Division of Technical Resources
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News to Use
Design Requirements Manual
The formulae $\frac{\partial U_i}{\partial t}+\frac{\partial}{\partial x_j}(\rho U_i U_j)=-\frac{\partial P}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu\frac{\partial U_i}{\partial x_j}\right)+g_i(\rho-\rho_0)$ for building $\frac{\partial}{\partial x_j}(\rho\overline{U_i}\overline{U_j})=-\frac{\partial P}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu\frac{\partial U_i}{\partial x_j}-\rho\overline{u_i u_j}\right)+g_i(\rho-\rho_0)$ state of the art $\frac{\partial}{\partial x_i}(\rho\overline{U_i}\overline{H})=\frac{\partial}{\partial x_i}\left(\lambda\frac{\partial T}{\partial x_i}-\rho\overline{u_i h}\right)$ 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

HVAC - Exhaust Air Systems

Federal energy conservation standards apply to the design of the exterior envelope and selection of Exhaust Air Systems (EAS). Exhaust Air Systems shall provide adequate ventilation to remove fumes, odors, airborne contaminants, and to safely operate fume hoods (FH) continuously. They shall be designed to maintain relative pressure differentials between spaces to prevent cross contamination.

Consideration shall be given to air quantity, filtration, construction materials, type of discharge, controls, emergency power, hours of operation, and usage of ductwork construction materials when designing the EAS. Exhaust air discharge and stacks must comply with requirements listed in the Design Requirements Manual (DRM) section 6-2-00 C. EAS shall be designed to operate 24/7. EAS capacity shall be increased by 20% to allow for future expansion. Avoid positive pressurized exhaust air ductwork. EAS are arranged with multiple manifolded fans, designed to achieve N+1 redundancy and maintain the EAS fully operational, at all times. Flammable storage cabinets shall not be vented or be located underneath FH. Ventilated corrosive storage cabinets are typically located underneath FH if present.

Generally, exhaust air does not require filtration or scrubbing. Where radioisotopes or certain hazardous chemicals are used, the exhaust air may require special filtration before being discharged to the outdoors. The A/E shall consult with NIH/DTR, NIH/DOHS, and NIH/ Radiation Safety Branch for specific requirements. When special filtration is required, provisions shall be made for filter loading and adjusting the system static pressure to maintain the required air flow amount. Filters or scrubbers shall be located as close to the source of contamination as possible while maintaining ready access for maintenance operations.

Research areas of a building shall have dedicated EAS separate from non-research functions. Isolation rooms, general lab research areas, FH exhaust, EAS dedicated to serve BSCs, radioisotope/radioactive FH, general animal research areas, cage washers, ductwork serving central sterilization processing areas, EtO sterilizers, battery-charging equipment, gas cylinders storage spaces, pot washing equipment, toilet EAS, Janitor's closets/locker rooms and other functions as designated by NIH/DOHSs shall be provided with dedicated separate EAS from any other EAS in the building.

Wet exhaust air from areas such as sterilizers, autoclaves, glass washers, cage washers, and pot-washing equipment, etc., shall be captured by using canopy-type stainless steel hoods. The canopy hood shall be located above the door to load and unload the equipment. In the case of double sided equipment, a canopy is placed above each equipment door. Exhaust air shall be at a minimum rate of 0.254 m/s (50 fpm) capture velocity at the face of the canopy hood. A drip ledge to collect condensate steam shall be provided and for large hoods, the collected condensate steam shall be piped to the nearest floor drain. Wet exhaust systems shall be separated from other EAS. Ductwork shall be pitched back toward the canopy hood. Canopy exhaust hoods are installed above steam vapor and heat generating equipment in both the "dirty" and "clean" sides of the equipment. NIH has developed Calculation Protocols for Canopy Hoods over Autoclaves which can be found in the DRM Apx E.5.

Exhaust air from animal rooms shall be discharged outdoors without recirculation into any other room. Animal room exhaust shall be filtered at the room exhaust grille with a rough filter to capture hair and dander by providing air filter tracks in the face of the room exhaust air grille. Filters shall be 25 mm (1-in.) throwaway type. Exhaust air grilles with face mounted air filters should be located at 300 mm (12-in.) above finished floor.

Reference shall be made to recent DTR research regarding location of exhaust grilles, control of IAQ and bench exhaust efficacy in "Analysis of Air Supply Type and Exhaust Location in Laboratory Animal Research Facilities (ARF) Using CFD"; Ventilation Design Handbook on ARF Using Static Microisolators, Vol I/ II; Ventilation Design in ARF Using Static Microisolators; Energy Efficient Laboratory Design: A Novel Approach to Improve Indoor Air Quality and Thermal Comfort"; ABSA Journal, V.12, No. 3, 2007. "Controlling Laboratory IAQ and Energy Costs"; HPAC, Oct. 2007, available through links in sections 6-1 and 6-2 of the DRM.

Further details on this month's topic are available on the DRM website
http://orf.od.nih.gov/PoliciesAndGuidelines/BiomedicalandAnimalResearchFacilitiesDesignPoliciesandGuidelines/DesignRequirementsManualPDF.htm
DRM Chapter 6 Section 6-1-00; Section 6-2-00.C "Location of Outdoor Air Intake and Exhaust Discharge"; Appendix E.5 "Calculation Protocols for Canopy Hoods over Autoclaves: NIH Local Exhaust Ventilation (LEV) test Protocol" ASHRAE Standard 90.1;• Energy Policy Act 2005;• International Energy Conservation Code