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

From: Lyne Brian [Brian.Lyne@dme.qld.gov.au]
Sent: Thursday, March 08, 2007 11:40 PM
To: Zipf, Richard K. (Karl) (CDC/NIOSH/PRL)
Cc: Brune, Jurgen F. (CDC/NIOSH/PRL)
Subject: FW: Seal designs in Queensland

Hi Karl, Jurgen
Here are some comments that I have made recently that you may find of interest
Regards

Brian Lyne

Chief Inspector of Coal Mines
Mines Inspectorate
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From: Lyne Brian
Sent: Tuesday, 27 February 2007 4:11 PM
To: 'Sproul.Kenneth@dol.gov'
Cc: Bell Stewart
Subject: Seal designs in Queensland

Dear Kenneth
In reply to your questions I am happy to advise that your understanding is correct on the use of seals in Queensland.
In practice, we use 50 psi seals where they are permanent structures sealing an area adjacent to ongoing working areas of the mine.
as the seals usually take several days to cure after building, mines commonly inert the sealed area (almost invariably). We would not leave a sealed area with explosive mixtures of methane contained other than the immediate fringe of gas behind the seal where it is under the influence of diurnal pressure changes and leakage through the seal.
We have literally hundreds of seals built in our mines, but could not estimate the number.
we originally required all seals to be tested at Lake Lynn but have now accepted certified Professional Engineering designs due to the large size range of seals being built in our mines and the wide range of materials being used.
They all have a 3hr fire rating as well
All of our mines are multi heading bord and pillar design and it is our belief that methane gas explosion pressures would not likely exceed 20 psi unless it involved coal dust. As people cannot survive an 20 psi overpressure, we have focussed on allowing survivors in other areas the ability to escape from the mine in any atmosphere.
From what I have read coming over here in reports from the USA, it seems that seal design has become a scientific/engineering program and not risk management based. The Sago explosion appears to have not progressed very far outside of the seals. Why not have a smaller seal and use inert gas to control the risk?
Using Risk Management logic, it uses one of the HIGH ORDER controls - Substitution.
Hope this helps in your consideration
Regards

Brian Lyne

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

From: Lyne Brian [Brian.Lyne@dme.qld.gov.au]
Sent: Friday, March 09, 2007 2:06 AM
To: Zipf, Richard K. (Karl) (CDC/NIOSH/PRL)
Subject: RE: Draft report on seals

Karl
Thanks for the invitation to comment on the draft document I have not been able to read the entire document but have had a brief scan through its contents. We will be giving some of your logic consideration over here in due course.
Comments
1 we have not had the experience of probable lightening strikes that you guys have had, all of ours have had identifiable ignition sources other that Moura No 4 in 1986 which was eventually put down to a faulty flame safety lamp. There are many who are yet to be convinced over that however--
2. the report appears to ignore what we see as the prime risk after a sealed area is inert, That is the failure of the seal. Seals can fail due to three events,

1.overpressure due to use of explosives or a methane gas explosion elsewhere in the mine in the intake airways

2.strata failure, floor heave or failure of the seal materials due to chemical action

3 mechanical failure due to uncontrolled vehicle movement If the seals fail after a methane explosion such as Moura No 2, rescue teams cannot re-enter the mine safely due to the residual explosive atmospheres. We have proof from our gas monitoring records that there is a lot of oxygen left in a mine after a methane explosion and if new sources of methane are freed from old sealed areas, that will prevent re entry by mines rescue persons every time.
3. it is not clear why an inert atmosphere needs a 50psi seal. Is there some technical explanation in the report some where or is it introducing a factor of safety?
4 it appears that it is assumed that a risk of explosion exists where a sealed area leaks oxygen and makes an explosive atmosphere immediately behind the seal. Does this mean that the ignition source is either lightening of someone using oxycutting in front of a seal? We have yet to experience such a circumstance and considerate most unlikely
5 the scientific diagrams in the appendices are interesting with 120 psi figuring regularly. What happened to the early research of Nagy where the 20psi level was measured? Why was it so wrong? (or is this a computer generate figure)
6 We could not comply with a licensed professional engineer inspecting and certifying every seal was installed correctly to their design This would be a job with a lot of travel due to the spacing of mines throughout the state. I could only think that it would be worse in the US
7 if the only hazard is by damaging the seals from the intake side, then if the pressure is over 20psi, the chances of people surviving is approaching zero. What is the purpose of the seal for explosion pressures over 20 psi? the risk management logic is not clear here
8 The report from line 463 covering Australian practice, omits to identify the Queensland practice of designing seals to stay operational after a methane ignition in a multi heading panel. 20psi seals are designed to keep the gasses in, not prevent the area exploding.

I trust you are well.
Kind regards

Brian

Brian Lyne

Chief Inspector of Coal Mines

Mines Inspectorate
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-----Original Message-----
From: Zipf, Richard K. (Karl) (CDC/NIOSH/PRL) [mailto:rbz3@cdc.gov]
Sent: Saturday, 10 February 2007 12:58 AM
To: Lyne Brian
Subject: Draft report on seals

Dear Brian,

I hope all is well with you since our last communications several months ago. Jurgen and I have been very busy developing our report.

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

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

R. Karl Zipf, Jr., Ph.D., P.E.
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Zipf, Richard K. (Karl) (CDC/NIOSH/PRL)

From: Lyne Brian [Brian.Lyne@dme.qld.gov.au]
Sent: Thursday, March 15, 2007 1:27 AM
To: Zipf, Richard K. (Karl) (CDC/NIOSH/PRL)
Subject: Seals

Karl
A question that Jan Oberholzer and I have had over a long period is "what is the definition of a failed seal?"
All seals leak and the surrounding strata, particularly the roof and floor.
Do you have any specification for sidewall adherence for the 50 psi seals?
Regards

Brian Lyne

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

From: Lyne Brian [Brian.Lyne@dme.qld.gov.au]
Sent: Wednesday, March 14, 2007 7:38 PM
To: Zipf, Richard K. (Karl) (CDC/NIOSH/PRL)
Subject: RE: Draft report on seals

Greetings Karl
Thanks for the explanation, I can now see where you are coming from a little better. What still seems to be missing is the big picture overview by MSHA. You have presented the science of explosions but what appears to be lacking is the logic of where it fits into practice.
What is the risk regime that is being catered for?
Is it to protect life or property and LIFE?
These high numbers in the draft standard appear to be protecting "property and life".
The Qld approach is if the companies want to take the risk of blowing up their mines when no one is there, it is an insurance matter, not a health and safety matter The are two additional parts of the standard that I thought would be beneficial for mining engineers to make informed judgements
1 A statement of expected explosive pressures on seals from ignitions of methane gas in operating mining areas such as longwall faces and continuous miner panels. I think that this is an important omission. I for one would take a great deal of notice of what your studies determined. To me, this is the key part of the design for seals and will prove or disprove whether 20 psi of 50 psi seals are required for mines where inertisation practices are conducted. I do note that you consider that 20 psi would be fine and this is also my expectation.
Confirmation by science would be good.
2 Explosive pressures that would cause 100% fatalities for people working in areas of a mine.
I know there has been a lot of research in the latter matter and that the armed forces have information developed during the Vietnam war.
There is also a difference in the effects on a person of the shock wave from explosives and methane gas ignitions that I understand are considerable. To my knowledge it has not been documented. Jurgen Michelis from Tremonia might have some relevant information but I am not aware of any published information, especially in English.
Kind regards

Brian Lyne

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-----Original Message-----
From: Zipf, Richard K. (Karl) (CDC/NIOSH/PRL) [mailto:rbz3@cdc.gov]
Sent: Thursday, 15 March 2007 4:47 AM
To: Lyne Brian
Subject: RE: Draft report on seals

Hi Brian,
Thank you very much for your comments. I'll respond in more detail to each shortly. Just one short comment on the 120 psi number - That is the so-called constant volume explosion pressure that develops when virtually any explosive mix (methane-air, coal dust-air, fuel-air) is ignited under completely confined, adiabatic conditions. It appears that earlier workers on sealing mines (Mitchell 1971 or Nagy 1981) did not fully consider the constant volume explosion pressure. Unfortunately, much of the chemistry and physics of methane-air explosions that we set forth in our report may not be fully appreciated by mining engineers at this time. We lay out what the worst case explosion could generate.

Fortunately, detonation of methane-air in mines has only been seen a few times - the Blacksville shaft explosion in 1992(?) and possibly Sago.

Our hope is that more mines in the US will adopt the monitoring and inertization practices so well developed in Australia. By monitoring and actively managing the sealed area atmosphere as done in Australia, we recommend that 50 psi seals are adequate, although I personally believe that 20 psi seals are perfectly fine if the monitoring is sufficient. However, for unmonitored and uncontrolled sealed area atmospheres, which is the common practice in the US, the explosion pressures have been seriously underestimated, that is until the appearance of our report.

We will be finalizing our report in the next month or two, and it may influence future MSHA regulations. I'll sent you a copy straight away and keep you informed as the drama unfolds.
All the best,
Karl

R. Karl Zipf, Jr., Ph.D., P.E.
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All the best,

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