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Introduction: Addressing air pollution and health science questions to inform science and policy

Paul A. Solomon

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This special issue of *Air Quality, Atmosphere and Health* (AQAH) is the sixth and final in a series of special journal issues (Solomon 2010, 2011a, b, 2012; Solomon et al. 2011) associated with the 2010 Air Pollution and Heath Conference: Bridging the Gap between Sources and Health Outcomes (Solomon et al. 2012). The conference was based on a series of eight policy-relevant science questions (SQ1–SQ8) and one policy question (SQ9, see Table 1). The policy question integrated across the source-to-health effects continuum (NRC 1998). Nine sets of plenary speakers were asked to address the questions listed in Table 1 in their presentations at the conference and then to present a more comprehensive survey of the vast literature on their topics in the papers presented within this issue. The journal articles in this issue represent a "snap shot" in time and are not comprehensive reviews of the literature, but their strength is collectively drawn from the series, which clearly advances the science, and as indicated by the conference theme begins to "bridge the gap between air pollution sources and health outcomes." Three science questions were not addressed (SQ2, SQ3, and SQ5), but information on these topics can be found in the series of EPA's integrated science assessments (http://www.epa.gov/ncea/isa/).

While not as detailed and with a focus on what was presented at the conference, the conference overview (Solomon et al. 2012) addresses all nine questions and was prepared by a different group of world-renowned scientists than those who prepared journal articles for this issue. This allows the questions in Table 1 to be considered from

P. A. Solomon (✉)
U.S. Environmental Protection Agency,
Office of Research and Development,
Las Vegas, NV, USA
e-mail: solomon.paul@epa.gov

Table 1 Policy-relevant science questions that were designed to begin to bridge the gap between sources and health outcomes and paper title and authors

Science question	Paper title; author
SQ1. Pollutants and sources associated with health effects (overarching theme). How does our understanding of the health effects of air pollutants (singly or in mixtures) help identify pollutants that can be linked to sources the control of which would provide maximal health benefits?	Air pollutants and sources associated with health effects; Ayala et al.
SQ2. Reliability of methods and approaches. How reliable are methods (measurements and models) and approaches (epidemiological and toxicological) for studying and quantifying the links between air pollutants (species and/or sources) and adverse health effects?	
SQ3. Pollutant characterization and population exposure. How do relevant pollutant properties vary in space and time from sources and in ambient air, and what are the implications of these variations for population exposure?	
SQ4. Relationship between exposure and dose. What advances have been made in understanding the relationships between exposure, both spatially and temporally, and estimates of dose that tie to health outcomes?	Macroscopic to microscopic scales of particle dosimetry: from source to fate in the body; Solomon et al.
SQ5. Mechanisms of action and biomarkers of exposure and effects. Are patterns emerging that relate component(s) of air pollution and/or source types to mechanisms? What is the status of identifying and measuring biomarkers of exposure and/or adverse health effects from air pollution?	

Table 1 (continued)

Science question	Paper title; author
SQ6. Susceptible populations. Who are the susceptible populations, what drives different susceptibilities to the same or different air pollutants, and are there susceptibility traits associated with specific health outcomes that are common among the subpopulations?	Air pollution and health: Emerging information on susceptible populations; O'Neil et al.
SQ7. Confounding or other factors. What roles do confounding or other factors have in increasing, decreasing, or obscuring attribution of the true health effects from ambient air pollutants?	Confounding and exposure measurement error in air pollution epidemiology; Sheppard et al.
SQ8. Accountability. Do actions taken to improve air quality result in reduced ambient concentrations of relevant pollutants, exposure, and health effects, and have we encountered unintended consequences?	(a) Accountability; air quality; epidemiology; exposure assessment; impact assessment; intervention; Erp et al. (b) Validity of observational studies in accountability analyses: the case of air pollution and life expectancy; Pope et al.
SQ9. Regulatory and policy implications. What are the policy implications of our improved understanding of the source-to-health effect paradigm?	(a) Particulate matter (PM) air pollution and health: regulatory and policy implications from an academic perspective; Lippmann (b) Role of science and judgment in setting national ambient air quality standards: how low is low enough?; McClellan (c) Understanding urban exposure environments: new research directions for informing implementation of U.S. Air Quality Standards; Hubbell

different viewpoints, those of the authors and the readers, and provides a broader perspective on the overall science-to-health outcome issue. While the policy articles (SQ9) within this issue address aspects related to specific public and private sector viewpoints, the overview paper clearly delineates a series integrated policy-relevant insights providing a different perspective than those within this issue.

Acknowledgments It was a great honor to organize the 2010 Air Pollution and Health conference and to see all six planned special journal issues published, especially this one, which puts into context the science and policy of interest to scientists, air quality managers, and policy makers in the public and private sectors across the source-to-health effects continuum. Still, the 2010 Air Pollution and Health Conference, sponsored by the American Association for Aerosol Research (AAAR), would not have been possible without the generous support of a number of organizations as indicated on the conference website (http://2010specialty.aaar.org). AAAR members along with AAAR staff were also pivotal in making the conference a huge success. Special thanks are given to Dr. Maria Costantini, conference co-chair, and others on the conference committees listed. Many of the authors of journal articles in this issue volunteered their time to produce this overarching issue to help ensure dissemination of the findings on this important subject, aimed at protecting human health and welfare. The U.S. Environmental Protection Agency through its Office of Research and Development reviewed this introduction. It has been subjected to the agency's administrative review and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Author's Note The conference website listed in the previous special issues and the overview paper has changed recently to http://2010specialty.aaar.org.

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