Breathing Patterns at Different Work Rates

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During the development of the International Standards Organization's next generation Respiratory Protective Standards, it was decided that the new standard will be based on the physiological requirements of human beings. The proposal from the working group is based on 8 different work levels, spanning from an average metabolic rate of 65 Wm^{-2} to 600 Wm^{-2}.

When testing respirators on a breathing machine, it is desirable to use breathing curves/patterns that represent the work load at which the particular RPD is intended to be used. In order to establish those breathing curves/patterns, a work protocol was developed using an ergometer sampling the air flow during both the inhalation and exhalation cycle. The protocol started at zero external work load, and was then increased by 25 W increments every five minutes until the test person reached 85% of his or her maximum work rate.

Special software was developed using LabView. The purpose of the new software was to establish typical breathing curves/patterns by analyzing and comparing breathing data for different people.

The aim was to establish a typical breath by calculating average breaths from a large number of individual breaths. In order to compare data between different people, the data from each breath is split into segments and then normalized in terms of time and volume. After this correction, each sample is made up of the same array of segments detailing each breath, with the same number of samples and also scaled to the same breathing volume (normalized to 1).

Once the full survey has been completed, these arrays can be averaged, sample by sample, in order to finally arrive at typical breath curves/patterns at different metabolic work rates.

The presentation will include breathing curves/patterns for all 8 work levels, with and without speech.