

Investigation of Novel Respirator Facepiece Pressurization Concepts

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(Paper presented by Paul Gardner)

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The U.S. Army Edgewood Chemical Biological Center (ECBC) continues to investigate novel respirator facepiece pressurization concepts and technologies for development of the next generation of joint service CBRN respirators. The focus of this study was on dual-cavity and low-flow powered air-purifying respirator (L-PAPR) pressurization concepts designed to enhance protection and wearer comfort. Dual-cavity pressurization of a full-facepiece respirator isolates the nose cup for respiration and forms a “dead zone” in the space between the nose cup and the peripheral seal (i.e., the eye cavity). This dead zone is pressurized using a miniature fan or blower to achieve positive pressure that effectively mitigates the impact of small intermittent peripheral seal leaks on protection levels. The conventional dual-cavity approach employs a separate filter to provide dedicated clean airflow to the eye cavity for pressurization. A variant of the dual-cavity concept that pulses filtered air during inhalation and exhalation to the nose cup and eye cavity of the mask, respectively, was investigated in this study. In addition, a L-PAPR concept that delivered filtered air from the eye cavity to the nose cup like a conventional PAPR was explored as a potential pressurization option. A modified commercial air-purifying respirator was used as a test bed to demonstrate feasibility of the two pressurization approaches (dual-cavity vs. L-PAPR). Prototype masks were evaluated at ECBC during wear trials to assess protection performance and subjective rankings of thermal sensation and comfort. An overview of the pressurization concepts evaluated and preliminary results will be presented.