

'Design Requirements Manual (DRM) News to Use' is a monthly ORF publication featuring salient technical information that should be applied to the design of NIH biomedical research laboratories and animal facilities. NIH Project Officers, A/E's and other consultants to the NIH, who develop intramural, extramural and American Recovery and Reinvestment Act (ARRA) projects will benefit from 'News to Use'. Please address questions or comments to: shawm@mail.nih.gov

BSL-3 and ABSL-3 HVAC System Requirements – Part II

Isolation Dampers

(1) Isolation Damper Locations: Bubble-tight (no-leakage) isolation damper shall be provided between the room supply air terminal and the room supply air diffuser and between the room exhaust grille and room exhaust air terminal.

(2) Access to Dampers: Access to the bubble-tight dampers shall be from outside the laboratory suite.

Autoclaves

(1) Exhaust Canopy Hoods: Autoclaves serving BSL-3 and ABSL-3 shall be provided with stainless steel exhaust canopy hoods over the door to capture steam and aerosols from the autoclave. In the case of double-sided autoclaves, stainless steel canopy hoods shall be provided over both the "dirty" (loading) side and the "clean" exit side door.

(2) Need for HEPA Filtration: The need for HEPA filtration of the exhaust air from the canopy serving the dirty side of the autoclave shall be reviewed by NIH Division of Technical Resources (DTR) and NIH Division of Occupational Health and Safety (DOHS).

(3) Autoclave Service: A steam isolation valve shall be located outside the containment barrier. To the extent possible, service to the autoclave shall be performed from outside the containment.

Service Access Panels and Mechanical spaces

Access panels through the containment barrier walls or ceilings shall be avoided. To the extent possible, piping, valves, dampers, air terminals, shall be located outside the containment barrier. Alternatively, the use of full stainless steel access cabinets with closed back and sides, gaskets, and stainless steel pipe inserts weld-sealed to the box can be utilized to provide a sealed box arrangement.

Major equipment serving the containment spaces shall be located in interstitial spaces or mechanical galleries or corridor.

Variable Frequency Drives (VFD)

Following a power outage and the initiating of the emergency electrical power, all VFDs associated with supply and exhaust fans serving BSL-3 or ABSL-3 spaces, which are required to maintain bio-containment, shall be provided with the ability to restart into a coasting motor without delays and without damaging the motor. That is, the drive shall be able to catch the motor on the fly. The drive shall be able to identify motor rotation and when the opposite rotation is detected, slow the motor down to zero speed, otherwise, smoothly accelerate the motor to the commanded speed with the correct direction without tripping on an overvoltage or overcurrent condition. Mechanical brakes or anti-ratcheting devices can be used to ensure that a fan does not rotate in the wrong direction.

Emergency Electrical Power

Supply air fans, exhaust air fans, and all devices and equipment serving and/or associated with BSL-3 and ABSL-3, which are required to maintain bio-containment of the space shall be connected to an emergency electrical power system. Emergency loads shall be able to supply standby power in 10 seconds or less.

Equipment, Ductwork, and Piping Identification

Equipment, ductwork, and piping systems shall be accurately identified and services specific to containment spaces shall clearly designate the specific function. Identification shall include the universal biohazard sign at ductwork, piping, and at equipment.

Biosecurity

Systems and equipment shall be located only in secured areas compliant with facility biosecurity requirements and the Risk Assessment. Suitable containment support spaces should be coordinated with the Risk Assessment.

Seismic Accommodation

In areas of seismic activity, accommodation shall be provided to preclude shearing of piping, ductwork, or critical equipment damage due to differential movements. Fixed equipment shall be properly anchored to structure. Such analysis and accommodation shall be performed by qualified structural and mechanical engineers in coordination with NIH Office of Research Facilities (ORF) and DOHS.

HVAC Plans

All design phases of the construction documents shall be reviewed and approved by the DTR and the DOHS. Documents shall include room pressurization diagrams, leakage/pressure calculations, and location of exhaust equipment.

Inspection, Testing, Validation, and Certification

Conformance with the requirements of this chapter shall be confirmed in the installation of HVAC systems serving BSL-3 containment. Systems shall be inspected throughout installation to ensure conformance with the requirements of the DRM. In addition, the following specific issues shall be addressed as part of quality control, testing, and commissioning plans. Below are some of the specific items to be reviewed and inspected within the HVAC discipline. The list is not intended to identify commissioning requirements or to be all inclusive.

(a) Visual inspection of all systems for compliance with the requirements of the DRM, Risk Assessment, and this section.

(b) Ensure all required standby power has been provided and proper response to integrated systems testing.

(c) Construction documents for BSL-3 and ABSL-3 facilities shall include the requirement to comply with and to obtain the BSL-3 laboratory certification in accordance with the requirements in the NIH Biosafety Level 3 – Laboratory Certification Requirements (http://orf.od.nih.gov/PoliciesAndGuidelines/Bioenvironmental/Documents/BSL3CertificationGuidelinesFINAL_508.pdf).

(d) The testing of ventilation system and controls shall follow the American National Standard Institute (ANSI) Standard Z9.14 Testing and Performance Verification Methodologies for Ventilation Systems for Biological Safety Level 3 (BSL-3) and Animal Biological Safety Level 3 (ABSL-3) Facilities.

(e) Refer to DRM chapter 7 Building Automation Systems Design for information on BAS, controls, and failure testing scenarios for HVAC systems serving BSL-3 and ABSL-3 bio-containment facilities.

Further details on this month's topic are available on the DRM website

<http://orf.od.nih.gov/PoliciesAndGuidelines/BiomedicalandAnimalResearchFacilitiesDesignPoliciesandGuidelines/Pages/DesignRequirementsManualPDF.aspx>

DRM Chapter 6, Section 6.6