

PROTECTIVE DEAD VOLUMES IN POWERED AIR PURIFYING RESPIRATORS

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Powered Air-Purifying Respirators (PAPRs) have dead volumes inside their facepieces just as Air-Purifying Respirators (APRs) do. However APR dead volume can impose a burden on the wearer because exhaled carbon dioxide can accumulate in the dead volume and be rebreathed during the subsequent inhalation. At low breathing rates (at low work rates) this additional inhaled CO₂ acts as a respiratory stimulant increasing the work of breathing. At high breathing rates (high work loads) this inhaled CO₂ adds to the CO₂; circulating in the blood and causes metabolic acidosis increased oxygen debt and shorter work performance times. PAPR blowers on the other hand can remove excess CO₂ from the dead volume. Blowers can also remove accumulated contaminants resulting from leakage into the facepiece. PAPR dead volumes thus become part of the protection afforded by the respirator. In respirators that we have measured, a little over 1 litre of purified air is available to the wearer because of dead volume air purged of contaminants and CO₂. One important function of the blower then is to cleanse dead volume air during the exhalation portion of the breathing cycle. Not all PAPR blowers are fully effective in doing this. PAPR protective dead volumes can also be increased by purposefully increasing the flow pathways from leakage sites to the mouth during inspiration. This can be accomplished by promoting twisting and turning of flow pathways inside the facepiece.