HARVARD SCHOOL OF PUBLIC HEALTH

Department of Environmental Health
Environmental Science and Engineering Program

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Progress Report II, Phase I, Potok 150-M-01 Test Program

This is a report of progress to date on a program of microbiological tests performed on an Potok 150-M-01 stand-alone unit. The tests use microbiological aerosols produced by nebulizing selected organisms from an aqueous suspension containing synthetic saliva. After air drying, they are introduced into the entry of the unit under test. Representative samples of the airborne microorganisms are taken simultaneously up- and downstream of the unit under test with identical 6-stage Anderson Biological Cascade Impactors. Analysis of viable microorganisms collected by the impactors gives total numbers in the air up- and downstream of the unit, particle size of the microorganisms, and efficiency of the unit for removing microorganisms from the air passing through it.

Tests were conducted using the unit's low and high electrical settings and at the unit's rated air flow of 77 cubic feet per minute (CFM) and at 100 CFM..

Detailed test results are shown in the five pages of attached tables with statistical analyses that indicate the confidence intervals around the averages of the multiple replicate tests. They are well within acceptable limits for microbiological aerosol studies. The results for the five microorganisms tested up to this date are summarized as follows:

(1) B. subtilis spores, a commonly used surrogate for anthrax spores. When the unit was operated at its characteristic airflow rate (77 CFM) and at the high voltage setting it destroyed 99.5% of the spores. At the same airflow rate and at low electrical setting the kill rate was 94.4%. When operated at 100 CFM and the high electrical setting, spore killing efficiency was 98.8%. These comparative results are in the expected direction, greater lethal effect at higher voltage and at lower airflow rate, i.e., longer treatment time inside the unit.

(2) Serratia marcescens, a vegetative organism commonly found in nature and frequently used in microbiological aerosol studies. At high electrical setting and characteristic airflow rate, reduction in viable bacteria was 99.4%. At the same airflow rate but at the low electrical setting, bacteria reduction was 97.3%. At the higher airflow rate (100 CFM), removal efficiency at the high electrical setting was 99.0% and at the low electrical setting, 92,4%. The relative efficiencies were in an expected mode.

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(3) Staphylococcus aureus, an organism commonly found in medical settings and currently under suspicion as a pathogen. At characteristic airflow rate and high electrical setting bacterial removal efficiency was 99.8%. At the same airflow rate but at the low electrical setting the removal efficiency was 97.6%. At an airflow rate of 100 CFM, removal efficiency was 99.4% at the high electrical setting and 97.0% at the low electrical setting.

(4) Pseudomonas aeruginosa, a vegetative bacterium sometimes found in medical settings and under suspicion as a pathogen. Unit efficiency for this microorganism at characteristic airflow rate and high electrical setting was 99.4%; at low electrical setting it was 98.0%. At the higher airflow rate, efficiency at high electrical setting was 99.5%. Although the kill percentage was slightly higher at the higher airflow rate in this case, the differences are well within the confidence intervals of each and within the variable nature of microbiological aerosol measurements.

(5) Aspergillus niger spores, a widely dispersed fungus in nature and frequently found in mold infestations in buildings, is a cause of respiratory illnesses. Unit efficiency for these spores was indistinguishable from total destruction when operated at low electrical setting with characteristic and elevated airflow rates. Tests were conducted with spores aerosolized from aqueous suspensions and with dry spores dispersed into the air stream. Efficiency was lower with dry spores. The reason for the difference is not known. Some additional testing may be called for here.

Results at the characteristic airflow rate (77 CFM ) and high electrical setting are excellent and could probably be made better still by increasing electrical voltage inside the instrument and increasing retention time by making the treatment chamber larger.

We are nearly ready to test the performance of the unit with a vaccine, namely Vaccinia, the usual surrogate for smallpox.

Best wishes,

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Enclosure