VHP as a Utility

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VHP as a Utility

Outline

• VHP 101
  – Advantages
  – Process
  – Vapor vs. Mist
  – Kill Curve
  – Emissions

• Portable or Modular
  – Why Modular

• Installation
  – Modular Schematic
  – Options for Integration
  – Single Pass
  – Recirculating

• Examples
  – Large Room
  – Pass-Throughs
  – HEPAs
  – BSL Labs
  – Automated Sequences
Why Use VHP?

✓ Consistency & Distribution
  ➢ Wet surfaces / minimal contact times - not an issue
  ➢ Passes through HEPA filters
  ➢ Decontaminates biosafety cabinets and HEPAs during room decon
  ➢ Kills airborne and surface microbes

✓ Labor
  ➢ Minimal labor required
  ➢ Easy to validate

✓ Environmental
  ➢ Excellent material compatibility
  ➢ Low toxicity
  ➢ No residues
  ➢ EPA approved
Boiling Points:
H2O 100°C
H2O2 150°C

...if you can see it, it's not a vapor
G. stearothermophilus spores inoculated on Stainless Steel Coupons at 30°C

VHP® Kill Matrix

1 mgH₂O₂/liter air = 720ppm

(~576 ppm)

(~70 ppm)
Application Example

300m³ (10600ft³)
Which VHP System?

**portable**

- Spaces not yet defined
- Uses in different buildings
- Typically less than 10,000 ft³
- Cycle time not a constraint
- Use of fans not an issue
- Less frequent use

**modular**

- Large and small spaces up to ~80,000 ft³
- Same enclosures repeatedly
- Frequent use (chamber)
- Short cycle times
- Automated sequenced decontamination of multiple rooms
Why Modular?

Keep Equipment Outside Space
Save space within room / Pass Through
Avoid cross contamination
Keep maintenance activities outside

No Set Up
Decon at the Press of a Button
Run Sequential Decons via BMS*
Reduced Handling of Peroxide
Excellent Distribution

Cost
Less expensive than multiple portables
Save on labor
The easier to use – the more frequent
the use – the cleaner the space

*BMS = Building Management System
Syringe Decon
VHP Modular Integration Schematic

Single Pass

VHP Supply to Room

VHP Exhaust from Room
Utilities & Communications

Remote OP + Printer

1ph/220V/50Hz/5A

MPI cable

Printer cable

VHP out

Pump box

Vaprox

Dry Hot Air

Remote Control

Process Air

Regen Air

1ph/220V/50Hz/10A

1ph/220V/50Hz/15A

MPI communications cable to BMS or dry contacts

Remote OP + Printer

1ph/220V/50Hz/5A

MPI cable

Printer cable

VHP out

Pump box

Vaprox

Dry Hot Air

Remote Control

Process Air

Regen Air

1ph/220V/50Hz/10A

1ph/220V/50Hz/15A

MPI communications cable to BMS or dry contacts
Single Pass System
Large Room Biopharmaceutical Fermentation Suite

Volume: 32,000ft³ (900m³)
Ceiling height: 28ft (8.5m)
Single pass, No fans
6-log reduction
Cycle time 6 hours
New construction

<table>
<thead>
<tr>
<th>Cycle Phase</th>
<th>Time min.</th>
<th>Airflow</th>
<th>Injection g/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dehumidification</td>
<td>30</td>
<td>6 A.E./ hour</td>
<td>-</td>
</tr>
<tr>
<td>Condition</td>
<td>30</td>
<td>120 cfm</td>
<td>96</td>
</tr>
<tr>
<td>Decontamination</td>
<td>90</td>
<td>120 cfm</td>
<td>60</td>
</tr>
<tr>
<td>Aeration</td>
<td>210</td>
<td>40 A.E./ hour</td>
<td>-</td>
</tr>
</tbody>
</table>

A.E. = Air Exchange
# Pass-Through Chambers

Shown above

<table>
<thead>
<tr>
<th>Enclosure Volume ft(^3)</th>
<th>Enclosure surface material</th>
<th>Injection rate Condition g/min.</th>
<th>Injection rate Decon g/min.</th>
<th>Decon time Min 6 log</th>
<th>Decon airflow ft(^3)/min</th>
<th>PPM</th>
<th>Aeration airflow ft(^3)/min</th>
<th>Total Cycle Time min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>460 (6x8x9.5’L)</td>
<td>Stainless</td>
<td>32</td>
<td>23</td>
<td>12</td>
<td>120</td>
<td>1000</td>
<td>765</td>
<td>45</td>
</tr>
<tr>
<td>175 (4x6x7’L)</td>
<td>Epoxy paint</td>
<td>12</td>
<td>9</td>
<td>8</td>
<td>40</td>
<td>950</td>
<td>1750</td>
<td>30</td>
</tr>
</tbody>
</table>
Automated Sequential Zone
BSL3 Lab Decontamination
Single Pass
Simultaneous Decon. of Primary Containment

A2 type biosafety cabinets can be decontaminated together with the room

- exhaust dampers above cabinets are closed
- cabinet blowers left on
HEPA Filter Decontamination

Exhaust

Inlet
RABS – (Restricted Access Barrier Systems)

Modular VHP systems can rapidly decontaminate both Active & Passive RABS and the rooms they are housed in.
U.R.S.

- VHP is treated as a building utility
- Decon can be performed after each
  - product change
  - product batch
  - during an incident
  - after maintenance
- No sealing of perimeter required, surrounding areas can continue to operate
- Zone 1 (AHUs 2-4, 2-5, and 2-6) will be decontaminated together
- Zone 2 (AHUs 2-9, 2-10 and 2-11) will be decontaminated together
- Multiple zones will be decontaminated sequentially
- Decontamination time per zone – about 2 hours *
- Aeration time per zone about 2 hours * (at 10 AE/hour)

* Typical timing only, actual timing depends on room load and configuration
Scope of work

• Conceptual design and specifications
  – Material, size, maximum lengths of VHP cPVC piping, connection to AHU ducting, etc
  – Type and sizing of dampers and valves
  – Recommended air exchanges
  – Utility requirements

• Equipment skid (1 x T4, 1 x Munters, handshake dry contacts, etc)

• SS braided tubing from T4 to bulk Vaprox (up to 10m)

• Sensors for H₂O₂ safety monitoring – 1 per zone

• Installation supervision
Process Concept Distribution

Injection point into common supply duct of each of the 3 AHUs per zone.
Automatización

VIRUS-I
- HR 41, HR 42
- Humidificación
- Desinfección
- Cancel
- Consignas

VIRUS-II
- HR 14, HR 15
- Humidificación
- Desinfección
- Cancel
- Consignas

VIRUS-III
- HR 16
- Humidificación
- Desinfección
- Cancel
- Consignas

CÉLULAS I
- HR 47, HR 48
- Humidificación
- Desinfección
- Cancel
- Consignas

CONCENTRACIÓN
- Humidificación
- Desinfección
- Cancel
- Consignas

Panel de Desinfección
- Consignas de desinfección
- Humedad: 30%
- Tiempo de aireación: 360 min

Espacio de desinfección
- Etiquetas de alarmas

360° solutions
Direct injection setup
Technical Area

Proposed area of installation on AHU mechanical floor

Zone 1

Zone 2
Recirculation concept
Application Cycle Développement

BI's incubated at 55°C for 7 days
It's just a thought
F & B
Horizontal Filling Lines
Flash Decon Theory
F&B application
Selected Installations

**Pharma / Animal Health**
- GSK
- Intervet
- Fresenius
- Sanofi
- Merial
- Alcon
- Pfizer
- Boehringer
- Hisun

**Public Health Labs**
- Indiana
- New Jersey
- West Virginia

**Others**
- Tripler- US Army
- Univ. Nebraska
- Lawrence Livermore National Labs
- INRS
- NCI
- WP-AFB
B & V TESTING and STERIS Advanced Biodecontamination Solutions (ABS)

• ABS: a Flexible service offering matching the field service expertise of B & V TESTING with STERIS VHP technology and EPA-registered consumables

Contract VHP biodecontamination services

• National leader in biodecontamination and contamination control technologies testing, certification and maintenance services:
  – 30 years experience performing gaseous Biodecontamination Services (formaldehyde, VHP, CD)
  – Testing, Certification and Maintenance of Cleanrooms, Biological Safety Cabinets, and HEPA-filtered systems

• STERIS is a global leader in infection prevention, contamination control, surgical and critical care technologies, and more. Manufacturers of EPA registered Vaprox® 35% and 59% hydrogen peroxide (EPA reg. no. 58779-4), Spor-Klenz (EPA reg. no. 52252-4-1043) and VHP® technology