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

From: Sam Spearing [sspearing@excelminingsystems.com]
Sent: Wednesday, March 14, 2007 4:33 PM
To: Zipf, Richard K. (Karl) (CDC/NIOSH/PRL)
Cc: Jim Earl, Jr.; John McDonnell; Scott Shapkoff
Subject: Comments on your NIOSH explosion proof seal paper

Attachments: explproofsealscommentsmar07.doc

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Hi Karl,

Great thorough paper, here are my comments as requested.

Hope to see you soon,

Best regards,
Sam

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SOME COMMENTS ON THE NIOSH REPORT ON EXPLOSION PROOF SEALS AS REQUESTED BY KARL ZIPF

March 14, 2007
Sam Spearing

Further to our brief discussion at the SME and after listening to your very comprehensive and well-presented lecture, I have the following comments on the paper, which I downloaded off your web site as you requested:

- I cannot comment on the analytical/modeling approach as I have not been involved in such work for many years. On the face of it however it all appears logical (and what would be expected from a very small seismic event).
- The two options investigated also make sense (i.e. monitored and unmonitored seals) and as we discussed the Australians in particular have considerable experience and success in using monitored seals. The main potential downside of monitoring seals is that action must be taken when indicated and without delay.
- Under an effective "monitoring and action" scenario I can see no reason why most current seals (50 psi and possibly even 20 psi) should not be adequate.
- The design charts (Figures 25 to 27 on pages 114 to 116) giving minimum seal thickness do not take into account the "keying into" the rock walls and the need for some minimum seal thickness (site dependent due to local geology) such that the explosion pulse cannot by-pass the seal and travel around it through the immediate surrounding rock.
- I do however believe that the design charts are missing the most technically and cost effective solution. This involves the use of "yielding support" – the same way as tunnel support is designed in seismically active areas. The most effective way of handling dynamic loading is by systems that absorb energy. In the case of seals this would be mainly low strength foams (say only 50 to 150 psi compressive strengths). The optimum properties could be established using a numerical code with dynamic loading ability (UDEC, 3DEC or PFC I guess could work). These systems would have numerous important benefits such as:
    - Existing products and proven experience and placement.
    - Energy absorption by "yielding/deformation" is the most effective and proven method to overcome dynamic loads (common in nature).
    - Ease of placement.
    - Relatively low cost.
    - Ease of rehabilitation after an explosion.
    - The seals would need to be wide and thus the mechanical key with the rock would be good possibly avoiding the need to "key it into the rock".
- It would seem that a weak foam would only have to be deformed/compressed by a couple of feet to absorb a 640 psi dynamic pulse. At Vaal Reefs Gold Mine in South Africa we used a foam around a tunnel that intersected a major seismically active fault and it sustained several rockbursts (>2 on the Richter Scale) with little damage.

Based on this very brief review therefore I don't share the industry's concern that creating unmonitored seals to withstand a pulse of 640 psi will be a huge cost although it will clearly increase the costs. The most logical approach however would still seem to be a monitored seal, but here again I still believe that a yielding/compressible material is the optimum approach.

If you want to discuss this further, please do not hesitate to contact me.