

# Ergonomics Study of Animal Care Positions At The University of California

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## Executive Summary

At the University of California, animal care employees play a critical role in maintaining the health and well-being of animal subjects and supporting ongoing university research. To perform these job functions, workers are exposed to ergonomic risks such as repetitive motion, strain, and awkward postures. During fiscal years 2009-2013, ergonomic injuries involving animal care staff accounted for 328 workers' compensation claims, with an actuarial estimated ultimate direct cost of \$1,045,955.15 (*loss data was valued as of December 31, 2012*).

At the request of University of California, Office of the President (UCOP) Risk Services, the UC Ergonomics Work Group conducted a study of the animal care staff to identify the top five areas of ergonomic risk and develop strategies to address these issues. A project team comprised of five ergonomists from various UC locations was formed.

Various approaches were used to meet the project objectives, including:

- Workers' Compensation data analysis
- Literature review
- Task analysis
- Direct observation and front line experiences at participating campuses

The top 5 high-risk tasks identified and addressed in this project include:

1. Handling water bottles
2. Changing cages
3. Cleaning cages
4. Moving carts and racks
5. Transporting feed, bedding, waste and trash

From the compiled data, a set of reference documents was developed, including:

- Best Practices Bulletins
- Product Recommendation Sheets
- Ergonomic Design Guidelines for New Construction and Existing Buildings

The *Best Practices Bulletins* provide work practice recommendations to reduce ergonomic risk

factors. Each bulletin also includes information on equipment selection, training concepts, body mechanics, and work and staffing guidelines. The *Product Recommendation Sheets* offer equipment recommendations that have proven successful at one or more UC locations. The *Ergonomic Design Guidelines for New Construction and Existing Buildings* offer valuable ergonomic considerations to implement in the design phase of construction projects.

UCOP Risk Services will provide funding, up to \$5,000 per location, to facilitate implementation of ergonomic interventions to address one or more of the high-risk tasks. The application and brief evaluation tool for this process are included in this report.

Project documents are available on the UC EH&S website at:

[http://ucanr.edu/sites/ucehs/Workgroups/Ergonomics/Projects\\_112/](http://ucanr.edu/sites/ucehs/Workgroups/Ergonomics/Projects_112/). Content will be updated as pilot projects are implemented and data changes.

## Project Sponsors

Cheryl Lloyd, Chief Risk Officer, *Office of the President*

Erike Young, Director of Environment, Health and Safety, *Office of the President*

## Project Team

Ergonomics Study of Animal Care Positions at the University of California

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## Participating UC Locations

Thank you to those who contributed to this project:

- UC Berkeley
- UC Davis
- UC Irvine
- UC Los Angeles
- UC Riverside
- UC San Diego
- UC San Francisco
- UC Santa Barbara
- UC Santa Cruz
- Lawrence Berkeley National Laboratory

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## Ergonomics Study of Animal Care Positions at the University of California

### Project Objective

At the request of University of California, Office of the President (UCOP) Risk Services, the UC Ergonomics Work Group conducted a study of the ergonomic risks associated with laboratory animal husbandry. The objective of the study was to develop system-wide strategies that reduce these ergonomic risks.

### Project Scope

The scope of the project involved identifying the top five at-risk tasks within these positions and developing strategies to reduce injuries and decrease workers' compensation costs. This was achieved by developing:

- **Best Practices Bulletins** to provide resources and guidelines for improving work practices
- **Product Recommendation Sheets** to provide information on equipment with proven success
- **Ergonomic Design Guidelines** for new construction and existing buildings
- **Pilot Project Guidelines** to assist each location in developing and implementing location-specific interventions to address one or more of the high-risk tasks
- **Evaluation Tool** and metrics for effectiveness

### Project Methodology

Injury and risk data was collected from each participating location using multiple means:

- Questionnaire (*Appendix A- Initial Questionnaire*)
- Recorded claims data
- Interviews with management and frontline employees

- Information provided by onsite ergonomists

After review and analysis of the data, the top five at-risk tasks were identified by the project team, as follows:

1. Handling water bottles
2. Changing cages and sanitizing the cage rooms
3. Cleaning cages and dispensing bedding
4. Moving heavy carts and racks
5. Transporting large bags of feed, bedding, waste and trash

Other at-risk tasks reported (but not included in this study) are small animal dentistry, cleaning large animal pens, lifting carboys, changing frog tubs, and transporting clean cages in bags.

A second questionnaire was then developed by the project team and distributed to the ergonomists at participating locations (*Appendix B- Task Information Questionnaire*). Responses to this questionnaire provided the project team with the necessary information to develop the Best Practices Bulletins, Product Recommendation Sheets and Ergonomic Design Guidelines.

## Findings and Recommendations

A set of recommended strategies to reduce the ergonomic risks associated with the five at-risk tasks was developed. Please refer to the **Best Practices Bulletins**, **Product Recommendation Sheets**, and **Ergonomic Design Guidelines** in this report for recommendation details.

## Project Metrics

The goal of the project is to provide information, tools and resources to each UC locations in order to implement specific and effective actions that will result in the reduction in the frequency and severity of injuries related to these top five at-risk job tasks.

Success measurements include:

- Completion and distribution of Best Practices Bulletins for each UC location to use as a resource to improve work practices

- Completion and distribution of Product Recommendation Sheets, providing equipment information that will assist with injury reduction strategies
- Completion and distribution of Design Guidelines for New Construction and Existing Buildings, providing guidelines to campus partners during the design phase of construction
- Ongoing system-wide support to implement recommended design guidelines
- Implementation of a one-year pilot project at participating locations, including an evaluation tool
- Integration of pilot project evaluation outcomes and lessons learned into work practices

Long-term success of the project will be assessed by reviewing university workers' compensation claim data. Following achievement of the above short-term measures, a decline in injury rates and cost is anticipated.

## **Next Steps**

University of California animal care departments interested in participating in a UCOP-sponsored pilot project should work directly with the campus ergonomics program to complete the Ergonomic Pilot Project Application (see *appendix E*). Instructions are included in the application. Upon completion of the pilot, animal care employees and managers are expected to provide feedback to share with other participating UC locations. The Pilot Project Survey (see *appendix F*) should be used to collect the feedback.



## 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

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## Process considerations

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- 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

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## General considerations

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- 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 work flow. Flow cycles for movement of personnel, animals and equipment 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

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## Plumbing considerations

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- 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.

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## Workstation considerations

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- 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.
- When possible, work surfaces should have sufficient leg clearance underneath to allow versatility for standing or seated work
- Use of non-glare glass on cage changing stations, biosafety cabinets, and dumping stations reduces eye strain

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## Equipment considerations

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Engineering, fabrication, installation, operation, and maintenance 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

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## Lighting and noise levels

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- 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.

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## Physical environment

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- 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

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## Housekeeping and maintenance considerations

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- 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.

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## Shipping and receiving

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- 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
- Sufficient space should be provided for all mechanical transportation devices
- 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*

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### Handling water bottles

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- 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

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- 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
- Animals 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

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- 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 automated and mechanical 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

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## Pushing and pulling carts or racks

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- 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.

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

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- 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

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# Handling Water Bottles



# Product Recommendation Sheet: *Handling Water Bottles*

## Animal Care Product Recommendations

**Equipment:** Hydropac watering system, automatic watering system, rubber stoppers and metal top remover

**Criteria:**

- Reduce the repetitive nature of handling water bottles
- Reduce the manual handling of bottles
- Reduce the repetition and pinch force to remove bottle caps or stoppers

### Hydropac®

**Application:** Provide water to rodent cages



Make	Model	Cost (approximate)	Comments (Pros and Cons)	
Hydropac	AWS 2500 or AWS 5000	Varies Contact Hydropac for specifications and quote	<b>Pro:</b> <ul style="list-style-type: none"> <li>• Eliminates use of water bottles</li> <li>• Reduces ergonomic risks associated with lifting/handling racks of water bottles</li> <li>• Requires less time and staffing than traditional water bottles</li> </ul>	<b>Con:</b> <ul style="list-style-type: none"> <li>• Some potential water leaking in cage</li> <li>• Training needed to learn how to properly insert plunger</li> <li>• Awkward gripping associated with inserting plunger</li> <li>• Floor space needed for Hydropac machine</li> </ul>
<b>For More Information:</b>	Joyce Rhoades, UCLA <a href="mailto:jrhoades@ehs.ucla.edu">jrhoades@ehs.ucla.edu</a>			
<b>Website:</b>	<a href="http://labproductsinc.com/product/hydropac-alternative-watering-system/">http://labproductsinc.com/product/hydropac-alternative-watering-system/</a>			

### Automated watering system

**Application:** Provide water to rodent cages



Make	Model	Cost (approximate)	Comments (Pros and Cons)	
Edstrom	Automated Animal Watering System	Varies Contact Edstrom for specifications and quote	<b>Pro:</b> <ul style="list-style-type: none"> <li>• Eliminates ergonomics risks of manual bottle process</li> <li>• Saves time and labor (compared to bottles or Hydropacs)</li> <li>• Water is purified through reverse osmosis</li> <li>• Eliminates need to check water levels and refill</li> </ul>	<b>Con:</b> <ul style="list-style-type: none"> <li>• Risk of water leaking into cages</li> <li>• Requires regular flushing of the lines</li> </ul>

# UNIVERSITY OF CALIFORNIA

## Best Practices Bulletin: *Handling Water Bottles*

*Presented by Office of the President Risk Services- June 2014*



Water bottles represent the most frequently “touched” item throughout the small animal cage cleaning process. The water bottle handling process includes cleaning, filling, capping and uncapping, transporting to and from cage room, placing on and removing from cages, emptying and sanitizing. Bottles are placed in racks and filled before transport, making it heavy and difficult to handle.

Ergonomic risk factors for these tasks include:

- Repetitive motion and forceful pinching/gripping associated with capping and uncapping bottles
- Forceful exertions and awkward postures when grasping and tipping racks to dump water
- Repetitive and awkward postures when lifting, carrying, loading and unloading heavy racks
- Sustained forceful exertion while pushing and pulling heavy racks of water bottles on carts
- Awkward postures when removing bottle racks from tunnel washer

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## Best Practices

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The best practice is automating the water dispensing process to improve efficiency and reduce the risk of injury. Recognizing that this equipment can be cost-prohibitive, the information below includes additional best practices that can be implemented to achieve the same goals of risk reduction and efficiency improvement. Implementing the best practices below reduces the number of touches and the weight of water being transported.

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## Transfer of water bottle from cage to bottle rack

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- Alternate lifting the water bottles with the left and right hand to break up repetitive tasks
- Arrange bottle rack within close proximity to minimize reach distance and the length of time

the bottle is held

- Wearing nitrile gloves reduces the required grip force, providing better grip efficiency

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## Lifting water bottle racks to and from the cart

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- In the cage room staging area, stack water bottle racks on 12" high dunnage racks to reduce the height of the lift (*refer to Product Recommendation Sheet*)
- Use specifically designed transport carts to:
  - Reduce the height of the lift
  - Eliminate overhead lifting by decreasing height of stacked racks
  - Improve wheel design for efficient maneuverability (*refer to Product Recommendation Sheet*)
- Improve grip on the bottles racks by ensuring the rack has appropriate handles. This includes a diameter of 1.6" (1.2-2.0" range), void of grooves, and fabricated of a textured or knurled surface to improve grip efficiency.
- Use proper body mechanics and follow material handling principles when lifting bottle racks (*refer to the Safe Material Handling Information, appendix A*)

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## Removing and replacing caps and stoppers

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- Replace screw-on caps with rubber stopper caps to reduce the repetitive motion while removing and replacing caps
- When removing stopper caps, use a 5" length of PVC pipe to remove stopper by inserting end of PVC pipe into drinking tube and tipping forward (*refer to Product Recommendation Sheet*)
- Train staff on the appropriate amount of pressure required to insert rubber stopper; avoid forcing stopper onto bottle

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## Filling water bottles

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- Use an automated water dispenser that can be set to specific fill quantities
- Use a conveyer table set at the same height as the filling stations so that bottle racks can pass through the area for both manual fill or with a dispenser. The conveyor table should allow for staging area at the end to facilitate cart transfer.

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## Equipment

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Selecting the most appropriate equipment is an important decision. Prior to purchasing:

- Contact the campus ergonomist and work together with a knowledgeable vendor to help with the selection process

- Include staff in the selection process
- Arrange for a demonstration of the product by the manufacturer or distributor
- Refer to the Ergonomics Product Recommendation Sheet (or consult with your campus ergonomist) for applications and recommendations
- Pilot the preferred equipment for a minimum two-week trial period

During the pilot period, consider the following:

- Adjustability, size and weight of equipment to accommodate wide range of body types
- Appropriate sized casters and swivel design to allow for easy rolling and maneuverability
- Location of controls and ease of operation
- Storage and transporting needs
- Equipment maintenance and replacement parts
- Battery life and charging time
- Need for back-up equipment

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## Training

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Initial training should be provided for new employees within the first 30 days and annually thereafter. Training should also be provided any time new equipment is introduced. Training is best provided in small groups with the involvement of supervisors, leads, ergonomists and vendors. Assign new employees to work with key veteran staff to learn on the job techniques that reduce repetition, force, and awkward postures and help decrease the risk of injury (i.e. adequate force needed to secure rubber stoppers into water bottles).

Training should include:

- Hands-on performance of job tasks and related activities
- Hands-on practice when new tools, equipment, or procedures are introduced to the workforce
- Equipment use, maintenance, storage, safety procedures and use of personal protective equipment (PPE) as required
- Instructions on ergonomic practices focusing on the following:
  - practicing neutral postures
  - safe lifting, carrying, and pushing techniques
  - proper body mechanics
- Verbal and/or written materials to accommodate non-English speaking workers as well as visual aids (e.g., pictures, charts, videos) of actual tasks in the workplace
- Sufficient opportunity for questions

## Body mechanics

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Reduce exertion and fatigue during material handling tasks by applying the following ergonomic practices:

- Minimize manual material handling with the proper selection and use of material handling equipment
- While the use of material handling equipment should typically be the first choice, a team lift may be appropriate if:
  - Appropriate equipment is not available **and**
    - The load is too heavy for one person, **or**
    - The load is large, bulky, or oddly-shaped
- Prior to moving anything:
  - Assess the load (including weight, size and shape) to determine the most appropriate means of moving it
  - Plan your path; ensure the path is clear and safe to prevent slips, trips, or falls
  - Minimize the distance loads are moved by selecting efficient routes
- Use proper body mechanics and lift or push/pull techniques

*For additional information on body mechanics and safe material handling, please refer to the Safe Material Handling Guidelines, Appendices A and B.*

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## Work and staffing guidelines

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Work and staffing guidelines ensure that employees are adequately trained and assigned reasonable workloads. Guidelines include:

- Staff levels that provide adequate coverage to complete assigned work tasks
- Staff levels to avoid overtime and rushing to complete tasks
- Back-up staffing to accommodate unplanned absences
- Use of task and job rotation to limit repetition and fatigue
- Use of teams for heavy lifting and moving tasks
- Pre-shift exercises to warm up muscles to prepare for work
- Short, frequent rest breaks throughout the day
- Implementation and support of a work hazard notification system to identify ergonomic problems or other safety issues

## References

Gober, J. (2011). *Get a Grip. Three things that are wrong with many handles*. Retrieved from <http://www.humantech.com/blog/>

bottles

**For More Information:** Kristie Elton, UC Riverside  
[kristie.elton@ucop.edu](mailto:kristie.elton@ucop.edu)  
**Website:** <http://www.edstrom.com/product/solutions/animal-watering/products/automated-animal-watering/>

## Rubber stoppers

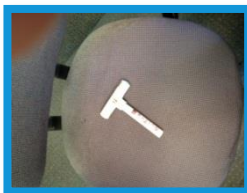
**Application:** Attaching and removing caps to water bottles



Make	Model	Cost (approximate)	Comments (Pros and Cons)
Ancare	Rubber stoppers	Varies by size Contact Ancare for specifications and quote	<b>Pro:</b> <ul style="list-style-type: none"> <li>Eliminates repetitive motion of twist-on caps</li> </ul> <b>Con:</b> <ul style="list-style-type: none"> <li>Some force is required to push the stopper on</li> <li>Mice may chew on the rubber</li> </ul>
<b>For More Information:</b>	Joyce Rhoades, UCLA <a href="mailto:jrhoades@ehs.ucla.edu">jrhoades@ehs.ucla.edu</a>		
<b>Website:</b>	<a href="http://www.ancare.com/products/watering-equipment/stoppers/rubber-stoppers">http://www.ancare.com/products/watering-equipment/stoppers/rubber-stoppers</a>		

## PVC metal pop top remover

**Application:** Attaching and removing caps to water bottles



Make	Model	Cost (approximate)	Comments (Pros and Cons)
Custom	Custom design 1-inch diameter PVC pipe (5" long) inserted into a "T" connector	\$2.00 ea.	<b>Pro:</b> <ul style="list-style-type: none"> <li>Can reduce repetitive wrist and hand motions</li> <li>Reduces contact stress on the hand</li> <li>Inexpensive to make</li> <li>Easy to use</li> </ul> <b>Con:</b> <ul style="list-style-type: none"> <li>Only works with metal pop tops</li> </ul>
<b>For More Information:</b>	Mallory Lynch, UC Berkeley <a href="mailto:mlynch@berkeley.edu">mlynch@berkeley.edu</a>		
<b>Website:</b>	None. This is a custom product from UC Berkeley.		

# **Cage Changing and Room Sanitization**



# UNIVERSITY OF CALIFORNIA

## Best Practices Bulletin: *Cage Changing/Sanitizing Small Animal Housing*

*Presented by Office of the President Risk Services- June 2014*



Laboratory animal care staff is an occupational group at high risk for injury throughout the UC system. This is a highly regulated work environment that requires a specialized skill set to provide care for animal subjects. The physical nature of the work involves repetitive tasks and staff use awkward postures and forceful exertions in areas crowded with cages and equipment.

Supplies for cage changing (clean rabbit cage racks, pre-filled rodent boxes, fresh feed, water bottles, etc.) are transported to the animal room. Racks are repositioned in the room and animals are transferred into clean caging. Trash is removed, floors are swept and mopped, and all surfaces are wiped down with disinfectant. Some rooms may require the walls to be sanitized. Ergonomic risk factors associated with these tasks include:

- Repetitive pinching, gripping, and awkward wrist postures when handling cage lids and rodents
- Static postures when holding cage lids during rodent transfers
- Bending and lifting while obtaining supplies and performing cleaning tasks
- Bending or kneeling to remove cages from racks
- Overhead reaching to access cages on top areas of racks
- Prolonged standing on hard floors

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### Best Practices

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The following best practices are offered to guide those responsible for supervising and/or ensuring the health and safety of these laboratory animal care workers when transferring animals and supplies to clean cages and sanitizing the cage rooms.



## Transferring rodents to clean cages

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- Provide an adjustable height changing station (*refer to Product Recommendation Sheet*)
- Adjust changing station height to be at elbow height or slightly below to allow for safe postures
- Place supplies such as feed, clean boxes and water bottles in close proximity to change station to reduce reaching distance
- Position rodent boxes on changing station directly in front and in close proximity to the body to avoid reaching
- Place the lid under the far end of the cage to angle it. This reduces forward bending of the neck and awkward wrist postures when transferring animals.
- Avoid holding the cage lid with one hand while transferring animals with the other
- Use the least amount of force necessary when pinching and gripping
- Alternate hands when transferring animals
- Provide anti-fatigue mats or shoe inserts to reduce fatigue associated with prolonged standing (*refer to Product Recommendation Sheet*). Ensure placement of the mat does not pose an unintended effect of placing carts or supplies too far from the work area.

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## Handling rodent boxes and cages

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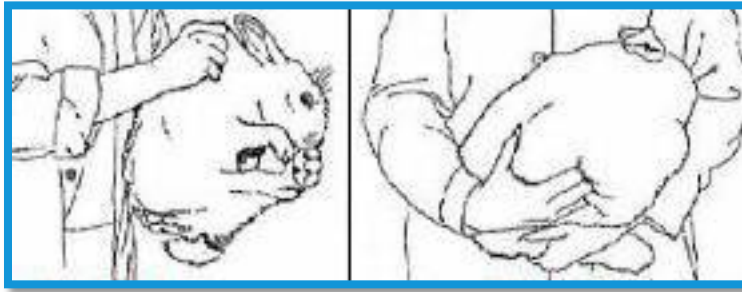
- When possible, cages should be positioned below shoulder height to eliminate repetitive overhead reaching. If there is sufficient space, consider using additional racks to avoid placing cages on the top row. If the top row on a rack must be used, a step stool is helpful to reduce overhead reaching.
- Use both hands when handling cages to reduce forceful gripping
- Work directly in front of the cage to prevent twisting and reaching and turn your entire body to face the direction you are going
- Avoid kneeling on hard surfaces for prolonged periods; use knee pads if kneeling is unavoidable

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## Transferring rabbits to clean cages

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- Position clean rack in close proximity to dirty rack and allow for room to move between them
- Turn the entire body toward the direction you are going to reduce twisting the low back
- Use a step stool when accessing cages positioned above shoulder height to reduce over reaching
- Use the AALAS transfer technique to lift and carry rabbits; this is consistent to safe material handling as it keeps the load close to your body (see photo below)



\*Assistant Laboratory Animal Technician Training Manual, 2013, American Association for Laboratory Animal Science, page 155

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## Transferring feed and water bottles

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- Utilize raised carts for feed that reduce bending forward at the waist (*refer to Product Recommendation Sheet*)
- When possible, use alternatives to water bottles to reduce risks associated with handling bottles

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## Mopping and sanitizing animal room floors

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- When possible, utilize automated floor cleaning equipment to reduce physical risks associated with manual mopping
- The use of microfiber, light-weight mop heads is recommended over heavy cotton loop mops (*refer to Product Recommendation Sheet*)
- Use buckets with spigots to reduce lifting (*refer to Product Recommendation Sheet*)
- Use a two-person lift for handling large floor grates
- Use a metal-hooked hand tool to lift large floor grates (*refer to Product Recommendation Sheet*)
- Consider modifying large floor grates to reduce the size and weight lifted (*refer to Product Recommendation Sheet*)
- Use long-handled locking nozzles to reach the high portions of the wall where hoses are used to sanitize rooms (*refer to Product Recommendation Sheet*)

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## Equipment

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Selecting the most appropriate equipment is an important decision. Prior to purchasing:

- Contact the campus ergonomist and work together with a knowledgeable vendor to help with the selection process
- Include staff in the selection process

- Arrange for a demonstration of the product by the manufacturer or distributor
- Refer to the Ergonomics Product Recommendation Sheet (or consult with your campus ergonomist) for applications and recommendations
- Pilot the preferred equipment for a minimum two-week trial period

During the pilot period, consider the following:

- Adjustability, size and weight of equipment to accommodate wide range of body types
- Appropriate sized casters and swivel design to allow for easy rolling and maneuverability
- Location of controls and ease of operation
- Storage and transporting needs
- Equipment maintenance and replacement parts
- Battery life and charging time
- Need for back-up equipment

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## Training

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Initial training should be provided for new employees within the first 30 days and annually thereafter. Training should also be provided any time new equipment is introduced. Training is best provided in small groups with the involvement of supervisors, leads, ergonomists and vendors. Assign new employees to work with key veteran staff to learn on the job techniques that reduce repetition, force, and awkward postures and help decrease the risk of injury (i.e. adequate force needed to secure rubber stoppers into water bottles).

Training should include:

- Hands-on performance of job tasks and related activities
- Hands-on practice when new tools, equipment, or procedures are introduced to the workforce
- Equipment use, maintenance, storage, safety procedures and use of personal protective equipment (PPE) as required
- Instructions on ergonomic practices focusing on the following:
  - practicing neutral postures
  - safe lifting, carrying, and pushing techniques
  - proper body mechanics
- Verbal and/or written materials to accommodate non-English speaking workers as well as visual aids (e.g., pictures, charts, videos) of actual tasks in the workplace
- Sufficient opportunity for questions

---

## Body mechanics

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Reduce exertion and fatigue during material handling tasks by applying the following ergonomic

practices:

- Minimize manual material handling with the proper selection and use of material handling equipment
- While the use of material handling equipment should typically be the first choice, a team lift may be appropriate if:
  - Appropriate equipment is not available **and**
    - The load is too heavy for one person, **or**
    - The load is large, bulky, or oddly-shaped
- Prior to moving anything:
  - Assess the load (including weight, size and shape) to determine the most appropriate means of moving it
  - Plan your path; ensure the path is clear and safe to prevent slips, trips, or falls
  - Minimize the distance loads are moved by selecting efficient routes
- Use proper body mechanics and lift or push/pull techniques

*For additional information on body mechanics and safe material handling, please refer to the Safe Material Handling Guidelines, Appendices A and B.*

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## Work and staffing guidelines

---

Work and staffing guidelines ensure that employees are adequately trained and assigned reasonable workloads. Guidelines include:

- Staff levels that provide adequate coverage to complete assigned work tasks
- Staff levels to avoid overtime and rushing to complete tasks
- Back-up staffing to accommodate unplanned absences
- Use of task and job rotation to limit repetition and fatigue
- Use of teams for heavy lifting and moving tasks
- Pre-shift exercises to warm up muscles to prepare for work
- Short, frequent rest breaks throughout the day
- Implementation and support of a work hazard notification system to identify ergonomic problems or other safety issues

## References

- Chengalur, S. N., Rodgers, S.H., Bernard, T.E. (2004). *Kodak's Ergonomic Design for People at Work* (2<sup>nd</sup> ed.). Hoboken, NJ: Eastman Kodak Company.
- Putz-Anderson, Vern (1988). *Cumulative Trauma Disorders: A Manual for Musculoskeletal Disease of the Upper Limbs*. Bristol, PA: Taylor & Francis.
- ILAR (Institute of Laboratory Animal Resources) (2011). *Guide For the Care and Use of Laboratory Animals*, 8<sup>th</sup> Ed. Washington DC: National Academies Press.

# Product Recommendation Sheet: *Cage Changing/Sanitizing Small Animal Rooms*

## Animal Care Product Recommendations

**Equipment:** Height adjustable transfer station, anti-fatigue matting and insoles, microfiber mopping systems, feed hopper, spray nozzles and height-adjustable carts

**Criteria:**

- Provide proper workstation height
- Provide anti-fatigue benefits for prolonged standing
- Reduce strain and sustained gripping during cleaning tasks
- Reduce bending and reaching when scooping feed
- Reduce lifting and lowering racks of water bottles
- Must meet regulatory standards for laboratory animal care environments

### Clean Bench Animal Transfer Station

**Application:** Transferring rodents to clean cages



Make	Model	Cost (approximate)	Comments (Pros and Cons)
Tecniplast	CS5 EVO	\$1500.00	<p><b>Pro:</b></p> <ul style="list-style-type: none"> <li>• Height adjustable</li> <li>• Manual and electric models available</li> <li>• Height range of work surface height is 36 1/4" to 48 1/8" from floor</li> <li>• Good lighting with dimmer option</li> <li>• Designed to maneuver from room to room</li> <li>• Reduces allergens</li> <li>• Slanted view screen</li> <li>• Minimal noise and vibration</li> </ul> <p><b>Con:</b></p> <ul style="list-style-type: none"> <li>• Adjustable height range of work surface is higher than the recommended 33-42" range; however, a platform or riser can be used by shorter employees</li> </ul>

**For More Information:** Janice Fletcher, UC San Diego Medical Center  
[jfletcher@ucsd.edu](mailto:jfletcher@ucsd.edu)

**Website:** <http://www.tecniplast.it/en/product/cs5-evo-changing-station.html>

## Anti-fatigue Mat

**Application:** Prolonged standing



### Make

**Pro-Tech Mats Industries, Inc.**

### Model

**Ortho 1**

### Cost

*(approximate)*

**Varies,**  
depending on  
the size of the  
mat

### Comments

*(Pros and Cons)*

#### Pro:

- Reduces fatigue from prolonged standing
- Customizable sizes
- Antimicrobial
- Withstands frequent sanitization
- Lightweight, easy to clean
- Beveled edges to help carts roll over the mat

#### Con:

- Can be difficult to maneuver certain racks and carts over mats
- Mats, in general, can create a trip hazard
- Moving mats requires squatting or stooping
- Must move for room sanitization

**For More Information:**

Joyce Rhoades, UCLA  
[jrhoades@ehs.ucla.edu](mailto:jrhoades@ehs.ucla.edu)

**Website:**

<http://www.protechmats.com/sub-categories-products.php?SubCatId=35>

## Anti-fatigue Shoe Insoles

**Application:** Prolonged standing and walking



### Make

**Impacto**

### Model

**Anti-fatigue  
molded insole**

### Cost

*(approximate)*

**\$20.00/pair**

### Comments

*(Pros and Cons)*

#### Pro:

- Reduces fatigue from prolonged standing and walking

#### Con:

- Training may be necessary for initial use and sizing issues
- May not be suitable for individuals with certain medical conditions, such as diabetes
- Need to be replaced every 6 months

**For More Information:**



Ginnie Thomas, UC Santa Barbara  
[gthomas@housingucsb.edu](mailto:gthomas@housingucsb.edu)

**Website:**

[http://www.grainger.com/product/IMPACTO-Anti-Fatigue-Molded-Insole-WP71606/-/N-ipg?s\\_pp=false](http://www.grainger.com/product/IMPACTO-Anti-Fatigue-Molded-Insole-WP71606/-/N-ipg?s_pp=false)


## Ancare Feed & Bedding Cart

**Application:** Scooping feed and bedding

	Make	Model	Cost (approximate)	Comments (Pros and Cons)
 	Ancare	ANLC2026FCLH	\$800.00	<b>Pro:</b> <ul style="list-style-type: none"> <li>• Positions feed and bedding at a higher level</li> <li>• Single and dual hoppers</li> <li>• Stainless steel</li> <li>• Locking casters helps hold unit in place</li> <li>• Built in lid holder</li> <li>• Lower level has 1/4" slope for drainage</li> </ul>
	<b>For More Information:</b> <b>Website:</b>	Janice Fletcher, UC San Diego <a href="mailto:jfletcher@ucsd.edu">jfletcher@ucsd.edu</a> <a href="http://www.ancare.com/products/bedding-nesting-and-enrichment/feed-bedding-and-enrichment-carts/ancare-feedbedding-cart">http://www.ancare.com/products/bedding-nesting-and-enrichment/feed-bedding-and-enrichment-carts/ancare-feedbedding-cart</a>	Kristie Elton, UC Riverside <a href="mailto:kristie.elton@ucop.edu">kristie.elton@ucop.edu</a>	<b>Con:</b> <ul style="list-style-type: none"> <li>• Baskets, bins and lids sold separately</li> </ul>

## Westward Pistol Grip Water Nozzle

**Application:** Sanitizing rooms

	Make	Model	Cost (approximate)	Comments (Pros and Cons)
	Westward	1HLW3	\$20.00	<b>Pro:</b> <ul style="list-style-type: none"> <li>• Flow control</li> <li>• Lockable trigger reduces squeezing trigger when washing down rooms</li> <li>• Cushioned grip</li> </ul>
	<b>For More Information:</b> <b>Website:</b>	Joyce Rhoades, UCLA <a href="mailto:jrhoades@ehs.ucla.edu">jrhoades@ehs.ucla.edu</a> <a href="http://www.grainger.com/product/WESTWARD-Water-Nozzle-1HLW3?searchQuery=1HLW3">http://www.grainger.com/product/WESTWARD-Water-Nozzle-1HLW3?searchQuery=1HLW3</a>		<b>Con:</b> <ul style="list-style-type: none"> <li>• None reported</li> </ul>

## Westward Water Nozzle Wand

**Application:** Sanitizing rooms



**Make**

Westward

**Model**

1HLV2

**Cost**  
(approximate)

\$20.00

**Comments**  
(Pros and Cons)

**Pro:**

- 32" handle reduces overhead reaching
- Locking trigger
- Light weight
- Insulated handle

**Con:**

- None reported

**For More Information:**

Joyce Rhoades, UCLA

[jrhoades@ehs.ucla.edu](mailto:jrhoades@ehs.ucla.edu)

**Website:**

<http://www.grainger.com/product/WESTWARD-Water-Nozzle-1HLV2?searchQuery=1HLV2>

## Hyde 38" Aluminum Spray Nozzle

**Application:** Sanitizing rooms



**Make**

Hyde

**Model**

Pivot Jet  
#28470

**Cost**  
(approximate)

\$50.00

**Comments**  
(Pros and Cons)

**Pro:**

- Longer handle
- Lightweight
- Pivoting nozzle
- Soap reservoir for sanitizing solutions

**Con:**

- Heavier due to soap reservoir

**For More Information:**

Joyce Rhoades, UCLA

[jrhoades@ehs.ucla.edu](mailto:jrhoades@ehs.ucla.edu)

**Website:**

[www.grainger.com](http://www.grainger.com)

## Microfiber Mopping System

**Application:** Sanitizing rooms



**Make**

Rubbermaid

**Model**

Q050  
Microfiber Finish System

**Cost**  
(approximate)

\$150

**Comments**  
(Pros and Cons)

**Pro:**

- Removable microfiber pads eliminate wringer
- Bottom mounted spigot allows emptying bucket without lifting
- Optional color

**Con:**

- Better suited for small areas; limited use in corridors and larger areas
- Hook and loop backing on pads can wear out over time and will need to be replaced

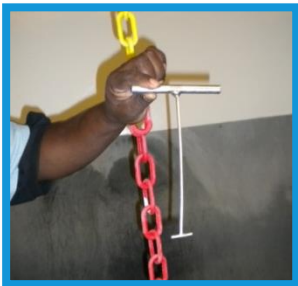


- coded pads can reduce cross contamination
- Not as durable as traditional mops
- Need washing machine to clean pads for reuse

**For More Information:** Jill Evans-Grinsbergs, UC Davis Medical Center  
[jill.evans-grinsbergs@ucdmc.ucdavis.edu](mailto:jill.evans-grinsbergs@ucdmc.ucdavis.edu)  
**Website:** <http://www.rubbermaidcommercial.com/rcp/products/detail.jsp?rcpNum=Q050&search=Q050>

## Custom T Hook Tool and Grate Supports

**Application:** Lifting heavy floor grates during cleaning



### Make

**Custom tool and modifications fabricated by campus sheet metal shop**

### Model

**Tool:** 6 inches long with 1 inch diameter on T-handle

**Floor grate:** cut in half and create sheet metal supports underneath for overall integrity

**Cost**  
(approximate)  
**\$50**

### Comment (Pros and Cons)

#### Pro:

- Reduces awkward lifts from floor
- Reduces weight being lifted

#### Con:

- None reported



**For More Information:** Joyce Rhoades, UCLA  
[jrhoades@ehs.ucla.edu](mailto:jrhoades@ehs.ucla.edu)

**Website:** None (custom tool fabricated by UCLA sheet metal shop)

# **Cage Cleaning and Bedding Dispensing**

## Best Practices Bulletin: *Cage Cleaning and Bedding Dispensing*

*Presented by Office of the President Risk Services- June 2014*



Dirty cages are transported to a dedicated emptying and cleaning area and typically dumped by manually tipping, banging and scraping the dirty bedding into an open container. To help control allergens, some UC locations use a ventilated dumping station. Once the bedding is emptied, the cages are turned upside down on a tunnel washer or placed on racks for the cage washer. Once the cages are cleaned, the new bedding is manually scooped or occasionally automatically dispensed into the clean cages. Some of the ergonomic risk factors for these job tasks include:

- Awkward gripping postures while grasping multiple cages and manually scooping bedding
- Bending forward at the waist while manually scooping bedding into cages placed low on carts
- Repetitive and forceful motions while banging cages to remove dirty bedding
- Awkward shoulder postures while holding cage to scrape contents

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### Best Practices

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The best practices are to automate these work processes with robotics in order to reduce the risk of injury and improve efficiency and air quality. Recognizing that this equipment can be cost-prohibitive, the information below includes additional best practices that can be implemented to achieve the same goals of risk reduction, efficiency improvement and air quality control.

## Transporting dirty cages to central washroom

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- Provide carts and racks that are easily maneuverable. For off-site locations, use a transport truck with an automatic lift gate and a dock leveler at the loading dock.
- On tiered racks, position top of cages no higher than 74 inches to prevent overreaching

## Handling and dumping dirty cages

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- Grasp no more than 1 cage per hand when dumping contents to decrease forces associated with gripping
- Utilize a step ladder to grasp cages positioned up higher on racks
- Where possible, provide a ventilated dumping station with a vacuum transport to reduce allergens and provide direct transport of dirty bedding to outside containers (*refer to Product Recommendation Sheet*)
- When a ventilated dumping station is not provided, place waste container under a table (height not to exceed 40") where a large hole has been cut to expose the container and provides surface area to aid in dumping
- Provide a sturdy, but flexible round handled scraper (1.2-2.0" grip diameter with a non-slip or high-friction surface) to aid with removal of stuck bedding

## Cage washing

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- Place dirty cages no more than 3 deep on the tunnel washer to decrease reaching when staff collect clean cages from the side
- Utilize a hose extension when washing cages on racks to reduce reaching
- The cage racks can be difficult to maneuver in and out of the cage wash; consequently, keep the rack close to the body to have the best control
- Ambient noise levels should be at or below 80 dB

## Handling clean cages

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- Place carts and tables near tunnel washer and cage racks to reduce reaching and bending forward at the waist
- Grasp clean cages off of tunnel washer and cage racks and place on a surface at or around waist height to dispense bedding (as opposed to placing cages on low surfaces such as a flatbed cart)

- Incorporate a floating staff position that rotates every 2 weeks to break up repetitive tasks associated with dumping and filling cages

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## Dispensing bedding

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- When possible, use an automatic bedding dispenser to reduce repetitive motions
- For manual dispensing
  - Use a custom multi scoop for light weight bedding, such as Sani-Chip, (this is a two person operation)
  - The bedding hopper should be wider vs. deeper when using this scoop so there is access for the custom tool (*refer to Product Recommendation Sheet*)
- When manually dispensing heavier bedding, use a single scoop and place cages at or near waist height
- Stack filled cages on carts and racks at  $\leq 74$  inches to decrease overhead reach
- Use a custom T-hook tool to aid lifting large floor grates when cleaning the floor; where possible, work with the sheet metal shop to modify the floor grates to reduce overall weight being lifted (*refer to Product Recommendation Sheet*)

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## Equipment

---

Selecting the most appropriate equipment is an important decision. Prior to purchasing:

- Contact the campus ergonomist and work together with a knowledgeable vendor to help with the selection process
- Include staff in the selection process
- Arrange for a demonstration of the product by the manufacturer or distributor
- Refer to the Ergonomics Product Recommendation Sheet (or consult with your campus ergonomist) for applications and recommendations
- Pilot the preferred equipment for a minimum two-week trial period

During the pilot period, consider the following:

- Adjustability, size and weight of equipment to accommodate wide range of body types
- Appropriate sized casters and swivel design to allow for easy rolling and maneuverability
- Location of controls and ease of operation
- Storage and transporting needs
- Equipment maintenance and replacement parts
- Battery life and charging time
- Need for back-up equipment

## Training

---

Initial training should be provided for new employees within the first 30 days and annually thereafter. Training should also be provided any time new equipment is introduced. Training is best provided in small groups with the involvement of supervisors, leads, ergonomists and vendors. Assign new employees to work with key veteran staff to learn on the job techniques that reduce repetition, force, and awkward postures and help decrease the risk of injury (i.e. adequate force needed to secure rubber stoppers into water bottles).

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- Instructions on ergonomic practices focusing on the following:
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  - safe lifting, carrying, and pushing techniques
  - proper body mechanics
- Verbal and/or written materials to accommodate non-English speaking workers as well as visual aids (e.g., pictures, charts, videos) of actual tasks in the workplace
- Sufficient opportunity for questions

---

## Body mechanics

---

Reduce exertion and fatigue during material handling tasks by applying the following ergonomic practices:

- Minimize manual material handling with the proper selection and use of material handling equipment
- While the use of material handling equipment should typically be the first choice, a team lift may be appropriate if:
  - Appropriate equipment is not available **and**
    - The load is too heavy for one person, **or**
    - The load is large, bulky, or oddly-shaped
- Prior to moving anything:
  - Assess the load (including weight, size and shape) to determine the most appropriate means of moving it
  - Plan your path; ensure the path is clear and safe to prevent slips, trips, or falls
  - Minimize the distance loads are moved by selecting efficient routes

- Use proper body mechanics and lift or push/pull techniques

*For additional information on body mechanics and safe material handling, please refer to the Safe Material Handling Guidelines, Appendices A and B.*

---

## Work and staffing guidelines

---

Work and staffing guidelines ensure that employees are adequately trained and assigned reasonable workloads. Guidelines include:

- Staff levels that provide adequate coverage to complete assigned work tasks
- Staff levels to avoid overtime and rushing to complete tasks
- Back-up staffing to accommodate unplanned absences
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- Use of teams for heavy lifting and moving tasks
- Pre-shift exercises to warm up muscles to prepare for work
- Short, frequent rest breaks throughout the day
- Implementation and support of a work hazard notification system to identify ergonomic problems or other safety issues

## References

<sup>1</sup> Hesler, J. , & Lehner, N. (Eds.), (2009). *Planning and Designing Research Animal Facilities.* London, UK: Elsevier Inc.

<sup>2</sup> Chengalur, S. N., Rodgers, S. H., & Bernard, T. E. (2004). *Kodak's Ergonomic Design for People at Work* (2<sup>nd</sup> ed.), Hoboken, NJ: John Wiley & Sons.

<sup>3</sup> Humantech. (2009). *The Handbook of Ergonomic Design Guidelines* (2<sup>nd</sup> ed.). Ann Arbor, MI: Humantech, Inc.

# Product Recommendation Sheet: *Cage Cleaning and Bedding Dispensing*

## Animal Care Product Recommendations

**Equipment Description:** Automatic cage and bedding processing unit; self-contained bedding dump station, multiple-scoop device for bedding dispensing, hook for lifting floor grates

### Criteria:

- Automate cage dumping and bedding dispensing
- Control allergens
- Reduce manual material handling of bagged trash to larger waste containers
- Reduce repetitive manual scooping and awkward hand/wrist postures

### Self-contained Waste Management System

**Application:** Dumping dirty bedding from small rodent cages



#### Make

Schlyer

#### Model

SCD6800

**Cost**  
(approximate)  
**\$300,000 -**  
**\$400,000**

#### Comments (Pros and Cons)

##### Pro:

- Reduces dust and allergens
- Large hopper
- Dump height same as washer
- Vacuum transport of bedding to large dumpsters

##### Con:

- Needs calibration
- Clogging issues
- Expensive
- Does not reduce ergonomic risk of dumping contents
- Dumping can occur on one side only

**For More Information:** Mallory Lynch, UC Berkeley  
[mlynch@berkeley.edu](mailto:mlynch@berkeley.edu)  
**Website:** [www.smc-roe.com](http://www.smc-roe.com)

### Stand Alone Waste Management System

**Application:** Dumping dirty bedding from small rodent cages



#### Make

Lab Products

#### Model

**59020**  
(46.5" L x 29.5" W x 66" H)

**Cost**  
(approximate)  
**\$10,140 list**

#### Comments (Pros and Cons)

##### Pro:

- Reduces allergens
- Two barrel compartment
- Cover over one slot to place cages

##### Con:

- Does not eliminate manual dumping and scraping



**For More Information:** Kristie Elton, UC Riverside  
[kristie.elton@ucop.edu](mailto:kristie.elton@ucop.edu)  
**Website:** <http://labproductsinc.com/product-cat/environmental-systems/>

## Multiple Scoop for Bedding Dispensing

**Application:** Dispensing bedding into clean cages



Make	Model	Cost (approximate)	Comments (Pros and Cons)	
Custom tool fabricated by campus sheet metal shop	Customized	\$243.00	<b>Pro:</b> <ul style="list-style-type: none"> <li>• Light weight at ~ 1 lb. empty</li> <li>• In house fabrication</li> <li>• Low cost</li> <li>• Increases productivity</li> </ul>	<b>Con:</b> <ul style="list-style-type: none"> <li>• Two-person task</li> <li>• Manual loading of bedding</li> <li>• Use only for light weight bedding, such as Sani-chip</li> </ul>

**For More Information:** Joyce Rhoades, UCLA  
[jrhoades@ehs.ucla.edu](mailto:jrhoades@ehs.ucla.edu)  
**Website:** None (custom tool fabricated by UCLA sheet metal shop)

## Automatic Bedding Dispenser

**Application:** Dispensing bedding into clean cages



Make	Model	Cost (approximate)	Comments (Pros and Cons)	
TBJ	BD-2000	\$21,000 including freight to dock	<b>Pro:</b> <ul style="list-style-type: none"> <li>• Automatic bedding transfer - low to upper hopper</li> <li>• Stand-alone unit</li> <li>• Reduces repetition and manual material handling</li> </ul>	<b>Con:</b> <ul style="list-style-type: none"> <li>• Only works with cob bedding</li> </ul>

**For More Information:** Kristie Elton, UC Riverside  
[kristie.elton@ucop.edu](mailto:kristie.elton@ucop.edu)  
**Website:** <http://www.tbjinc.com/Product.aspx?id=24101>

## Detach Automated Cage and Bedding Processing System

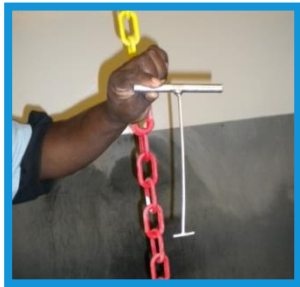
**Application:** Dumping dirty bedding from small rodent cages and/or dispensing bedding into clean cages  
(system is customizable)



Make	Model	Cost (approximate)	Comments (Pros and Cons)	
Detach	Automated Cage and Bedding Processing System	Varies – depends on design of project	<b>Pro:</b> <ul style="list-style-type: none"> <li>• Reduces FTEs</li> <li>• Processes over 1000 cages/day</li> <li>• Bedding and disposal can be incorporated</li> <li>• Train on-site maintenance staff to limit down time for basic issues</li> </ul>	<b>Con:</b> <ul style="list-style-type: none"> <li>• System occasionally goes down</li> <li>• More expensive</li> </ul>
<b>For More Information:</b> Mallory Lynch, UC Berkeley <a href="mailto:mlynch@berkeley.edu">mlynch@berkeley.edu</a> <b>Website:</b> <a href="http://www.detach.com/index.html">http://www.detach.com/index.html</a>				

## Custom T Hook Tool and Grate Supports

**Application:** Lifting heavy floor grates during cleaning



Make	Model	Cost (approximate)	Comment (Pros and Cons)	
Custom tool and modifications fabricated by campus sheet metal shop	<b>Tool:</b> 6 inches long with 1 inch diameter on T-handle  <b>Floor grate:</b> cut in half and create sheet metal supports underneath for overall integrity	\$50	<b>Pro:</b> <ul style="list-style-type: none"> <li>• Reduces awkward lifts from floor</li> <li>• Reduces weight being lifted</li> </ul>	<b>Con:</b> <ul style="list-style-type: none"> <li>• None reported</li> </ul>
<b>For More Information:</b> Joyce Rhoades, UCLA <a href="mailto:jrhoades@ehs.ucla.edu">jrhoades@ehs.ucla.edu</a> <b>Website:</b> None (custom tool fabricated by UCLA sheet metal shop)				

# Moving Carts and Racks

# UNIVERSITY OF CALIFORNIA

## Best Practices Bulletin: *Moving Carts and Racks*

*Presented by Office of the President Risk Services- June 2014*



Animal care tasks involve frequent pushing, pulling, or maneuvering large carts and cage racks. This includes maneuvering cage racks into and out of the cage washer and moving these racks within the rooms or from room-to-room. It also involves maneuvering loaded carts (or similar material handling equipment) to transport equipment, supplies, large cages, etc. within the facility. Challenges reported with these push/pull tasks include limited space, poor cart/rack maneuverability, inappropriate and poorly-maintained casters, steep ramps and heavy loads. Ergonomic risk factors for these tasks include:

- Awkward shoulder, hand, and wrist postures while grasping the handles
- Lower back, neck, and shoulder strain to maneuver heavy loads or push up steep ramps
- Forceful grip on handles

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### Best Practices

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The following best practices are intended to be a guide to ensure the health and safety of animal care employees when moving the large and heavy carts/racks within designated animal care rooms or into and out of cage washers.

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### Maneuvering cage racks into/out of cage washer

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- Ramps leading into cage washers should have a gradual slope to minimize the forces required to push racks into the washer
- Casters and wheels on cage racks should be carefully evaluated and selected so there are minimal push and pull forces required to move the racks
- Position the racks close to the body, with elbows slightly bent, to make it easier to maneuver them

## Maneuvering cage racks room to room or within the rooms

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- Cage rooms should be arranged so that doors can be opened and equipment can be regularly accessed without having to move racks
- Select wheels and casters that work best in small area; wheels with crown treads may be preferable when moving racks in tight spaces, as they make it easier to turn
- Ensure that your path is clear as carts are large and often prevent a clear line of sight

## Maneuvering loaded carts within the facility

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- Enclosed carts or carts with covers increase the stability of the load and may prevent items from falling
- Loaded cart height should not exceed 56" to ensure shorter handlers are able to see over the load during operation
- Carts should be selected based on the size and weight of the load being transported. The weight of the load should never exceed the equipment capacity.
- There should be a sufficient supply of material handling equipment stored in an area that makes it readily available and easy to access
- Ensure that your path is clear as carts are large and often prevent a clear line of sight

## Caster and wheel selection

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- The size, type and design of the casters or wheels can significantly impact the ease of handling a cart. Research and product evaluation is necessary when selecting casters or wheels. Consult with a manufacturer or vendor regarding the task specifics, as well as operating conditions and environment, prior to caster selection.
- Casters should provide optimal maneuverability, turning and swivel capabilities. Swivel casters should be on the end of the cart with the handle(s) for easier maneuverability.
- Casters on carts and racks should require minimal initial and sustained push/pull force requirements. The recommended force measurements below assume the force is exerted around waist height in a horizontal direction.
  - Initial or start forces should not exceed 50 foot-pounds
  - Sustained force (rolling force) should not exceed 40 foot-pounds
    - The sustained force should not exceed 25 foot-pounds if the force is sustained for greater than 1 minute
    - The sustained force should not exceed 7.5 foot-pounds when exerted for 4 minutes or more
- The following criteria should be considered when selecting casters for carts:
  - Vertical clearance of cart

- Weight capacity
- Swivel
- Lockable casters
- Temperature threshold (especially in cage washer and autoclaves)
- Wheel brakes should minimize emergency stopping forces to 80 foot-pounds or less

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## Cart handles

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When ordering new carts, consider the ergonomic specifications below for handle design, which provide for easy access and maneuverability. For existing carts, consider re-designing the handles or ordering different handles to meet the ergonomic specifications.

- Vertical handles that can be grasped anywhere along their length allow individuals of various heights to position arms, shoulders and hands in neutral positions that minimize force and effort
- For carts with horizontal handles, consider the use of adjustable handles to accommodate different user heights
- The height range for vertical or adjustable horizontal handles should include 29-47"
- The handle height on tall, narrow carts may go as high as 50" from the floor to provide better maneuverability and control of the cart
- Fixed, horizontal handles should be positioned within the range of 36-44" from the floor
- Handles should be positioned so the right and left hand placement does not exceed 18" apart
- Handles should provide a minimum of 5-6" for finger clearance; 8" for gloved hands
- Handles should be 1-1.5" in diameter and shaped so that they do not cause concentrated pressure on any specific part of the hand (i.e., no sharp edges, pronounced ridges, etc.)
- When gripping the handle, the handler's fingers should not overlap, and the handle should be wide enough to accommodate the entire hand
- Ergonomic grips or wraps can be placed on cart handles to reduce grip force applied when pushing or pulling. Grip force with the wrist in a neutral position should not exceed 40 foot-pounds.

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## Preventive maintenance

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Develop a scheduled preventive maintenance program. This should include:

- Clean the dirt and debris from the wheels and casters on all carts/ racks daily
- Wheels and casters should be inspected regularly for wear, flat spots, rust, damage and debris
- Casters and wheels should be lubricated regularly, according to the manufacturers'

recommendation

- Replace casters and wheels when performance is diminished or the unit is damaged

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## General guidelines for cart use

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- Loads greater than 500 lb. should not be transported on a hand cart or truck. Reduce the load or utilize power assist equipment.
- The handler's footwear is an important factor in minimizing effort to push and pull. Flat, rubber soles that provide sufficient slip resistance with the surface are best.

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## Equipment

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Selecting the most appropriate equipment is an important decision. Prior to purchasing:

- Contact the campus ergonomist and work together with a knowledgeable vendor to help with the selection process
- Include staff in the selection process
- Arrange for a demonstration of the product by the manufacturer or distributor
- Refer to the Ergonomics Product Recommendation Sheet (or consult with your campus ergonomist) for applications and recommendations
- Pilot the preferred equipment for a minimum two-week trial period

During the pilot period, consider the following:

- Adjustability, size and weight of equipment to accommodate wide range of body types
- Appropriate sized casters and swivel design to allow for easy rolling and maneuverability
- Location of controls and ease of operation
- Storage and transporting needs
- Equipment maintenance and replacement parts
- Battery life and charging time
- Need for back-up equipment

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## Training

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Initial training should be provided for new employees within the first 30 days and annually thereafter. Training should also be provided any time new equipment is introduced. Training is best provided in small groups with the involvement of supervisors, leads, ergonomists and vendors. Assign new employees to work with key veteran staff to learn on the job techniques that reduce repetition, force, and awkward postures and help decrease the risk of injury (i.e. adequate force needed to secure rubber stoppers into water bottles).

Training should include:

- Hands-on performance of job tasks and related activities
- Hands-on practice when new tools, equipment, or procedures are introduced to the workforce
- Equipment use, maintenance, storage, safety procedures and use of personal protective equipment (PPE) as required
- Instructions on ergonomic practices focusing on the following:
  - practicing neutral postures
  - safe lifting, carrying, and pushing techniques
  - proper body mechanics
- Verbal and/or written materials to accommodate non-English speaking workers as well as visual aids (e.g., pictures, charts, videos) of actual tasks in the workplace
- Sufficient opportunity for questions

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## Body mechanics

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Reduce exertion and fatigue during material handling tasks by applying the following ergonomic practices:

- Minimize manual material handling with the proper selection and use of material handling equipment
- While the use of material handling equipment should typically be the first choice, a team lift may be appropriate if:
  - Appropriate equipment is not available **and**
    - The load is too heavy for one person, **or**
    - The load is large, bulky, or oddly-shaped
- Prior to moving anything:
  - Assess the load (including weight, size and shape) to determine the most appropriate means of moving it
  - Plan your path; ensure the path is clear and safe to prevent slips, trips, or falls
  - Minimize the distance loads are moved by selecting efficient routes
- Use proper body mechanics and lift or push/pull techniques

*For additional information on body mechanics and safe material handling, please refer to the Safe Material Handling Guidelines, Appendices A and B.*

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## Work and staffing guidelines

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Work and staffing guidelines ensure that employees are adequately trained and assigned reasonable workloads. Guidelines include:



- Staff levels that provide adequate coverage to complete assigned work tasks
- Staff levels to avoid overtime and rushing to complete tasks
- Back-up staffing to accommodate unplanned absences
- Use of task and job rotation to limit repetition and fatigue
- Use of teams for heavy lifting and moving tasks
- Pre-shift exercises to warm up muscles to prepare for work
- Short, frequent rest breaks throughout the day
- Implementation and support of a work hazard notification system to identify ergonomic problems or other safety issues

## References

- Centers For Disease Control and Prevention (CDC). *Ergonomic Guidelines for Manual Material Handling*. Web. 12 Jan. 2012. <<http://www.cdc.gov>>.
- Chengalur, S. N., Rodgers, S.H., Bernard, T.E. (2004). *Kodak's Ergonomic Design for People at Work* (2<sup>nd</sup> ed.). Hoboken, NJ: Eastman Kodak Company.
- Darcor Ltd., (2000), "*Caster and Wheel Comparison Guide*."
- Darcor Ltd. "The Ergonomics of Manual Material Handling." [http://www.darcor.com/\\_common/pdfs/Ergonomics-of-Manual-Material-Handling-Whitepaper-Darcor-Casters.pdf](http://www.darcor.com/_common/pdfs/Ergonomics-of-Manual-Material-Handling-Whitepaper-Darcor-Casters.pdf) 2012. 2012. Darcor Casters in cooperation with Ergoweb. 10 Mar. 2014.
- Humantech, Inc. (2009) "The Handbook of Ergonomic Design Guidelines" (2<sup>nd</sup> ed.), Chapter 6, "Manual Material Handling". Ann Arbor, MI. ISBN 978-0-9821894-4-3
- Mital, A., Nicholson, A.S., Ayoub, M.M. (1997), *A Guide to Manual Materials Handling* (2<sup>nd</sup> ed.). Washington, D.C.: Taylor & Francis.
- United States Department of Labor, Occupational Safety. *Ergonomics for the Prevention of Musculoskeletal Disorders*. OSHA 3213-09N.

## Product Recommendation Sheet: *Moving Carts and Racks*

### Animal Care Product Recommendations

**Equipment Description:** Customized rack, bulk truck, hydraulic lift and motorized tug

**Criteria:** Reduce ergonomic risks and minimize effort required to move carts and cage racks within the animal research facility

#### Bulk truck

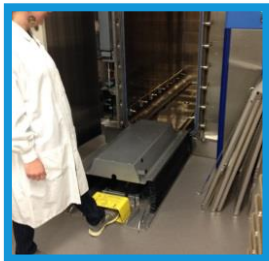
**Application:** Transporting stacks of animal cages within the facility



Make	Model	Cost (approximate)	Comments (Pros and Cons)
Alternative Design	BT-CH-60x24x28-MD	\$3400.00	<p><b>Pro:</b></p> <ul style="list-style-type: none"> <li>Stack mouse cages in an organized manner</li> <li>Allow ease of storing large number of cages off the ground</li> <li>Truck has compact feel</li> <li>Optional cover keeps cages clean and prevents them from falling</li> <li>Brakes work well and keep the truck from moving</li> </ul> <p><b>Con:</b></p> <ul style="list-style-type: none"> <li>Requires two people to maneuver if the cages are stacked high</li> <li>If a shelf is used it is difficult to stack under the shelf</li> </ul>
<b>For More Information:</b>	Julie McAbee, UC Santa Barbara <a href="mailto:julie.mcabee@ehs.ucsb.edu">julie.mcabee@ehs.ucsb.edu</a>		
<b>Website:</b>	<a href="http://www.altdesign.com/test/bulktruck_MD.html">http://www.altdesign.com/test/bulktruck_MD.html</a>		

#### Getinge Hydraulic Cart Lift

**Application:** Loading carts of cages into and out of the autoclave



Make	Model	Cost (approximate)	Comments (Pros and Cons)
Getinge	Scissor Lift for Sterilizer	\$14,400.00	<p><b>Pro:</b></p> <ul style="list-style-type: none"> <li>Makes it easy to maneuver carts into the autoclave</li> <li>Don't have to get into autoclave</li> <li>Eliminates awkward bending and lifting</li> <li>Easy to load carts</li> </ul> <p><b>Con:</b></p> <ul style="list-style-type: none"> <li>Base mount rusts over time</li> <li>Pulling carts out of autoclave can be challenging with the pole</li> </ul>
<b>For More Information:</b>	Julie McAbee, UC Santa Barbara <a href="mailto:Julie.mcabee@ehs.ucsb.edu">Julie.mcabee@ehs.ucsb.edu</a>		
<b>Website:</b>	<a href="http://www.getinge.com/us-ca/">http://www.getinge.com/us-ca/</a> (no specific web page for product)		

## Motorized Tug

**Application:** Transport heavy loads or loads over significant distances (greater than 100 feet)



Make	Model	Cost (approximate)	Comments (Pros and Cons)
Ergo Tug	Lynx	Varies, several models available; contact Ergo Tug for pricing	<b>Pro:</b> <ul style="list-style-type: none"> <li>Automatic hitch works with most cart types without hitch modifications</li> <li>180-degree steering assists with maneuvering in tight locations</li> </ul> <b>Con:</b> <ul style="list-style-type: none"> <li>Requires dedicated storage area</li> </ul>
<b>For More Information:</b> Joyce Rhoades, UCLA <a href="mailto:jrhoades@ehs.ucla.edu">jrhoades@ehs.ucla.edu</a> <b>Website:</b> <a href="http://www.ergotug.com/puller_benefits.html">http://www.ergotug.com/puller_benefits.html</a>			

## Motorized Tug

**Application:** Transport heavy loads or loads over significant distances (greater than 100 feet)



Make	Model	Cost (approximate)	Comments (Pros and Cons)
Ergo Express	4000	Various models available; contact vendor for pricing	<b>Pro:</b> <ul style="list-style-type: none"> <li>Can be operated in forward or reverse (to push or pull)</li> <li>Can tow multiple carts (with coupling hitch)</li> <li>Custom hitches available for specific applications</li> <li>Can pull up to 2,000 lbs.</li> <li>Easily maneuverable</li> </ul> <b>Con:</b> <ul style="list-style-type: none"> <li>Works best on smooth, level surfaces (indoor use)</li> </ul>
<b>For More Information:</b> Joyce Rhoades, UCLA <a href="mailto:jrhoades@ehs.ucla.edu">jrhoades@ehs.ucla.edu</a> <b>Website:</b> <a href="http://www.phswest.com/motorized_tugs.htm">http://www.phswest.com/motorized_tugs.htm</a>			

## Custom Carts

**Application:** Originally, this cart was designed to transport cages to and within the cage rooms. Because the cart was too large to fit in the rooms, it was repurposed to transport supplies and equipment.



Make	Model	Cost (approximate)	Comments (Pros and Cons)	
DC Trailer	Customized	\$1500.00	<b>Pro:</b> <ul style="list-style-type: none"> <li>• Works well for transporting outside of research facilities</li> <li>• Good for moving a large volume of materials around</li> </ul>	<b>Con</b> <ul style="list-style-type: none"> <li>• Too large for moving cages within rooms so it was repurposed</li> </ul>
<b>For More Information:</b> Danny Nou, UC Davis <a href="mailto:dsnou@ucdavis.edu">dsnou@ucdavis.edu</a>				
<b>Website:</b> No specific web page available. This is a custom cart made by DC Trailer. Wheels are from Industrial Castor and Wheel. <a href="http://www.industrialcasterandwheel.com/">http://www.industrialcasterandwheel.com/</a>				

# **Transporting Feed, Bedding, Waste and Trash**

## Best Practices Bulletin: *Transporting Feed, Bedding, Waste and Trash*

*Presented by Office of the President Risk Services- June 2014*



**Transporting Feed and Bedding:** The method of delivery and transport for feed, bedding, waste and trash varies among locations within the University of California system. In general, feed and bedding are delivered, either on a pallet or in large containers, to a loading dock or central storage area. Feed and bedding containers are transported to specific storage sites manually or with material handling equipment. At storage sites, the bags of feed and bedding are arranged on racks or shelves and stock is rotated. Additionally, products may be transported using mechanized systems.

**Transporting Waste and Trash:** The task of lifting, moving and disposing waste and trash varies among locations. In general, bags of waste and trash are carried manually or transported, using large containers or wheeled carts, to specified dump or disposal sites. At the disposal site, the bags are either manually removed or the entire container is mechanically lifted and dumped into waste bins or compactors.

Ergonomic risk factors for these tasks include:

- Lower back, neck and shoulder strain while lifting, carrying, or pushing/pulling heavy, bulky or awkward loads
- Awkward back, shoulder, hand and wrist postures while placing items onto and removing items from storage racks, shelves or waste receptacles
- Awkward shoulder, hand, and wrist postures while grasping cart handles
- Sustained, forceful grip on cart handles (especially over long distances)

## Best Practices

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To reduce manual material handling, the use of mechanical equipment or adoption of an automated process are the best practices for transporting feed, bedding, waste and trash. Implementing the information below can reduce risk, improve efficiency and employ safer work practices.

### Delivery of feed and bedding

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- Order feed and bedding in small bags (30 pounds or less is recommended) to reduce the weight required when lifting
- Coordinate vendor delivery training to promote an efficient and consistent process
- Develop vendor contracts to include the following, which can optimize work flow and minimize handling of deliveries by animal care staff:
  - Deliver products directly to the storage area, a designated receiving area or alternative location(s) near the storage area
  - Sort and stage the products for easy access and distribution

### Transporting feed and bedding

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- Automated systems and conveyor systems reduce ergonomic risks and improve material transport efficiency (*refer to Product Recommendation Sheet*)
- If these systems are not feasible, use hydraulic or powered material handling equipment (*refer to Product Recommendation Sheet*)
- If items must be manually moved, exercise the following ergonomic principles:
  - Use proper body mechanics and safe manual material handling principles (*refer to Safe Manual Material Handling Information, Appendix A*)
  - Divide heavy lifting tasks among multiple workers to reduce risk of overexertion
  - Each employee should rotate lifting and other physically-challenging tasks with less strenuous tasks to reduce risk of fatigue
- When using carts to transport bags:
  - Avoid overloading carts; manually transporting heavy loads can lead to fatigue and strain
  - Use carts appropriate for the size and weight of the load and the type of terrain
  - Use tugs or motorized carts for distances greater than 100 feet or paths with steep inclines or ramps (*refer to Product Recommendation Sheet*)
  - The cart design should provide easy access to the items to discourage awkward

postures when loading or unloading

- Height-adjustable carts can reduce lifting and lowering product during transport (*refer to Product Recommendation Sheet*)
- When height-adjustable carts are not available, select a fixed-height cart that is at or around the same height as shelving and workstation counters to encourage sliding vs. lifting and lowering
- Loaded cart height should not exceed 56" to ensure shorter handlers are able to see over the load during operation
- Walkways should be kept clear to provide sufficient space for use of material handling equipment
- Ensure that a sufficient supply of appropriate material handling equipment is readily available and easy to access
- Select short, direct routes when transporting large, awkward or heavy containers
- When using a vehicle to transport items, ensure the vehicle is equipped with an automatic hydraulic lift gate to assist with loading and unloading

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## Stockroom

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- Store heavy materials where there is sufficient space to lift them safely, between knee and waist height without reaching or twisting
- Develop an efficient method of stock rotation for food and bedding (a system for first in – first out) that minimizes lifting the same item multiple times
- Utilize mobile, height-adjustable shelving units as an efficient method for stock rotation. Bags are placed on mobile shelving units per delivery date, which allows for wheeled shelving to be moved vs. individual bags (*refer to Product Recommendation Sheet*)
  - If there is not sufficient space in the stockroom for material handling equipment during delivery, wheel the mobile shelving units outside of the stockroom (next to the delivered load) to transfer bags
- Use proper body mechanics and safe manual material handling principles (*refer to Safe Manual Material Handling Information, Appendix A*)

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## Transporting bedding into and out of the autoclave

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- Purchase irradiated bedding to eliminate the need to autoclave the bags
- If irradiated bedding is not an option, implement the following:
  - When transporting and using carts into and out of the autoclave:



- Do not over stack carts
- Use task-specific carts appropriate for the autoclave
- Assure carts are well maintained with appropriate wheels for the surface and temperature (*refer to sections below for specifics*)
- Use specified safe lifting methods when lifting bedding into or out of the autoclave (*refer to Safe Manual Material Handling Information, Appendix A*)

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## Transport and dumping of waste and trash

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Refer to “Transporting bedding and feed” section above. Additional considerations include:

- Ensure that containers have wheels or are placed on dollies (*refer to Product Recommendation Sheet*)
- Use motorized tugs or carts when transporting heavy loads over 100 feet (*refer to Product Recommendation Sheet*)
- When using a vehicle to transport items between buildings, ensure the vehicle is equipped with an automatic hydraulic lift gate to assist with loading and unloading
- If the loading dock is not equipped with a hydraulic lift, provide a mobile or stationary lifter (*refer to Product Recommendation Sheet*)
- Use motorized lifters to eliminate manual lifting when dumping trash and waste into the outside dumpster (*refer to Product Recommendation Sheet*)
- Cart selection should be compatible with motorized lifters (*refer to Product Recommendation Sheet*)
- Toters or waste carts with spring-loaded platforms reduce the bending required when lifting bags to place in outside dumpsters

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## Best practices for utilizing carts

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### Caster and Wheel Selection

The size, type, and design of the casters or wheels can significantly impact the ease of handling a cart. Research and product evaluation is necessary when selecting casters or wheels. Consult with a manufacturer or vendor regarding the task specifics as well as operating conditions and environment prior to caster selection.

- Casters should provide optimal maneuverability, turning and swivel capabilities. Swivel casters should be on the end with the handle(s) for easier maneuverability.
- Casters on carts should require minimal initial and sustained push/pull force requirements. Recommended force measurements below assume the force is exerted around waist height in a horizontal direction.
  - Initial or start forces should not exceed 50 foot-pounds
  - Sustained force (rolling force) should not exceed 40 foot-pounds

- Sustained force should not exceed 25 foot-pounds if the force is sustained for greater than 1 minute or if the cart is pushed more than 10 ft.
- The sustained force should not exceed 7.5 foot-pounds for longer distances, requiring force for 4 minutes or more
- Consider the following when selecting casters and wheels:
  - Match wheel material and diameter with floor surface, terrain and environmental conditions
  - The weight of loaded equipment should not exceed load ratings for specific casters
  - Brakes or locking casters may be needed if heavy loads are moved up/down sloped surfaces
  - Wheel brakes should minimize emergency stopping forces to 80 foot-pounds or less

### Cart Handle Selection

When ordering new carts, consider the ergonomic specifications below for handle design, which provide for easy access and maneuverability. For existing carts, consider re-designing the handles or ordering different handles to meet the ergonomic specifications.

- Vertical handles that can be grasped anywhere along their length allow individuals of varying heights to position arms, shoulders and hands in neutral positions that minimize force and effort
- For carts with horizontal handles, consider the use of adjustable handles to accommodate different user heights
- The height range for vertical or adjustable horizontal handles should include 29-47"
- The handle height on tall, narrow carts may go as high as 50" from the floor to provide better maneuverability and control of the cart
- Fixed, horizontal handles should be positioned 36-44" from the floor
- Handles should be positioned so that the distance between the right and left hand placement does not exceed 18"
- Handles should provide a minimum of 5-6" for finger clearance; 8" for gloved hands
- Handles should be 1-1.5" in diameter and shaped so that they do not cause concentrated pressure on any specific part of the hand (i.e., no sharp edges, pronounced ridges, etc.)
- When gripping the handle, the handler's fingers should not overlap, and the handle should be wide enough to accommodate the entire hand

- Ergonomic grips or wraps can be placed on cart handles to reduce grip force applied when pushing or pulling. Grip force with the wrist in a neutral position should not exceed 40 foot-pounds.

## Preventive Maintenance

Develop a regular scheduled maintenance program. This should include:

- Cleaning the dirt and debris from the wheels and casters on all carts/ racks daily
- Inspecting wheels and casters regularly for wear, flat spots, rust, damage and debris
- Lubricating casters and wheels regularly, according to the manufacturers' recommendation
- Replacing casters and wheels when performance is diminished or the unit is damaged

## General Guidelines

- Loads greater than 500 lbs. should not be transported on a hand cart or truck. Reduce the load or utilize power assist equipment.
- The handler's footwear is an important factor in minimizing effort to push and pull. Flat, rubber soles that provide sufficient slip resistance with the surface are best.

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## Equipment

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Selecting the most appropriate equipment is an important decision. Prior to purchasing:

- Contact the campus ergonomist and work together with a knowledgeable vendor to help with the selection process
- Include staff in the selection process
- Arrange for a demonstration of the product by the manufacturer or distributor
- Refer to the Ergonomics Product Recommendation Sheet (or consult with your campus ergonomist) for applications and recommendations
- Pilot the preferred equipment for a minimum two-week trial period

During the pilot period, consider the following:

- Adjustability, size and weight of equipment to accommodate wide range of body types
- Appropriate sized casters and swivel design to allow for easy rolling and maneuverability
- Location of controls and ease of operation
- Storage and transporting needs
- Equipment maintenance and replacement parts
- Battery life and charging time

- Need for back-up equipment

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## Training

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Initial training should be provided for new employees within the first 30 days and annually thereafter. Training should also be provided any time new equipment is introduced. Training is best provided in small groups with the involvement of supervisors, leads, ergonomists and vendors. Assign new employees to work with key veteran staff to learn on the job techniques that reduce repetition, force, and awkward postures and help decrease the risk of injury (i.e. adequate force needed to secure rubber stoppers into water bottles).

Training should include:

- Hands-on performance of job tasks and related activities
- Hands-on practice when new tools, equipment, or procedures are introduced to the workforce
- Equipment use, maintenance, storage, safety procedures and use of personal protective equipment (PPE) as required
- Instructions on ergonomic practices focusing on the following:
  - practicing neutral postures
  - safe lifting, carrying, and pushing techniques
  - proper body mechanics
- Verbal and/or written materials to accommodate non-English speaking workers as well as visual aids (e.g., pictures, charts, videos) of actual tasks in the workplace
- Sufficient opportunity for questions

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## Body mechanics

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Reduce exertion and fatigue during material handling tasks by applying the following ergonomic practices:

- Minimize manual material handling with the proper selection and use of material handling equipment
- While the use of material handling equipment should typically be the first choice, a team lift may be appropriate if:
  - Appropriate equipment is not available **and**
    - The load is too heavy for one person, **or**
    - The load is large, bulky, or oddly-shaped
- Prior to moving anything:
  - Assess the load (including weight, size and shape) to determine the most appropriate means of moving it

- Plan your path; ensure the path is clear and safe to prevent slips, trips, or falls
- Minimize the distance loads are moved by selecting efficient routes
- Use proper body mechanics and lift or push/pull techniques

*For additional information on body mechanics and safe material handling, please refer to the Safe Material Handling Guidelines, Appendices A and B.*

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## Work and staffing guidelines

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Work and staffing guidelines ensure that employees are adequately trained and assigned reasonable workloads. Guidelines include:

- Staff levels that provide adequate coverage to complete assigned work tasks
- Staff levels to avoid overtime and rushing to complete tasks
- Back-up staffing to accommodate unplanned absences
- Use of task and job rotation to limit repetition and fatigue
- Use of teams for heavy lifting and moving tasks
- Pre-shift exercises to warm up muscles to prepare for work
- Short, frequent rest breaks throughout the day
- Implementation and support of a work hazard notification system to identify ergonomic problems or other safety issues

## References

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## Product Recommendation Sheet: *Transporting Feed, Bedding, Waste & Trash*

### Animal Care Product Recommendations

**Equipment:** Tubular drag conveyor system, powered hand truck, cart with spring-loaded platform, container dolly, dumpster lid prop, portable conveyor system, pallet truck, motorized tug, lifter, height adjustable cart and adjustable shelving

**Criteria:**

- Minimize manual handling of large, heavy bags (lifting, carrying, pushing, and pulling)
- Reduce reaching and bending at the waist when handling bags of trash or waste
- Provide wheeled transport of large containers
- Prop dumpster lid open while loading bags of trash or waste
- Lift large containers of trash or waste into dumpsters or secondary containers
- Provide adjustable, mobile shelving in storage room

### Hapman System

**Application:** Automates the transportation of large, heavy products in a tubular sealed system



Make	Model	Cost (approximate)	Comments (Pros and Cons)
Hapman	Various configuration and options available; contact the manufacturer for details	Contact Hapman for specifications and quotes	<p><b>Pro:</b></p> <ul style="list-style-type: none"> <li>• Assists in reducing manual transport of products</li> <li>• Can be configured to convey your product vertically, horizontally, at any angle, and around corners</li> <li>• Modular design makes future reconfigurations achievable</li> </ul> <p><b>Con:</b></p> <ul style="list-style-type: none"> <li>• Slightly noisy when run empty</li> <li>• Initial start-up investment can be costly</li> </ul>

**For More Information:** Brian MacDonald, UC Santa Cruz  
[bmacdon1@ucsc.edu](mailto:bmacdon1@ucsc.edu)

**Website:** <http://www.hapman.com/products/tubular-drag-conveyor.html>

Note: Information and feedback provided is for the Series 4000 Tubular Drag Conveyor System, Model # 12858, configured to transport dirty bedding. The system can be configured to transport other materials.

## Motorized dolly/hand truck

**Application:** Transport large, heavy containers

Make	Model	Cost (approximate)	Comments (Pros and Cons)
Wesco	Cobra Pro	\$1,350.00	<p><b>Pro:</b></p> <ul style="list-style-type: none"> <li>• Drive can be disengaged to be used in manual mode</li> <li>• Power drive works in 2-wheel or 4-wheel drive</li> <li>• 1200-pound capacity in 4-wheel mode, 600-pound capacity in 2-wheel mode</li> <li>• Converts from dolly to hand truck</li> <li>• Can be used indoors and outdoors</li> <li>• Can be used on a ramp up to 17.5 degrees</li> </ul> <p><b>Con:</b></p> <ul style="list-style-type: none"> <li>• Short battery life</li> <li>• Unit weighs over 100 pounds</li> <li>• Maximum capacity of 950 lbs. in 4-wheel mode when used on ramps</li> <li>• May lurch forward when starting if load is too light</li> <li>• The base is narrow and therefore may have a limited application</li> <li>• To change modes, accessing the mechanism requires bending to the wheel base</li> </ul>



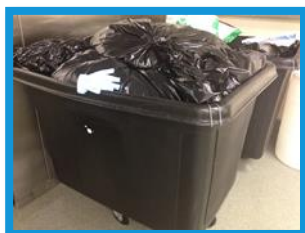
**For More Information:** Kristie Elton, UC Riverside  
[kristie.elton@ucop.edu](mailto:kristie.elton@ucop.edu)

**Website:** [http://www.wescomfg.com/html/hand\\_trucks/aluminum\\_cobrapro\\_convertible.htm](http://www.wescomfg.com/html/hand_trucks/aluminum_cobrapro_convertible.htm)

## Waste carts with spring platform

**Application:** Transporting bags of trash and waste

Make	Model	Cost (approximate)	Comments (Pros and Cons)
Rubbermaid	#4610	\$351.50 (120-lb. capacity)	<p><b>Pro:</b></p> <ul style="list-style-type: none"> <li>• Spring platform brings contents to a convenient working level for safer and less-fatiguing handling of material</li> <li>• Metal frame provides durable support</li> <li>• Diamond wheel placement for maneuverability</li> </ul> <p><b>Con:</b></p> <ul style="list-style-type: none"> <li>• May be too big for smaller areas</li> </ul>
	<b>Spring Platform kit</b> (fits truck #4611 or cube truck #4614)	\$379.50 (180 lb. capacity)	



**For More Information:** Kristie Elton, UC Riverside  
[kristie.elton@ucop.edu](mailto:kristie.elton@ucop.edu)

**Website:** <http://www.rubbermaidcommercial.com/rcp/products/detail.jsp?rcpNum=4610>

## Brute Dolly

**Application:** Transporting heavy containers of feed, bedding, waste or trash



### Make

Rubbermaid

### Model

**#2640  
BRUTE®  
Dolly** (for  
2620, 2632,  
2643, 2655  
containers)

### Cost

(approximate)

**Single:**  
**\$103.00-115.00**

**Tandem:**  
**\$259.00**

### Comments

(Pros and Cons)

#### Pro:

- Easy mobility and maneuverability of heavy loads
- Available in single and tandem models
- Holds up to 350 pounds
- All plastic construction resists rust, chipping and denting
- Wheels swivel for easy mobility

#### Con:

- Use for specific size containers only
- Cannot easily remove container from the dollies

**For More  
Information:**

Kristie Elton, UC Riverside  
[kristie.elton@ucop.edu](mailto:kristie.elton@ucop.edu)

**Website:**

[http://www.rubbermaidcommercial.com/rcp/products/detail.jsp?categoryCode=waste&subCategoryCode=waste\\_brute\\_utility&rcpNum=2640](http://www.rubbermaidcommercial.com/rcp/products/detail.jsp?categoryCode=waste&subCategoryCode=waste_brute_utility&rcpNum=2640)

## Dumpster prop

**Application:** Placing trash in dumpster



### Make

Flexible  
Scientific

### Model

**Dumpster Prop**

### Cost

(approximate)

**\$50.00**

### Comments

(Pros and Cons)

#### Pro:

- Eliminates twisting while one hand holds up the lid
- Reduces strain on shoulders and back

#### Con:

- Need to locate storage for it near dumpster or on cart

**For More  
Information:**

Julia Jensen, UC San Diego  
[jjensen@ucsd.edu](mailto:jjensen@ucsd.edu)

**Website:**

<http://www.flexiblescientific.com/dumpster-prop>



## Name of Product: Portable conveyor system

**Application:** Transporting heavy containers of feed or bedding



Make	Model	Cost (approximate)	Comments (Pros and Cons)
Cisco-Eagle	Flexible Gravity Skate-wheel Conveyor	Varies with size and length	<p><b>Pro:</b></p> <ul style="list-style-type: none"> <li>Conveyor expandable up to 4 times its retracted size</li> <li>Can be ordered in 12 different lengths</li> <li>Height adjustable</li> </ul> <p><b>Con:</b></p> <ul style="list-style-type: none"> <li>Necessary to have sufficient floor space to position</li> <li>Must be placed in close proximity to areas of transport and storage</li> </ul>
<b>For More Information:</b>	Julia Jensen, UC San Diego <a href="mailto:jjensen@ucsd.edu">jjensen@ucsd.edu</a>		
<b>Website:</b>	<a href="http://www.cisco-eagle.com/catalog/c-4263-bestflex-gravity-roller-conveyor.aspx">http://www.cisco-eagle.com/catalog/c-4263-bestflex-gravity-roller-conveyor.aspx</a>		

## Pallet truck

**Application:** Transporting pallets of supplies



Make	Model	Cost (approximate)	Comments (Pros and Cons)
Yale/Chase B827	MPB040-E (4000 pound capacity)	\$4,850	<p><b>Pro:</b></p> <ul style="list-style-type: none"> <li>Fork height range 3.25" – 8.25" allows use with dumpsters</li> <li>Low profile – easy to view tip of forks when approaching pallet</li> </ul> <p><b>Con:</b></p> <ul style="list-style-type: none"> <li>Battery-operated; outlet must be available in storage area to recharge</li> <li>Requires room to turn</li> </ul>
<b>For More Information:</b>	Ginnie Thomas, UC Santa Barbara <a href="mailto:gthomas@housingucsd.edu">gthomas@housingucsd.edu</a>		
<b>Website:</b>	<a href="http://northamerica.yale.com/yna_product_details.asp?product=MPB040E&amp;page=yna_motorized_hand_trucks.asp">http://northamerica.yale.com/yna_product_details.asp?product=MPB040E&amp;page=yna_motorized_hand_trucks.asp</a>		

## Motorized Tug

**Application:** Transport heavy loads or loads over significant distances (greater than 100 feet)



Make	Model	Cost (approximate)	Comments (Pros and Cons)
Ergo Tug	Lynx	Varies Contact Ergo Tug for pricing	<b>Pro:</b> <ul style="list-style-type: none"> <li>Automatic hitch works with most cart types without hitch modifications</li> <li>180-degree steering assists with maneuvering in tight locations</li> </ul> <b>Con:</b> <ul style="list-style-type: none"> <li>Requires dedicated storage area</li> </ul>
<b>For More Information:</b> Joyce Rhoades, UCLA <a href="mailto:jrhoades@ehs.ucla.edu">jrhoades@ehs.ucla.edu</a> <b>Website:</b> <a href="http://www.ergotug.com/puller_benefits.html">http://www.ergotug.com/puller_benefits.html</a>			

## Motorized Tug

**Application:** Transport heavy loads or loads over significant distances (greater than 100 feet)



Make	Model	Cost (approximate)	Comments (Pros and Cons)
Ergo Express	4000	Various models available Contact vendor for pricing	<b>Pro:</b> <ul style="list-style-type: none"> <li>Can be operated in forward or reverse (to push or pull)</li> <li>Can tow multiple carts (with coupling hitch)</li> <li>Custom hitches available for specific applications</li> <li>Can pull up to 2,000 lbs.</li> <li>Easily maneuverable</li> </ul> <b>Con:</b> <ul style="list-style-type: none"> <li>Works best on smooth, level surfaces (indoor use)</li> </ul>
<b>For More Information:</b> Joyce Rhoades, UCLA <a href="mailto:jrhoades@ehs.ucla.edu">jrhoades@ehs.ucla.edu</a> <b>Website:</b> <a href="http://www.phswest.com/motorized_tugs.htm">http://www.phswest.com/motorized_tugs.htm</a>			

## Mobile Lifter

**Task:** Lifting heavy containers of waste or trash into large dumpsters or disposal containers



Make	Model	Cost (approximate)	Comments (Pros and Cons)
Toter	Saddle Mobile Lifter 3081-MT-5000	\$ 4,500- \$5,000	<b>Pro:</b> <ul style="list-style-type: none"> <li>• Easy to maneuver</li> <li>• Battery powered</li> <li>• Can be used with multiple pieces of equipment at one facility</li> <li>• Unit is equipped with casters for easy maneuverability</li> <li>• 350 lb. load rating</li> <li>• 68" to 84" dump height</li> <li>• Easily fits through a 32" door opening</li> </ul> <b>Con:</b> <ul style="list-style-type: none"> <li>• Requires 42" x 42" footprint</li> </ul>
<b>For More Information:</b>	Joyce Rhoades, UCLA <a href="mailto:joyce.rhoades@ehs.ucla.edu">joyce.rhoades@ehs.ucla.edu</a>		
<b>Website:</b>	<a href="http://www.wastequip.com/products/product-detail.cfm/category/materialhandling/subcategory/cartlifters/product/mobilecartlifter">http://www.wastequip.com/products/product-detail.cfm/category/materialhandling/subcategory/cartlifters/product/mobilecartlifter</a>		

## Name of Product: Stationary Lifter

**Application:** Lifting heavy containers of waste or trash into large dumpsters or disposal containers



Make	Model	Cost (approximate)	Comments (Pros and Cons)
Toter	Stationary Cart Lifter	Varies Contact vendor for pricing	<b>Pro:</b> <ul style="list-style-type: none"> <li>• Designed for use with two-wheeled toter and caster carts</li> <li>• Dump height ranges from 45" to 70", depending on container</li> <li>• 350 pound capacity</li> </ul> <b>Con:</b> <ul style="list-style-type: none"> <li>• Requires sufficient footprint to accommodate this unit</li> </ul>
<b>For More Information:</b>	Joyce Rhoades, UCLA <a href="mailto:joyce.rhoades@ehs.ucla.edu">joyce.rhoades@ehs.ucla.edu</a>		
<b>Website:</b>	<a href="http://www.wastequip.com/products/product-detail.cfm/category/materialhandling/subcategory/cartlifters/product/stationarycartlifter">http://www.wastequip.com/products/product-detail.cfm/category/materialhandling/subcategory/cartlifters/product/stationarycartlifter</a>		

## Stationary Universal lifter

**Application:** Lifting large loads of trash into dumpster or other disposal containers



### Make

Toter

### Model

3078-XX-6000

### Cost

(approximate)

\$9000-\$10,000

### Comments

(Pros and Cons)

#### Pro:

- Lifts multiple container sizes
- Dump heights is between 48" -70"
- Universal adapter available for caster and two-wheel carts
- Load capacity 2500 lbs.

#### Con:

- Requires compatible containers
- Requires storage space

**For More Information:** Joyce Rhoades, UCLA  
[joyce.rhoades@ehs.ucla.edu](mailto:joyce.rhoades@ehs.ucla.edu)

**Website:** <http://www.amsalesco.com/univlift.htm>

## Dock lift

**Application:** Lifting heavy loads at the dock



### Make

Superior Handling Equipment

### Model

Speed Lift SL-5000-A

### Cost

(approximate)

Varies

Contact vendor for pricing

### Comments

(Pros and Cons)

#### Pro:

- Eliminates manual lifting of containers for unloading materials
- Equipped with automated folding ramps
- Can be anchored securely at grade level, thus there is no need for pits or bollards
- Mobile and can also be transported to other facilities
- Dual controls allowing for operation from the lift, platform, truck or ground
- Range of loading capacities available

#### Con:

- Often requires transporting containers to permanent dock/loading sites vs. staging locations
- Requires available space for placement/storage

**For More Information:** Julie McAbee, UC Santa Barbara  
[julie.mcabee@ehs.ucsb.edu](mailto:julie.mcabee@ehs.ucsb.edu)

**Website:** [www.superiorlifts.com](http://www.superiorlifts.com)

## Height adjustable cart

**Application:** Transporting bags of feed and bedding



### Make

**Dandy Lift**

### Model

**Scissor Lift  
Cart #4YZ97**

### Cost

*(approximate)*

**\$1,551.00**

### Comments

*(Pros and Cons)*

#### Pro:

- Load capacity is 1760 lb.
- Platform size is 39.5"L by 23.5" W
- Platform height range is 13"-40"

#### Con:

- Footprint may be too large for some areas

**For More  
Information:**

Joyce Rhoades, UCLA  
[joyce.rhoades@ehs.ucla.edu](mailto:joyce.rhoades@ehs.ucla.edu)

**Website:**

<http://www.grainger.com/product/DANDY-LIFT-Scissor-Lift-Cart-4YZ97?searchQuery=4YZ97>

## Height adjustable cart

**Application:** Transporting bags of feed and bedding



### Make

**Dayton**

### Model

**Scissor Lift  
Cart**

### Cost

*(approximate)*

**Varies with  
model and  
size**

### Comments

*(Pros and Cons)*

#### Pro:

- Fork height range 3" – 7 11/16"
- Works well in dock/ storage room application

#### Con:

- Battery-operated; outlet must be available in storage area to recharge
- Requires room to turn
- Footprint may be too large from some areas

**For More  
Information:**

Ginnie Thomas, UC Santa Barbara  
[gthomas@housing.ucsb.edu](mailto:gthomas@housing.ucsb.edu)

**Website:**

[http://www.grainger.com/product/DAYTON-Scissor-Lift-Cart-WP161857/-N-bihZ1z0r596/Ntt-dayton+material+handling?sst=All&s\\_pp=false](http://www.grainger.com/product/DAYTON-Scissor-Lift-Cart-WP161857/-N-bihZ1z0r596/Ntt-dayton+material+handling?sst=All&s_pp=false)

## Platform lift

**Application:** Transferring bags of feed and bedding to storage shelves



**Make**  
Vestil

**Model**  
Quick Lift

**Cost (approximate)**  
\$2,772.75

### Comments (Pros and Cons)

#### Pro:

- Maneuverable in small spaces
- Includes a built-in on-board battery charger
- Two height ranges available: 5.25-57" or 5.25-72"
- Weight capacity is 175 lbs. for the 57" height model; 125 lbs. for 72" height model

#### Con:

- Platform may be too small for large or bulky items

**For More Information:** Joyce Rhoades, UCLA  
[joyce.rhoades@ehs.ucla.edu](mailto:joyce.rhoades@ehs.ucla.edu)  
**Website:** <http://www.alimed.com/quick-lift.html>

## Self-elevating spring lift work table

**Application:** Transferring bags of feed and bedding to storage shelves



**Make**  
Vestil  
Manufacturing

**Model**  
WBB54043  
(other sizes available)

**Cost (approximate)**  
\$1,190.00

### Comments (Pros and Cons)

#### Pro:

- Weight capacity
- Vertical range varies depending upon model from 11" to 38"
- Electric toe guard protects from pinch points while lowering the table

#### Con:

- Platform may be difficult to maneuver

**For More Information:** Joyce Rhoades, UCLA  
[joyce.rhoades@ucla.edu](mailto:joyce.rhoades@ucla.edu)  
**Website:** <http://www.globalindustrial.com/p/material-handling/lift-tables/mobile-work-positioning/self-elevating-spring-table-3>

## Adjustable shelves

**Application:** Feed and bedding storage

**Make**

Ancare

**Model**

Varies with  
size

**Cost**

(approximate)

Varies with  
model and size

**Comments**

(Pros and Cons)

**Pro:**

- All racks are 72" high; custom sizes are available
- Wheels are autoclavable and 2 wheels have brake mechanisms

**Con:**

- Footprint and height may not fit in smaller areas

**For More  
Information:**

Joyce Rhoades, UCLA  
[joyce.rhoades@ehs.ucla.edu](mailto:joyce.rhoades@ehs.ucla.edu)

**Website:**

<http://www.ancare.com/products/material-handling-and-storage/shelf-racks/adjustable-shelf-racks>

# Appendices



UNIVERSITY  
OF  
CALIFORNIA

Environment, Health, and Safety  
The Office of the President  
1111 Franklin Street, 10<sup>th</sup> floor  
Oakland, California 94607-5200

## Ergonomics Study of Lab Animal Care 2013

### Questionnaire: Identify Top At-Risk Tasks

**Instructions:** Please complete the questionnaire by providing answers to the following questions. Your completed questionnaire can be returned to [kristie.elton@ucop.edu](mailto:kristie.elton@ucop.edu) by **October 11, 2013**. *Your input will be included in the final project report.*

1. With respect to ergonomics, what are the top 5 at-risk tasks for your location's animal care employees (1 being the most at-risk, 5 being the least)?

Task	
example	Maneuvering cage racks into/out of cage washer has caused back injuries
1	
2	
3	
4	
5	

2. Indicate if your Laboratory Animal Care Staff are required or incentivized to obtain certification from the American Association for Laboratory Science (AALAS). If so, please check the box below and also indicate the job title(s) that apply.

Required		Job Title(s):
Receive Incentive		Job Title(s):
Encouraged but no incentives		Job Title(s):

November 25, 2013

Dear UC Ergonomists-

The following is a questionnaire created by the Animal Care Study Project Team designed to collect information from all UC locations that will assist us with the Animal Care project. We are asking that each of you complete the attached questionnaire with information specific to your location. It is our team's goal to use this information to create the following documents: *design guidelines for animal care areas, best practices bulletins, and product recommendation sheets*.

The questionnaire has five pages and each page contains a set of questions that addresses one of the top 5 at-risk tasks. These include:

1. Handling water bottles
2. Changing cages
3. Cleaning cages
4. Moving carts and racks
5. Transporting feed, bedding, waste and trash

As you complete this questionnaire, please consider the following:

1. The information is best communicated when you schedule an in-person meeting with the staff to discuss the answers. We recommend that you meet with supervisors and/or managers to review SOP's and any design issues. We also recommend that you spend time with front-line employees to gain their perspective on the task issues.
2. While meeting with the staff, please ask to see the equipment and tasks so that you can best understand how you want to record their feedback.
3. We are asking that you take the time to compile the answers in the attached questionnaire (electronic format).
4. Please provide your answers in a **concise, bulleted** format. The fields expand to fit content.
5. If permissible by the Animal Care Management, consider providing photos (to be used confidentially for this project only) to illustrate task and risk descriptions. Photos should not include animals or faces of employees.

We envision that this may take a significant amount of your time and appreciate your contribution to this project. The ease with which we can complete this project and the quality of the product is dependent on the information that we collect from this questionnaire. **Completed questionnaires are due to Kristie Elton on or before December 18, 2013.**

Thank you for your assistance with this project,

The Animal Care Project Team

**Location:** \_\_\_\_\_

# Handling Water Bottles

Please check the following characteristics of the water bottles used on your campus

Type:	Glass _____	Plastic _____	Other _____
Size:	9oz _____	16oz _____	Other _____
Tops:	Screw Cap _____	Rubber Stopper _____	_____

What percentage of your watering system involves bottles? \_\_\_\_\_

**Maintaining a clean environment for rodents requires a 3 phase cycle of cage cleaning: Removing items from cage to wash room cart, washroom cart to actual wash (dirty side), and clean side to cart and back to cage room.**

**Please describe below how a water bottle(s) moves through each cycle.**

- Cage Room:** List every action involved with handling water bottle(s). *(For example: bottle lifted from cage, placed in basket, full baskets stacked, etc.)*

- Cage Cleaning (dirty side):** List every action involved with handling water bottle(s). *(For example: full basket taken from cart, stacked 4 high, tops removed, etc.)*

- Cage Cleaning (clean side):** List every action involved with handling water bottle(s). *(For example: basket removed from autoclave, lifted to fill station, caps put on, etc.)*

Please list the total number of times a water bottle is handled throughout the entire 3 phase cycle and include handling both single bottles and full baskets. TOTAL = \_\_\_\_\_

## Regarding the 3 tasks above:

Which of the 3 major areas above is the most difficult and why? *(Example: clean side because more weight is lifted)*

What is the most common injury that occurs among the tasks involving the handling of water bottles?

How many compartments are in the water bottle baskets: 15, 20, or 24?

What is the frequency the small rodent cages are cleaned and what is the small rodent population in your facility?

What process changes have you implemented that have improved workflow, efficiency, or reduced injury risk?

What equipment do you use that has improved workflow, efficiency, or reduced injuries? *(Example: converted to waterless system, hydropacs, etc.)*

# Cage Changing

**Describe (show me) the steps for the following tasks associated with cage changing/sanitizing housing areas for rodents and other small animals.**

1. Preparation of supplies needed for cage changing/sanitizing (examples: clean water bottles, rodent boxes/tops, cage card holders, feeders/fresh feed). Include the use of carts to transport these items if applicable.

2. Any preparation of clean caging (examples: flushing water lines, placement of drop pans/liners)

3. Transferring animals & cage cards and other items (clean water bottles & feeders/feed, enrichment items) placement of into/onto clean cages. Include the use of transfer stations, forceps, temporary holding cages if applicable.

4. Room/area sanitizing tasks (examples: mopping floors, sanitizing walls/counters/sinks).

## Regarding the 4 tasks above:

Provide details of any task(s) that are particularly difficult in terms of awkward body postures, excessive force and repetition.

What would you do/ have you done to improve the process?

What equipment do you use to make these job tasks easier? *Please include make and model*

What **additional** equipment do you think would help you do your job? *Please include make and model*

If you could re-design the workspaces to make these tasks easier what changes would you make?

What design changes have you implemented that have improved workflow, efficiency, or reduced injury risk?

What changes have you tried that have not worked?

What additional ideas do you have to make these job tasks easier? (example: task rotation)

Anything else you would like to add?

# Cage Cleaning

**Describe (show me) the steps for the following tasks:**

1. Retrieve dirty cages and racks and transport to the dirty side of the cage washing area

2. Remove and dispose of soiled bedding from boxes, pan liners, etc.

3. Prepare items to go into the cage washer

4. Place dirty cages/boxes/racks in cage washer, wash

5. Retrieve clean cages/boxes/racks from washer

6. Prepare clean cages for next use (fill boxes with bedding, replace pan liners)

**Regarding the 6 tasks above:**

What do you like or not like about the process?

What, if anything, has been done to improve the process?

Has job rotation been tried?

Is there any equipment that you are using to make this task easier? (Make and model)

What on the job techniques have you learned to reduce using awkward hand/arm postures?

What on the job techniques have you learned to reduce bending and reaching?

If you could re-design the work space to make any tasks easier, what changes would you make?

What design changes have you implemented that have improved workflow, efficiency, or reduced injury risk?

What have you tried that has not worked? Why not?

Any other ideas that you have that you believe would help?

## Moving Carts and Racks

Describe (show me) the steps for the following tasks:

1. Maneuvering racks for washing/cleaning (*to/in the cage washer or otherwise*)

2. Maneuvering cage racks room to room or within the room

3. Maneuvering loaded carts (or other material handling equipment) to transport equipment, supplies, large cages, etc. (*Please include distances that loaded carts are transported*)

Regarding the 3 tasks above:

What do you like about the processes?

What would you do/ have you done to improve the process to make the above tasks easier?

What equipment (cart, rack, etc.) do you use to make these 3 job tasks easier? (*Make and model*)

What **additional** equipment do you think would help you do your job? (*Make and model*)

If you could re-design the workspaces to make these tasks easier what changes would you make?

What design changes have you implemented that have improved workflow, efficiency, or reduced injury risk?

What changes have you tried that have not worked? (*process changes, equipment, etc.*)

What additional ideas do you have to make these job tasks easier?

Do you have a preventive maintenance program for the wheels on your cage racks or other material handling equipment?

## Lifting and Moving Large Bags of Feed, Bedding, Waste, and Trash

### Describe (show me) the steps for the following tasks:

1. The delivery of feed and bedding (for example: on pallets or floor, left on dock or delivered to the storage room)

2. Moving/Transferring feed or bedding from the loading dock/storage room into site specific storage areas

3. Lifting, moving and distributing large bags of feed and bedding

4. Lifting, moving and disposing waste and trash

5. Lifting and moving bedding into and out of the autoclave

6. Any additional task(s) that involves manually moving large bags of feed, bedding, waste or trash

### Regarding the 3 tasks above:

What do you like about the processes?

What don't you like about these processes? Provide details of any tasks that are particularly difficult in terms of awkward body postures, excessive force, and repetition.

What would you do or have you done to improve these processes?

What equipment do you currently use to make these job tasks easier? (*Make and model*)

What additional equipment do you think would help you to do these tasks either safer or easier?  
(*Make and model*)

What design changes have you implemented that improved workflow, efficiency or reduced injury risk?

If you could re-design the workspaces including location, access or organization to make these tasks easier what changes would you make?

What additional changes have you tried that have not worked?

What additional ideas do you have to make these job tasks easier?

# Safe Manual Material Handling

Many jobs require frequent lifting, carrying, pushing, pulling, lowering and raising materials by hand. These job tasks are often referred to as manual materials handling. Staff who lift or perform other materials handling tasks may be at risk for back or other injuries. These injuries may be prevented by redesigning jobs and practicing safe lifting.

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## Layout of Work Area

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- The layout of work areas can be arranged to prevent awkward postures such as bending, twisting and over-reaching
- Work surfaces should be at waist height, or height-adjustable, to prevent bending
- There should be sufficient space to turn around and prevent twisting
- Materials should not be stored directly on the floor
- Frequently used and heavy items should be stored between knee and waist height
- Elevated platforms or step stools should be provided to reach items above chest level

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## S.M.A.R.T. lifting technique

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### *Size up the load*

- Assess the size, weight and shape. Remove obstacles from the load (such as loose wrapping materials).
- Assess whether the load actually needs to be moved
- Where is the load going to be placed? Remove obstacles from your path.
- Determine whether mechanical or other assistance is required

### *Move the load as close to your body as possible*

- The whole hand should be used to ensure a firm grip
- Position yourself as close as possible

### *Always bend your knees*

- Maintain balance
- Keep your feet apart and in a comfortable position
- Minimize bending at the waist
- Bend your knees to a semi squat

### *Raise the load with your legs*

- Lift smoothly, without jerking
- Maintain the normal curve of your spine throughout the lift



### *Turn your feet in the direction that you want to move the load*

- Avoid unnecessary bending, twisting and reaching
- Change direction by turning your feet and not your back
- To set down a load, squat down and keep your head up. Let your legs do the work.

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## The Power Zone

The power zone for lifting is close to the body, between mid-thigh and mid-chest height. Comparable to the strike zone in baseball, this zone is where the arms and back can lift safely with the least amount of effort. (See picture)



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## Team Lifting

- Team lifts are appropriate if:
  - The load is too heavy for one person
  - The load is large, bulky or oddly-shaped
  - If you feel uncomfortable lifting the load by yourself
  - Appropriate material handling equipment is not available
- Whenever possible, team members should be of or around the same height and build. If this is not possible, taller members should be at the back.
- Designate a lift leader, who:
  - Plans and coordinates the lift
  - Provides simple and clear instructions
  - Ensures that you lift and lower the load together
- Assess the weight of the load
- Follow the S.M.A.R.T. lifting technique (*above*)
- The lift leader should ensure that all team members are comfortable once the load has been lifted. If not, the load should be carefully and immediately lowered.

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## Overhead loads

- Always use a stool or ladder to lift loads above chest level
- Test the weight of the load before removing it from the shelf
- Slide the object toward you, to the edge of the shelf
- Hold the load close to your body as you lower it
- Whenever possible, hand down the load to a co-worker before descending a stool or ladder

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## Awkward loads

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Sometimes different lifting techniques need to be adopted to move awkward loads.

### *Over-sized or Odd-shaped*

- In many cases, oversized loads may be light enough to carry, but block vision or may be difficult to hold. In such cases, use mechanical assistance or seek help from a co-worker.

### *Long, light objects*

- Support the load on your shoulder
- Keep the front end higher than the rear

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## Pushing and Pulling

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- Keep your back straight, avoiding excessive bending or twisting
- Use your legs to push or pull
- Keep the load as close to your body as possible
- When using mechanical equipment to push and pull, the handles should be positioned at a height between the shoulder and waist
- When pushing on a slope or ramp, ask for assistance whenever necessary. Keep in mind that the incline can significantly increase the forces.
- Unevenly distributed loads also require increased push and pull forces

## References

Occupational Safety & Health Organization (OSHA). *Ergonomics eTool: Solutions for Electrical Contractors*. <http://www.osha.gov>. Web. 12 January 2012.

Centers For Disease Control and Prevention (CDC). *Ergonomic Guidelines for Manual Material Handling*. <http://www.cdc.gov>. Web. 12 January 2012.

Health and Safety Executive. *Getting to Grips with Manual Handling*. <http://www.hse.gov.uk> INDG143 (rev2) September 2011. Web. 12 January 2012.

# Safe Manual Material Handling- *For management and supervisors*

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## Identifying hazards

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Not all manual handling tasks are hazardous. A manual task becomes hazardous when it involves one or more of the following:

- Repetitive or sustained application of force (moving cage racks)
- Repetitive or sustained awkward posture (dumping dirty cages)
- Repetitive movement (transferring mice between cages; manually dispensing bedding)
- Prolonged positions (standing for long periods of time)
- Application of high force (moving/lifting heavy bags of feed and bedding)
- Tasks involving handling of unstable or unbalanced loads (pushing and pulling carts with high stacks of cages)

The following information is designed to help you minimize the hazards of manual material handling within your animal facilities.

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## Layout of work area

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- The layout of work areas should be arranged to prevent awkward postures such as bending, twisting and over-reaching
- Work surfaces should be at waist height, or height-adjustable, to prevent bending
- There should be sufficient space to turn around and prevent twisting
- Materials should not be stored directly on the floor
- Frequently used and heavy items should be stored between knee and waist height
- Elevated platforms or step stools should be provided to reach items above chest level

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## Guidelines for safe manual material handling

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- Plan the workflow to eliminate unnecessary lifting and minimize distances traveled
- Organize the work so as to gradually increase physical demands and work pace
- Slide, push or pull instead of carrying, whenever possible
- Reduce the distances that loads are carried to a minimum; use equipment for longer distances
- Keep arms bent and close to the body when pushing and pulling carts and racks
- Minimize the vertical distances loads are lifted and lowered

- Avoid manually lifting or lowering loads from/to the floor
  - Store products and materials off of the floor
  - If needed, arrange for materials to be delivered on pallets and keep the materials on pallets during storage
  - Use mechanical assistance to lift or lower an entire pallet, rather than lifting and lowering the material individually
  - Arrange to have material off-loaded from vendor directly into the storage area or a nearby staging area to reduce the manual handling required by staff
  - Use mechanical assistance whenever possible
- For loads that are unstable and/or heavy
  - Tag the load to alert workers
  - Test the load for stability and weight before carrying the load
  - Use mechanical devices to lift
  - Reduce the weight of the load by:
    - Putting fewer items in the container
    - Using a smaller container
  - If necessary, repack containers so that contents will not shift and the weight is balanced
  - Use team lifting only as temporary measures in lieu of measures identified above
- Reduce the frequency of lifting and the amount of time employees perform lifting tasks by
  - Rotating workers in lifting tasks with other workers in non-lifting tasks
  - Having workers alternate lifting tasks with non-lifting tasks
- Clear spaces to improve access to materials or products being handled. Easy access allows workers to get closer and reduces reaching, bending and twisting.

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## Guidelines for equipment use

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### *Equipment*

- Be sure you buy and use equipment of appropriate capacity for your specific work loads
- Choose equipment appropriate for the materials being handled, the layout of your workspace and the tasks being performed
- Consider using powered equipment for heavy loads or long distances
- Select equipment with vertical handles so the workers' hands are in their power zone (between thigh and mid-chest height)
- Choose wheeled equipment which minimizes start forces and reduces rolling resistance
- Ground all electrically-operated equipment
- Ensure that equipment alarms and warning devices are audible and working properly
- Inspect and maintain equipment according to manufacturers' recommendations

- Follow all manufacturers' recommendations for proper equipment use

### *Work environment*

- Clear aisles and doorways for safe passage and maneuvering of equipment
- Set barriers that prevent employees from coming close to or beneath supported or moving loads
- In tight spaces, use equipment with four swivel casters or wheels, making loads easier to turn and control

### *Work practices*

- Train employees on proper use of material handling equipment and appropriate work practices
- Push and pull equipment using proper body mechanics
- When moving heavy loads over long distances, either reduce the weight of the load or use powered equipment
- Inspect loads before loading or moving them

## References

Centers For Disease Control and Prevention (CDC). Ergonomic Guidelines for Manual Material Handling. <http://www.cdc.gov>. Web. 12 January 2012.

T.R. Waters, "Manual Material Handling", in: Physical and Biological Hazards of the Workplace (Second Edition). Edited by P. Wald and G. Stave. New York: John Wiley and Sons, 2002.

## Ergonomics checklist- *For Manual Material Handling Tasks*

This checklist can be used as a tool to quickly identify potential risks with manual material handling tasks. “Yes” responses are indicative of conditions that present a risk of injury (especially to the lower back). The greater number of “yes” responses that are noted, the greater the potential risk.

Risk Factor	Yes	No
<i>General</i>		
Does the load exceed 35 pounds?		
Is the object difficult to bring close to the body because of its size, bulk or shape?		
Is the load difficult to handle because it lacks handles or cutouts for handles, or does it have slippery surfaces or sharp edges?		
Is the footing unsafe? (e.g. slippery floor, incline or uneven surfaces)		
Does the task require fast movement such as throwing, swinging or rapid walking?		
Does the task require stressful body postures (e.g. stooping to the floor, twisting, reaching overhead, excessive side bending)?		
Does the task require working in extreme temperatures, with noise, vibration, poor lighting or airborne contaminants?		
Does the task require working in a confined area?		

### *Specific*

Does the lifting frequency exceed 5 lifts per minute?		
Does the vertical lift distance exceed 3 feet?		
Do carries last longer than 1 minute?		
Do tasks require large sustained pushing or pulling forces that exceed 30 seconds in duration?		
Do tasks require extended reaching that exceeds 1 minute in duration?		

## Ergonomic Pilot Project Application

### *Animal Care*

UCOP Risk Services would like your help in reducing the ergonomic risk factors and risk of injury associated with:

- Handling water bottles
- Changing cages
- Cleaning cages
- Moving carts and racks
- Manually handling feed, bedding, waste and trash

As an ergonomist, you can help reduce injury risk by working directly with your animal care staff to apply for a \$5,000 grant from UCOP. The grant is intended to fund a pilot project at your location that will reduce ergonomic risks associated with the tasks listed above.

## Instructions

1. Complete the application below with detailed information regarding the proposed project
2. Email the completed application to Kristie Elton at [kristie.elton@ucop.edu](mailto:kristie.elton@ucop.edu)
3. Once your project is approved, establish a trial period for your pilot
4. At the conclusion of this trial period, ensure that animal care employees complete the pilot project survey (provided) to share the outcomes of the proposed initiative; completed surveys will provide valuable, front-line information for animal care staff at other University of California locations

APPLICANT INFORMATION	
Date	
UC Location	
Ergonomist's Name	
E-mail Address	
Phone Number	
Animal Care Department Contact	

## PILOT PROJECT

Identify the at-risk task(s) you wish to address  
(see list above)

Name of the department piloting this project

Provide a brief explanation of the proposed project. Include specific product information or anticipated design changes

Total cost of project



Ergonomic Pilot Project Survey  
Animal Care

Your feedback is important to us. Please take a few moments to complete this form and return it to your campus ergonomist.

Date:	
UC Location:	
Type of Project: <i>(design change, equipment, etc.)</i>	
Equipment being evaluated: <i>(make, and model)</i>	

Using the scale: 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent

1. How would you rate your overall satisfaction with the pilot project?	1	2	3	4	5
2. To what extent will these changes make it easier to do your job?	1	2	3	4	5
3. How often will these changes impact your job?	Daily	Weekly	Seldom		
If the pilot project involved new equipment:					
4. Did you receive training on the proper use of the equipment?	Yes	No			
5. If so, how well did the training prepare you?	1	2	3	4	5

6. Please list the specific work activities where you used this equipment:
7. Please indicate the aspects of the changes that you find most helpful:
8. Please indicate the aspects of the changes that you feel need improvement:

Additional comments