

Animal Research Facilities Ergonomics Design Guidelines

For New Construction and Existing Buildings

FOREWORD: The care and use of laboratory animals is governed by federal, state, and local regulations. The following guidelines are intended to reduce the ergonomic risks for lab animal care staff and to support the existing codes and regulations governing the housing and care of laboratory animals.

The size and design of an animal care facility depend on the scope of the institution's research activities and goals, as well as the types of animals housed. Additionally, the design and construction of animal care facilities should meet the following objectives:

- Support the institutional research needs and goals
- Compliance with regulatory requirements
 - The Guide for the Care and Use of Laboratory Animals
 - Animal Welfare Act
 - The Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching
 - CDC/NIH Biosafety in Microbiology and Biomedical Laboratories
 - State and local codes
- Provide an environment that meets the needs of the animal
- Facilitate efficient daily operations
- Support effective and controlled research
- Support ease of maintenance and sanitation
- Provide flexibility
- Provide security and daily operational control
- Employ sound occupational health and safety features

Effective planning and design should actively engage all stakeholders. It should include input from experienced animal care design personnel, engineering, operations, management, animal care staff, research staff, maintenance staff, Environmental, Health & Safety (EH&S) and campus ergonomists.

The following ergonomics design guidelines were developed for safe operations in the subsequent areas:

- Small animal housing rooms
- Cage sanitation areas (dirty and clean sides)

- Storage areas (feed, bedding and supplies)
- Receiving

Process considerations

- Ensure the contractor is experienced with animal research facilities
- Use an independent commissioning agent early in design and construction
- Design and construction meetings should include representatives from physical plant, facilities, EH&S, campus ergonomics, research, and animal care staff throughout the entire planning and building process
- Include all representatives in “value engineering” decisions

General considerations

- The vivarium design should anticipate and accommodate development, growth, or change in use without compromising the well-being of animals or safety of employees
- Building materials should be durable, moisture-proof, seamless, and smooth to facilitate ease of cleaning and sanitation. This protects the integrity of the research and health and safety of the animals and staff.
- The design should facilitate efficient and effective flow of traffic. Flow cycles for movement of personnel and animals should be carefully planned with animal care staff.
- Cage and equipment design (and vendors) should be identified early in the process as this has a significant impact on facility design and size

Plumbing considerations

- Sinks with frequent use should be hands-free or foot-operated
- Access to floor drains should not be inhibited by cages or cage racks
- Consider installing reliable self-priming trap drains, where feasible, to eliminate the time and ergonomic risks involved in manually dumping water into drains
- When designing large floor drains, consider the heavy weight of the large grates that cover this area. Either reduce the size of the area or cut the large floor grates into multiple smaller grates (with reinforcement underneath) to reduce the weight and size when lifted for cleaning purposes.

Workstation considerations

- Workstation surfaces should be height adjustable from at least 28-42”
 - Workstation surfaces for light work (rodent cage handling or processing) should be height-adjustable within the range of 33-42” from the floor

- For continuous work, handling equipment or materials weighing more than 10 pounds, workstation surfaces should be height-adjustable within the range of 28-39" from the floor
- If a workstation height is fixed and permanent, the height should be near the higher end of the range to accommodate taller individuals. Shorter individuals can be accommodated with the provision of risers or platforms.
- Use of non-glare glass on cage changing stations, biosafety cabinets, and dumping stations reduces eye strain

Equipment considerations

Engineering, fabrication, installation, and operation considerations for special equipment should be included in the design phase. This special equipment can include the following:

- Cage washers
- Tunnel washers
- Cabinet washers
- Batch washers
- Bedding disposal systems
- Automatic bedding dispensers
- Automated bottle fillers and cleaners
- Robotic cage-washing and waste-disposal systems
- Conveyor systems
- Sterilization equipment

Lighting and noise levels

- Consider dual-level lighting in animal housing rooms, which meet the requirements of *The Guide for the Care and Use of Laboratory Animals* and provide for adequate human visual acuity
 - General lighting should provide 30-35 foot candles when measured 1 meter from the floor
 - Higher level lighting should be used when animal care tasks require enhanced visibility. These tasks can include animal handling, observing, examination and reading cage cards. This lighting should provide a minimum of 46 foot candles and a maximum of 93 foot candles, when measured one meter from the floor.
- An ambient noise level at or below 80 dB is recommended for human workers and is compatible with the requirements set by *The Guide for the Care and Use of Laboratory Animals*. Consider noise abatement measures where noises generated by equipment, animals, or staff are anticipated to exceed this level.

Physical environment

- The recommended temperature range for a work environment that involves moderate active work is 63-74°F. This range is also acceptable for most species, particularly rodents.
- Animal care staff should have direct access to temperature controls due to considerations for the following:
 - Animal care staff are often required to wear Personal Protective Equipment (PPE), which can increase the likelihood for heat stress and fatigue
 - The cage sanitation area is likely higher in temperature and humidity, which can also contribute to heat stress and fatigue

Housekeeping and maintenance considerations

- There should be sufficient storage with easy access to cleaning supplies and equipment provided. Plan for storage of large equipment, such as walk-behind floor cleaners, with resources such as a power outlet and water/hose included.
- Floors, walls, and joints should be smooth and without crevices for ease of cleaning and sanitation
- Plan for sufficient interstitial space to provide easy access to water lines, drainpipes, coils and valves, electric service connections, HVAC vents and other utilities. This affords necessary access to maintenance staff without compromising posture or body mechanics and without disrupting laboratory operations or animal housing areas.

Shipping and receiving

- There should be a dedicated dock for the delivery and shipment of vivarium-related goods
- The dock should be equipped with either a permanent, stationary or mobile dock lift
- The size of the dock is dependent on the animal population and size
- Provisions should be made to separate clean and dirty shipments

Task-Specific Design Guidelines

Addressing the University of California's top at-risk tasks

Handling water bottles

- If the facility uses a large volume of water bottles, the logistics and equipment for handling, sanitizing, and filling water bottles must be considered during the planning and design phases
 - If an automatic watering system is currently being used or being considered for future use, a dedicated mechanical room (or sufficient space) must be provided to allow for easy access to the equipment requiring daily maintenance
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Changing cages

- Animal housing rooms should be sized so that caging and equipment is not crowded and provides sufficient room for husbandry and research procedures to be accomplished efficiently and safely
 - Animal housing rooms should have adequate space so that all cages in the room can be easily accessed without moving the racks or other heavy equipment
 - Animal housing rooms should include sufficient space for the storage and daily use of a changing station, when necessary. The changing station should be easily accessible for use, without moving it or racks. There should also be sufficient space around the changing station for storage and direct access to supplies and equipment used during the cage changing process.
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Cleaning cages

- The material handling process in the cage sanitation area should be thoroughly evaluated in the design phase as it impacts the space requirements for cage washing, associated equipment and cage-washing protocols. Considerations must also be given for equipment such as sinks, bottle washers and filling stations.
- Careful planning and attention to engineering and fabrication requirements should be evaluated when considering robotic cage-washing and waste-disposal systems
- Consider automatic sensors or hands-free mechanisms to operate doors. This is particularly important in cage sanitation rooms and storage areas with high volume of carts and cage racks. Activation controls should be no higher than 48 inches (per ADA guidelines).
- Sufficient space should be dedicated for staging and maneuvering equipment within the cage sanitation areas (clean and dirty sides)
- Routes from cage sanitation areas and related operational areas should be direct with minimal distances required to maneuver carts and racks. These areas include:

- Bedding dispensing
 - Waste disposal
 - Applicable storage areas
- There should be sufficient, dedicated space and utilities infrastructure to allow for dumping stations equipped with allergen control components

Pushing and pulling carts or racks

- Door width should be a minimum of 42 inches; however the preferred width is 48 inches as this is better suited for safe and easy movement of various types of equipment and materials in and out of rooms and storage areas.
- Door height should be a minimum of 90 inches; however the preferred height is 96 inches to accommodate cage racks. *Note: Standard-issue casters on cage racks often create amplified push/pull forces. Modified or upgraded casters used to reduce required effort to move the racks may also increase the overall height of the rack.*
- Consider automatic sensors or hands-free mechanisms to operate doors. This is particularly important in cage sanitation rooms and storage areas with high volume of carts and cage racks. Activation controls should be no higher than 48 inches (per ADA guidelines).
- In cage sanitation areas, storage areas, and animal housing rooms, doorway thresholds should be flush to minimize effort required to maneuver wheeled carts and racks in and out of rooms
- Flooring should be impact-resistant and smooth. It should be capable of supporting loaded racks, equipment, and stored supplies without becoming gouged, cracked, or pitted as this can increase the effort required to maneuver heavy carts and racks.
- All ramps (including those at the entrance/exit of the washer or autoclave) should have a slope no greater than 4.75° (1:12 grade) to minimize the push/pull forces required when maneuvering the loaded carts and racks
- Cart and rack routes traversed as part of the daily husbandry and cleaning tasks should be considered when planning and designing the vivarium layout to minimize the distances required to move heavy racks and carts
- Cage washers should be pit-mounted, pass-through design. Entries and exits of washers and autoclaves should be flush with the floor (thereby eliminating the need for a ramp). This minimizes push/pull effort when loading or unloading.
- Corridor width should be a minimum of 6 feet; however a width of 8 feet is preferred to provide for the efficient movement of personnel and equipment. Protective rails or bumpers, alarm panels, and fire extinguishers must be considered in the overall functional width.

Manually handling large bags of feed, bedding, waste and trash

- The delivery and storage of bedding or feed can be automated by the use of specially-designed conveyor systems (*refer to Product Recommendation Sheet*). Use of these systems

may require additional space for operation. Sufficient space should be considered for their use and for direct, easy access to load and unload bags of feed or bedding.

- Storage areas for delivered feed and bedding should be on the same level as loading dock to reduce the manual transport and material handling of the heavy bags
- For locations with multiple levels:
 - Freight elevators should be accessible for the transport of feed, bedding, trash and waste
 - The distance from the dock (receiving area) to the freight elevator should be no greater than 50 feet with no impediments such as stairs, textured surfaces, bumps, drains or slopes greater than 2%
- Loading docks should be designed to accommodate a hydraulic lift from ground level to dock height
- If docks are not equipped with hydraulic lift, a ramp with a grade not to exceed 4.75° (1:12 grade) should be included. Another option is to include sufficient space to accommodate either a mobile or stationary lift.
- Dedicated storage space sufficient for material handling equipment should be near the receiving area and easily accessible
- Entry ways into bulk feed and bedding storage areas should be wide enough to accommodate the passage of a pallet. A standard pallet is 40"x48"; however specific sizes used should be confirmed.
- There should be a dedicated storage room for feed and bedding, with the following considerations:
 - Easy to sanitize
 - Proximal to the clean side of cage sanitation
 - Sufficient space for dunnage racks or mobile racks
 - Sufficient space for material handling equipment (in the room or in close proximity)
 - Sufficient space for employees to conduct necessary manual material handling tasks without awkward postures such as bending, twisting, or crouching

References

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