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News to Use
Design Requirements Manual
The formulae for building state of the art biomedical research facilities.

'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: ms252u@nih.gov

Placement of a Biological Safety Cabinet in the Laboratory

Biological Safety Cabinets (BSCs) are designed to provide personnel, environmental and product protection when appropriate practices and procedures are followed. BSCs are typically used in research or pathology labs, animal facility procedure and housing areas. Three kinds of BSCs, designated as Class I, II and III, have been developed to meet varying research and clinical needs. At NIH, BSCs are typically Class II. Class III BSCs may be installed in BSL-3/BSL-4 laboratories.

Class I BSCs include HEPA filtration of the exhaust air leaving the cabinet. Class II BSCs include internal down airflow, which is HEPA filtered. This is in addition to the separate HEPA filtration of the exhaust air leaving the cabinet. Class III BSCs consist of ventilated glove boxes, which are gas-tight chambers. They include HEPA filtration of the inward airflow and double HEPA filtration of the exhaust air leaving the cabinet.

Recognized standards for the design, fabrication and performance of BSCs include: NSF/ANSI 49-2009 Class II (Laminar Flow) Biosafety Cabinetry by the National Sanitation Foundation and the American National Standard Institute; and the CDC/NIH 2007 "Primary Containment for Biohazards: *Selection, Installation and Use of Biological Safety Cabinets"* 3rd Edition. These standards are intended to provide: personnel, product, and environmental protection; reliable operation; durability and structural stability; ease of cleaning; limitations on noise level; illumination; vibration; and motor/blower performance.

When designing a room containing one or more BSCs, consideration must be given to the location of each BSC in relation to room heat loads and air circulation patterns within the room.

Appendix I of the DRM: Biosafety Cabinet (BSC) Placement Requirements for new Buildings and Renovations was added to the DRM in May 2010. Appendix I clearly defines specific minimum requirements for placement of a BSC through the use of "Do's and Don'ts" diagrams. The design team should refer to Appendix I for the placement of every BSC.

Performance of BSCs can be affected by the presence of disruptive air flow patterns. Placement of BSCs shall avoid disruptive air flow patterns at the face of the cabinets. They shall be located out of the laboratory mainstream personnel traffic pattern or at the end of isles. In addition, they shall not be placed directly across from one another.

A work zone around the BSC needs to be established. The work zone must include: a minimum of 40 inches in front of the BSC; a minimum of 12 inches, on either side, to adjacent walls or columns. In addition, clear spaces are needed around BSCs: a minimum of 80 inches from opposing walls and/or 60 inches to opposing bench tops or areas of occasional traffic; and a minimum of 40 inches are also needed between the BSC and bench tops along a perpendicular wall. This clear floor space shall not overlap with another BSC.

In rooms with multiple BSCs, the use of staggered arrangements is preferred. If this is not possible, there shall be at least 120 inches between two BSCs facing each other. If two BSCs are placed next to each other, there shall be at least 40 inches between them. BSCs along perpendicular walls shall be placed 48 inches apart.

It is not recommended that a BSC be placed near an entryway. If the placement of a BSC near an entryway is unavoidable, the BSC face shall be placed, at least, 60 inches from behind the doorway or 40 inches from an adjacent doorway.

Air supply diffusers or exhaust vents shall not be placed directly over or in front of BSCs, where air movement can affect the airflow into the cabinet. In BSL-3 laboratories, the placement of BSCs shall consider the total room ventilation rates. The design team shall be responsible for coordinating the exhaust air requirements for the BSCs.

Lack of compliance with the criteria listed above can affect the ability of a BSC to maintain proper airflow to ensure safety and proper containment of contaminants.

Pressurized gases shall not be piped into BSCs. The use of compressed gasses (such as lab air) has been shown to disturb intended airflow patterns within BSCs. The use of fuel gas has also proven hazardous, and is *generally* not required or desired in BSCs.

BSL-3 laboratories, with Class III BSCs, shall be provided with a dedicated exhaust air system. This dedicated exhaust air system shall not be used to serve the rest of the laboratory space. Redundant exhaust fans and assessment of the location where the exhaust air is discharged are very important to ensure there is no re-entrainment back to outdoor air intake.

Further details on this month's topic are available on the DRM web site
http://orf.od.nih.gov/PoliciesAndGuidelines/BiomedicalandAnimalResearchFacilitiesDesignPoliciesandGuidelines/DesignRequirementsManualPDF.htm
DRM Chapter 4 Section 4-5-00 C.2; Section 4-7-10 A.1;Section 10-5 Chapter 6-1-00 D.5; Appendix I: Biosafety Cabinet Placement Requirements for new Buildings and Renovations; BMBL 5th ed. 2007, CDC/NIH; the ACGIH, Industrial Ventilation, a manual of recommended practices. Chapter VIII.HVAC; Methodology for Optimization of Laboratory Hood Containment. Memarzadeh, F. National Institutes of Health, 1996; Microbiological Safety Cabinet Recommendations for Cabinet Installation, British Standards Institution, BS 5726:2005.

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