

Personal Exposure to Airborne Particles and Metals: Results from the Particle Team Study in Riverside, California

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The cardiopulmonary health effects of airborne particles have been studied extensively since the “London Smog” episode of 1952. The U.S. EPA began the regulation of total suspended particles in air in 1970; these regulations were named the National Ambient Air Quality Standards (NAAQS). Research in the mid-1980s that indicated that harmful particles were more likely to be in the smaller total suspended particles led EPA to revise its NAAQS to apply only to particles less than 10 micrometers in diameter (PM₁₀). Since no studies of personal exposure to particles in this size range had been undertaken, Congress mandated in 1986 that the EPA undertake a study of exposure to particles.



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Thus, the Particle Total Exposure Assessment Methodology study was the seminal large-scale probability-based study of personal exposure to particles. The study was a collaborative undertaking between investigators at the Research Triangle Institute and the Harvard University School of Public Health. We designed and constructed a 4-lpm, battery-operated personal monitor for inhalable particles smaller than 10 microns that could be worn comfortably for up to 14 hours by persons from 10 to 70 years old. During the fall of 1990, 178 participants representing 139,000 nonsmoking residents of Riverside, California, wore the monitor for two consecutive 12-hour periods (day and night).. Nearly identical monitors were employed to collect concurrent indoor and outdoor samples. The monitors were equipped with a different sampling nozzle to collect fine (PM_{2.5}) particles.

Population-weighted daytime personal PM₁₀ exposures averaged around 150 micrograms of particles per cubic meter and 63 percent higher than concurrent indoor and outdoor concentrations. This suggested the existence of excess mass near the person, a “personal cloud” that appeared related to personal activities. Fourteen of 15 prevalent elements tested for were also elevated in the personal samples. The two major indoor sources of indoor particles were smoking and cooking; even in these homes, however, more than half of the indoor particles came from outdoors, and a substantial portion of the indoor particles were of undetermined indoor origin.

Outdoor concentrations near the homes were well correlated with outdoor concentrations at the central site, supporting the idea of using the central site as an indicator of ambient concentrations over a wider area. Indoor concentrations were only weakly correlated with outdoor concentrations, however, and personal exposures were even more poorly correlated with outdoor concentrations, indicating that the use of ambient concentration data by themselves is problematic in estimating people’s exposure to particles.