



Tecniplast Emerald EM500 Individually Ventilated Cages Allergens Containment Test

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Abstract

Objectives

Objective of the trial was to evaluate the containment capability of the new Emerald EM500 IVC, when standard husbandry practices are performed.

Methods

Allergen samples of mouse urinary protein (MUP) were taken at regular intervals through allergens pumps installed at different positions around the rack and the changing station.

Samples were then analyzed by an independent test laboratory.

Results

Analyzed samples showed significantly low levels of MUP detected.

Conclusions

EM500 IVC showed an ideal containment performance, resulting in a reduction in the potential for environmental contamination and personnel exposure from very low to not detectable levels.



INTRODUCTION

In the last 20 years Individually Ventilated Cages (IVCs) have been extensively used in vivariums, thanks to a number of advantages they have brought about.

In details, IVCs are able to protect animals, operators and environment, while providing a controlled, standardized and reproducible test environment.

Amongst others, one of the main features of an IVC is the capability of reducing exposure of operators to allergens coming from the animals housed.

This report was performed to animal allergen test the new Emerald IVC cages to confirm the cages are sealed and prevent the release of laboratory animal allergens (LAA) under normal operational conditions.

MATERIALS

- Empty animal room (previously animal allergen tested in December 2018; no allergens were detected).
- IVC Emerald rack suitable for 77 EM500 cages (COMFORT Rack).
- EM500 IVCs, either with flat bases or In-Richment (an elevated surface embedded in the cage bottom).
- Tecniplast AWS manifold and auto-watering valves.
- · Smart Flow AHU, positive pressure mode.
- Casella APEX Air sampling pumps flow range: 2 litres/minute.
- · Mouse model: C57Bl/6J Babr, WT strain.

METHODS

 Test duration of sixteen days. The below spreadsheet highlights key days throughout the trial i.e. background allergen samples, when animals were added to the cages, and subsequent allergen samples:

| DAY | DATE | ТАЅК | NUMBER OF ALLERGEN SAMPLES |
|-----|------------|--|-------------------------------|
| -1 | 29/01/2019 | Background allergen sample with system running, bedding and diet with no animals | 1 |
| 0 | 30/01/2019 | Animals added to cages | |
| 1 | 31/01/2019 | | |
| 2 | 01/02/2019 | | |
| 3 | 02/02/2019 | Rack allergen samples | 4 |
| 4 | 03/02/2019 | | |
| 5 | 04/02/2019 | Rack allergen samples | 4 |
| 6 | 05/02/2019 | | |
| 7 | 06/02/2019 | Background allergen samples | 1 |
| 8 | 07/02/2019 | | |
| 9 | 08/02/2019 | Rack allergen samples | 4 |
| 10 | 09/02/2019 | | |
| 11 | 10/02/2019 | Rack allergen samples | 4 |

- The bottom row of the rack was not in use for the duration of the trial - fourteen self-sealing nozzles were installed across the bottom row of the rack to prevent any egress ingress of airflow within the unused spaces (Figure 1).
- Cages were given one type of bedding Datesand Grade
 With volume of bedding as per BSU standard (approx. 50 grams per cage).

- 4. Nesting used Enrich-o-nest. Approx. volume of nesting was 10 grams per cage (Figure 2).
- 5. Cages were equipped with red plastic tunnels attached to the wire bar lids to function as an escape area in the event of the cage flooding.
- 6. All equipment was autoclaved into the unit (121°C cycle).

NOTE - Emerald rack and cages were autoclaved twice prior to the start of the trial. Initially the rack and cages were autoclaved into the unit, then once the red plastic tunnels were added to each cage the complete set up was re-autoclaved.

- 7. 70% of cages were populated with mice.
- 8. 34 cages contained stock animals (17 cages of males and 17 cages of females).
- 9. 15 cages contained breeding trios (with or without offspring).
- 10. Weekly cage occupancy was recorded at the beginning of the week, see TABLE A, B and C.
- 11. Allergen pumps (Figure 3 and 4) set up for a duration of eight hours (standard working day).
- 12. Filters were added to allergen monitoring pumps within a Class 2 MSC.
- Allergen samples were stored in a fridge until the end of the trial; all samples sent together to the Health and Safety Laboratory in Buxton.

CURRENT HUSBANDRY PROCEDURES

- AM checks: checking animals to ensure their wellbeing as well as levels of food and presence of water, and checking for any new born animals; the presence of the water within the holding unit is checked by priming the first nozzle on the top row.
- PM checks: checking presence of water nozzles and welfare of the animals.



Figure 1



Figure 2



Figure 3



11 Ε Ε Ε Ε Ε Ε Ε 10 5M 5M 4F 5F 5F 5M 5M 9 1M 3M 3F 4F 5F 2M 4M 1M 2F 1M 2F 8 1M 2F 1M 2F 1M 2F 1M 2F 1M 2F 11P 3P 1M 2F 7 1M 2F 1M 2F 1M 2F 8P 1M 2F 1M 2F 1M 2F 1M 2F 6 Ε Ε Ε Ε Е Ε 4F 1M 5F 5F 5M 5M 5 5M 4 5M 5M 4F 5F 4F 5M 1M 3 5M 5F 5F 5F 5F 4F Ε 2 Ε Ε Ε Ε Ε Ε Ε use 1 с D Е F G в А

TABLE A: Week commencing - 28/1/19 (rack populated on 30/1/19)

| 11 | E | E | E | E | E | E | E |
|----|-------------------|--------------|--------------|-------------|--------------|--------------|--------------|
| 10 | 5M | 5M | 4F | 5F | 5F | 5M | 5M |
| 9 | 1M | 3M | 3F | 4F | SF | 2M | 4M |
| 8 | 1M 2F 1P | 1M 2F 7P | 1M 2F 14P | 1M 2F 8P | 1M 2F 23P | 1M 2F 13P | 1M 2P 11P |
| 7 | 1M 2F 7P | 1M 2F 11P | 1M 2F 12P | 1M 2F 7P | 1M 2F 1P | 1M 2F 6P | 1M 2F 7P |
| 6 | 1M 2F 7P | E | ε | ε | E | ε | E |
| 5 | 1M | SM | 4F | 5F | 5F | 5M | 5M |
| 4 | 5M | 5M | 4F | 5F | 4F | 5M | 1M |
| 3 | SM | SF | SF | SF | 5F | 4F | E |
| 2 | E | E | E | E | E | E | E |
| 1 | row not in use | | | | | | |
| | A | В | с | D | E | F | G |

TABLE B: Week commencing - 4/2/19

| ŝ | E | E | E | E | ε | E | E |
|---|-------------------|--------------|--------------|-------------|--------------|--------------|--------------|
| l | 5M | 5M | 4F | 5F | SF | 5M | 5M |
| | 1M | 3M | 3F | 4F | 5F | 2M | 4M |
| | 1M 2F 4P | 1M 2F 17P | 1M 2F 10P | 1M 2F 6P | 1M 2F 19P | 1M 2F 12P | 1M 2F 11P |
| | 1M 2F | 1M 2F 6P | 1M 2F 10P | 1M 2F | 1M 2F | 1M 2F 6P | 1M 2F 9P |
| | 1M 2F | E | E | ε | ε | E | ε |
| | 1M | 5M | 4F | 5F | SF | 5M | 5M |
| | 5M | 5M | 4F | 5F | 4F | 5M | 1M |
| | 5M | SF | 5F | 5F | SF | 4F | E |
| ŝ | E | E | E | ε | E | E | E |
| 1 | row not in use | | | | | | |
| | A | В | с | D | Ε | F | G |

TABLE C: Week commencing - 11/2/19 (NOTE - trial ended on 13/2/19)

WEEKLY CAGE OCCUPANCY

49 cages populated (70%) 15 cages containing BPs 34 cages containing stock

KEY: M - male adults F - female adults BP - breeding pair

were in each cage.

P - pups (before weaning) E - empty cage

pair

Numbers next to the letter(s) indicate how many animals there

Figure 4

RESULTS

Here below the table of allergens concentrations sampled, by an independent testing laboratory:

| Sample | | Comple Turne | Mus m1 | | |
|---------------------------------|---------|--------------|--------|--------|--|
| Reference | HSL ID | Sample Type | ng | ng/m^3 | |
| | | | _ | | |
| CONTROL TP TRIAL RACK | 1901181 | Filter | ND | ND | |
| DAY -1 BACKGROUND | 1901182 | Filter | ND | ND | |
| PUMP 5 RACK SAMPLE 02/02/19 | 1901183 | Filter | 0.08 | 0.08 | |
| PUMP 6 RACK SAMPLE 02/02/19 | 1901184 | Filter | 0.24 | 0.25 | |
| PUMP 9 RACK SAMPLE 02/02/19 | 1901185 | Filter | ND | ND | |
| PUMP 10 RACK SAMPLE 02/02/19 | 1901186 | Filter | 0.2 | 0.21 | |
| PUMP 5 SAMPLE 04/02/19 | 1901187 | Filter | 0.12 | 0.12 | |
| PUMP 6 RACK SAMPLE 04/02/19 | 1901188 | Filter | ND | ND | |
| PUMP 9 RACK SAMPLE 04/02/19 | 1901189 | Filter | ND | ND | |
| PUMP 10 RACK SAMPLE 04/02/19 | 1901190 | Filter | ND | ND | |
| DAY 7 BACKGROUND | 1901191 | Filter | ND | ND | |

| Sample | | Course la Trans | Mus m1 | | |
|---------------------------------|---------|-----------------|--------|--------|--|
| Reference | HSL ID | Sample Type | ng | ng/m^3 | |
| PUMP 5 RACK SAMPLE 08/02/19 | 1901192 | Filter | ND | ND | |
| PUMP 6 RACK SAMPLE 08/02/19 | 1901193 | Filter | ND | ND | |
| PUMP 9 RACK SAMPLE 08/02/19 | 1901194 | Filter | ND | ND | |
| PUMP 10 RACK SAMPLE 08/02/19 | 1901195 | Filter | 0.24 | 0.25 | |
| PUMP 5 RACK SAMPLE 10/02/19 | 1901196 | Filter | 0.12 | 0.12 | |
| PUMP 6 RACK SAMPLE 10/02/19 | 1901197 | Filter | 0.04 | 0.04 | |
| PUMP 9 RACK SAMPLE 10/02/19 | 1901198 | Filter | 0.04 | 0.04 | |
| PUMP 10 RACK SAMPLE 10/02/19 | 1901199 | Filter | 0.04 | 0.04 | |
| PUMP 6 BACKGROUND | 1901201 | Filter | ND | ND | |

CONCLUSIONS

The Emerald EM500 IVC significantly reduces the potential for environmental contamination and occupational exposure to mouse aero-allergens.

The recorded levels of MUP of the test samples were extremely low, often down to non-detectable levels.

The study was designed and the data analysed by Tecniplast but carried out in the BSU

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