

# ***Assessment of Faceseal Leakage in a Half-mask Respirator Used by Firefighters***

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Firefighters are often exposed to ultrafine combustion particles during the fire overhaul. The ultrafine aerosol exposures at workplaces have been associated with impairments of cardiovascular function and other adverse health outcomes. To control the exposure, the firefighters and first responders conventionally wear half-mask elastomeric respirators. Currently, it is unknown how the faceseal leakage occurring when wearing such a respirator affects its performance. To address this issue, we propose to conduct a respirator performance evaluation study using the size-selective measurements of the aerosol concentrations inside and outside the respirator.

First, each subject of the standard NIOSH 25-subject panel wearing a half-mask respirator will undergo a series of exercises while exposed to the NaCl surrogate of combustion aerosols, and the total inward leakage (TIL) will be determined particle-size-selectively. Second, the subject- and exercise-specific breathing patterns will be recorded and replicated on a breathing manikin with the tested respirator sealed on it. Again, the aerosol concentrations inside and outside the respirator will be measured to determine the filter penetration (in absence of the faceseal leakage). This approach will allow differentiating the relative contribution of the two penetration pathways: the filter media and the faceseal leakage. The effects of facial/body movements, particle size, and breathing patterns on the protection efficiency of the half-mask respirator will be quantified.

The results will help establish a better understanding of the respirator performance against combustion aerosols and develop strategies for its improvement. The proposed study will not only benefit firefighters but also other workers since the half-mask respirators are widely used throughout occupational environments.

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