

BEHAVIOR OF BACTERIA ON RESPIRATOR FILTERS - REENTRAINMENT AND SURVIVAL. Tiina Reponen, Zheng Wang, Klaus Willeke, Ying Qian, Sergey Grinshpun, and Elzbieta Jankowska, Aerosol Research and Exposure Assessment Laboratory, Department of Environmental Health, University of Cincinnati, P.O. Box 670056, Cincinnati, Ohio 45267-0056, USA

When a respirator wearer breathes normally, airborne bacteria and particles will be collected by the filter medium of the respirator. These particles may be reentrained by sneezing or by coughing. If bacteria are able to survive on filter media, they may be infective after reentrainment and pose a secondary health risk. If bacteria are able to multiply on filter media, their probability for reentrainment may increase. In the first part of this study, we examined the possibility of reentrainment of bacteria from respirator filters immediately after loading the bacteria on the filters. The second part of the study was conducted to determine whether bacteria may grow, and how long they may survive on a respirator filter.

*Bacillus subtilis*, *Bacillus megatherium*, *Pseudomonas fluorescens*, and *Mycobacterium smegmatis* as well as PSL particles of different sizes were used for the tests. A preconditioned 37 mm filter was cut from an N95 respirator filter and was loaded with the aerosolized bacteria or PSL particles at a filtration velocity of 8 cm/s. The percentages of reentrainment were measured in a test setup where the reentrainment air flow was opposite to the loading flow, and varied from 8 to 300 cm/s. In the survival study, bacteria were loaded on the filter samples while coated with water, human saliva, or nutrition broth to simulate different nutritional conditions on the filter. The filters were incubated for 0, 1, 3, 6, 9 and 13 days and analyzed for culturable and total count.

The reentrainment experiments showed that no bacteria were reentrained during normal exhalation. Reentrainment of 0.1% or less was observed only at humidity less than 35% and at air velocities of 300 cm/s or higher, which corresponds to violent sneezing or coughing. None of the test bacteria were able to grow on the N95 respirator material. However, *B. subtilis* spores could survive on filters over 13 days, while *M. smegmatis* survived for 1-3 days depending on the nutritional conditions.

It is concluded that the reaerosolization of particle and bacteria, collected on the fibrous filters of N95 respirators, is possible only in extremely high air flow conditions. The survival study shows that bacteria are able to survive on respirator filters and, thus, used respirators may also be a potential bacterial source if improperly stored and re-used.