University of California, San Diego
Institutional Animal Care and Use Committee
Animal Care Program
Standard Operating Procedure

Cage changes for rodents in standard housing

Author: IACUC Subcommittee on Cage Changing Standards  Date: 03/2014
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1. Purpose
The SOP defines standards and criteria for changing bedding and primary enclosures for rodent husbandry.

2. Scope
The SOP applies to all personnel responsible for changing rodent cages at UCSD vivaria.

3. Responsibility
ACP personnel is responsible for ensuring that the minimum cage changing standards are maintained at all times.

4. Definitions
Cage changes refer to replacement of the cage bottom and bedding. Supplies of food and water need to be adequate at all time to ensure animal health, but are not directly impacted by the standards.

5. Procedures
5.1. These criteria constitute the minimum standards for individual cages that must be followed by default in all UCSD vivaria.
5.2. ACP may impose more frequent cage changing based on veterinary or operational needs.
5.3. Investigators may request more frequent cage changing, which will be implemented in consultation with ACP personnel (and recharged as appropriate).
5.4. Investigators may ask ACP personnel to accommodate experimental objectives in the planning and execution of cage changes, as long as the minimum standards are met at all times.
5.5. Nothing in the SOP supersedes the requirements as specified in the Animal Welfare Act for hamsters and other USDA-covered species.

5.6. All new caging setups including weaned animals start with all freshly cleaned or sterile equipment.

5.7. Cage bottoms are minimally changed when ANY of the following is observed:
   a. Wet bedding connects any two corners of the cage
   b. Dry bedding areas ("islands") are not large enough for all animals to sit or lie on
   c. Volume of feces exceeds volume of bedding
   d. An adult animal is found dead in the cage and the cage does not contain a nursing litter
   e. Hamster and other USDA-covered species’ cages shall be sanitized at least once every 2 weeks

5.8. Cage lids (filter top lids) are minimally changed when ANY of the following is observed:
   a. The filter is greater than 50% discolored brown
   b. Any material buildup is visible around the water bottle opening
   c. Feed is observed to be soft or moldy
   d. A structural defect is identified in the cage lid (filter top lid) – this includes improper fitting of the cage to the bottom, defects to any required perforations, and improper filter positioning or condition (holes)

5.9. Wire bar lids are minimally changed when ANY of the following is observed:
   a. A structural defect is identified (large opening between wires, broken wires, etc.)
   b. Center divider not working properly to separate feed from water or is falling between wires
   c. Any buildup of debris is identified
   d. Feed is observed to be soft or moldy

5.10. Feed hoppers are minimally changed when ANY of the following is observed:
   a. Any associated support brackets are out of place
   b. Any buildup of debris is identified
   c. Feed is observed to be soft or moldy
c. Feed is observed to be soilt or molted

d. All food receptacles for hamsters and other USDA-covered rodent species shall be kept clean and shall be sanitized at least once every 2 weeks.

6. Background

Mice soil their cages with feces and urine, requiring regular replacement of bedding and cages to maintain and ensure animal health. Recommendations vary widely about how to best achieve this outcome. The Guide for the Care and Use of Laboratory Animals, Eighth Edition (2011) provides only general guidance, stating the following: “Soiled bedding should be removed and replaced with fresh materials as often as necessary to keep the animals clean and dry and to keep pollutants, such as ammonia, at a concentration below levels irritating to mucus membranes. The frequency of bedding change depends on multiple factors, such as species, number, and size of the animals in the primary enclosure; type and size of the enclosure; macro- and microenvironmental temperature, relative humidity, and direct ventilation of the enclosure; urinary and fecal output and the appearance and wetness of bedding; and experimental conditions, such as those of surgery or debilitation, that might limit an animal’s movement or access to clean bedding. There is no absolute minimal frequency of bedding changes; the choice is a matter of professional judgment and consultation between the investigator and animal care personnel. It typically varies from daily to weekly. In some instances, frequent bedding changes are contraindicated; examples include portions of the pre- or postpartum period, research objectives that will be affected, and species in which scent marking is critical and successful reproduction is pheromone dependent.”

No scientific consensus exists on the most appropriate cage changing standards, with some investigators claiming superior mouse health and well-being with frequent changes, and others recommending infrequent changes to keep the cage environment as stable as possible. Furthermore, although it is clear that infrequent changes can affect the health and well-being of the animal handlers, no objective standards exist that could be readily applied at the individual cage level. Beyond scientific considerations, further difficulties arise from different cage formats and caging systems that can affect the accumulation of moisture and ammonia. Furthermore, detailed quantitative measures for the degree of cage soiling are impractical from the compliance perspective, inviting disagreement and discontent.

Overview

An IACUC subcommittee was convened at the end of 2013 to recommend new cage changing standards for mouse colonies. The subcommittee considered the regulatory and scientific environment, and had discussions with the major stakeholders (i.e., investigators, compliance personnel, and animal care providers), in developing the recommendations listed above.

Starting in 2016, ACP embarked on an extended evaluation of the cage environment relative to the wellbeing of mice. Much of the impetus for this evaluation was at the direction of the UCSD IACUC which had reviewed ACP’s newly developed method for a review of caging which was
IACUC which had reviewed ACP’s newly developed method for a subset of caging which was based not on a time interval, but rather on the status of each cage. The evaluation focused closely on cage bottoms, bedding, food and water due to the degree with which the animals come into direct contact with these. Much of the evaluation was done using a caging system with sensors that detect multiple conditions including moisture and movement throughout the entire cage floor area. Caging density was varied and included 1-5 adult animals. Multiple blinded professional daily assessments of the cage conditions for these animals were collected for up to 6 months. Additional data collected included cage ammonia levels, animal health evaluations, animal activity levels, feces to bedding ration, visual cage conditional assessment, and animal breeding success. Upon analysis of these data, parameters were established which could reliably be used to determine when an individual cage required changing in order to assure the health of cage occupants. An ACP cage changing standard operating procedure (#601 Attachment: Ventilated Rodents 09012018.doc) was established, reviewed and accepted by the IACUC, implemented institution-wide. The practice has been reviewed by multiple AAALAC and OLAW site visit teams all with positive reviews and endorsement.

Components were included in this determination of changing frequency, but parameters were not specifically assigned to each individual component. Components lasted the length of the studies. The parameters determined as important for change intervals were primarily associated with the cage bottom and bedding substrate. The rate-limiting cutoff was generally found to be the fecal:bedding ratio. This indicated to us that components could safely go beyond the 6 months identified cutoff. Consistent with this finding is the nature of the interactions between the cage inhabitants and the caging components. Animals do not come into direct contact with cage lids. Animals have minimal contact with wire-bar lids and feeders. Animals have variable direct contact with miscellaneous components such as shelters, huts and manipulanda.

These all were taking into account when coming up with the aforementioned set of criteria related to the specific component change schedule.