

Zipf, Richard K. (Karl) (CDC/NIOSH/PRL)

From: McNider, Tommy [TMcNider@jwrinc.com]
Sent: Friday, February 16, 2007 10:21 AM
To: Zipf, Richard K. (Karl) (CDC/NIOSH/PRL)
Cc: Donnelly, Rich; Marston, Bill; Humphreys, Johnny; Ferguson, Alan; Byram, Dale; jll@bellsouth.net; BWatzman@nma.org
Subject: RE: Draft seals report

Dear Jurgen,

Thank you for having Richard send me a copy of the report concerning sealing underground. Jurgen I am concerned that this report has set the footprint that MSHA will use in allowing an operator to seal. If MSHA follows NIOSH's recommendation, which I think they will, then sealing will be very difficult if not impossible to do. I am not in the position to argue the physics of an explosion but it seems strange that we have gone from one extreme to another. To me it seems that to have a 640 psi explosion would require the different factors to line up perfectly. It is like having the perfect storm, what are the odds of this happening.

If the odds are favorable, why does the rest of the world accept 75 psi seals? I don't think the physics of an explosion has changed and I know other parts of the world have dealt with sealing methane latent atmospheres. Jurgen you have worked for a coal company and I think you know to build a 640 psi seal in remote areas of a mine will be virtually impossible to do. To build a seal out of concrete which I am assuming would be 2-3000 psi is much different than pumping 2-400 psi cement. I think we have overlooked the good that sealing can do for a mine such as controlling spontaneous combustion, more efficient ventilation, eliminating inspections in deteriorating areas of the mine, etc. (I think we have lost the practicality that must be blended with the science).

Several of the explosions you referenced in your report are believed to have ignited because of lightning. Did NIOSH consider trying to eliminate this potential by looking into how enough energy gets into the mine to ignite the gas? Could it be that steel protruding into the sealed area could be the conduit? What about stopping steel short of the mine or running non-conductive material into the sealed area such as fiberglass or some other material. Also closer inspections of seals underground to make sure steel does not enter the sealed area in these locations. In my conversation with experts in this area the primary control is to not have steel enter the sealed area, the surface is not the concern but underground.

In your report you discuss managing a gob, how do you do this when a sealed area can be several miles long by several miles wide. With the type topography that we have how do you do this. What about out west in the mountains. Managing leakage through a seal line implies pressure balancing this line that can be several miles long. This can be difficult for a seasoned ventilation man much less many of the people who will be responsible to manage this. To properly balance a seal line could mean frequent adjustment of the regulators. The sealed area reacts to the barometer and it is constantly changing some areas of the country worst than others.

In summary, to me, a much better approach would have been to provide a safer sealed environment by the following:

- Increase the strength of a seal to say 100-120 psi which would be far greater than 20 psi and stronger than what anyone else in the world requires.
- Reduce the ignition potential caused by lightning by not allowing steel to enter the sealed area once the area is sealed.
- Reduce leakage by requiring a minimum thickness of the seal or some way to reduce flow paths around the perimeter of seals.
- Have a responsible person at the mine to assure that seals are constructed properly. If it is a specialized construction insist that it is constructed with the assistance of the technical representative selling the seal material.
- Once an area is sealed under the above criteria it is sealed.

-----Original Message-----

From: Zipf, Richard K. (Karl) (CDC/NIOSH/PRL) [mailto:rbz3@cdc.gov]
Sent: Friday, February 09, 2007 12:23 PM
To: McNider, Tommy
Subject: Draft seals report

Hi Tommy,

My colleague, Jurgen Brune, thought you might be interested in having a copy of the NIOSH draft report entitled, "Explosion Pressure Design Criteria for New Seals in U.S. Coal Mines."

This report addresses two critical issues: 1) what explosion pressures can develop during an explosion within a sealed area?, and 2) what are appropriate design criteria for seals that will withstand these pressures?

Based on fundamental knowledge of explosion chemistry and physics and knowledge about sealed areas in mines, NIOSH engineers recommend a three-tiered explosion pressure design criteria for seals in coal mines.

- 1) For unmonitored seals where there is a possibility of methane-air detonation behind the seal, the recommended design pulse rises to 4.4 MPa (640 psi) and then falls to the 800 kPa (120 psi) constant volume explosion overpressure.
- 2) For unmonitored seals with little likelihood of detonation, a less severe design pulse that simply rises to the 800 kPa (120 psi) constant volume explosion overpressure, but without the initial spike, may be employed.
- 3) For monitored seals where the amount of potentially explosive methane-air is strictly limited and controlled, engineers can use a 345 kPa (50 psi) design pulse if monitoring can assure 1) that the maximum length of explosive mix behind a seal does not exceed 5 m (15 ft) and 2) that the volume of explosive mix does not exceed 40% of the total sealed volume.

Based on these explosion pressure loads, NIOSH engineers used a dynamic computer modeling program and other methods to determine minimum seal thickness to resist these explosion pressure loads. The analyses show that resisting the worst case 4.4 MPa (640 psi) design pulse is reasonable using modern materials. For example, a 6.1 m (20 ft) entry that is 1.5 m (60 in) high requires a 0.9 m (36 in) concrete seal, whereas a 2.4 m (96 in) high seam would require a 1.2 (48 in) concrete seal.

The report also provides an alternative to these worst-case scenarios, if the atmosphere behind the seals is monitored and inerted, as is done in many mines abroad. In that case, seals to withstand a pressure of 345 kPa (50 psi) may be adequate.

If you have any thoughts on the report, please let me know.

All the best,

Karl Zipf

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