been a catastrophic spill outside of BSC
- Containment is dependent upon
  - Primary devices (BSC)
  - Procedures
  - Facility design

Biocontainment HVAC Design Requirements

- Keep it simple:
  - When, not if, the system fails, it must fail:
    - Neutral or slightly negative
  - Minimal Nuisance Alarms
  - Easy to Maintain
- Separate Containment HVAC from the rest of the building

Biocontainment HVAC Design Requirements

- **There are no legal requirements for the design of Biocontainment HVAC systems.**
- The standard of the industry is the NIH Design Requirements Manual
- Note: This manual is a requirement for NIH buildings, but should be used as a guide for other facilities

Containment HVAC Design: Complex vs. Simple

- Operational Differences
  - Complex Design
    - Requires personnel trained on specifics of control systems
    - More complex, more potential problems with operation and maintenance
    - More expensive to build
    - More expensive to operate

Containment HVAC Design: Complex vs. Simple

- Operational Differences:
  - Simple Design
    - Simple Control System
    - Less Maintenance
    - More cost effective

Failure Is An Option!

- Trying to design the system so it never fails makes it doomed to fail!
  - creates more failure points which are difficult to control
  - makes the system more difficult to diagnose when there is a failure
  - Makes the system more difficult to maintain
- **There is no Failure Proof System!**

Complicated Programing

- Some systems have a program to reset the ΔP at the doors each time a door is opened or loses a pressure set point.
- This is a problem because once the first door starts the action, the rest of the doors start resetting creating an endless loop.

Low/high alarm set

- Establishing a point for the ΔP monitors,
  - Low pressure alarm is good to let you know that the door is nearing the failure point
  - having a high alarm indicates that the lab is going more negative,
    - Causes nuisance alarms

"Green Buildings"

- The containment laboratory is only a small part of the overall building
  - The correct HVAC system is critical for containment laboratories
  - Having a setback for off hours is not necessary
  - **<u>Look at other areas of the building for energy savings.</u>**

Decontamination Systems

- Attempting to have an automatic decontamination setting on the HVAC adds complexity and cost to the system
- Gas decontamination is rarely needed.
  - Can be done more efficiently and economically with portable units.

BSC Exhaust

- Avoid designing an exhaust system where the only room exhaust is through a ducted BSC
- This creates a condition where the exhaust can't be adjusted, because the exhaust setting for the BSC is specific and critical for operation of the cabinet.

Inclusion of Class II B2 Cabinets

- Class II, B2 biological safety cabinets
  - Always cause significant problems because B2 cabinets have a high make up air requirement
  - Require balancing of both supply and exhaust
  - Operation effects other areas

Conclusions

- **<u>There is no ONE way to design the HVAC system for a containment lab</u>**
- Keep it simple
- Don't "Value Engineer" containment HVAC systems
- Remember the one requirement is directional air flow
- Must fail neutral or slightly negative

Bibliography

- US Dept. of Health and Human Services, NIH Office of Research Facilities, Design Requirements Manual, 2008.
- US Dept. of Health and Human Services, CDC/NIH Biosafety in Microbiological and Biomedical Laboratories, 5th Ed., 2009.

Questions?

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