Grant AFC215-15
Title: Improved Face Ventilation for Extended-Cut Continuous Mining using a Wing Regulator and Scrubber Control System

Organization: University of Kentucky

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Focus Area: Health and Safety Interventions
Topical Area: Dust Control

Problem Statement and Justification: During deep cut mining of coal with a continuous miner, the ventilation system has difficulty delivering fresh air to the region immediately out by the face when using curtains. Whether a blowing or exhausting curtain is used, the fresh air in the intake does not reach the face but rather takes the path of lesser resistance. For blowing systems, this phenomenon can be described as early airflow separation from the rib. This leaves a region close to the face with elevated concentrations of methane and dust. This dusty air presents a health hazard for miners operating the continuous miner and shuttle car operators as it rolls back over them, in the form of elevated risk of coal worker's pneumoconiosis. Elevated methane concentrations increase the potential for ignition, due to the action of the continuous miner's bits at the face. Various controls have been used to address this problem, including a machine mounted scrubber and sprays, but fail to address the root of the problem. Additional fresh air needs to be brought closer to the face to dilute the dust and methane generated by activity of the continuous miner.

Impact of the Research: The impact of the research will have three major influences in the mining community. The immediate impact is the knowledge gained through the research effort which should lead to an improved understanding of how to manage the health and safety hazards of dust and methane at the face, using the best combination of technology available. It will further provide a near term impact to the health and safety of the mine workers provided the wing regulator technology is advanced to a design that MSHA approves and miners will adopt. The third major lasting impact is the availability of a dust gallery for future studies which will assist the industry in meeting the new dust standards.

Objectives and Research Approach: The primary objective is to determine how best to ventilate a coal mine face, using the best available technology which includes the wing regulator. The research approach is a layered sequence of experimentation and CFD modeling that builds towards real world testing. Reduced scale physical modeling and CFD modeling add insight to the problem of air reaching the face. This in turn helps develop the next step in modeling which is full scale modeling at a dust gallery to be constructed in an underground limestone mine. This model, with the full array of ventilation controls used to ventilate the face of a room and pillar coal mine, will allow the team to determine the impact of each of these controls on dilution efficiency. This will be further served by CFD modeling. Once the response of the ventilation system is understood, a set of best practices for using the wing regulator will be developed and validated with testing at three or more mine sites. The major outputs include the refinement of a compelling piece of technology which has the potential to solve the problem of dilution of dust and methane at the immediate face, and a set of guidelines for how best apply the device in the mine, in conjunction with the scrubber and sprays systems