Inhalation Toxicology

International Forum for Respiratory Research

ISSN: 0895-8378 (Print) 1091-7691 (Online) Journal homepage: https://www.tandfonline.com/loi/iiht20

What Are We Breathing and How Can It Best Be Characterized?

Robert F. Phalen

Inhalation Toxicology, 12(Supplement 1):13–14, 2000

0895-8378/00 $12.00 + .00

WHAT ARE WE BREATHING AND HOW CAN IT BEST BE CHARACTERIZED?

Robert F. Phalen

Department of Community and Environmental Medicine, University of California, Irvine, Irvine, California, USA

The opening session of the colloquium, which addressed the issues of defining and characterizing relevant PM exposures, consisted of introductory and summary talks, poster viewing, and a discussion between the audience and an expert panel. The platform presentations and expert panel members' comments tended to point to areas in need of new research, while the 50 posters documented recent advances in knowledge. This commentary highlights some of the information that was presented.

Several speakers emphasized that understanding "personal exposures" is a key to uncovering who might be affected by PM inhalation, under what circumstances they might be affected, and what pollutant sources (or atmospheric chemical processes) might be producing the effects. Jack Spengler (Boston) commented that the average person spends 87% of his or her time indoors, that air conditioning can greatly reduce the penetration of outdoor PM into the indoor air, and that as the number of people in a room increases, so do the pollutant levels. Also, O_3-generating "air cleaners" can greatly increase the ultrafine particle count indoors. He pointed to several areas in need of further research: chemical characterization of indoor PM; the toxicology of indoor PM; emission source characteristics; infiltration and turnover rates for air contaminants indoors; and how human activities modify indoor PM exposures. Petros Koutrakis (Boston) stated that the "personal cloud" is largely composed of coarse-mode (>2.5 μm aerodynamic diameter) particles, and that the greatest differences in outdoor versus indoor PM is expected in the wintertime. Koutrakis called for additional research on defining actual exposures (both personal and community), better chemical and temporal characterizations of exposures, and uncovering the factors that produce subject variability in PM exposures; such research will require improvements in methodology. Harriet Burge (Boston) emphasized the serious lack of understanding of exposures to biological aerosols. She commented that pollen and spore levels are associated with asthma, hospitalizations, and mortality. Burge remarked that a single inhaled ragweed pollen grain can produce symptoms in a sensitive person. Judith Chow (Reno, NV) indicated that there is also a need to improve the consistency among the many PM sampling methods that are commonly

Address correspondence to Dr. Robert F. Phalen, Department of Community and Environmental Medicine, University of California, Irvine, Irvine, CA 92697-1825, USA. E-mail: rfphalen@uci.edu

used. Glen Cass (Pasadena, CA) also emphasized the importance of biological aerosols as potentially significant confounders in epidemiologic studies of the effects of PM; for example, paved road dust has about 20 biological components. Cass also commented that many complete chemical analyses of environmental aerosols are already available and emerging, and the real challenge is what will be done with the large amount of data that is being generated. He saw the need to shift focus from individual PM components and move toward understanding mixtures of air pollutants and how specific sources contribute to these mixtures. Mike Lebowitz (Tucson, AZ) added that there is tremendous allergenic potential in PM2.5 samples.

Summarizer George Thurston (Tuxedo, NY) raised some questions that must be better answered: What are the characteristics of PM that can and should be measured? How can ambient PM be concentrated so that it can be studied toxicologically? How well do central site monitoring stations reflect personal exposures? Should there be greater emphasis on understanding the contributions of specific sources to PM exposures as opposed to the focus on PM characteristics alone?

Current research efforts, as evidenced by the posters, are only addressing some of the aforementioned problems. Several studies are looking at traffic, including diesel engine related, as a significant contributor to indoor and outdoor PM exposures. Data on indoor exposures in hospitals and homes are elucidating the roles of the specific activities of people as modifiers of PM exposures. Also, the currently accepted trimodal size distribution of urban aerosols is too simplistic to be universally applied; particle size change due to hygroscopic growth is more significant than has been previously appreciated. It is clear that the current research is raising additional important questions.

Even given the large number of relevant current studies, many gaps in knowledge exist. Details on personal exposures (with respect to chemistry, size distributions and variability) are still largely lacking. Information on peak exposures, where and when they occur and their chemistry, is nearly nonexistent. Other than for traffic, specific sources are not well tied to human exposures. Also, the methods for characterization of particle surfaces are not very advanced, which is a problem when one considers that the particle surface is what initially contacts the cells of the respiratory tract. Although the current research efforts are largely on track for contributing to understanding the consequences of PM inhalation, there are obviously many significant unresolved relevant problems.