An evaluation of the deterioration of respirator quantitative fit factors after initial training

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ABSTRACT

Quantitative fit tests were carried out using the condensation nuclei counting technique (Portacount 8020) and OSHA methodology on staff of a UK speciality chemical manufacturer. The protection achieved by two disposable masks, models 9332 and 4255 (both ex 3M) was investigated. Initial testing with no intervention gave a prevalence of acceptable fit under the existing training regime. All subjects were then individually trained in mask fitting and where necessary retested until an acceptable fit was achieved. The testing was then repeated after 5 months to determine if there was any deterioration in performance.

The 9332 mask gave an initial failure rate of 50% (n=20), 5 months after training the failure rate was 25%. The results were analysed by paired t-test (p= 0.462) and 95% confidence interval of the mean difference (-30 to 63) which indicated there was no significant difference in the two data sets. The fails on retest were ascribed to closeness of the measured fit to the pass mark (Fit factor 100) and the high variability in the test results. This variability results in a “test until pass” effect.

The 4255 mask with a rubber ori-nasal facepiece gave a higher prevalence of initial fit 86% (n=29) and retained a 100% pass rating after 5 months. Paired t-test (p=0.907) and 95% confidence interval of the mean difference (-174 to 153) indicated there was no significant difference in the two data sets. Less frequent retesting is recommended for this mask type.

Four subjects presenting with beards were tested using the standard method, two persistently failed the test with the 9332 mask and two failed the initial test on the 4255 mask but passed on retest. A single user trial was conducted with four masks with frequent fit testing during the course of beard growth. The masks demonstrated different tolerances to stubble length but although the mean fit factor decreased and the variability of the fit factor increased it proved possible to pass a fit test with a full beard, especially with the 4255 mask.
Strategies to improve the fit testing regimes to increase user protection are recommended. For 9332 masks where disposable RPE is a primary method of control, frequent training to reinforce the correct fitting technique is required. In addition an alternative protocol involving 3 separate mask donnings with a reduced exercise set is recommended to reduce the fit test variability.

The 4255 mask gave consistently high fit factors in the study. A biannual retest frequency is recommended.

In accord with HSE guidelines, users of RPE reliant on a close face seal should be clean shaven as facial hair gives rise to a sub-optimal performance.