Silica and Associated Respirable Mineral Particles

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Foreword

THIS COMPILATION OF Selected Technical Papers, STP1565 on Silica and Associated Respirable Mineral Particles, contains peer-reviewed papers that were presented at a symposium held October 25–26, 2012 in Atlanta, GA, USA. The symposium was sponsored by ASTM International Committee D22 on Air Quality and Subcommittee D22.04 on Workplace Air Quality.

The Symposium Co-Chairpersons and STP Co-Editors are Drs. Martin Harper and Taekhee Lee, National Institute for Occupational Safety and Health, Morgantown, WV, USA.
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Overview

In the USA alone, it has been estimated that 1.7 million workers in various industries are affected by exposure to respirable crystalline silica. Exposure is associated with an increased risk of developing silicosis, tuberculosis, other non-malignant respiratory diseases, and autoimmune respiratory diseases. Crystalline silica is classified as a “Group One” human carcinogen by the International Agency for Research on Cancer. A National Institute for Occupational Safety and Health (NIOSH) hazard review report concluded that the estimated risk of silicosis for a 45-year working lifetime is 47–95% for cumulative respirable crystalline silica exposures at the current permissible exposure limit regulated in the USA. In addition, the same report also found the lifetime risk of silicosis to be approximately 10–30% when concentrations are equal to the NIOSH recommended exposure limit (0.05 mg.m⁻³). In the United Kingdom, the Health and Safety Executive calculated the risk to be 0.5% (1 in 200 workers) of developing silicosis, even at 0.04 mg.m⁻³. A threshold limit value (TLV) for silica of 0.025 mg.m⁻³ was accepted in 2006 by the American Conference of Governmental Industrial Hygienists (ACGIH). The U.S. Assistant Secretary of Labor for Occupational Safety and Health has also made a preliminary determination that employees exposed to respirable crystalline silica face a significant risk to their health at the current permissible exposure limits and that promulgating new proposed standards will substantially reduce that risk. A major question posed in this proposal is whether the technology of sampling and analysis is capable of making accurate measurements of workers exposure around these lower exposure limit values.

This publication of papers from the Second ASTM International Symposium on Silica and Associated Respirable Mineral Particles (together with a reprint of some papers from the 2004 ASTM Symposium on Silica: Sampling and Analysis) is, therefore, timely with respect to this current rulemaking activity from the U.S. Occupational Safety and Health Administration (OSHA), and may also be helpful to other agencies around the world which may be re-considering appropriate exposure limit values for respirable crystalline silica. The First ASTM Symposium relating to respirable crystalline silica was held in conjunction with the ASTM Committee Week Meeting in Salt Lake City, UT in April 2004. This follow-up Symposium was held on October 25th and 26th, 2012 at the ASTM International Committee Week Meeting in the Grand Hyatt Hotel in Atlanta, GA. The final program of the Second Symposium featured speakers from the USA, Canada, the United Kingdom, Belgium, France, Germany, Sweden, Norway, Ireland, Spain, South Africa and India. Although two of our speakers were forced to withdraw due to family emergencies, the Symposium still featured 23 high quality platform presentations and posters, ranging from legal issues, through
summaries of past work, to cutting edge research. We are particularly indebted for the support of researchers from the U.S. National Institute of Occupational Safety and Health (NIOSH), who provided a large proportion of the papers (six, and with co-authorship on another), and for the travel support offered by ASTM International to some of our speakers. It was the intention of the organizers from the outset that the state of the art should be recapitulated as the basis for current ideas and developments, and thus not all presentations were sufficiently novel to allow publication in this Special Technical Publication. However, the audience was able to reap the benefit of this historical perspective, which is important in any field where there is rapid change. The eleven papers that do appear in this Special Technical Publication have all been exactlying reviewed by peers and considered acceptable for publication. They are joined with reprints of those papers from the 2004 Symposium that were originally published in the Journal of Testing and Materials. The Co-Chairs trust that this volume will be an important resource for those involved in both basic research and application of research findings, as well as those involved in regulation. We respect that there are legal, economic, and social aspects to this issue and have been fortunate to have attracted speakers qualified to both tackle these subjects and assist us in placing our research in the context of greater human activity.

The basic conclusion of the scientific research work presented at this Symposium is that it is possible to accurately measure respirable crystalline silica using properly applied analytical techniques that employ appropriate calibration, as well as the highest levels of quality control, but further assurance of analytical accuracy can be achieved through increasing the sampled mass by increasing the sample volume collected. Sampling devices for this purpose are commercially available and many have been tested for performance in the laboratory (although field comparisons against lower flow samplers are challenged by the typical situation of sampled masses below the limits of analytical quantification in those samplers). There is, however, only a finite additional sample that can be collected because of the limitations on the additional burden of larger and heavier sampling equipment that will be accepted by employees. Nevertheless, it is generally agreed that exposures at current and proposed limit values can be assessed through the application of currently available technology.

Martin Harper and Taekhee Lee
Dr. Taekhee Lee (left) and Dr. Martin Harper (right) with their Awards of appreciation for outstanding service from ASTM International Committee D22 on Air Quality for organizing the Symposium on Silica and Associated Respirable Mineral Particles.