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## Back to the Future: Reducing Atmospheric Particulate Matter Levels to Improve Human Health

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The human development of our planet has a variety of negative impacts on the composition of its atmosphere at every scale – locally, regionally, and even globally. One of these dramatic changes has been the increase in the mass concentrations of sub-micrometer particles by one to sometimes two orders of magnitude over populated areas in the Northern Hemisphere. These atmospheric aerosols can cause serious health problems, reduce visibility, contribute to acidic deposition and material damage, but are also cooling the planet by reflecting sunlight back to space. Atmospheric chemistry occurs within a fabric of complicated atmospheric dynamics and physics. This interplay often results in nonlinear and often counterintuitive changes of the system when anthropogenic emissions change. A major goal of our research has been to gain a predictive understanding of the physical and chemical processes that govern the dynamics, size, and chemical composition of atmospheric aerosols.

To illustrate the advances in the experimental techniques and theoretical tools in atmospheric aerosol science, we will go back to the beginning of the 21<sup>st</sup> century and we will revisit the design a particulate matter control strategy for the Eastern US based on the data, knowledge, and tools available at that time. We will then look at the effects of the parts of this control strategy that have been materialized and their effects on public health using the current understanding. Finally, we will look forward in ways of further improving air quality in the US and Europe.