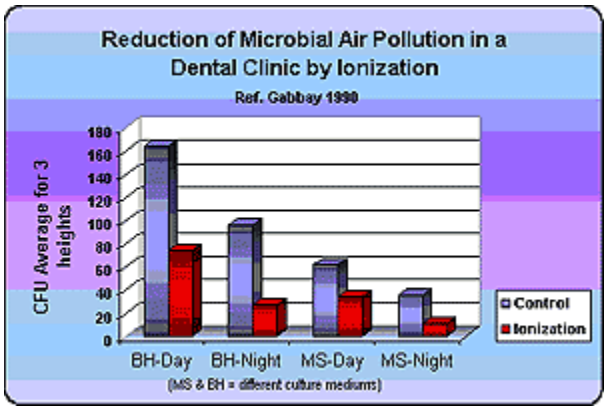
PENN STATE UNIVERSITY

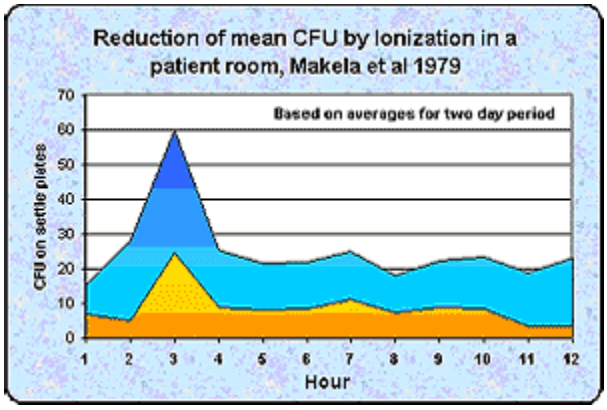
Research 1 - Negative Air Ionization

Negative air ionization has the potential to reduce the concentration of airborne microorganisms. The effect appears to result from the ionization of bioaerosols and dust particles that may carry microorganisms, causing them to settle out more rapidly. Settling tends to occur on horizontal surfaces, especially metallic surfaces, and generally in the area near the ionization unit. Ionization may enhance agglomeration, creating larger particles out of smaller particles, thereby increasing the settling rate. Ionization may also cause attraction between ionized particles and grounded surfaces.

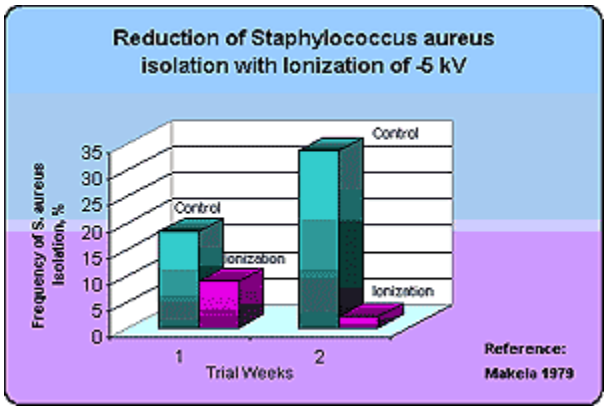
In situations where dust may carry microorganisms, negative air ionization can be economical to use to reduce infections. It has been used economically to reduce the incidence of Newcastle Disease Virus in poultry houses (Mitchell 1994). Poultry houses can be notoriously dusty.



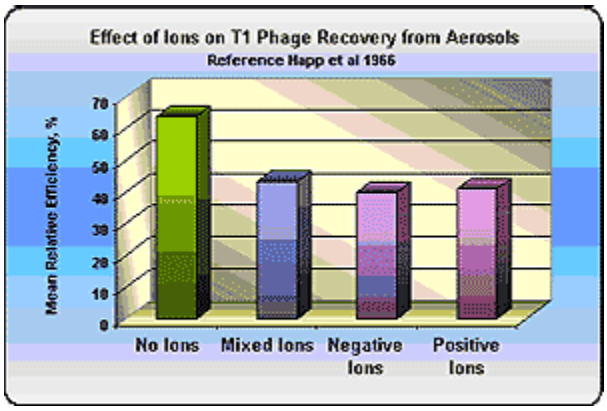
The chart shows the Colony Forming Units (CFU) measured with and without ionization in a dental clinic by Gabbay et al (1990). Airborne microbial levels were reduced by 32-52% with ionization. He also found that horizontal plates picked up considerably more cultures than vertical plates, strongly suggesting that settling out of ionized particles was the primary mode of removal.



This chart summarizes the results of studies by Makela et al (1979), who found that bacterial aerosols in patient rooms of a burns and plastic surgery unit could be reduced with air ionization. Variations in the bacterial levels were associated with bed-changing and other room activities. The humidity in the rooms was low, which may have enhanced the effect.



In this chart, also based on results from Makela et al (1979), specifically identified Staphylococcus aureus levels in a room with and without ionization. The average for two days of monitoring indicated a definitive reduction in airborne levels. Staphylococcus aureus is a potential nosocomial infectious agent of wounds and burns.



The chart on the left summarizes some results from Happ et al (1966), who found that levels of aerosolized virus T1 bacteriophage were reduced under various types of ionization, which included mixed ions, negative ions and positive ions. All three types of ionization had comparable results in terms of reducing airborne levels. The method used by Happ involved testing the filtration efficiency, in which lower filter efficiencies demonstrated lower recoveries from the air. These lower recoveries suggested either that the phage was not present in the air or had perhaps been inactivated.

TYPICAL SPECIFICATIONS FOR ION GENERATORS	
Ion Generation Method	Pulse Ionization Field
Power Supply	9 kV - 15 kV
Wattage	0.75 - 2.7 W
Ozone Production	< 0.02 PPM

REFERENCES:

1. Gabbay, J. (1990). “Effect of ionization on microbial air pollution in the dental clinic.” Environ. Res. 52(1): 99.
2. Happ, J. W., J. B. Harstad, et al. (1966). “Effect of air ions on submicron T1 bacteriophage aerosols.” Appl. Microb. 14: 888-891.
3. ICCCS (1992). The Future Practice of Contamination Control. Proceedings of the 11th International Symposium on Contamination Control, Westminster, Mechanical Engineering Publications.
4. Mitchell, B. W. a. D. J. K. (1994). “Effect of negative air ionization on airborne transmission of newcastle disease virus.” Avian Diseases 38: 725-732.
5. Mitchell, B. W. (1994). “Effect of negative air ionization on airborne transmission of Newcastle Disease Virus.” Avian Dis. 38(4): 725.
6. Phillips, G., G. J. Harris, et al. (1963). “The effect of ions on microorganisms.” Int. J. Biometerol. 8: 27-37.
7. Estola, T., P. Makela, et al. (1979). "The effect of air ionization on the air-borne transmission of

experimental Newcastle disease virus infections in chickens." J. Hyg. 83: 59-67.
8. Kreuger, A. P., R. F. Smith, et al. (1957). "The action of air ions on bacteria." J. Gen. Physiol. 41: 359-381.
9. Krueger, A. P. and E. J. Reed (1976). "Biological Impact of Small Air Ions." Science 193(Sep): 1209-1213.
10. Lehtimaki, M. and G. Graeffe (1976). The effect of the ionization of air on aerosols in closed spaces. Proceedings of the 3rd International Symposium on Contamination Control, Copenhagen.
11. Makela, P., J. Ojajarvi, et al. (1979). "Studies on the effects of ionization on bacterial aerosols in a burns and plastic surgery unit." J. Hyg. 83: 199-206.
12. Phillips, G., G. J. Harris, et al. (1964). "Effect of air ions on bacterial aerosols." Intl. J. of Biometerol. 8: 27-37.
13. Soyka, F. & A. Edmonds (1991). "The Ion Effect" Bantam Books.