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COLLOQUIUM ABSTRACTS

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Session 2. What Properties of Particulate Matter are Responsible for Health Effects?

023 EFFECTS EXERTED BY PM IN MINUTES TO HOURS, INVOLVING IMMUNOLOGICAL AND ELECTROPHYSIOLOGICAL MECHANISMS, CAN ACCOUNT FOR EPIDEMIOLOGICAL ASSOCIATIONS OF DAILY MORBIDITY AND MORTALITY WITH 24-HOUR-AVERAGE PM IN AIR.

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Daily airborne PM-10 concentrations within the 150- $\mu\text{g}/\text{M}^3$ NAAQS are associated with morbidity and mortality. The U. S. EPA has changed the size and concentration, but not the 24-hour averaging time, of PM addressed by the standard. We report on emerging evidence of shorter-term mechanisms of PM toxicity, justifying consideration of a shorter regulatory averaging time, such as one hour, in addition to 24-hour and annual averaging times in the NAAQS. PM instilled intratracheally or inhaled caused morbidity in animals within minutes, including apnea and electrophysiological effects in dogs. PM killed rats within one hour to a few hours via electrophysiological mechanisms. In clinical settings, PM effects have occurred in asthmatics during brief exercise or, in one study, rest. Allergenic bioaerosols (fragments of mesquite pollen and dried alfalfa) incapacitated 300 people, many within minutes following exposure outdoors. Cockroach allergen in airborne PM indoors was identified as a major cause of asthma among urban children in the U. S. Daily asthma symptoms were most strongly associated with the maximum one-hour average airborne PM concentration during the day, whereas the association lost strength with dilution into eight-hour and then 24-hour averaging times. In Australia, daily mortality was associated with daily maximum one-hour, but not 24-hour, PM concentrations. Documented PM excursions lasting minutes to hours frequently reached concentrations eliciting effects noted above. We conclude that PM epidemiological effects are consistent with causation by mechanisms of PM action acting over shorter times than the NAAQS now regulates, including electrophysiological and immunological processes. Further research is required into PM toxicity, and into the relative importance of identified mechanisms in contributing to the epidemiological observations. However, real-time PM data and toxicological evidence indicate that, despite 24-hour PM control, potentially health-significant PM excursions occur over shorter time frames, such as one hour, whose regulation therefore should be considered.