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Title: Exploration of Temporal Changes in Respirable Coal Mine Dust Characteristics

Organization: Virginia Tech

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Partnerships: NIOSH, Pittsburgh Mining Research Division

Focus Area: Injury and Disease Exposure and Risk Factors: Respiratory Disease

SYNOPSIS

Historic data on respirable coal mine dust characteristics is really a key puzzle piece to understanding the reasons for elevated occurrence of CWP and other pulmonary disease in miners, and thus to developing prevention measures.

Problem statement: Since the late 1990s, there has been a resurgence of rapidly progressive lung disease among central Appalachian coal miners, including relatively young miners. To explain the disease resurgence, there has been considerable speculation about changes in mining practices and conditions that might have led to changes in respirable coal mine dust characteristics. Decreased particle size or increased mineral content, for example, could affect the lung response to dust exposures. While recent studies, including those in our research group, have yielded significant data on modern dust characteristics (i.e., since 2013), there is really no comparable data available from earlier periods. This represents a huge knowledge gap and an obvious limitation to evaluating temporal trends.

Research approach: The reason that little is known about if or how dust characteristics have changed over time is that historical samples are scarce. Samples collected for regulatory compliance are no longer available for detailed characterization studies; they have generally been weighed to determine dust mass concentration, and then either disposed or destructed for silica content analysis. However, NIOSH has recently located numerous respirable dust samples that it collected as part of various Federal research projects over the past three decades. The samples primarily represent mines in Appalachia, and NIOSH has graciously agreed to provide them for this research project.

The project includes three main objectives:

1. Establish a methodology for handling the historical samples, from which dust must be carefully recovered for analysis;
2. Characterization of the historical dust samples, by SEM-EDX and other analytical methods, to gather data (e.g., on particle size and mineralogy) that can be compared with modern dust; and
3. Analysis of temporal trends, to explore what changes in dust characteristics have occurred.

Impact of the research: This project will yield long-sought data on respirable coal mine dust characteristics over the past decades, thereby allowing comparisons to modern dust characteristics. This is very significant to the effort to explain the resurgence of lung disease in miners, because evidence-based discussion on the role of changes in dust particle size and constituents will finally be possible. The data gathered on this project should also inform future studies in areas such as dust toxicity, epidemiology, and dust control and monitoring technologies.