

# News to Use

## Design Requirements Manual

*The formulae  $\frac{\partial Q_{in}}{\partial t} + \frac{\partial (\rho U)}{\partial t} = -\frac{\partial Q}{\partial t} + \frac{\partial (\rho U)}{\partial t} + s(\rho - \rho_0)$  for building  $\frac{\partial (\rho U)}{\partial t} = -\frac{\partial Q}{\partial t} + \frac{\partial (\rho U)}{\partial t} - \rho \bar{u}^2 + s(\rho - \rho_0)$  state of the art  $\frac{\partial (\rho U)}{\partial t} = \frac{\partial (\rho U)}{\partial t} - \rho \bar{u}^2$  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](mailto:ms252u@nih.gov)

## Heating Ventilation and Cooling (HVAC) System Redundancy

Since research laboratories and animal facilities may conduct studies of long duration, which need to be performed under consistent environmental conditions in order to achieve repeatable results, a failure of the HVAC system and other systems is unacceptable. A variety of mechanical and electrical systems in NIH facilities are to be designed with N+1 redundancy to maintain operation at all times. Among these are supply air handling systems, certain exhaust systems and chilled water systems dedicated to special areas.

Systems serving areas of critical nature shall offer 100% redundancy for all vital components and shall be powered from an emergency power source. 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.

Central HVAC systems shall be provided with multiple air handling units and exhaust fans to provide redundancy and improve reliability. These systems shall be designed to include manifolded air handling units (AHU) to achieve redundancy and maintain operation at all times.

Air handling systems shall be provided with the following:

- AHUs shall be designed to provided N+1 reliability and 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.
- Upon failure of any major component related to an AHU serving non-containment such as biosafety level (BSL) 2 biomedical laboratories, the remaining available air handling equipment

shall provide a minimum ventilation rate of 6 air changes per hour (ACH) in the affected area.

- Upon failure of any major component related to an AHU serving non-containment such as animal biosafety level (ABSL) 2 animal housing and support facilities, the remaining air handling equipment shall meet the entire HVAC load in the affected areas.
- 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.
- AHUs serving ABSL facilities shall be completely separate from other air handling systems.

Exhaust air systems shall be arranged with multiple manifolded fans designed to achieve N+1 redundancy and maintain the exhaust air system fully operational, at all times. 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
- Any other function as designated by NIH/DOHS

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.