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PARTICULATE EMISSIONS FROM ENERGY SYSTEMS

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Particulate Emissions From Energy Systems

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General models of aerosol dynamics, originally developed to simulate atmospheric aerosol behavior, have been extended for application to combustion and other high temperature processes. These models are now being used to study the fate of ash vapors in conventional pulverized-coal combustion. Field measurements have shown that the vapors condense preferentially on the surfaces of the smaller ash particles. Previous simplified calculations have suggested that large numbers of very small particles may also be formed by the condensation of these vapors. The new, exact calculations will be used to explore the relative importance of new particle formation and condensation on existing particles, the size distributions of the particles produced under various combustion conditions, and the distribution of chemical composition with respect to particle size.

In the coming year, these models will be used to explore the particulate pollution likely to result from alternate technologies for using our fossil fuel resources. The emphasis of this research will be on the formation of small particles which are difficult to remove from the flue gases and which represent potentially serious environmental hazards. Examples of special interest are the fluidized bed combustion of coal and the diesel engine. Only limited data are available on the physical and chemical characteristics is known about the nature of the particles formed in the diesel engine, but we still do not understand the formation processes well enough to prevent their formation. We anticipate that the computational studies of fine particle formation in these and other energy conversion systems will help us to identify some of the important mechanisms. Controlled laboratory studies will then be

carried out in order to develop a fundamental understanding of the mechanisms by which fine particles are formed, to improve the predictions of the characteristics of the particulate emissions from future sources, and to examine possible control strategies. The results of these studies should play an important role in understanding the environmental effects of changes in the ways we use fossil fuels.