From Mines to Lungs: Navigating the Landscape of Respirable Dust Characterization

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ABSTRACT

The resurgence of Silicosis and Coal Worker's Pneumoconiosis (CWP) in mining and the escalating demand for critical minerals underscore the imperative to comprehensively address health hazards in diverse mining operations. Worker exposure to particulate matter, encompassing coal dust, silica, and critical minerals, remains a pressing concern demanding nuanced exploration.

In mining and engineered stone operations, concerns about worker exposure to particulate matter have been reignited by the resurgence of Silicosis and CWP. The established link between silica and respiratory diseases necessitates a more profound understanding of the impact of particle size, shape, and mineralogical constituents on health. While current monitoring relies on total mass, it is increasingly evident that the size and shape of particles play a crucial role in determining health impacts.

Simultaneously, the surging demand for critical minerals, integral to low-carbon economies, emphasises the need for a focused examination of their extraction and processing. Critical minerals, crucial in technologies like lithium-ion batteries and high-performance alloys, are central to achieving global environmental goals. Despite significant efforts in their development and processing, there remains a considerable gap in addressing potential health risks, urging comprehensive health risk assessments.

To tackle these challenges, the University of Queensland has developed innovative methodologies, including the Mineral Liberation Analyser (MLA), a scanning electron microscope, to characterise respirable and inhalable dust samples. This advanced technique, initially applied in coal and metals mining, is expanding to critical minerals mining, unraveling diverse mineralogical components and particle size distributions.

This conference presentation will showcase the latest research, emphasising the use of advanced analytical techniques to deepen our understanding of the size, shape, and mineralogical composition of particulate matter. By synergising insights from coal dust, silica, and critical minerals assessments, we aim to proactively manage health risks, contributing to safer workplaces and responsible production practices in the mining sector.