A Markov Chain Model for Supermicron Particle Fate and Transport in Indoor Air

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Abstract

A Markov chain can be applied to predict supermicron particle fate and transport in indoor air. The model construct considers particle movement via advective air flow, turbulent diffusion, and gravitational settling; and considers particle removal from room air via deposition onto room surfaces and exhaust air flow. The first-order rates by which a particle would exit a state in the Markov chain (a state is a small volume in the room, or a surface) in a small time step due to these mechanisms are used to specify the probability with which a particle remains in a given state or moves to one of six adjacent states along three orthogonal axes. The Markov chain model will be illustrated in a hypothetical room, and evaluated with experimental data for floor deposition of cobalt oxide particles released in a building lobby. The Markov chain model provides spatially and temporally refined estimates of airborne and surface particle concentrations in indoor environments with computational ease.