

# Disinfection by ‘fumigation’ an overview

Biological Safety Officers’ Event

16 May 2023

- 69 sent out, 63 responses (91%)
  - 51 departments have Microbiological Safety Cabinets (MSCs)
  - 24 Recirc; 5 Ducted; 22 Mixture
- Qu. 'What method do you use to fumigate MSCs'
  - Some misunderstanding of MSC disinfection indicated in responses ..

# ABSQ - 2021

- Vaporised Hydrogen Peroxide (VHP) 34/51
- VHP mainly by Contractor; Limited 'in-house'
- Formaldehyde indicated by 2 depts.
- 'Don't know – contractor does it'
- 'Fumigants not required for human or animal pathogens'
- Fumigants indicated as liquid Distel, alcohols, peroxide and UV
- Some indicated fumigation done, but on very infrequent basis

# ABSQ - 2021 – Contractors used for VHP

- Crowthorne Hitec (CHTS)
- Castium
- Contained Air Solutions (CAS)
- Esco
- Steris Solutions Ltd.
- Walker Safety Cabinets
- Environmental Validation Solutions (EVS Ltd)
- **In-house (x7)**

# What do regs & guidance say?

## CoSHH (Human pathogens)

- **Specified** disinfection procedures required CL2/3/4
- **Efficacy** must be assessed at **all containment levels** for both **routine use** and following **accidental release** of biological agents.

**CL1?** No legal min. containment requirement. However, the **practices, safety equip & facilities** are **similar** to those for **CL2**, as reqd by assessment of the risks + general COSHH control measures.

If work at this (or any level) involves GM, other legislative controls, in addition to COSHH apply.

# What do regs & guidance say?

## GMO(CU14) (Human & enviro risk): **General principles of GMP & GOSH**

- **Exposures** to GMMs kept to lowest reasonably practicable level
- **Specified** disinfection procedures
- **Effective** (validated or verified) disinfectants against GMOs in use
  - **GM Class 1&2:** Manufacturer's data *may* be enough – if representative of the conditions disinfectant is used in
  - **Higher risk** contained use: **Surface disinfectants** may not be sufficient to remove residual risk – use in **combination** with **fumigation/other**

# What do regs & guidance say?

## Animal pathogens (non-zoonotic); Plant pathogens

- CoSHH Principles of GMP and GOSH still apply
- Criteria for disinfection as specified in applicable **licences & SOPs**

# Disinfectant Efficacy

**Select** disinfectant carefully - effective against bioagent/GMO in use

**Factors affecting efficacy** include:

- Pathogen: Veg/Spore; Env/Non-env virus; Biofilm; Prion; Titre
- Type & Mode of action; Concentration; Contact/dwell time
- Organic/proteinaceous matter e.g. blood, serum
- Other factors: Chemicals; temp, humidity, pH, UV
- Expiry date? Freshly prepared?



# Decontamination

Safe and effective decontamination of work surfaces and equipment is important when managing the risks associated with working with infectious pathogens, GMMs & agents under licence - SAPO, Plant Pathogens etc.

**Decontamination** – destruction or removal of contaminants including microorganisms and rendering the equipment safe.

This covers...

- **Cleaning:** Removal of dirt, organic matter and bulk of MO/GMMs
- **Disinfection:** Biocides to kill most, but not all MOs Log 4-5 ... Log 6
- **Sterilisation:** Killing all viable MOs, incl. spores – Log 6 reduction

# Surface Disinfectants – ‘flavours’

- Alcohols
- Chlorine/Chlorine compounds
- Aldehydes
- Hydrogen peroxide
- Iodophors
- Peracetic acid
- Peroxygen compound
- Phenolics
- Quaternary Ammonium Compounds



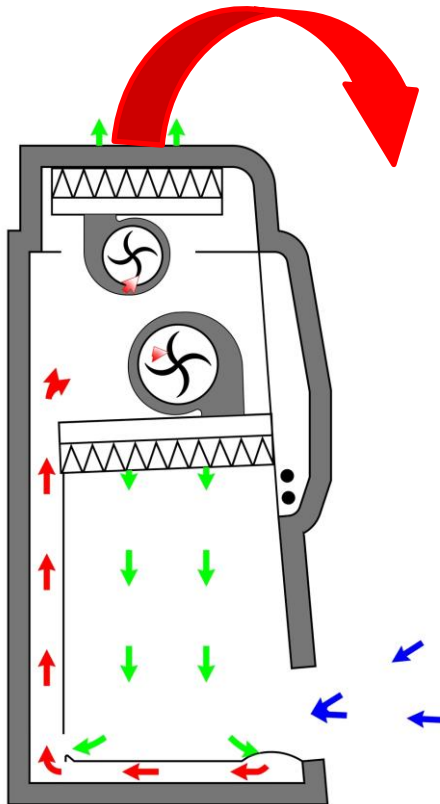
# Surface Disinfectants

- Biocidal Products Regulation
- Check products comply – HSE database
- Efficacy: Manufacturer, Peer Reviewed Lit, In-house testing
- Validated: type, conc., contact time
- Some incorporate detergents to aid cleaning
- Risk assess: Safety, environ. Incompatibilities
- Training & written procedures
- ‘High Level’ - broad spectrum
- Avoid ‘domestic’ products



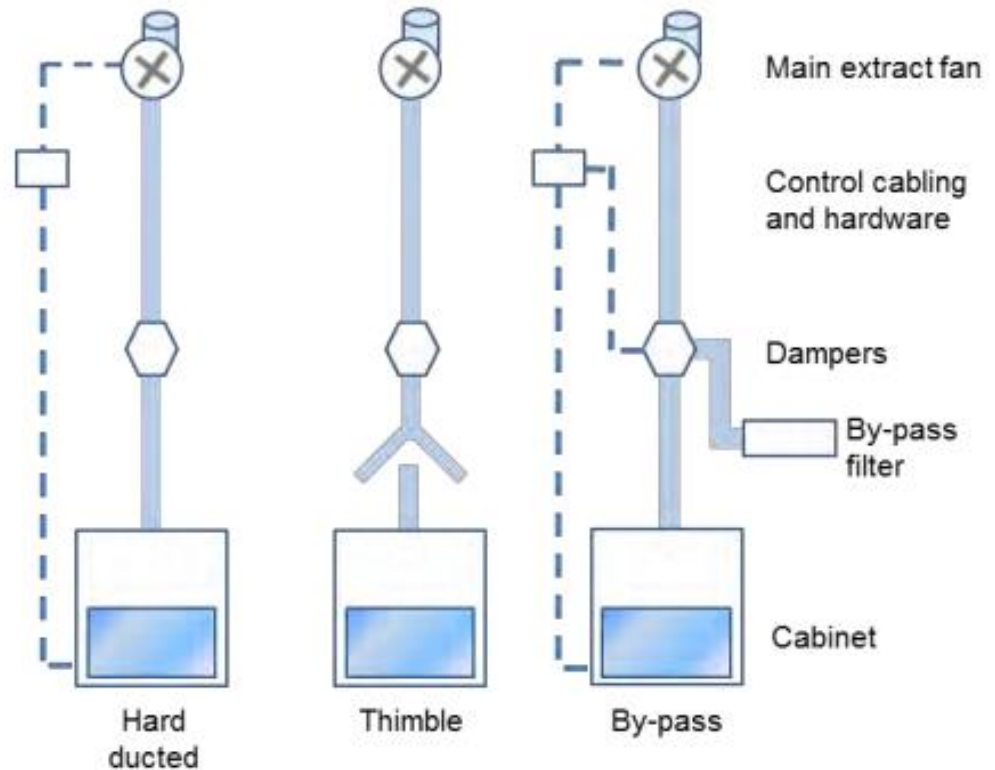
# MSC Ventilation and Fumigants

Recirculating Class II



Ducted MSCs

*Extract fan and MSC fans interlinked*





# Ducted - Thimble Recirculating



# Fumigants

## Hydrogen Peroxide

- Broad spectrum disinfectant
- Liquid, vapour and as a fog/mist
- Hazardous - low WEL: 1ppm LTEL; 2ppm STEL
- Non-carcinogenic
- Less sensitive to temperature variation (Vapour phase 4-80c)
- Breaks down into harmless O<sub>2</sub> and H<sub>2</sub>O
- It's 'lazy' – needs to be pushed around rooms and through filters

# Fumigants

## Vaporised Hydrogen Peroxide (VHP 'dry') (HPV 'wet')

- Contractor service (whole rooms & equipment)
- H<sub>2</sub>O<sub>2</sub> c.35%
- Sophisticated technology
- Some CL3s & UBS have own system. Expensive!
- Validated to rooms/equipt
- Spore strips used - Log-6 reductions
- Equipment/rooms safely 'sealed'
- VHP doesn't readily penetrate HEPA – Lazy!
- VHP recirculated across filters
- Older MSCs adapted to enable HP fumigation
- Aeration - in-built catalyst breaks down to O<sub>2</sub> & H<sub>2</sub>O



# Fumigants

## Hydrogen Peroxide 'Dry Foggers'

- Developed for decon. Hospital wards
  - Venturi effect to create airborne mist
  - Disperses in rooms/equipment by Brownian motion
  - Won't penetrate filters without fan assistance
  - Need cycle validation
  - Lower Conc H<sub>2</sub>O<sub>2</sub> typically 7-12% + Silver
  - Equipment affordable vs VHP
  - HSE and others sceptical
  - Still hazardous substance
- 
- AMB 1yr+ expensive validating for A-CL3. VHP services caused damage to paintwork and couldn't validate whole room-MSD-duct-HEPAs.

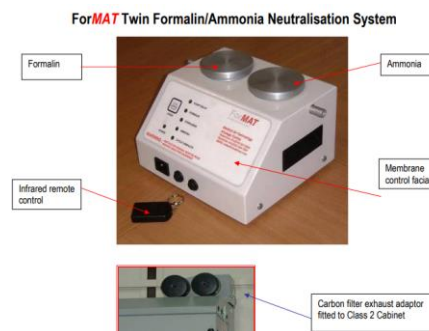




# Fumigants

## Formaldehyde

- Cheap. Effective. Gas but still lazy.
- WEL 2ppm & Carcinogen – increasing enviro concerns
- 37% in solution; MeOH stabilised.
- Different methods to deploy/removal
- c. 30ml+30ml H<sub>2</sub>O
  - boil off and vent (Ducted MSC)
  - external carbon filter (non-ducted)
  - Integrated carbon filter
  - Integrated ammonia neutralisation + carbon extract
  - Laycock: Paraformaldehyde + Potassium permanganate + water (ducted)
- DO NOT USE UNLESS 100% JUSTIFIED
- Notify SSO/SO intent to use



# Other disinfectant fumigants

**Chlorine Dioxide** (WEL LTEL 0.1ppm / STEL 0.2ppm)

**Ethylene oxide** (WEL LTEL 1ppm Carc. Sk)

**Ozone** (WEL STEL 0.2ppm)

**Neopredisan** phenolic



# Fumigants

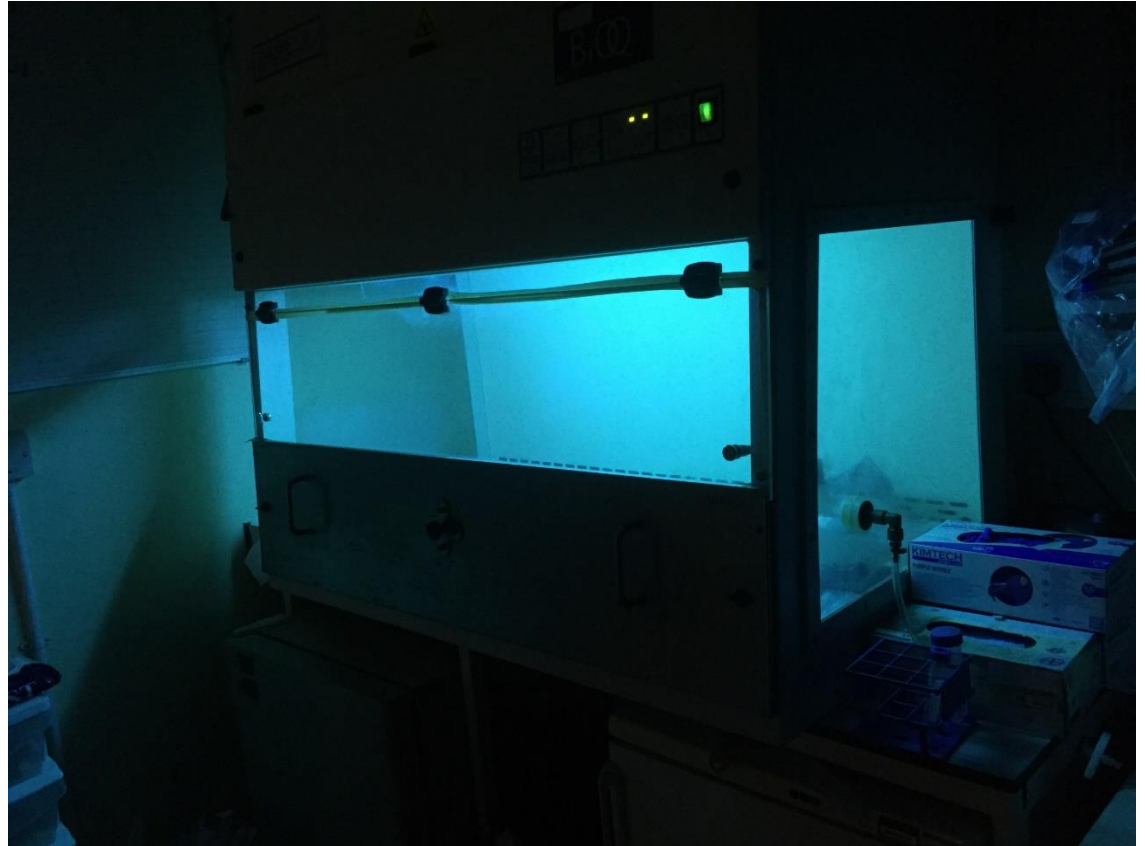
- **Justify** fumigation - risk based...
  - **Significant spill** of pathogens/GMMs at CL2/3
  - **Engineer access** to contaminated side of filter CL2/3
  - HEPA removal / MSC **disposal**
- **ALL fumigants are hazardous** – some more than others
- No one disinfectant is suitable for all MOs
- VHP/HPV – OK for most work at Cambridge.

# Fumigants

- Use **approved contractors** where possible
- Ask for **RAMS**
- Use of other fumigants – **consult** with SSO/SO
- **Trained, competent** persons & under supervision.
- All parts of filter/internal ‘dirty’ areas of MSC should be fumigated.
- Cabinets (rooms) – **effective sealed**. Leak tests.
- Fumigant **monitoring**
- **Permit to work**

# Bio-decontamination - UV

To UV or not to UV?



# Bio-decontamination - UV

- UV Bard?
- Poor microbiological practice in MSCs/CLs
- 'blue light' - false sense of security
- Efficacy unknown. Unvalidated. Affected by airflow, humidity, shadows.
- Ozone
- Where used –
  - UV risk assessments
  - Safety interlocks, UB bulb timers, Bulbs - regular replacement





I'm trying to clean the toilets.  
Who's nicked the toilet bleach  
from my cleaner's cupboard ...  
again!



Not drinking water  
Laboratory use only

