

## **Final Report on the effect of Chlor-Clean applications to mattress cover material over a period equivalent to 10 years.**

### **Background**

Department of Health guidelines recommend the use of chlorine products at a strength of 1,000 ppm (0.1%) available chlorine for environmental disinfection of surfaces likely to be contaminated with *Clostridium difficile*, MRSA, VRE, *Acinetobacter*, and other potentially harmful micro-organisms.<sup>1 & 2</sup> Some Health Care Workers have expressed the belief, probably based on previous experience with alcohol wipes or phenolic disinfectants, that such chlorine solutions have a detrimental effect on the mattress covers used in health care. However a previous study conducted by this author has shown no adverse effect on polyurethane impregnated mattress cover materials supplied by Barrington Healthcare International.

### **Objective of the Study**

This study has been instigated to determine what effects repeated applications of chlorine solutions have on mattress cover materials supplied by Invacare UK Ltd.

### **Materials and Methods**

The mattress cover samples tested were provided by Invacare UK Ltd. Pencoed Technology Park, Pencoed Bridgend CF35 5HZ from their Softform Premier range of mattress covers. This material consists of a polyurethane transferred coating on a weft knitted fabric.

The chlorine solutions used were made up using Chlor-Clean tablets, as used in many hospitals throughout the UK and supplied by Guest Medical Ltd of Edenbridge, Kent. The Chlor-Clean solution, when correctly made up gives effective chlorine disinfection together with cleaning action provided by a special chlorine-compatible surfactant.

The sample materials were divided into two sections. One section was treated with ordinary local tap water as a control, the other with either a 1,000 ppm (0.1%) Chlor-Clean solution or a 10,000 ppm (1%) Chlor-Clean solution. Both the Chlor-Clean solutions were made up freshly every day in ordinary tap water and maintained at a temperature between 18 and 22°C.

Six applications of each of the solutions (including the plain tap water) were made at regular intervals to the appropriate sample each working day for a total of twelve weeks and 1 day between 29 September 2010 and 11 January 2011. In total therefore, each sample received 366 applications. The solutions were applied to the mattress cover samples with a 'rubbing' motion and then left to dry without any wiping off or rinsing in order to replicate the cleaning action and method used by Health Care Workers performing disinfection practices such as 'Terminal Cleans' or 'Isolation Cleans'.

The samples were carefully observed with a 14x jeweller's loupe at regular intervals throughout the 12 week period for signs of chemical or physical deterioration. In particular, each sample was stretched over a light source to be examined for minute holes or minor abrasions in the proofing material. Untreated samples of the material were also examined in the same way each time for comparative purposes.

## **Results:**

No detrimental effect or penetration of the surface of the membrane or signs of any chemical deterioration have been detected following the twelve week trial using the two strengths of chlorine solution.

The Invacare material is a maroon colour printed with the supplier's details in white. Care was taken to ensure the samples tested included some of the printing in order to confirm that the application of chlorine solutions would not obscure the information. Neither solution had any effect on the printed material.

Some minor white marking was observed on the samples treated with the stronger (10,000 ppm) solution. Previous experience has shown this can happen with the strong solution and is attributed to some calcium being deposited from 'hard' tap water by the chlorine. This was confirmed in this case by the application of a dilute lime-scale remover solution to the marks, which disappeared immediately. These marks are surface deposits only and have no detrimental effect in the integrity of the polyurethane coating or the effectiveness of the chlorine disinfection.

In areas of very hard water (for example, many parts of Leicestershire and areas near the Chiltern Hills) this effect may be expected to be more obvious and may be misinterpreted by Health Care Workers as damage to the mattress cover. Care should be taken however in trying to remove the marks as undiluted solutions of lime-scale remover will have an adverse effect on polyurethane impregnated materials. A dilute solution of EDTA (ethylene diamine tetra acetic acid) may be a more appropriate treatment, however the manufacturer's of the polyurethane impregnated materials should perform extensive testing with this chemical themselves – such investigations have not been a part of this study.

## **Discussion:**

In general NHS use, Chlor-Clean at the 1,000 ppm strength would be applied to a mattress cover only when a bed had been occupied with a patient who had a specific infection, and then usually only when the patient ceased to occupy that bed (i.e. to disinfect the mattress and frame before the next patient takes up residence, this process is usually called a "Terminal Clean"). Only in exceptional cases would the mattress be disinfected from time to time during patient occupation.

For non-infected cases the mattress cover would normally be cleaned with detergent wipes or neutral detergent solutions only – i.e. no disinfection would be required. It would be for very exceptional cases, for example serious outbreaks of infection and then only for a short period of time (a few weeks at the most) that the mattress cover would be disinfected with chlorine solutions on a daily basis.

The 366 applications of the total study represent a theoretical daily cleaning regime over a one year period; however in practise it is more likely to represent actual applications of chlorine solutions to the materials over at least three to four times that length of time.

Chlor-Clean is not intended to be used at the 10,000 ppm strength. This concentration of chlorine is recommended by the Department of Health for spills of blood and blood-stained body fluids.<sup>3</sup> This solution would be applied directly to the spill area then mopped up quickly afterwards. The area would then be cleaned with detergent and water or wipes, so that the stronger chlorine solution would only have a minimal contact time with the mattress cover or other surfaces.

The study using the stronger 10,000 ppm solution was performed to observe the likely effect of chlorine build-up on the cover over an extended period of time – basically to test it to destruction. The 366 applications of the ten-times-stronger-than-normal solution would therefore donate the amount of chlorine chemical equivalent to daily applications of the 1,000 ppm solution over approximately ten years.

The overall conclusion is that Chlor-Clean solutions used at the correct concentration of 1,000 ppm available chlorine applied to this mattress cover material will have no detrimental effect over many years of service.

Two of the sample materials tested are being returned to Invacare UK Ltd. with this report for further examination by the manufacturer of the material.

Roger Wakeford-Brown  
Scientific Director: Guest Medical  
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#### References:

1. epic2: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England. *Journal of Hospital Infection*, 2007: **65S**, S1 – S64
2. *Clostridium difficile* Infection: How to deal with the problem. Published jointly by the Department of Health and the Health Protection Agency, January 2009. Available from DoH Publications.
3. Guidance for Clinical Health Care Workers: protection against infection by blood-borne viruses. Published by the Department of Health, 1998. Available at [www.open.gov.uk/doh/chcguid1](http://www.open.gov.uk/doh/chcguid1)