# Effects of Breathing Rate and Activity Level of Efficiency of Respirators

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A parametric evaluation of the effects of breathing rate and work activity level on workplace protection factors (WPFs) provided by two common types of respirators (an elastomeric respirator and an N95 filtering facepiece respirator) will be conducted through laboratory and field experiments. First specific aim is to evaluate the effects of breathing rate and work activity level on WPFs of respirators in actual work places. Eight human subjects will be selected for the field sampling among the subjects that have been recruited for an ongoing NIOSH-funded study. Since heart rate is known to be correlated with activity level and age, heart rate will be used as the primary surrogate for work activity level. Work activity level also affects breathing rate, which may also affect the WPF. While heart and breathing rate correlate with level of physical activity, it may not be possible to differentiate the relative contribution of each. In the field sampling, WPF will be determined for 15 min at three different activity levels such as walking, feeding animals, and shoveling/spreading, with simultaneous measurement of heart rate and breathing rate using a LifeShirt system (RAE Systems Inc., USA). LifeShirt is a lightweight chest strap embedded with sensors which can measure several life sign parameters: breathing rate, heart activity, position, activity, skin temperature and movements of the person. While the first two parameters are the primary targets in this study, we will also explore the usefulness of the other parameters during this pilot study. Second specific aim is to evaluate the effect of breathing rate alone on the particle penetration in manikin-based laboratory experiments. Breathing rate of each human subjects tested in the field will be replicated in the laboratory. Particle penetration through the respirator filter will be determined when the respirator is fully sealed on a manikin face, and penetration through the faceseal leaks will be tested using artificial leaks. Comparison of field and laboratory data will give insights of the effects of breathing rate vs. human activity level on the WPF. Furthermore, faceseal leakage will be estimated by deducting filter penetration, which will be obtained from the laboratory experiment, from total penetration, which will be attained from the field experiment.

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