Animal Allergen Exposure Control Program

University of Minnesota
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Program Description

See the U of MN Respiratory Protection Program for more details. This program applies to Research Animal Resources, Investigator-Managed Housing Areas, and research laboratories where operations involving rodents and/or rabbits occur more than one hour per week.

Authority and Responsibilities

University Office of Occupational Health and Safety (UOHS)

UOHS has the authority for oversight and management of this program.

UOHS will provide training resources, as needed and when requested by the RAR Director and Principal Investigators.

The UOHS Respiratory Protection Program Administrator is responsible for:
1. Assisting employees with scheduling for respirator fit testing
2. Informing Principal Investigators, the Director of RAR, supervisors and employees when employees are due for annual updates
3. Maintaining respirator medical recommendations and respirator fit testing documentation for each employee

Principal Investigators and Director of Research Animal Resources (RAR)

Principal investigators and the Director of Research Animal Resources (RAR) are responsible for:
1. Identifying and informing personnel required to wear respiratory protection
2. Ensuring that personnel receive medical evaluation and fit testing
3. Providing personnel with respirators as needed during their work.
4. Enforcing the use of respirators where required.
5. Ensuring that all personnel receive annual training on animal allergy exposure control

**Employees**

Employees required to wear respirators are responsible for:
1. Making and keeping appointments for medical evaluation and fit testing
2. Using a respirator during high exposure activities
3. Properly wearing, maintaining, storing and replacing their respirator.
4. Attending annual training on laboratory animal allergy exposure control.

**Department of Environmental Health and Safety (DEHS)**

DEHS is responsible for:
1. Providing assistance with training associated with exposures and controls
2. Assisting with or conducting exposure measurements
3. Assisting with design and implementation of exposure controls

**Occupational Exposure Guideline for Laboratory Rodent and Rabbit Allergens**

In October 2008, the University of Minnesota Health and Safety Steering Committee approved the adoption of 5 ng/m$^3$ as a 30-min short term exposure guideline for mouse urinary proteins (MUP), to be used as an internal employee exposure guideline for the prevention of laboratory animal allergy.

**Exposure Control**

The University shall make every effort to provide local exhaust ventilation for high exposure activities.

Personnel conducting activities with exposure levels greater than 5 ng/m$^3$ MUP (30 min time-weighted average) shall be required to wear respiratory protection. In cases where exposure is less than 10 times the exposure guideline, a filtering facepiece respirator (N95 filters) shall be provided (at a minimum). Where exposures exceed 10 times the exposure guideline, a
respirator with higher protection (e.g. full facepiece or powered air purifying respirator) will be required.

**Cage Dumping**

All cage dumping operations shall have local exhaust ventilation. No cage dumping shall be performed without local exhaust ventilation.

All personnel shall be required to wear filtering facepiece respirators with N95 filters, at a minimum, when performing cage dumping tasks (with local exhaust ventilation).

If future sampling demonstrates that exposure levels are below the internal guideline of 5 ng/m$^3$ MUP, then requirements for respiratory protection will be re-assessed.

**Cage Changing**

All rodent areas shall use corncob (or similar) bedding rather than wood chips.

All horizontal or vertical hoods shall be replaced with Class II Biosafety Cabinets (BSC-II) in all rodent-handling facilities. The highest priority for BSC-II hoods shall be those spaces where cages do not have filter tops and no hoods are currently in use.

Eventually, all areas performing rodent-handling operations shall have access to BSC-II hoods for employee protection.

Personnel performing cage changing operations without a BSC-II hood shall be required to wear respiratory protection. The minimum level of respiratory protection shall be a filtering facepiece respirator with N95 filters.

**Occupational Health Screening**

Medical surveillance and evaluation play an important role in preventing LAA by: 1) identifying employees who may be at increased risk, 2) assisting with decisions about methods for minimizing exposures for potentially-susceptible employees and 3) developing information for initial risk
assessment and on-going evaluation of effectiveness of program and controls.

All personnel with exposure to animals must receive preliminary medical surveillance. Periodic re-evaluation may be necessary for some personnel who are found to be at increased risk.

All personnel in the highest category of exposure must receive medical evaluation prior to wearing a respirator. Medical evaluation for respirator wear should be repeated as recommended by the Occupational Health Care Provider or when job duties or health status change.

**Respiratory Protection**

Personnel conducting activities with exposure levels greater than 5 ng/m$^3$ MUP shall be required to wear respiratory protection. Those personnel in lesser categories of exposure who choose to wear respirators voluntarily must also receive medical evaluation. Fit testing is also strongly recommended for those wearing respirators voluntarily. Supervisors may choose to make respirators available for voluntary purposes, but are not required to do so.

All personnel must be tested for respirator fit prior to wearing a respirator. Fit testing shall include training in the proper methods for checking the seal of their respirator, proper donning and doffing techniques, procedures for maintenance and information about when to discard used respirators.

Guidelines for use of respiratory protection are summarized in Table 1.
### Table 1 Selecting Respiratory Protection for Laboratory Animal Allergen Exposures

<table>
<thead>
<tr>
<th>Job/Area/Task</th>
<th>Exposure Level (ng/m³)</th>
<th>Exposure Guideline (ng/m³)</th>
<th>Respirator Protection Factor Needed</th>
<th>Minimum type of respirator</th>
<th>Type of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cage Dumping without local exhaust ventilation*</td>
<td>300</td>
<td>5</td>
<td>60</td>
<td>Full facepiece powered air purifying respirator (PAPR) with N95 filter**</td>
<td>Mandatory</td>
</tr>
<tr>
<td>Cage dumping with local exhaust ventilation</td>
<td>50</td>
<td>5</td>
<td>10</td>
<td>Half mask air purifying respirator with N95 filters</td>
<td>Mandatory</td>
</tr>
<tr>
<td>Cage cleaning or changing with local exhaust ventilation</td>
<td>Estimate 25 – 50</td>
<td>5</td>
<td>5-10</td>
<td>Half mask air purifying respirator with N95 filters</td>
<td>Mandatory</td>
</tr>
<tr>
<td>Cage cleaning in hood (not BSL2)</td>
<td>10-20</td>
<td>5</td>
<td>2-4</td>
<td>Half mask air purifying respirator with N95 filters</td>
<td>Mandatory</td>
</tr>
<tr>
<td>Cage cleaning in BSL2 hood</td>
<td>&lt; 5</td>
<td>5</td>
<td>Not applicable</td>
<td>Not required</td>
<td>Voluntary</td>
</tr>
<tr>
<td>Working in areas with high density of animals and cages without filter tops</td>
<td>Estimate 10-20</td>
<td>5</td>
<td>2-4</td>
<td>Half mask air purifying respirator with N95 filters</td>
<td>Mandatory</td>
</tr>
<tr>
<td>Performing lengthy experiments without local exhaust ventilation or in non-BSL2 hood</td>
<td>Estimate 10-20</td>
<td>5</td>
<td>2-4</td>
<td>Half mask air purifying respirator with N95 filters</td>
<td>Mandatory</td>
</tr>
<tr>
<td>Performing lengthy experiments with local exhaust ventilation (BSL2 hood)</td>
<td>Estimate &lt; 5</td>
<td>5</td>
<td>Not applicable</td>
<td>Not required</td>
<td>Voluntary</td>
</tr>
</tbody>
</table>

* Local exhaust ventilation is required on all cage dumping operations.
** May use a hood or helmet PAPR if manufacturer has demonstrated a protection factor of at least 1000.

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**Employee Training**

All personnel working with animals must receive annual training about laboratory animal allergy (provided by UOHS), which shall cover the recognition of high exposure tasks and methods for minimizing exposure. Training records shall be maintained by Principal Investigators and the Director of RAR.
APPENDIX

The Animal Allergen Exposure Control Program at the University of Minnesota was developed to address employee exposures to animal allergens experienced during the care and use of laboratory animals.

Almost half of laboratory animal workers in the United States develop allergy to laboratory animals. More than 10% of workers with symptoms develop occupationally-related asthma with persistence of symptoms even after leaving their job. More than a third of affected lab animal workers lose time from work due to symptoms. The Association for Assessment and Accreditation of Laboratory Animal Care International (AAALAC), which accredits laboratory animal research programs, states that “an occupational health and safety program must be part of the overall animal care and use program.” Reduction of the incidence of laboratory animal allergy (LAA) among laboratory animal workers is an important element of such an occupational health and safety program.

Lab animal allergy (LAA) is an important occupational health and safety risk for laboratory animal researchers, particularly when working with rodents and furred animals. It is possible to lower the risk for LAA by decreasing the level and duration of exposures to sensitizing animals. It is not clear, however, whether the risk can be completely eliminated.

Initial Risk Assessment

Based on a preliminary risk assessment, the University of Minnesota Office of Occupational Health and Safety (UOHS) determined that (Table 2):

- The highest exposure levels will be associated with activities involving management of used bedding and care of live animals (cage dumping, cage cleaning, animal feeding) when there are no controls present that limit the buildup or release of allergens to the environment (e.g. local exhaust ventilation, downdraft hoods, filter top cages, ventilated cages, appropriate bedding, etc.). A high density of animals in a space will also lead to higher levels of airborne allergens.
- Moderate levels will be associated with the same activities described above, but with controls to minimize buildup or release of allergens.
- Low exposure levels will occur during the experimental use of animals (technicians, students, investigators).
This table was constructed prior to any exposure sampling and was based entirely on review of published reports. Allergen levels in the highest risk level were expected to be at least 50 times greater than exposures in the moderate risk level. Levels in the moderate risk level were expected to be 5-10 times greater than those in the lowest risk levels.

**Table 2 – Risk Levels Associated with Lab Animal Allergen Exposures**

<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Animal or Bedding Contact*</th>
<th>Near Animals or Bedding**</th>
</tr>
</thead>
</table>
| High       | > Frequent handling of animals without LEV  
> Frequent handling or changing cages or bedding without LEV | > High density of animals |
| Moderate   | > Frequent handling of animals with LEV  
> Frequent handling or changing cages or bedding with LEV  
> Infrequent handling or changing cages or bedding without LEV | > Unventilated, open cages  
> Wood-based bedding |
| Low        | > Infrequent handling of animals with LEV | > Filter top cages  
> Positive pressure ventilated cages  
> Absorbent bedding  
> Non-contact bedding |
| Very Low   |                               | > Negative pressure ventilated cages |

* Frequent ≥ 1 hr/day; Infrequent < 1 hr/day  
** Male rodents generally more allergenic than female

LEV = local exhaust ventilation (hoods or other devices to capture contaminant near its source). Note: horizontal work benches are not considered LEV; biosafety cabinets and fume hoods are considered LEV.

Engineering controls should be the primary method for lowering exposure to animal allergens. Cage dumping operations must be equipped with local exhaust ventilation. Cage changing operations should be conducted in a hood designed to prevent personnel exposure to allergens (biosafety, backdraft or downdraft booths).

The best building or room design features include:

1. Non-recirculating, one-way airflow systems in animal handling rooms
2. Animal rooms at negative pressure compared to corridors
It is recognized that these features may not always be compatible with best practices for ensuring animal health.

The best design features for animal cages that will limit airborne emission of LAA include:
1. Ventilated or filter-top cages
2. Absorbent (best) or corncob bedding
3. Non-contact bedding

The best design features for controlling individuals’ exposures to LAA during experimental use activities are:
1. Biosafety cabinets
   or
2. Ventilated workstations with down-draft or back-draft systems

A variety of administrative controls can also be effective for lowering LAA exposures, including:
1. Restricting personnel access
2. Using female rodents instead of male
3. Rotating jobs to minimize exposure duration
4. Limiting wear of street clothes during work and leaving work clothes at work
5. Practicing basic hygiene (e.g. hand washing)

Personal protection may be necessary in addition to engineering and administrative controls, but should not be relied upon as the sole method for lowering exposures. Respiratory protection should be provided to those with significant risk of exposure and health outcomes in the interim period when exposures are being evaluated and engineering or administrative controls are being implemented and evaluated for effectiveness.

There are no specific OSHA regulations and no current regulatory or voluntary exposure guidelines for lab animal allergens. There is no standard method for measuring exposures. Specific protein allergens have been identified for most allergenic species and personal sampling methods are available for most of these. Measurements can be used to compare exposures in different locations and for different tasks. Measurements can also used to assess the effectiveness of controls.
Preliminary Recommendations and Actions

In November 2007 UOHS concluded from a preliminary risk assessment that employees performing work that corresponds to the high and medium risk categories (Table 2) should be encouraged to wear respiratory protection. At a minimum, these employees would be encouraged to use filtering facepiece (N95) respirators. At the same time, the UOHS decided to conduct a more thorough assessment of employee exposures and engineering and administrative control practices in animal research areas. A re-evaluation of the risk assessment was planned for mid-2008.

An interim program – Voluntary Use of Respiratory Protection for Exposure to Animal Allergens – was developed for employees and students involved in animal research activities in January 2008. This program included:

- Identifying all personnel in the high and moderate exposure categories (Table 1).
- Informing workers who are in the high and moderate exposure categories.
- Purchasing filtering facepiece respirators and making them available to any employee wishing to wear a respirator voluntarily to minimize exposures to LAA.
- Training all animal care personnel on exposures to lab animal allergens and respiratory protection.
- Encouraging employees to obtain medical evaluation and fit testing prior to wearing respirators.

All Research Animal Resources personnel whose jobs involved dumping soiled bedding from mouse and rat cages were required to enroll in the University of Minnesota Respirator Protection Program and required to wear filtering facepiece respirators with N95 filters (at a minimum).

Determining an Exposure Limit

There are currently no regulatory guidelines for exposure to lab animal allergens. Some universities (including Johns Hopkins) have adopted 5 ng/m³ (mouse urinary proteins) as an internal exposure guideline.

The University of Minnesota Research Occupational Health and Safety Coordinating Committee (ROHSC) conducted some informal benchmarking and recommended adopting this value, as well.
**Exposure Sampling**

**Cage Dumping**
RAR, Duluth: Airborne levels of mouse allergens during cage dumping were 10 times greater than the exposure guideline of 5 ng/m³ (UMD Allergen Report, Sept 3, 2008, Environmental Health and Safety, Inc.). The operation uses a Biobubble, which provides some degree of local exhaust ventilation.

RAR, Twin Cities (Molecular & Cellular Biology; Jackson Hall): Airborne levels of mouse allergens during cage dumping operations were 60 times greater than the exposure guideline of 5 ng/m³ (U of M Allergen Report, April 8, 2008, Environmental Safety and Health, Inc.). No local exhaust ventilation was provided for cage dumping operations.

**Cage Changing**
Following a site visit in January 2008, AAALAC stated:

"Changing cages is an activity that has the potential to create dust aerosols and subsequent exposure of personnel to allergens. Performing this procedure in a laminar flow cabinet may direct the aerosols toward personnel, potentially increasing their exposure."

Laminar flow hoods are designed to protect animals from researcher-generated aerosols, but do not provide protection for researchers from animal-generated aerosols.

Sampling conducted by UOHS and DEHS during cage changing operations corroborated this observation. Comparisons of levels among several types of hoods showed that only Biosafety Level 2 (BSL2) hoods were capable of reducing personal exposures to acceptable levels (< 5 ng/m³). Side-by-side comparisons of three types of hoods showed personal exposures to LAA were 4 times greater when using a horizontal flow hood compared to a BSL2 hood. Personal exposures using a laminar flow hood were 2 times greater than exposures using a BLS2 hood (U of M Allergen Hood Side-by-Side, July 2008, Environmental Health and Safety, Inc.).
Final Recommendations for Controlling Exposures

The Research Occupational Health and Safety Coordinating Committee recommended the following for minimizing employee exposures to lab animal allergens:

Cage Dumping

All cage dumping operations should have local exhaust ventilation. No cage dumping should be performed without local exhaust ventilation.

All personnel should be required to wear filtering facepiece respirators with N95 filters, at a minimum, when performing cage dumping tasks (with local exhaust ventilation).

No respiratory protection will be required if sampling demonstrates that exposure levels are below the internal guideline of 5 ng/m³.

Cage Changing

All rodent areas should be using absorbent (corncob) bedding rather than wood chips.

All horizontal or vertical hoods should be replaced with BSC-II in all animal-handling facilities. The highest priority for BSC-II should be those spaces where cages do not have filter tops and no hoods are currently in use.

Eventually, all areas performing animal-handling operations should have access to BSC-II for employee protection.

Personnel performing rodent cage changing operations without a BSC-II should be required to wear respiratory protection. The minimum level of respiratory protection should be a filtering facepiece respirator with N95 filters.