

*Winner of the 2012 ISRP Americas Section Student Research Award for  
Best Full Paper using the NIOSH Anthropometric survey data set:*

## **Computational Fluid Dynamics-Based Respirator Fit Prediction-A Pilot Study**

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This paper presents a computational fluid dynamics-based approach to predict the fit factor of the N95 filtering facepiece respirator (N95 FFR). This work was based on the final stage of contact simulation between a respirator and a headform. The headform and respirator models were obtained from the NIOSH database. The chamber between the respirator and headform was formed after the respirator was donned. The air flow field driven by the human respiration and the freestream towards the human face was calculated. The particle movements, driven by the air drag force and gravity force, were also calculated. The geometries of the human face and N95 FFR affected the flow outside of the N95 FFR, while human breathing dominated the air flow inside the deadspace. The particles inside the deadspace were not uniformly distributed. This paper is a pilot study to investigate a simulation-based methodology to predict the fit factor. A medium size headform and a medium respirator were used to test the method. The simulation results were used to predict the fit factor. Fit factors decreased with the increasing particle sizes. The simulations gave fit factors (average 26.14) lower than the experiment measurement (68), suggesting that further improvement is needed.