

A REVIEW OF THE PHYSIOLOGICAL EFFECTS OF CARBON DIOXIDE AND OXYGEN IN THE BREATHING ENVIRONMENT AND THEIR RELEVANCE TO RESPIRATORY PROTECTIVE DEVICES

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The normal atmospheric concentrations of oxygen (O₂) and carbon dioxide (CO₂) are ~21% and 0.03% respectively. Complex integrated physiological mechanisms have evolved to transport O₂ to body tissues and to eliminate metabolically produced CO₂ from the body. These physiological mechanisms are robust and allow humans to tolerate within limits occupational exposure to deviations from the normal atmospheric concentrations of O₂ and CO₂. However these compensatory mechanisms can result in profound physiological effects such as increased minute ventilation visual disturbances headache a sense of air hunger loss of consciousness and death due to asphyxia. From a practical standpoint respiratory protective devices (RPDs) must protect the wearer against external respiratory hazards while maintaining a breathable atmosphere compatible with life. Inappropriate use of an RPD can be hazardous or fatal. For example using an air purifying respirator in a low O₂ or high CO₂ environment can result in a serious health hazard to the user even if other hazardous particulates are filtered efficiently. An RPD that allows for the build up of CO₂ in the breathing space or does not supply sufficient O₂ can also result in a health hazard. Thus it is critical that the concentrations of O₂ and CO₂ in the breathing space of RPDs be carefully controlled. This presentation will address the physiological responses to occupational exposure to O₂ and CO₂ and their relevance to the use of RPDs. This presentation is a summary of ISO Technical Specification 16976-3 developed by the author for the ISO TC94SC15WG1PG5 Human Factors Committee.