

Controlling and Monitoring Biosecurity on Vivarium Floor Surfaces

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ABSTRACT:

Individuals are required to wear personal protective equipment (PPE) in an animal facility in order to reduce the entry and spread of contaminants and for safety protection. In our facility, individuals are expected to wear a lab coat, gloves, dedicated safety shoes or shoe covers over closed-toed shoes, a respirator (a task-based requirement) and safety glasses. Historically, wearing shoe covers has been a standard component of the PPE that must be worn before entering an animal facility.

With the installation of antimicrobial mats at the main entrances of our facility & dock areas, we are interested in determining the effectiveness of these mats in trapping contaminants that could potentially enter the area. Tests will be performed to determine how well the antimicrobial mats trap contaminants.

VIVARIUM/BUILDING DESIGN

Three vivarium floors that includes Barrier, Biocontainment, Canine, Nonhuman Primate, and Quarantine/Acclimation areas

An administrative area on the 4th floor (outside the vivarium)
Three main employee entrances

145 rooms which includes animal holding, procedure, storage, restrooms, surgery, and cage wash

RELEVANT BIOSECURITY PRACTICES

Cleaning Procedures

Floors throughout the vivarium are cleaned using an approved disinfectant

Vivarium floors are mopped five days a week

Sanitized
3 x week: Quatricide® PV (Pharmaceutical Research Laboratories, Inc.)
Decontaminated
2 x week: 10% Sodium Hydrochloride solution (bleach)

Biosecurity Mats

All matted areas have a minimal stepping distance of 4 feet
Dycem® CleanZone Mat, Dycem Limited, Warwick, RI
Clean Room Sticky Mats (various vendors)

Antimicrobial mats are sponge-mopped and squeegeed dry twice daily, M-F, according to Dycem's® recommendations, using Quatricide® PV (Figure 1)

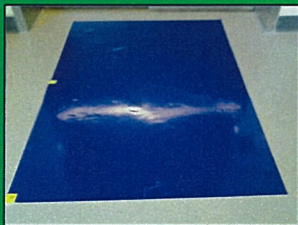
Adhesive mats are peeled twice weekly or as needed when soiled (Figure 2)

Figure 1



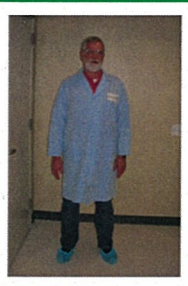
Dycem® CleanZone antimicrobial mat at one of 3 entrances to the vivarium

Figure 2



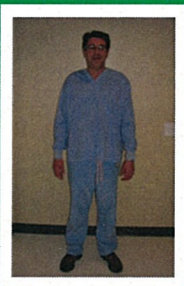
Adhesive contact mats at the 4th floor entrance to the vivarium

Figure 3



Non-vivarium staff wear a lab coat, shoe covers and safety glasses (not pictured) before entering the vivarium

Figure 4



Vivarium staff wear a dedicated uniform, dedicated safety shoes and safety glasses (not pictured) before entering the vivarium

PPE Requirements

Non-vivarium personnel must wear shoe covers, a lab coat and safety glasses before entering vivarium (Figure 3)

Vivarium staff must wear a dedicated uniform and dedicated safety shoes, safety glasses before entering vivarium (Figures 4)

Other Requirements

All wheels and equipment must be decontaminated prior to entering the vivarium by either antimicrobial mats, adhesive mats, or 10% bleach spray

MATERIALS AND METHODS

Materials

novaLUM®, Charm Sciences, Inc – unit used to measure adenosine triphosphate (ATP) levels (Figure 5)

Pocket Swab Plus®, Charm Sciences, Inc – apparatus used to collect samples which are then measured by the novaLUM®

Method of Testing

- 1 A baseline swab was collected from each antimicrobial and adhesive mat before being sanitized or soiled adhesive layer being removed, respectively
- 2 A 2nd swab was collected from each antimicrobial and adhesive mat after being sanitized or soiled adhesive layer being removed, respectively
- 3 A swab was then collected from a soiled cart wheel before crossing each mat
- 4 A 2nd swab of the cart wheel was collected to measure ATP levels after crossing each of the sanitized mats or of an unsoiled layer of the mat

Figure 5



novaLUM® luminometer – a handheld instrument used for ATP-based hygiene monitoring by measuring light intensity

DISCUSSION

The vivarium has five high-traffic entrances/area, each fitted with a Dycem® CleanZone antimicrobial mat or an adhesive mat. Hygiene monitoring was conducted using the novaLUM® and Pocket Swab Plus®, Charm Sciences, Inc. The swabs are treated and can break down biofilm to detect any form of adenosine triphosphate (ATP) or biological material.

ATP is present in all microorganisms, including methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* spp., *Clostridium difficile*, *Candida albicans*, and *Acinetobacter* spp.

Studies have validated that measurement of ATP is applicable for monitoring cleanliness. ATP is sufficiently stable over a ten-day period, unperturbed by sanitizer, and is subsequently removed with effective cleaning (similar to bacterial removal), as measured using ATP testing. The study serves as a model for cleaning validation and verification and for the evaluation of ATP testing systems.

The antimicrobial mats are designed to significantly reduce microbial materials. This product is designed to attract and collect up to 99% of particulate from shoes and wheels via electromagnetic force in the product. Adhesive materials do not have that capability.

We did not measure the electromagnetic capability of the antimicrobial mats, however our results indicate that these mats do a better job of collecting matter from contact surfaces.

CONCLUSION

Both matted materials provide a preventive barrier by trapping particulate and organic materials transferred by foot and/or wheel traffic into the vivarium. However, we were able to document a noticeable reduction of microbial load for the antimicrobial mats.

The antimicrobial mats provide a better preventive barrier than the adhesive mats.

REFERENCES

Allen KP et al. Comparison of methods to control floor contamination in an animal research facility. *Lab Animal* 2012; 41: 1-7

Sandle T. Examination of air and surface particulate levels from cleanroom mats and polymeric flooring. *Eur J Parenteral & Pharm Sci* 2012; 17: 110-119

RESULTS (TABLE 1)

Antimicrobial mats: There was a noticeable reduction of particulate and organic material after sanitizing these mats. This reduction was also noted after cart wheels cross the mats.

Adhesive mats: There was a reduction in particulate and organic material once the soiled layer has been removed. However, there was minimal adherence of material onto the mat from cart wheels.

Table 1
ATP Results on Five Matted Locations

Locations	ATP Count Before Cleaning Mat (RLU**)	ATP Count After Cleaning Mat (RLU**)	ATP Count on Wheel Before Contact with Mat (RLU**)	ATP Count on Wheel After Contact with Mat (RLU**)
*4th floor	130,300	885	12,100	10,800
3rd floor	257,700	1,100	47,600	15,500
1st floor	680,000	3,262	156,900	63,400
Trash Dock	1,400,100	3,262	171,900	52,500
Receiving Dock	810,900	5,000	12,400	900

*adhesive contact mat
** measured in Relative Light Units (RLU)