

# News to Use

## Design Requirements Manual

*The formulae  $\frac{\partial \sigma_{ij}}{\partial x_k} + \frac{\partial}{\partial x_j} (\rho \sigma_{ij}) - \frac{\partial \sigma_{ij}}{\partial x_k} + \frac{\partial}{\partial x_j} (\rho \sigma_{ij}) + \rho (\sigma_{ij} - \rho)$  for building  $\frac{\partial}{\partial x_i} (\rho \sigma_{ij}) - \frac{\partial \sigma_{ij}}{\partial x_k} + \frac{\partial}{\partial x_j} (\rho \sigma_{ij}) - \rho \sigma_{ij} + \rho (\sigma_{ij} - \rho)$  state of the art  $\frac{\partial}{\partial x_i} (\rho \sigma_{ij}) - \frac{\partial \sigma_{ij}}{\partial x_k} + \frac{\partial}{\partial x_j} (\rho \sigma_{ij})$  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)

### Noise in Biomedical Research Laboratories and Animal Facilities

Noise is an environmental stressor for both people and animals. In laboratories, noise sensitive areas include space where procedures that require a high degree of manual precision or mental concentration are performed. Equipment such as chemical fume hoods, centrifuges, and vacuum pumps contribute to the high noise levels within the laboratory. Noise levels in laboratories and animal facilities are difficult to control because room finishes are generally hard and nonabsorbent.

In an animal research facility, the immediate environment directly and indirectly affects an animal's biological and behavioral responses and thus will have an effect on the research being performed. Most small animals are stimulated and may be stressed by noise. Noise disturbances are less of a factor for large animals unless they are involved in behavioral testing. Different species of animals will have different tolerances for high or low frequency noises. Certain frequencies can have an adverse affect on sensitive animals. These issues must be discussed with the facility users.

Animal species that generate noise should be isolated from those that are noise sensitive by either distance or sufficient acoustical isolation. Often, large animals generate noise whereas smaller animals are typically less noisy. Birds are noisier in relation to their size than rodents. Thus it is important for the designer to be familiar with the species that will be housed in the facility.

Although rodents can adjust to constant low level background noise, background noise should be minimized or removed through the use of innovative design. It is imperative to eliminate the effects of sudden and variable noise producing elements, such as fire alarms, throughout the animal holding environments.

Power ventilated racks generate noise. The rack density in a room will affect the noise level. Mechanical equipment may generate noise frequencies that are not noticeable to humans but will potentially affect animals housed near the source of the noise. Equipment that generates noise should be remote or acoustically isolated from animal holding

rooms wherever possible. Noise exposure to personnel must be considered when selecting cage rack washers. Noise conductivity through the duct system should also be taken into consideration. Sound attenuators shall be used for controlling noise. Duct lining is not permitted in NIH facilities.

For aquatic species research, the location of pumps and other mechanical equipment associated with the aquatic facility is a critical design feature and shall be located remotely from the holding rooms so as not to create noise and vibration.

Noise is characterized by a certain spectrum indicating the sound pressure level at various frequencies. Very often, the spectrum of a noise is as important as its absolute level. The level of such background sounds is commonly related to a series of noise criteria (NC) or room criteria (RC) curves. To determine the NC/RC value in the field, sound pressure levels should be measured with an octave-band sound-level meter.

The maximum allowable background Noise Criteria (NC) for a research laboratory is 40-45 NC based on rooms not being occupied with all user equipment off. When evaluating the noise levels in research animal housing areas, it is necessary to consider both the people and the animals in these spaces. For reasonable speech communication in these spaces, a maximum noise level of NC-45 shall be maintained. The acoustical consultant shall determine specific requirements for animal research areas on a per project basis with the Project Officer and research staff. All rooms in all buildings, except special acoustical laboratories, are exposed to some level of audible and measurable ambient sound. The maximum allowed airborne sound power levels from mechanical system equipment shall not exceed the values listed in the DRM Chapter 6.5. For each piece of machinery in the human environment, do not exceed the maximum airborne sound levels 84 dB.

Acoustical control is an important planning consideration and shall be evaluated during design. By examining adjacencies, the effects of noise can be addressed in the design layout.