

Decontamination of Laboratory Animal Research Rooms Using Vaporized Hydrogen Peroxide (VHP®)

Introduction

Walter Reed Army Institute for Research is a U. S. government laboratory facility located in the Washington D.C. area.



Figure 1. VHP 1000 Mobile Biodecontamination Systems

Construction of the state-of-the-art facility began in 1994. The institute houses an animal research facility consisting of over 15 animal rooms, designed for several different types of laboratory research animals, a BL2 lab and a BL3 lab.

The animal rooms as well as equipment and animal cages periodically require decontamination; especially before housing a new group of animals or in the event of suspected contamination. The rooms have been designed and constructed to use VHP for decontamination.

The focus of this case study is cycle development and decontamination testing of two animal rooms having volumes of 1750 ft³ (50 m³) and 1875 ft³ (53 m³) using a VHP 1000 Biodecontamination* System. (Figure 1) The study was completed in April 2001.

Room Construction/Room Articles

Animal rooms of six different sizes exist in this particular block of the building. The smallest room volume is 900 ft³ (26 m³) while the largest room volume is 3,025ft³ (86 m³).

A VHP decontamination cycle has been developed for Room AG104/GW71C (Room C) having volume of 1,750ft³ (50 m³), and Room AG108/GW71D (Room D) having volume of 1,875ft³ (53 m³). Both rooms have sealed ceiling tiles and separate external exhausts that can be controlled from outside the room. An automated floor rinse system, which can be turned off and capped during decontamination, has also been constructed. All doors can be sealed with duct tape during decontamination and aeration. Each room is humidity and temperature controlled.

Room C contains a fume hood, floor hood with shaker incubator, cabinets, refrigerator, freezer, and tissue culture incubators while Room D contains a large stainless steel animal cage that houses eight primates, one laminar flow hood, a plastic floor matt, a mop, and a large trash can with lid.

All room construction materials and room articles are compatible with VHP and require no special consideration prior to decontamination.

VHP Inlet/Outlet Ports

All rooms contain at least one pair of inlet/outlet ports to deliver and return VHP. More than one pair of inlet/outlet ports were installed on some of the larger volume rooms in case more than one



Figure 2. VHP Inlet/Outlet Ports

VHP 1000 would be required to provide decontamination (Figure 2). The hall-side of the VHP ports is constructed of 1.5-inch quick coupler connectors, while the room-side of the VHP ports is constructed of three-inch quick coupler connectors. The ports are about two inches from each other and are welded to a stainless steel port plate the size of a cinderblock. Port plates are the same size as cinderblocks so that they can easily be added to additional rooms which may require decontamination in the future. All ports are capped when not in use. To promote distribution of the VHP, Room D has a three-inch wide, 12-foot long PVC hose attached to the VHP supply room port. The PVC hose is extended to the center of the room on the floor. Room C was has ceiling piping to accommodate distribution and exchange of VHP (Figure 3).

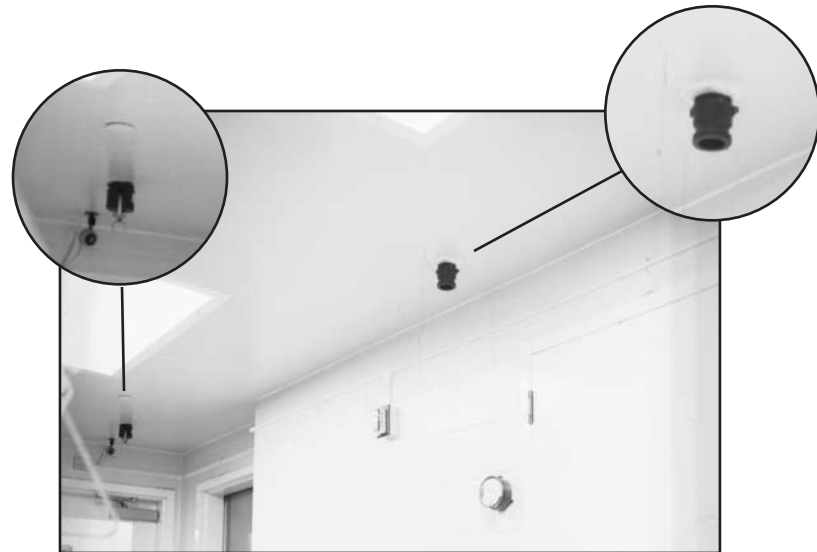


Figure 3. VHP Inlet/Outlet Ceiling Piping

Room Preparation for VHP Decontamination

Room C and D were prepared for decontamination by cleaning the rooms and allowing the rooms to air-dry. The floor drains in both rooms were not sealed with drain covers.

To facilitate VHP distribution, one medium size fan was placed in Room D and one large size fan was placed in Room C.

The VHP ports to be used were uncapped from both inside and outside of the rooms.

NB305 VHP Chemical Indicators (CIs) and NA300-P Spordex®-Polyflex VHP Biological Indicators-E5 B. *stearothermophilus* (BIs) packaged in a *Tyvek® pouch were hung throughout the rooms. There were 18 CI's and 18 BIs in Room D, and 20 CI's and 20 BI's in Room D. Two unexposed BI's served as positive controls for each room.

The doors to the rooms were closed and cracks around the doors were sealed using duct tape. A switch outside the door turned the external exhaust system off.

VHP Cycle

The VHP cycle was developed for Room C and Room D:

Dehumidification

Airflow = 20 cfm (34 m3/h)
Time = 30 min.

Conditioning

Airflow = 20 cfm (34 m3/h)
Time = 45 min.
Injection Rate = 9.5 g/min.

Sterilization

Air Exchange = 20 cfm (34 m3/h)
Time = 60 min.
Injection Rate = 8.5 g/min.

Aeration

Air Exchange = 20 cfm (34 m3/h)
Time = 10 min. with VHP 1000 followed by over night aeration using the external exhaust system

The total Vaprox® Hydrogen Peroxide Sterilant (H₂O₂) used for both rooms was 937.5 g (840.18 ml). No leak test or pressure control was programmed into the cycle. The rooms were externally aerated overnight. The hoses to the VHP unit were disconnected and capped. The VHP room ports were also capped, releasing the VHP unit to be used to decontaminate additional rooms. The CI's and BI's were collected for analysis.

Results

All CIs exhibited uniform color change from blue to gray confirming even distribution of H₂O₂ in the rooms.

All BI's were cultured aseptically in a trypticase soy broth (TSB) media and incubated at 55-60 °F (13-16 C°) for seven days. All BIs showed no growth, confirming kill. As expected, the two positive controls showed growth.

Conclusion

A VHP decontamination cycle has been developed for animal rooms having volumes of 1,750 ft³ (50 m³) and 1,875 ft³ (53 m³), at Walter Reed Army Institute for Research. BI and CI results confirmed the effectiveness of the VHP 1000 for room decontamination. Additionally, VHP was found to be compatible with room construction materials and room articles.

VHP decontamination cycles are currently being developed for four additional rooms and there are plans to develop cycles for the remaining rooms.

*Tyvek® is a registered trademark of DuPont.

*When using VHP® equipment with Vaprox Hydrogen Peroxide Sterilant in the United States, the term biodecontamination referred to in this document is defined as sterilization of exposed porous and non-porous surfaces in a pre-cleaned, dry, sealed enclosure. Any reference to biodecontamination as it relates to the use of this equipment in the United States does not impart additional claims of effectiveness beyond that approved in the EPA-registered labeling of Vaprox Hydrogen Peroxide Sterilant.

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STERIS Corporation
5960 Heisley Road
Mentor, OH 44060-1834 ■ USA
440-354-2600 ■ 800-548-4873
www.steris.com