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News to Use

Design Requirements Manual

The formulae $\frac{\partial \rho U_i}{\partial t}+\frac{\partial}{\partial x_j}(\rho U_i U_j)=-\frac{\partial P}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu\frac{\partial U_i}{\partial x_j}\right)+g_i(\rho-\rho_0)$ *for building* $\frac{\partial}{\partial x_j}(\rho\overline{U_i}\overline{U_j})=-\frac{\partial P}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu\frac{\partial\overline{U_i}}{\partial x_j}-\rho\overline{u_i'u_j'}\right)+g_i(\rho-\rho_0)$ *state of the art* $\frac{\partial}{\partial x_i}(\rho\overline{U_i}\overline{H})=\frac{\partial}{\partial x_i}\left(\lambda\frac{\partial\overline{T}}{\partial x_i}-\rho\overline{u_i'h'}\right)$ *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

Heating Ventilation and Cooling (HVAC) System Redundancy

Research laboratories and animal facilities may conduct studies of long duration. They need to be performed under consistent environmental conditions in order to achieve repeatable results. Failure of the HVAC system and other systems is unacceptable. HVAC systems shall be reliable, redundant and operate without interruption while being efficient both in terms of energy consumption and from a maintenance perspective. All critical associated systems and components serving the HVAC systems (electrical, controls, chilled water, hot water, etc.) shall be arranged to provide N+1 redundancy to preclude single point failures from compromising the reliability of the HVAC systems. Planning for redundancy begins in the pre-design phase. The A/E shall review redundancy requirements for each particular system with the program user and the NIH/DOHS.

Among the mechanical and electrical systems in NIH facilities to be designed with N+1 redundancy to maintain operation 24/7 are: supply air handling systems, certain exhaust systems and chilled water systems dedicated to special areas. Systems serving areas of a critical nature shall offer 100% redundancy for all vital components and shall be powered from an emergency power (EP) source.

Central HVAC systems shall be provided with multiple air handling units (AHU) and exhaust fans to provide redundancy and improve reliability. These systems shall be designed to include manifolded AHUs. Capacity and size of the air handling system serving containment devices/equipment shall correspond to 120% of the programmed containment devices/equipment. Capacity of the cooling system shall include the program cooling demand plus an allowance for 20% future expansion of internal heat gain requirements.

Air handling systems shall be provided with:

- N+1 reliability and ability to maintain 100% capacity in the event of a lead component failure.
- Multiple parallel AHUs shall be provided to operate simultaneously to meet full load conditions. Each AHU and its related components shall be capable of total isolation by the use of isolation dampers located upstream and downstream of each AHU.
- Manifolding of AHUs to the same header shall be allowed for units operating at external static pressure differing not more than 0.19 kPa (0.75 in. wg) from each other.

Exhaust air systems shall be arranged with multiple manifolded fans designed to achieve N+1 redundancy and maintain the exhaust air system fully operational 24/7. Capacity of exhaust air systems shall be increased by 20% to allow for future expansion. Electrical motors associated with exhaust fans shall be upsized by one motor size.

Each manifolded fan shall be designed to be fully isolated while the overall system remains fully operational. In the case of single fan systems, in addition to the main fan, a standby fan shall be provided. Regardless of the system size, the following exhaust systems shall be provided with an N+1 redundancy:

- Isolation rooms
- Laboratory general research areas
- Fume hood exhaust
- Radioisotope/radioactive fume hoods
- Animal general research areas
- Cage washers
- Other systems designated by NIH/DOHS or DTR

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 E.2; Section 6-1-00 F.; Section 6-1-30 A.1; Section 6-2-00 A.1; Section 6-3-00 B; Section 6-3-00 C.3; Section 8-8-00 D.1.Chapter 10 Sec.5 Emergency Power.

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