Dragon, Karen E. (CDC/NIOSH/EID)

From:	Jurgen Brune <jbrune@mines.edu>
Sent:	Wednesday, October 03, 2012 4:00 PM
To:	NIOSH Docket Office (CDC)
Cc:	Lee Saperstein (saperste@mst.edu); Jenkins, F. Michael (Mike) (CDC/NIOSH/OMSHR); Hugh Miller
Subject:	246 - Draft National Mining Agenda
Attachments:	Brune2012_NORA_Comments.docx

Dear Lee Mike, and NORA Administrators,

attached please find my comment regarding the NORA Draft National Mining Agenda.

Thank you for your consideration.

Jürgen

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Comment regarding the Draft National Mining Agenda

The current Draft National Mining Agenda[1] lists Objective 1: Reduce the likelihood of disasters in mines. The document cites fire, explosion, collapse of ground and inundation as main causes for mine disasters.

The sub-objectives listed in the current draft do not appear to include the prevention of methane face ignitions nor coal dust explosions which have led to some of the most devastating mine explosion in the United States, including the explosion at the Upper Big Branch mine in 2010, the worst US mining disaster in over 40 years.

I therefore suggest that the following sub-objectives be added:

Objective 1.4: Reduce the risk of mine explosions

Research must address the risk of face and gob ignitions as well as the risk of coal dust explosions that can propagate through vast areas or entire mines, killing dozens or even hundreds of miners.

Objective 1.4.1: Reduce the risk of methane face ignitions in continuous miner development and production faces

Research must address ways to improve face ventilation and water spray arrangements to dilute accumulations of methane gas and ways to incorporate active explosion barriers on continuous miners. Such barriers are currently available on roadheaders and mandated in European mines. It should not be acceptable to experience 50 or more face ignitions events annually and not addressing their causes nor way to prevent them.

Objective 1.4.2: Reduce the risk of methane ignitions in longwall production sections

Research is needed to investigate if improved ventilation around shearer cutting drums and better arrangements of water sprays can reduce the likelihood of face ignitions on longwall shearers.

[1] Draft National Mining Agenda, CDC NIOSH docket website, accessed on October 3, 2012; http://www.cdc.gov/niosh/docket/review/docket246/

Objective 1.4.3: Reduce the risk of methane ignitions in longwall gobs

Research is needed to study the ventilation and gas composition patterns in longwall gobs to create a better understanding how and where clouds of explosive methane can form and how the explosion risks can be minimized by choosing appropriate ventilation and inertization methods.

Objective 1.4.4: Reduce the risk of coal dust explosions

Research is needed to study the potential for and prevention of coal dust explosions. Research must address if the current standards of 80% rock dust inertization are sufficient. European mines require explosion barriers in addition to rock dust inertization. Research is also needed to develop appropriate sampling procedures to ensure that rock dust inertization is sufficient. Current sampling methods scoop coal and rock dust from the floor and other surfaces yet it is the concentration and mixture of dust entrained in air which determines if coal dust will explode. Finally, if it is determined that barriers can reduce the risk of coal dust explosion propagation in US mines, research is needed to develop passive or active barriers capable of arresting coal dust explosions and preventing their propagation.

Background

MSHA statistics[2] reveal that, in 2010, US coal mines experienced 56 ignition and explosion events in addition to the explosion at the Upper Big Branch mine. In 2011, 68 ignitions or explosions were reported to MSHA. Most of these events are ignitions of methane gas in continuous miner and longwall production faces. Often, local accumulations of explosive methane-air mixtures are ignited by cutting bits. If the quantity of explosive gas is limited and unconfined, these ignitions deflagrate without developing much pressure and with a limited flame volume. In most cases, no miners are injured. However, if the volume of explosive gas mixture is larger and/or there is a presence of float coal dust in flammable concentrations, any face ignition can turn into a devastating explosion.

A number of mine explosions and fires originated from methane ignitions in longwall gobs. According to official investigation reports, the fires at the Willow Creek mine (1998 and 2000, 2 fatalities in the 2000 fire) and at the Buchanan Mine (2005 and 2007) resulted from ignitions within the gob or from explosive gas mixtures pushed from the gob into the active face areas, where they ignited. Numerous other instances are reported where methane ignited in mined-out areas. It is likely that all bleeder-ventilated gobs contain clouds of explosive methane-air mixtures along the fringes, and these clouds can be ignited within the gob or pushed into the active mining areas by roof falls or sudden barometric pressure drops.

On April 5, 2010, an explosion at the Upper Big Branch mine in West Virginia fatally injured 29 miners. It is suspected that this explosion was caused by coal dust that had been dispersed in air and ignited by a methane-air explosion. The initial methane-air mixture may have been located in the gob near the tailgate.

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[2] Mine Safety and Health Administration, Accident and Injury Database

U.S. mines use inert rock dust (usually limestone dust) mixed with the fine coal dust to prevent coal dust explosions. Based on NIOSH research findings, in 2010 the amount of incombustible dust required to mix with the coal dust has been increased to greater that 80% throughout the mine.

A current NIOSH research project examines the methods of determining the adequacy of rock dust through proper sampling and analysis procedures including an assessment of the coal dust explosibility meter.

European standards also require a minimum of 80% inert dust throughout the mine – this standard has been established since the 1970's. As supplementary protection, European coal mines employ passive barriers to stop developing coal dust explosions. In these barriers, rock dust or water troughs are arranged on shelves in the top third of the entry cross section. The pressure wave from an explosion will dislocate the shelves and the water or dust will extinguish the explosion. Although the barriers are quite effective, the technology is not used in U.S. coal mines. Researchers in the U.S., Poland and Germany have conducted much experimental research to determine the most effective design and arrangement of passive barriers.

Researchers at the Colorado School of Mines reviewed 25 recent explosions and believe barriers would have helped in several cases, including the Jim Walter Resources No.5 mine explosion in 2001 as well as the Upper Big Branch explosion in 2010.

Besides passive barriers, there are also active or triggered barriers. In these barriers, a propellant is used to disperse the extinguishing agent, rock dust, water or a chemical powder. The propellant is triggered by a flame sensor, a pressure sensor or a combination. The advantage of a passive barrier is that much less extinguishing agent is required since it is possible to time the dispersion of the extinguishing agent much better so that it is released at the right moment as the explosion flame passes the barrier. Therefore, passive barriers can be designed in a compact, movable arrangement which may be suitable for use as a supplemental explosion protection device for U.S. coal mines. Unlike rock dust, diammonium phosphate is capable of extinguishing even a methane-air explosion, and compact triggered barrier arrangements using this substance are mandated for roadheaders in coal mine development in Europe.

Still, European mines do not currently use triggered barriers in place of passive barriers. While much experimental research on coal dust explosions and the function of triggered barriers has been conducted by European, U.S., South African and Australian researchers, test results have been mixed. Full scale explosion tests are expensive and there are few facilities worldwide that are suited to perform such tests. We believe that computational fluid dynamics (CFD) numeric modeling would be useful to better understand the reactive flow phenomena in a coal dust explosion and of the mechanisms of extinguishing these explosions with barriers. Modeling cannot eliminate experimental testing but it can greatly reduce the number of experiments required. Numerical modeling these complex dust explosions will involve development of large amounts of new programming that will need to be written and verified using laboratory and full-scale testing.