Results

Vapor distribution temperature ranges inside the test rooms were 20-25˚C during decontamination cycles. Vapor distribution throughout the test rooms was verified by chemical indicator color change. All 30 chemical indicators within the testing rooms showed a positive change indicating the presence of hydrogen peroxide for each cycle. UOP sensor readings for H_2O_2 reached a maximum level of .9 mg/L during the decontamination phase of the cycle.

Exposed Biological Results in the 5,500 ft^3 testing facility (MPV) and *Bacillus stearothermophilus* samples were exposed and recovered. Log reductions of all test organisms in 5,500 ft^3 test facility for three trials are presented in Tables 1-3.

Test Organism	Log Reduction
Mouse Parvovirus	10^3
B. stearothermophilus	10^5

Table 1. Trial One

Test Organism	Log Reduction
Mouse Parvovirus	10^3
B. stearothermophilus	10^5

Table 2. Trial Two

Test Organism	Log Reduction
Mouse Parvovirus	10^3
B. stearothermophilus	10^5

Table 3. Trial Three

Discussion

When aeration was completed and UOP sensor reported < .1 mg/L of H_2O_2, rooms were entered. Biological samples were aseptically collected and processed. After samples were collected, rooms were inspected and no visible and textural change in surfaces was detected.

Parvoviridae are generally considered to have low sensitivity to chemical biocides and are recognized as the most resistant viral family to disinfectants and sterilants[1]. They are classified as small, non-enveloped, DNA viruses and cause a variety of animal diseases. Feces, respiratory secretions, food, or contaminated blood/blood products may transmit parvovirus. Due to the ability to survive adverse environmental conditions, parvovirus is particularly contagious and difficult to eradicate from animal facilities and other critical environments.

It is accepted that bacterial spores, particularly *Bacillus stearothermophilus* spores, are the most resistant micro-organism to hydrogen perioxide vapor[2]. Efficacy against spores in this application was also confirmed for this reason.

Conclusion

The antimicrobial efficacy of the VHP 1000 room decontamination cycle was sufficient to significantly reduce test bioburdens. A reduction of three logs of (MPV) illustrates the capabilities of VHP technology as an anti-viral agent. A reduction of five logs of *Bacillus stearothermophilus* illustrates VHP technology as a bactericidal agent. In critical environments, a Vaporized Hydrogen Peroxide application can prove to be both an effective and efficient method of environmental control.

Advantages to this type of room decontamination:

1) Assurance of broad-spectrum anti-microbial efficacy.
2) Rapid cycle time and turnaround time.
3) Compatible with many types of material.
4) The process is adaptable and easily controlled.
5) The process is easily validated to meet user need.
6) The sterilant decomposes to environmentally friendly products.
7) Personnel safety and health issues are minimized because of containment.

** The American Type Culture Collection (ATCC) made a change to the scientific name of *Bacillus steearothermophilus* to Geobacillus stearothermophilus; this is a change in name only.

References

1. Prince, H.N. et al.Disinfection, Sterilization, and Prerservation S.S. Block, Lea, & Febiger, Philadelphia, PA. Pp.411-444. (1991).

2. Rickloff, J.R., Orelski, P.A., 89th Annu. Meeting Am. Soc. Microbiol., New Orleans, LA (1989).

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Room Decontamination with Vaporized Hydrogen Peroxide (VHP®) for Environmental Control of Mouse Parvovirus

Introduction

Decontamination of animal facility rooms with known pathogens has traditionally been performed using chemical disinfectants such as sodium hypochlorite or gaseous disinfectants such as formaldehyde. Although these methods have proven to be effective in many applications, overall ease of use, safety/health concerns, antimicrobial efficacy, and turnaround time has been questioned. The application of Vaporized Hydrogen Peroxide in room applications has been gaining wide acceptance for clean room applications. Common outbreaks of bacterial and viral pathogens can now be decontaminated with the application of Vaporized Hydrogen Peroxide. In this case study, samples of Mouse Parvovirus (MPV) and *Bacillus stearothermophilus*** spores were placed throughout a 5,500 ft³ animal facility that was then decontaminated using a VHP 1000 Generator (Figure 1) with specifically developed cycles for this application. The study objective is to determine the efficacy of VHP room decontamination applications effectiveness against (MPV) and bacterial spores.

Figure 1. STERIS Corporation VHP 1000 Generator.

Methods

Room Specifications

The facility volume for this testing was 5,500 ft³. The facility consisted of 20 individual holding rooms and a general purpose area (Figure 2). Electrical fans were dispersed randomly to aid in vapor distribution during test cycles. Vent airflow was turned off during the test cycles to maintain proper vapor concentrations throughout the test area.

Bacterial and Viral Suspensions

Inoculated petri plates of MPV to a population of 10^3 were prepared by the Fort Dodge Animal Health Facility, Ft. Dodge, Iowa. *Bacillus stearothermophilus* (ATCC#7953) coupons inoculated to a population of 105 were prepared by STERIS Corporation, Mentor, Ohio (Polyflex-NA300P). Organism samples were randomly placed throughout the test rooms and locations recorded.

Sterilant Exposure

The 5,500 ft³ animal facility used for testing was installed with two wall portals outside the room for connection to a VHP 1000 Generator, one used for inlet of VHP gas, the other used for airflow return to the generator. A third portal was installed for sensor probe lines to a UOP Guided Wave Hydrogen Peroxide Sensor to monitor concentration levels during the decontamination cycle. Cycle parameters were developed and optimized for each test room. The VHP 1000 Generator was programmed to the following parameters for the 5,500 ft³ animal facility decontamination cycle and performed in triplicate:

Dehumidification Phase:	Airflow = 20 scfm (34 m³/h) Time = 20 min
Conditioning Phase:	Airflow = 20 scfm (34 m³/h) Time = 1 min Injection Rate = 10 g/min
Decontamination Phase:	Airflow = 20 scfm (34 m³/h) Time = 97 min Injection Rate =10 g/min
Aeration Phase:*	Airflow = 20 scfm (34 m³/h) Time = 10 min

*Following generator aeration, the room ventilation was turned on and an additional ventilation time of 60 minutes was performed for total cycle time of three hours. The test organisms were present in the holding room for all phases of the cycle and additional aeration.

Vapor Distribution and Temperature Mapping

Temperature throughout the test room areas was monitored and recorded with remote thermometer probes (Datatrace Model 5200TMPII). Electrical fans were placed in the test area to aid in vapor dispersion. Vapor distribution through test areas was qualitatively monitored using STERIS VHP Chemical Indicators (NB305 Lot204506). A total of 30 chemical indicators were used per facility exposure cycle. Vapor distribution through test areas was quantitatively monitored using a UOP Guided Wave H_2O_2 monitor.

Biological Sample Processing

A total of 60 coupons of *Bacillus stearothermophilus* were exposed per cycle. These were recovered and incubated in tryptic soy broth for seven days at 55˚C. These were checked for turbidity as a positive for growth.

A total of seven petri plates with (MPV) were exposed per cycle. These were recovered and inoculated into prepared monolayers, incubated and examined for the presence of the virus.

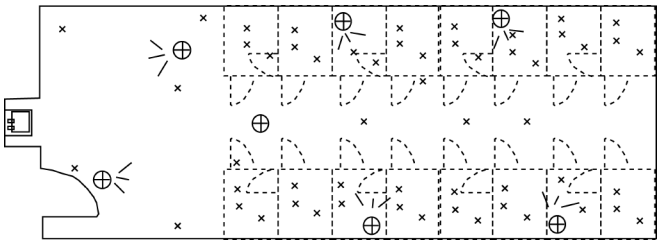

Figure 2. Test Area Layout.