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Design Requirements Manual **News to Use**

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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 $\frac{\partial}{\partial x_j}(\rho\overline{U_i}\overline{U_j})=-\frac{\partial \overline{P}}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu\frac{\partial \overline{U_i}}{\partial x_j}-\rho\overline{u_i'u_j'}\right)+g_i(\rho-\rho_0)$ 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.

Animal Locker Room Design Considerations

Designing an animal research facility (ARF) requires a comprehensive understanding of various standards and guidelines. For NIH-funded projects, the NIH *Design Requirements Manual* (*DRM*), *Biosafety in Microbiological and Biomedical Laboratories (BMBL)*, and the *Guide for the Care and Use of Laboratory Animals* (*Guide*) serve as primary references. The *DRM* covers space requirements, environmental controls, and layout, while the *BMBL* addresses essential biosafety protocols, and the *Guide* describes currently accepted standards in the care and housing of animals used in research.

Locker rooms play a critical role in maintaining safety, cleanliness, and well-being for both animals and staff. To design effectively, the project team must perform a comprehensive risk assessment; identify specific users (e.g., researchers, technicians, maintenance staff); determine user needs (e.g., personal protective equipment [PPE], clothing changes, hygiene protocols); develop a detailed Basis of Design (BOD); and identify potential hazards and appropriate mitigations.

ARF locker rooms can vary significantly in size and features based on the program, the required biosafety level, the type of species to be housed, and whether more than one species is present in the facility. The most basic is a simple room with lockers, but programmatic requirements may require a changing/locker room, a locker/shower room, or a locker room with shower and restroom facilities.

Location

The location of the locker room must address BOD requirements and the functional zoning of the ARF. The locker room should be located near the animal areas for efficiency and convenience but sufficiently distanced enough to minimize contamination risk. If the locker room is a barrier between the animal areas and the rest of the facility, it is required to be near ventilation and decontamination zones/utilities as needed to support contamination control (including odor as a contaminant). This configuration may require all personnel to enter through the locker room, doff street clothes, shower, and don a facility-specific uniform (usually scrubs) and PPE prior to entering the animal areas. This process is reversed upon exiting.

Layout

There are several requirements for a basic layout: room size, space for changing, storage (lockers), hygiene (handwashing and showering), and circulation. The circulation of people and materials should minimize distance and congestion but allow for maneuverability. The workflows for people, equipment, and clean/soiled materials passing through the locker room must be distinctly defined. In addition to the circulation criteria, there should be an allowance for all other required components that could impact access and operational protocols. Equipment and furniture often include storage for PPE, containers for soiled items, lockers, and benches.

The ARF should develop risk-based SOPs to define the required PPE, which is the last line of protection for staff and animals in the hierarchy of controls. PPE may be as simple as lab coats and disposable gloves or include protective headgear, hearing protection, safety shoes/foot protection, respirators/masks, safety eyewear, and special protective clothing. There should be enough space for the storage, donning, and doffing of PPE before entering and exiting the ARF. PPE storage should be separate from the storage for the staff's street clothing.

Safety, Privacy, and Security

To ensure safety and the flow of personnel, the locker room must be well-lit with consideration for the placement of lockers and/or benches so they do not obstruct pathways or impede egress to exit(s). For privacy, consider providing separation by gender or individual changing areas. The design must prevent direct sightlines from public spaces into the locker/changing rooms. For basic security, lockers may have secure access (e.g., card swipe or combination locks). The locker room may be required to have controlled access, especially if it is a direct passthrough as part of the facility's biosecurity protocol.

Finishes

All hard surfaces should be constructed of durable, smooth, moisture-resistant, non-porous, easy-to-clean materials to facilitate routine cleaning and decontamination. Materials must withstand frequent exposure to harsh cleaning agents used in ARFs. For example, seamless epoxy flooring with integral coved bases helps prevent moisture intrusion and microbial growth at the wall-floor interface. Animal facilities may use specialized cleaning agents which can affect the wear of surface materials. Joints, transitions, and voids (cracks, crevices, and hollow areas) that could harbor contamination, pests, and vermin must be solidly filled or completely sealed. Floors must be slip-resistant for safety, seamless, and integral with a coved base. Walls must be moisture- and impact-resistant. There should be a smooth juncture between the wall and the upper edge of the integral coved base. A solid, monolithic base or curb should be provided to support fixed, floor-mounted casework and lockers so that the floor base can be extended around them.

Lockers

The locker material must be resistant to corrosion and harsh cleaning materials and methods. Material options include epoxy-coated metal, stainless steel, or polymer. The selected material will be based upon the required function, appearance, and maintenance.

ARF lockers may have sloped tops or be recessed beneath a bulkhead to prevent unwanted buildup of dirt and discourage the top from being used for excess storage. Lockers should be placed upon a solid stand or platform and be well-sealed to the walls and floor to inhibit pests.

Locker configurations shall be ABA compliant and appropriately sized based on storage and standard operating procedure requirements. Many facilities opt for traditional full-height lockers, while others use oversized

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lockers to house bulky gear or cubby lockers to hold smaller equipment (which can be stacked for multi-tiered storage). PPE and workwear may be required to be stored separately from personal clothing, which would necessitate additional storage.

Environmental Considerations

Locker rooms require adequate ventilation, air quality, temperature control, and humidity control to remove odors and maintain air quality and staff comfort.

Conclusion

Locker room design is an integral component of animal research facilities. The ARF design intent shall be developed in consultation with veterinarians, animal care/maintenance staff, and stakeholders and documented in a BOD. Furthermore, it is essential for the designer to incorporate the appropriate codes, standards, and guidelines, inclusive of the ARF's operational and functional design requirements.