

POTENTIAL FOR HARMFUL LEVELS OF HYDROGEN PEROXIDE VAPOUR FOLLOWING DECONTAMINATION DUE TO PROLONGED OUTGASSING FROM PLASTICS

Introduction

Decontamination / disinfection by Vapour Phase Hydrogen Peroxide (VPH) is becoming widely used in a variety of applications from healthcare to industry. Whilst the hazards associated with VPH whilst in use are widely recognized there is less discussion about potentially harmful levels of hydrogen peroxide vapour being released by materials and furnishings following decontamination. This article intends to look at the available literature to determine if further research is needed into this area.

Background

VPH Decontamination has its beginnings as an alternative to ethylene oxide (EtO) sterilisation widely used for medical instruments etc. It has since been used for clean rooms, safety cabinets etc. and has recently been taken up as an infection control system within hospitals and care homes. There are also a number of private companies offering a VPH service to private customers.

VPH Decontamination is typically carried out using one of two methods loosely defined as “wet” or “dry”(1) which relates to the humidity level at time of operation and as to whether condensation is formed during operation. Due to the nature of the process, both methods produce sufficient concentrations of hydrogen peroxide to promote outgassing in certain materials.

There have been a number of cases of healthcare workers suffering ill health following use of VPH (2) as well as an increased risk of long-term health conditions (3), (4) associated with use of hydrogen peroxide. Whilst VPH machines are used in unoccupied areas and most use monitoring equipment to

ensure vapour levels are below hazardous concentrations before re-entry, there appears to be little consideration of residual levels following use.

Discussion

Hydrogen peroxide is aggressive to many materials causing degradation or discolouration. Less widely known is its ability to be absorbed. This occurs during the conditioning and decontamination phases of VPHP treatment. The final (aeration) phase of treatment is meant to allow for the outgassing of absorbed vapour but does not take into account the prolonged release of vapour from some materials.

Outgassing has been observed and studied in clean room materials (5) using a variety of plastics and different absorption/desorption rates have been measured. These findings concur with other studies measuring migration of hydrogen peroxide in sterilised I.V. pouches (6) and outgassing from different articles (7) (8).

Results show that some common plastics (PVC, PMMA(Perspex®), amongst others) have a tendency to slowly release hydrogen peroxide vapour in excess of safe exposure levels (9) over prolonged periods of time measured from days to weeks (7) (8) and that temperature has an effect on the rate of outgassing.

In one study, a plastic stapler was subjected to VPHP and outgassing of hydrogen peroxide was observed for 24 days before levels reduced to 1ppm – the recognised safe exposure level.

Some of the manufacturers appear to be aware of the potential for prolonged outgassing (10) but there currently appears to be little appreciation of the potential for health effects by both manufacturer and end user alike.

Conclusion

VPHP Decontamination will bring about prolonged outgassing from common materials. That the levels of hydrogen peroxide vapour emitted can exceed safe exposure levels for weeks is a matter of concern. There is potential for a localised build up of vapour in confined spaces and thereby an exposure risk to people. Further research should be conducted to determine the likelihood of an overexposure event in general settings following VPHP decontamination.

References

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