

Follow Up Grant AFC316-11: Proof-of-Concept Work to Demonstrate Optical Microscopy with Image Analysis as a Tool for Semi-continuous Coal Mine Dust Monitoring

Initial Grant AFC316-11: Connecting Dust Characteristics and Worker Health in Underground Coal Mining

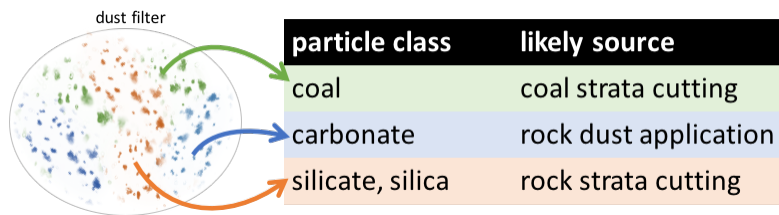
Initial Grant AFC316-17: Further Characterizing Respirable Coal Mine Particulates: Submicron Particles, Metals and Diesel Exhaust

Organization: Virginia Tech

PI: Emily Sarver

Focus of the proposed follow-on work: The follow-on project proposed here is for proof-of-concept work to support development of a semi-continuous field monitor for respirable coal mine dust. The monitoring concept involves use of optical light microscopy with automated image analysis to count and classify dust particles on samples collected at regular time intervals (e.g., every 15 minutes). Upon demonstrating the efficacy of the analytical method, we envision a second phase of work under a subsequent project to prototype a field-ready monitor. The monitor would employ an advanceable filter tape for incremental sample collection, and a simple cell-phone camera and software application for microscopic imaging and analysis.

Expected Outcome: In that prior research, we have effectively been asking “what is in the dust and where is it coming from?” We have found that there are generally four main mineralogical classes of respirable dust particles, which can often be attributed to three major sources.



This paradigm will serve as the basis for the particle classification scheme to be used in the envisioned dust monitor. The primary outcome of this work will be an optical microscopy method that can serve as the basis for a new monitor for use in coal mines.

Specific Aims of Proposed Research: To address the need for enhanced dust monitoring, we envision a novel instrument that combines established analytical techniques with new capabilities in portable microscopy. The specific aim of the research proposed here is to demonstrate that optical light microscopy with image analysis can be used to count and classify typical coal mine dust particles. This would allow an understanding of the relative contribution of dust from major sources, which may represent varying degrees of hazard and prompt different approaches to dust control. Further, with a portable microscope, this approach can eventually be applied in the field for semi-continuous dust monitoring.