Laboratory Animal Allergy
Mouse Urine Protein as an Indicator

John Schaefer, CIH,
Associate Director, Health Safety & Environment
Assistant Professor of Medicine
Assistant Professor of Environmental Health Science

JOHNS HOPKINS
MEDICINE

LABORATORY ANIMAL ALLERGY(LAA)

- Significant Occupational Health Problem
- Approximately 2 million workers in the U.S. have jobs with routine contact with animals.
  - 33% of animal handlers will develop allergic symptoms
  - 10% of animal handlers will develop animal induced asthma
- 1998 NIOSH issued an Alert entitled:
  - Preventing Asthma in Animal Handlers DHHSNIOSH 97-116
    - Using proper protective equipment
      - Gloves, Particulate respirators, Face shields
    - Training for workers about animal allergies
    - Modifying ventilation & filtration systems
    - Providing health monitoring of exposed workers

LABORATORY ANIMAL ALLERGY (LAA)

- Classified as immediate hypersensitivity reactions or Type I
  - Involves production of Immunoglobulin E (IgE)
  - Forming a complex cascade of reactions leading to allergic inflammation
- Contact with animal allergens
  - Inhalation (Primary source)
  - Direct Skin contact

LABORATORY ANIMAL ALLERGY

- Onset can range from minutes to hours after exposure with mild to severely debilitating reactions
  - Skin
    - Hives
    - Rashes
    - Watery Eyes
  - Respiratory
    - Sneezing
    - Coughing
    - Wheezing
    - Asthma

ANIMAL POPULATION

- Johns Hopkins University
  - 90% of the animal population for JHU are Mice
  - Concern over allergen in laboratory animal facilities
  - Source
    - Urine-Major source due to persistent proteinuria
    - Hair
    - Dander

Mouse Urine Protein Study

Purpose

- Determine airborne concentrations of Mouse Urinary Protein (MUP) in close proximity to animal holding areas
- Determine the effectiveness of various types of engineering controls
- Determine what are the levels of MUP in various locations throughout the Institution

MOUSE URINARY PROTEIN
Particle Size

- Current literature reports that mouse allergens can reside on particles ranging
  - >0.5um to <10um
  - **Respirable**
    - Particles less than 10 microns are considered respirable.
    - Can easily enter the lower portion of the respiratory tract
    - More likely to cause an adverse effect.
      - Particles between 10-100 microns are trapped by the upper respiratory tract (nose, throat) and removed from body
      - Particles above 100 microns are not considered an inhalation risk.

ENGINEERING CONTROLS

- Containment
  - The animal holding area is negatively pressurized to the surrounding areas, preventing allergens from entering other areas
  - The animal cage is maintained under control ventilation to prevent release of allergen into the work area
- Engineering Control Data
  - Open Wire Cage
  - Micro Isolated Cage
  - Ventilated or Exhausted Rack
  - Integrated Cage Rack System

Engineering Controls Effectiveness

Engineering Controls	Mean / range (MUP ng/m^3)
Cage design	
Wire top cage no controls	96.0 / 8.1 - 464.0
Cage with microisolator cover	2.6 / 0.2-12.2
Wire top cage on rack with negative exhaust	1.4 / 0.1-3.6
Cage with integrated supply and exhaust	<0.1
Ventilation design	
Older cage wash facility with limited ventilation	12.3 / 6.5-90.0
New cage wash facility with ventilation control	1.0 / 0.5-4.8

AIRBORNE CONCENTRATION RECOMMENDATIONS

- According to S. Gordon
  - Suggested risk of sensitization & development of symptoms to mice is increased MUP concentrations **>5ng/m^3**
- Great Britain Recommendations
  - Exposure in Animal Work Area
    - **<3ng/m^3**
- Johns Hopkins University/Department of HSE
  - Exposure in Non-Animal Work Area
    - **<1ng/m^3**

SITE DESCRIPTIONS

SITE	RANGE (MUP ng/m^3)
Restricted employee Access	0.199-0.975
Animal Transportation Hallways-	0.452-2.78
General Service Hallways	<0.05-0.05
General Service Hallways-	<0.05-0.532
General Service Hallways-	<0.05-0.172
Hallway Outside of Research Lab	0.0820-0.696
Service Elevator Stop-	<0.05-0.340
General Office Area	<0.05-0.05
Restricted Animal Holding Areas	0.2-2.8

SUMMARY

- Effective engineering controls with respect to the housing of mice can reduce exposure significantly (greater than 90%)
- Effective ventilation control can reduce exposure to those in common areas (corridors)
- Effective ventilation design can reduce worker exposure to Mouse Urine Protein while performing cage washing duties

- The Johns Hopkins University
- Center for Excellence in Healthcare Safety and Environmental Health

Contact Information

- John A. Schaefer
- E mail jas@jhmi.edu
- Phone 410 502 3025

- Thank You
- QUESTIONS ?