Project Title: Development of a New Rock Dust Sampling Instrument

Organization: Colorado School of Mines

Partnerships: None

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Focus Area: Safety

SYNOPSIS

Problem Statement and Justification: A violent coal dust explosion at the Upper Big Branch mine on April 5, 2010 killed 29 miners and injured two. Accident investigators found that the coal dust in the mine had been inadequately inertized with rock dust and caused an explosion that propagated through miles of underground mine workings. To improve the mine operator's ability to evaluate whether mine dust is explosive, project researchers will design, build and test a pneumatic, handheld device to sample mine dust in underground coal mines, the Dust Sampling Device (DSD). The pneumatic action in the DSD mimics the dust entrainment process that happens during a coal dust explosion. Current dust sampling is carried out with a pan and brush, which may lead to inaccurate, non-representative and non-repeatable samples.

Impact of the Research: Researchers believe that an objective sampling method is necessary to help identify areas in mines where the level of inertization is insufficient and where additional rock dust must be applied. Every mine operator needs to effectively control the coal dust explosion hazard, which requires objective and accurate mine dust sampling. Researchers believe that pneumatic sampling is more accurate and objective than conventional sampling. The DSD will be used in conjunction with the NIOSD-developed Coal Dust Explosibility Meter (CDEM) and provide a near- instantaneous assessment of the coal dust explosibility hazard. Researchers expect that the DSD will become commercially available within five years.

Objective(s) and Research Approach: Researchers will use Computational Fluid Dynamics (CFD) modeling to design a handheld, pneumatic mine dust sampling unit, the DSD. The goal is to sample only the portion of the mine dust that would be entrained by an explosion and would propagate it. Mine dust that cannot be entrained because it is wet or buried too deeply will not participate in a dust explosion and therefore, should not be included in a sample. Researchers will build the DSD from commercially available components.

Researchers will first verify and document the DSD function and sampling process in the laboratory. Pneumatic sampling will be compared to conventional, pan-and-brush sampling. Next, the DSD will be tested in an actual mine setting in the Colorado School of Mines Edgar Experimental Mine, where realistic mine dust conditions can be created in a controlled environment with consistent mine ventilation. Side-by-side comparisons with conventional mine dust sampling will be carried out and documented. Finally, researchers will test, demonstrate and verify the DSD function and accuracy in several underground coal mines, again comparing results to conventional samples taken with a pan and brush.