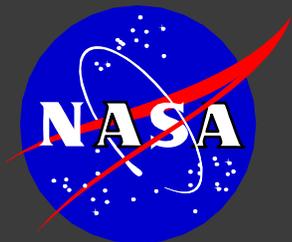


JSC ASTRONAUT MICE DISSECTION TRAINING MOUSE URINARY PROTEIN EXPOSURE EVALUATION

David T. Rose, MS, CIH, CSP
Industrial Hygiene Manager
NASA-Johnson Space Center, Bioastronautics Contract
Wyle Science, Technology and Engineering Group

Sean R. Keprta, MS, CIH
Occupational Health Officer
NASA – Johnson Space Center



Overview



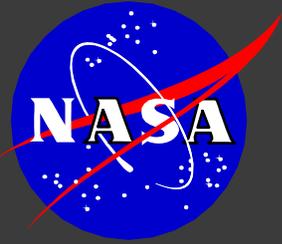
- Purpose & Scope
- Facilities Description
- PPE & Chemical Use
- MUP Sampling Method & Analysis
- MUP Acceptable Levels
- MUP Results
- Conclusions



Purpose and Scope



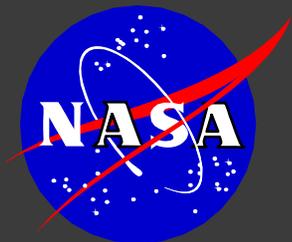
- Astronauts being trained to dissect mice at JSC to eventually be performed on ISS
- IH requested to evaluate potential health concerns as a baseline exposure assessment
- Baylor and Johns Hopkins had done studies sampling for MUP as an indicator for Laboratory Animal Allergy
- After initial meeting, IH to investigate chemical use and sample for potential mice allergens
- Are Astronauts being sensitized to mice allergens during training?



Mouse Urinary Protein (MUP)



- The main mice allergen is a protein identified as Mus m-1. This protein is found in urine, hair and dander
- Mice spray urine, proteins dry-up and become airborne on dust particles
- Exposures occur through inhalation, eye and skin contact
- Symptoms have included rhinitis, hives, conjunctivitis and asthma
- Type I Hypersensitivity Reaction
 - Production of IgE antibodies



Facilities Description



● Cage Room

- Two OptiMICE cage carousel systems, one Allergard NU-619 Cage Changing Station and one Viking Medical Bedding Disposal Unit (BDU)

● Cage Cleaning Room

- Rinse cages in sink and sterilize with steam in Douglas Washing and Sanitizing System.

● Dissection Training Room

- Performed in Microgravity Science Glovebox simulator or Lab hood



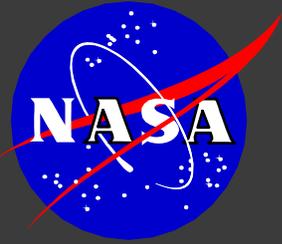
OptiMICE Cage Carousel System





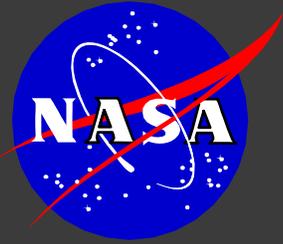
Individual Cage





Cage Changing Station





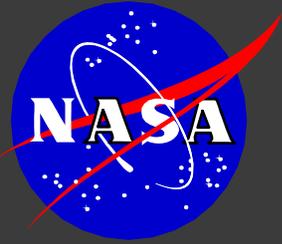
Bedding Disposal Unit





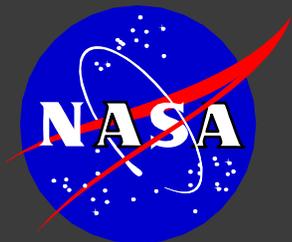
Cage Rinsing Sink





Washing and Sanitizing System

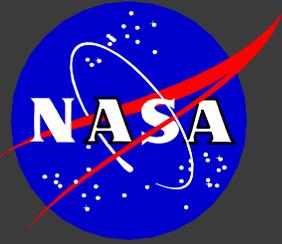




Dissection Training

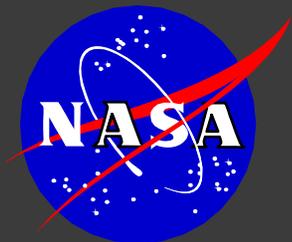


- 2 Training classes per month
 - 1 or 2 days each (maybe more)
- Astronauts catch, handle (scruff), anesthetize, euthanize, dissect the mice
 - Dissection time 15 minutes per mouse
 - Up to eight mice per day
- Retrieve mice from Transfer box (no bedding) or cage with bedding
- Actual contact time with mice 1 to 4 hours per day



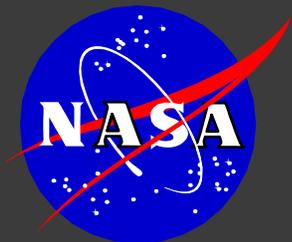
MSG Simulator





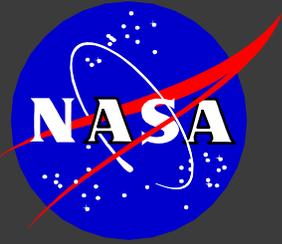
MSG Exhaust





Lab Hood Dissection Station



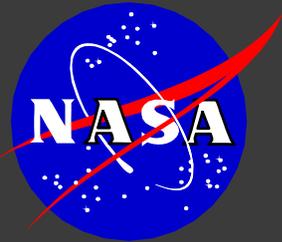


PPE Use



- ◎ Astronauts, Animal Handler, Intern:
 - Nitrile gloves, safety glasses and disposable or washable lab coats.

- ◎ Astronauts (optional):
 - 3M 1860 N95 Health Care Particulate Respirator and Surgical Mask.



Chemical Use

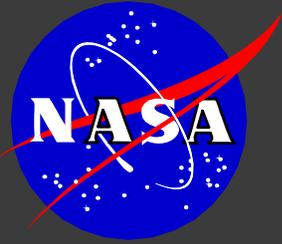


⦿ Astronauts:

- Combination of xylazine and ketamine in a syringe for anesthetic
- Euthasol in syringe to end life of mouse
- Saline wipes to hold mice dander down
- Benzalkonium (BZK) wipes to clean tools

⦿ Animal Handler/Intern only

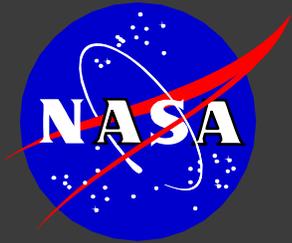
- Novus Plastic Polish #1 on splash shields
- Quatracide to disinfect surfaces



MUP Sampling

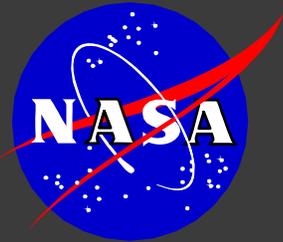


- ⦿ There is no standard sampling method for MUP.
 - Used methods described in Johns Hopkins and Baylor studies
- ⦿ Used 37 millimeter cassettes with PTFE filters (1 micron pore size)
- ⦿ Used Gilian GilAir Plus or Environmental Monitoring Systems (EMS) Mega-Lite sampling pumps.



MUP Analysis

- There are no standardized methods for quantitating exposures.
- All samples were analyzed for Mus m-1 by the Johns Hopkins University DACI Reference Laboratory
- Quantified by ELISA test



MUP Acceptable Levels?



- There are no regulatory exposure standards established
- Per S. Gordon (British Researcher)
 - Sensitization > 5 ng/m³
 - Symptoms at levels 2 to 3 times higher
- Johns Hopkins
 - Refers to S. Gordon level
 - Great Britain: animal work areas at < 3 ng/m³
- Baylor
 - Sensitization > 3 ng/m³
 - Symptoms > 5 ng/m³
- Merck
 - WOEL 5 ng/m³ ceiling limit
- University of Minnesota
 - Adopted 5 ng/m³ as 30 minute STEL



MUP Results



Table 1: November 21, 2013 MUP (Mus m-1) Sampling Results

Sample Location	Sample Time (Minutes)	Pump Flow Rate (LPM)	Air volume (liters)	Results ng/filter	Results (ng/m ³)
Area: Cage Room	36	2.008	72.3	< 0.5 < = less than LOD	< 6.9
Personal: Animal Handler (Changing and dumping 3 cages)	34	1.967	66.9	< 0.5	< 7.5
Area: Dissection Room	25	1.946	48.7	< 0.5	< 10.3
Personal: Intern Dissecting in hood	21	1.996	41.9	< 0.5	< 11.9



MUP Results



Table 2: December 12, 2013 MUP (Mus m-1) Sampling Results

Sample Location	Sample Time (Minutes)	Pump Flow Rate (LPM)	Air volume (liters)	Results ng/filter	Results (ng/m ³)
Personal: Animal Handler (Dumping ~20 cages in BDU and rinsing in sink/steam cleaning)	56	2.482	139.0	< 0.5 < = less than LOD	< 3.6
Area: Cage Room (Inside BDU hood)	48	10.14	486.7	4.8	9.9
Area: Cage Room (Beside BDU)	45	10.02	450.9	< 0.5	< 1.1
Area: Cage Cleaning Room (Beside sink & near Steam cleaner)	52	10.04	522.1	0.8	1.5



MUP Results



Table 3: January 10, 2014 MUP (Mus m-1) Sampling Results

Sample Location	Sample Time (Minutes)	Pump Flow Rate (LPM)	Air volume (liters)	Results ng/filter	Results (ng/m ³)
Personal: Astronaut (Dissecting in MSG)	174 Handling & Dissecting for approx 90 min.	2.496	434.3	< 0.5 < = less than LOD	< 1.2
Area: Dissection Room (Near MSG)	212	10.27	2177.2	< 0.5	< 0.3
Area: Dissection Room (Inside hood above HEPA filtered exhaust of the MSG)	212	10.03	2126.4	< 0.5	< 0.3



MUP Results



Table 4: January 30, 2014 MUP (Mus m-1) Sampling Results

Sample Location	Sample Time (Minutes)	Pump Flow Rate (LPM)	Air volume (liters)	Results ng/filter	Results (ng/m ³)
Personal: Astronaut 1 (Dissecting in hood)	410 Handling & Dissecting for approx 270 min.	2.522	1034.0	<0.5 < = less than LOD	< 0.5
Personal: Astronaut 2 (Dissecting in hood)	409 Handling & Dissecting for approx 270 min.	2.492	1019.2	< 0.5	< 0.5
Area: Dissection Room (Near hood)	409	10.06	4114.5	< 0.5	< 0.2

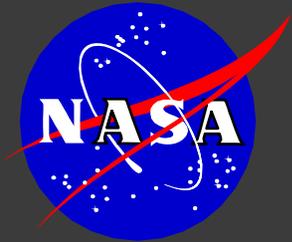


MUP Results



Table 5: January 31, 2014 MUP (Mus m-1) Sampling Results

Sample Location	Sample Time (Minutes)	Pump Flow Rate (LPM)	Air volume (liters)	Results ng/filter	Results (ng/m ³)
Personal: Astronaut 1 (Dissecting in hood)	229 Handling & Dissecting for approx 210 min.	2.522	577.5	< 0.5 < = less than LOD	< 0.9
Personal: Astronaut 2 (Dissecting in hood)	229 Handling & Dissecting for approx 210 min.	2.492	570.7	< 0.5	< 0.9
Area: Dissection Room (Near hood)	229	10.06	2303.7	< 0.5	< 0.3



Conclusions



- Exposures to mice allergens and chemicals are being properly controlled and it is very unlikely that Astronauts will become sensitized to the mice allergens during their training at JSC.
- No detectable MUP in any of the personal samples