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HEPA FILTER PARTICLE LOADING

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ABSTRACT:

We have developed a theoretical model of HEPA filter loading by particles that is in agreement with most of the experimental studies on HEPA filter media and full-scale filters. The theoretical model is given by

$$\left(\Delta P - \Delta P_0\right)\frac{\rho_p D_P^n}{V} = k\ \frac{M}{A}$$

Where:

- ΔP = Pressure drop for particle loaded filter, Pa
- ΔP_0 = Pressure drop for clean filter, Pa
- V = Face velocity, cm/s
- M = Mass of particle deposits, g
- ρ_p = Particle density, g/cm^3
- A = Filter area, m^2
- D_P = Particle diameter, cm
- n = Number, 1 for pure dendritic loading and 2 for pure surface loading
- k = Constant

Experimental studies show that for HEPA filters, n=1, which is characterized by dendritic loading. Lower grade fibrous filters with large particles tend to have n=2, indicative of surface loading. Comparison of the loading model with experimental studies show good agreement with all of the parameters except the particle density. Further analysis is required to resolve this discrepancy in the model. The filter loading model will be useful for HEPA filter designers and for nuclear safety analysts.