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BOOK REVIEW

Aerosol Inhalation: Recent Research Frontiers

Edited by J. C. M. Marijnissen and L. Gradoń

This 301 page volume containing 23 separate contributions is the proceedings of an international workshop held September 14–16, 1995, near Warsaw, Poland. The purpose of the workshop was to bring together scientists from various disciplines “to get a complete view of the aerosol inhalation, lung transport and deposition in relation to the current environment.” No single workshop or volume can be expected to achieve such an ambitious goal. However, several of the papers included provide timely and excellent reviews of important topics, and other papers present detailed reports of the specific research of the authors. In addition, two papers summarize panel discussions and two others provide perspectives on the workshop. The strength of this book lies in its several lucid papers that contain either new information or original perspectives on topics of current interest. The main weakness is that the production quality is poor. For example, some papers resemble early drafts and some have missing information because the printed page in my copy was not sufficiently wide to capture the entire complement of text. Still, the book is highly recommended to all aerosol scientists who are interested in environmental particulate exposures and human health.

The lead paper by Morton Lippmann presents a comprehensive review of early and recent epidemiological evidence for the adverse health effects of atmospheric aerosols. Lippmann considers three eras: the “highly-polluted coal-smoke era,” the “less-polluted intermediate era,” and the “recent past (since 1985).” He identifies

key unresolved questions regarding the health effects of current PM-10 (particulate mass in particles under 10 μm aerodynamic diameter), including a discussion of possible causal factors for mortality and morbidity (PM-2.5 mass, hydrogen ion, particle number, and hybrid factors such as acid-coated fine particles are suggested). With nearly 70 references, this paper provides an excellent update on the issue of modern particulate material and the related human mortality and morbidity.

The second paper, by Roger McClellan, thoroughly covers the topic of cancer risks in relation to the inhalation of diesel exhaust and carbon black. In addition to reviewing and discussing the risk assessments made by various governmental and other agencies, McClellan presents an in-depth mechanistic analysis of the numerous relevant rodent studies that have been conducted and identifies several issues that call into question the extrapolation of the results of such studies to human populations. This well-referenced chapter (with over 100 citations) presents the full complexity and identifies the important gaps in knowledge relating to risk assessments for diesel exhaust soot and carbon black. Among the author’s conclusions is that “the exposure–response relationship observed at high exposure levels should not be extrapolated to low-level exposures typical of well controlled work places or the general environment.”

Particle deposition and clearance, major emphases of the book, are discussed in 10 papers. Among these, one finds: an exami-

nation of "deterministic" and "stochastic" approaches to modeling the deposition of inhaled particles, by Werner Hofmann; a review of the current understanding of particle deposition (including ultrafine particles) in the nasal and oral airways, by David Swift; a paper on fiber deposition in bead beds as models for lung airways, by Jan Marijnissen and colleagues; a discussion of hygroscopicity and its implications for the deposition of inhaled environmental aerosols, by George Ferron and Bernhard Busch; a paper on the influence of electrical charge on the deposition of inhaled particles, by Beverly Cohen and colleagues; two papers on air flow and particle motion in the alveolus—one by Yoshio Otani and colleagues and one by Dariusz Orlicki and Leon Gradoń; a theoretical paper relating to treatment of simultaneous interacting particle deposition mechanisms, by James Gentry and N. C. Liu; a paper relating to particle clearance, by Leon Gradoń and Albert Podgórski; and an excellent in-depth review of the current state of knowledge concerning differences among animal species (and related topics) in relation to particle deposition and clearance, by Ronald Wolff. These 10 papers constitute the main strengths of the volume.

Other papers deal with a variety of topics, including a proposed optical particle counter for concentrated aerosols, by Władysław Szymanski; a discussion of the potential for extreme toxicity associated with ultrafine particles (less than 50 nm in diameter), by Günther Oberdörster; a discussion of the physiochemical characteristics of environmental aerosols in relation to human health effects, by Kvetoslav Spurny; a review of the state of aerosol fit testing techniques for respirators, by Klaus Willeke and Don-Hee Han; a description of several methods for generating and delivering pharmaceutical aerosols for toxicity testing in laboratory animals, by Magnus Dahlbäck and colleagues; a paper on the various roles that pollen grains may have with respect to environmental allergy, by Gabriel Peltre; and an unusually provocative paper by Rein

Roos, in which macroscopic atmospheric phenomena, including thermal and electrical gradients, are related to popular beliefs about health.

The final portion of the book has a set of four brief contributions. The summary of a discussion on aerosol deposition and retention, written by Patricia Keady, clearly shows that a major emphasis of the workshop was the issue of possible changes in regulatory air quality standards for particulate matter. This summary is one of the gems in this book, as it captures the variety of viewpoints (and frank disagreements) held by key scientists. The second panel discussion, on "Social, Economic-Regulatory and Research Implication of the Latest Developments in the Atmospheric Particle/Human Lung System," by David Swift, is a further elaboration on the lack of consensus regarding the basis for new standards related to particulate material. The biggest unresolved issue seems to relate to just what should be measured and/or controlled. The only point of agreement seems to be that PM-10 mass is not the proper measure.

A brief commentary by Kvetoslav Spurny emphasizes the biomodal nature of the atmospheric aerosol and the importance of basing regulations on both size and chemical characteristics. The final paper consists of remarks by Othmar Preining; this contribution also underscores the need for appreciating the full chemical complexity of the atmospheric aerosol. Preining also pointed out that the public has a tendency to develop irrational fears relating to pollution in general, and that such fears are overly dramatized by the media. He encouraged the scientific community to avoid supporting such developments and suggests that open discussion of the full complexity of such issues by environmentalists, economists, scientists, and political leaders will be needed to find "policies for an acceptable future."

Reviewed by Robert F. Phalen