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Preface

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PREFACE

SYMPOSIUM PROCEEDINGS—OCCUPATIONAL LUNG DISEASE IN RESPONSE TO MIXED EXPOSURES: APPROACHES TO IDENTIFY THE TOXICITY OF PROCESS-DEPENDENT CONTAMINANTS

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To date, the majority of exposure limits set by the Occupational Safety and Health Administration (OSHA) or the U.S. Environmental Protection Agency (EPA) have been for individual particulate agents or chemical compounds. However, modern industrial operations generate complex mixed aerosols, the components of which are often process dependent. For example, the chemical composition of welding fume varies with the type of shielding and electrode used, while microbial contamination of organic dusts or used metalworking fluids can dramatically alter the biological response upon exposure to these materials. In addition, the types and amounts of organic chemicals adsorbed onto the carbon core of particles generated by diesel engines can depend on engine speed, load, and the type of fuel consumed. There is increasing awareness that the toxicity of a mixed exposure may not simply be the additive effects of its components. Indeed, synergistic effects, involving soluble metals, adsorbed organics, surface acidity, microbial contamination, and particle size or surface area, may occur. For this reason, the National Institute for Occupational Safety and Health (NIOSH) has listed "mixed exposures" as a priority area in its National Occupational Research Agenda that must be addressed to allow appropriate and complete risk assessment in complex occupational settings.

A workshop on this issue, entitled "Occupational Lung Disease in Response to Mixed Exposures: Approaches to Identify the Toxicity of Process-Dependent Contaminants," was held at the 42nd Annual Meeting of the Society of Toxicology in Salt Lake City, UT, on March 12, 2003. The following are five reports concerning the issue of mixed exposures. The first article, entitled "Issues That Must Be Addressed for Risk Assessment of Mixed Exposures: The U.S. EPA Experience with Air Quality," by Daniel Costa, notes that ambient air represents a complex mixture of particulate and gaseous components, which are time and source dependent. Guidance is presented on methods to evaluate mixed exposures from a scientific and regulatory perspective. An article by

Terry Gordon, "Metalworking Fluid—The Toxicity of a Complex Mixture," emphasizes that the toxic properties of a mixture of components often changes with use and storage. In this case, microbial contamination of used machining fluids has been linked to pulmonary effects. James Antonini et al. present an article entitled "Pulmonary Responses to Welding Fumes: Role of Metal Constituents." In this piece, data are presented that indicate that the pulmonary toxicity of welding fume is process dependent; that is, the toxicity of mild steel versus stainless steel welding fume differs significantly. Soluble nickel and chromium and the insoluble particulate fraction play important roles in the induction of lung injury and inflammation and the increased susceptibility to pulmonary infection resulting from welding fume exposure. In the article "Effect of Diesel Exhaust Particles (DEP) on Immune Responses: Contribution of Particles versus Organic Soluble Components," Paul Siegel et al. present data indicating that the adsorbed organics on DEP depress the innate immune response of the lung by affecting alveolar macrophage function, while the carbon core of DEP enhances humoral immune response. The last article, by Jenny Roberts et al., entitled "Soluble Metals Associated With Residual Oil Fly Ash Increase Morbidity and Lung Injury After Bacterial Infection in Rats," demonstrates that the soluble metal components of ROFA play an important role in pulmonary toxicity.

It is hoped that these reports as well as the Society of Toxicology Workshop act as catalysts to increase interest in the evaluation of the adverse health effects of exposure to complex mixtures of pollutants found both in workplace and ambient air. Such research is vital in the attribution of risk to specific components of these mixed exposures and to the understanding of their interactions.