IN MASK PARTICLE GENERATION AND ITS EFFECT ON THE MEASUREMENT OF HIGH PROTECTION FACTORS WITH PORTACOUNT

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The Portacount$^®$ determines protection factors, PF, of gas masks by comparing the concentration of particles inside the mask and outside in the environment. The fact that people produce particles in the lungs or mouth, especially when talking or after smoking, has been known for quite some time. This in-mask particle generation causes underestimation of the PF. The effect has been quantified by Harrison and Liang* for some standard exercises. They showed that to ensure that a PF 6700 is achieved a challenge concentration in the environment of around $40*10^3$ particle per cm^3 is advisable.

With the advent of high protection factor measurements of a thousand up to a million under operational conditions the influence of in-mask particle generation became even more important. Observations showed that some test persons with good fits had a high in-mask particle concentration which is generally attributed to lung- and mouth-generated particles.

The research presented here shows that some test persons produce relatively large quantities of particles without a clear cause whereas others do not. We also show that through subsequent measurements at two environmental concentrations the real protection factor and in-mask generation can be inferred with similar results as direct measurement.

In conclusion we found that in order to be able to measure protection factors of 10^5-10^6 for a person with average in-mask particle generation, environmental concentrations of 10^6 particles/cm^3 are required. We also found that Portacounts should be calibrated especially for the corresponding range of low particle concentrations to ensure precision of the measurements.

*B. Harrison and S. Liang, Quantitative fit testing of military gas masks with the TSI Portacount: Part II-Quantifying the limitations and recommendations for use, JISRP Vol. 22, pp. 55-67 (2005)