
**Experience of Using Hydrogen Peroxide Vapor
for Preventing Environmental Transmission of
Multi-drug Resistant Organism
- Vancomycin-Resistant Enterococcus**

VRE Outbreak

- * Several outbreaks of VRE have occurred in HA hospitals since 2011
- * Clinical impact of VRE
 - * Reduces therapeutic options
 - * Resistance genes can transfer from enterococci to other Gram-positive organisms (e.g. MRSA)
- * Environmental contamination has been considered an important factor leading to patient-to-patient transmission

Environmental decontamination

Important to achieve a satisfactory environmental decontamination

Major Concerns in Environmental Decontamination

- * Limitations with standard environmental cleaning method
- * Transmission via hands of health care workers

Hydrogen Peroxide Vapor Decontamination (HPV)

H₂O₂ - Microbiological efficacy

- * Microbial components are killed by the hydroxyl radical of H₂O₂
- * Sporicidal, bactericidal, mycobactericidal and virucidal

Passaretti et al. Clinical Infectious Disease 2013: 56 (1 January)

J.A. Otter et al. Journal of Hospital Infection 83 (2013) 1-13

H₂O₂ - other properties

- * H₂O₂ is broken down to water vapor and oxygen
- * Compatible with most inanimate materials including electronics
- * Can reach sites that are difficult to access

Falagas et al. Journal of Hospital Infection 2011; 78:17

Rutala WA, Weber DJ, ICHE(http://www.icas.org.sg/Ed_IC_Week/IC%20Week%202011.pdf)

The HPV System

(Bioquell System)



Generator



Aeration Unit



The control and monitoring unit outside the room

HPV Decontamination-Technology description

*Generator

- * Generates HPV from 30% aqueous hydrogen peroxide, vapourizes at 130°C.
- * High velocity gas distribution nozzles
- * Delivery of H₂O₂ continues until air inside the enclosure becomes saturated, and H₂O₂ starts to condense.



Fu T Y et al. Journal of Hospital Infection 80 (2012) 199-205

J.A. Otter et al. Journal of Hospital Infection 83 (2013) 1-13

<http://www.bioquell.com/products/bioquell-z-2/>

HPV Decontamination-Technology description (Cont'd)

* Aeration unit

- * Catalyse the breakdown of HPV after the exposure period
- * Converts the H_2O_2 vapor to water vapor and oxygen



Fu T Y et al. Journal of Hospital Infection 80 (2012) 199-205

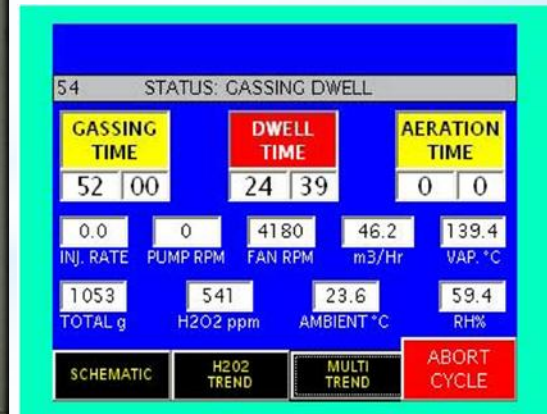
J.A. Otter et al. Journal of Hospital Infection 83 (2013) 1-13

<http://www.bioquell.com/products/bioquell-z-2/>

HPV Decontamination-Technology description (Cont'd)

* Instrumentation module

- * Controls cycle conditions
- * Measures and monitors the concentration of hydrogen peroxide, relative humidity and temperature inside the room.



HPV Decontamination

Multi-disciplinary

HPV Decontamination - Multi-disciplinary

- *Ward staff
- *Infection Control Team
- *Facility Management
- *EMSD
- *Microbiology laboratory

HPV Decontamination

- making request.....

Initiation - Assessment - Approval

- *Ward nurse raises request
- *Infection control team assesses request and grants approval according to criteria

Joint Site Inspection

- * Ward staff
- * Infection Control Team
- * Facility Management
- * EMSD

HPV Decontamination

- Room Preparation

Facility Management

- *Identify leakage of construction
- *Fix the leak

Ward staff

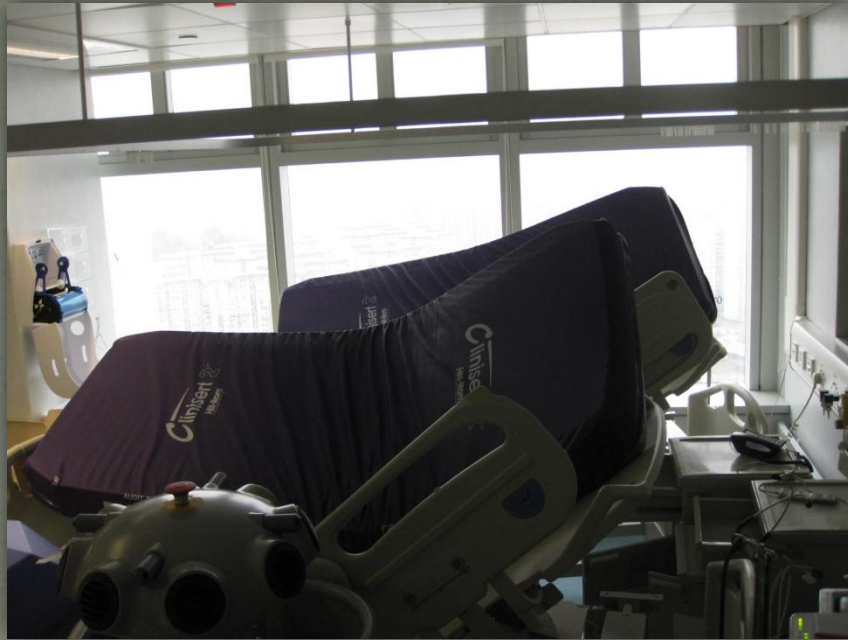
- * Perform thorough environment cleaning using standard method
- * sodium hypochlorite 1,000ppm

Ward staff (Cont'd)

- * Send bed clothing for laundry
- * Discard disposable items
- * Leave reusable equipment and items inside the room
- * Maximize exposure to HPV
 - * Open drawers, locker and cupboard doors
 - * Pull items away from walls
 - * Prop up items (e.g. mattress)
 - * Raise bed-side rails
 - * Leave blood pressure cuff connection port open and hang the cuff free from environmental surfaces
 - * Let down window blinds

Maximize exposure

Paper towel holder opened



Mattress propped up



Drawers, cupboard and locker doors opened



Leave electronic equipment inside room

Infection Control Team

- * Check cleanliness of room
 - * Soiling especially organic matter has been removed
- * Affix biological indicators in places that are difficult to bio-decontaminate



Some of the locations where biological indicators will be placed

EMSD (Cont'd)

- * Seal off the room
 - * Stop the ventilation
 - * Seal off the supply and exhaust grills
 - * Close off supply and exhaust dampers
 - * Add water to floor drain/ sink
 - * Cover fire sensors to prevent false alarms during fumigation
 - * Arrange fans in strategic position to maximize exposure to H_2O_2
 - * Ensure that all windows are closed
 - * Confirm that all personnel have left the room
 - * Seal the room door

Room Preparation



Seal off
air grills



Cover the
fire sensor



Add water to
floor drain and sink



Arrange fan
in strategic position



Seal the room door

Decontamination Process

Different phases.....

The Decontamination Process

- * Starting the decontamination cycle

- * Specify the volume of the room

- * Set the type of loading

- * Light/ medium/ heavy

The Decontamination Process

Decontamination



Monitor for leakage of H_2O_2
during the procedure

The Decontamination Process

- * **Aeration phase and ending the cycle**
 - * The aeration unit converts the H_2O_2 vapor to water vapor and oxygen
 - * Can end cycle once the concentration of gas inside the room has dropped to below 1ppm.

Evaluation of Performance

- * Biological indicators

- * inoculated with *Geobacillus stearothermophilus* endospores

HPV Decontamination

- * From 2011 November through 2013 January
 - * 33 episodes of HPV bio-decontamination were performed in HAIDC.
 - * Using the biological indicator as a measure of success, only one episode failed, making a successful rate of 97%.

HPV Decontamination

- * On the episode that failed
 - * the spores on one of the biological indicators were not completely killed
 - * was attributed to possible inadequate circulation of H_2O_2
 - * recommended that more attention be paid to ensure adequate distribution of H_2O_2 across the room

HPV Decontamination



Environmental decontamination
plays an important role in the
prevention of transmission of VRE

The experience in HAIDC
has shown that HPV is a
feasible and effective approach to
thorough terminal environmental
disinfection

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Thank you