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

From: Stewart Gillies [S.Gillies@minserve.com.au]
Sent: Tuesday, March 13, 2007 6:00 PM
To: Zipf, Richard K. (Karl) (CDC/NIOSH/PRL)
Cc: h.wu@minserve.com.au
Subject: Re: Review of "Explosion Pressure Design Criteria for New Seals in US Coal Mines"
Attachments: ReviewCommentForm.doc

Oops, forgot attachment

Karl,
Please find attached a review of your report.
It is by and large a water-shed report in terms of aspects you have included, the depth of thinking and a major step forward from the past.
Congratulations to Jurgen, Mike and yourself for your efforts.
Regards,
Stewart

At 04:26 PM 02/08/2007 -0500, you wrote:

> Dear Stewart,
>
> I hope all is well with you since our last communications several months ago.
>
> Attached is a copy of the NIOSH draft report entitled, "Explosion Pressure Design Criteria for New Seals in U.S. Coal Mines." I would like to ask for your review of this draft report.
>
> 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.

At this time, I ask for your thoughtful review of this draft report. Please use the attached review form and attach additional comments. I'd like to receive your comments no later than Friday 9 March 2007.

Thank you very much for your time and consideration. I look forward to receiving your comments on this important topic.

Best regards,

Karl Zipf

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Try the new Web Site http://www.cdc.gov/niosh/mining/

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NIOSH MANUSCRIPT REVIEW FORM

Reviewer: A. D. Stewart Gillies Affiliation: Director, Gillies Wu Mining Technology Pty Ltd

Please review the attached manuscript and return the comments, in the areas checked below, to the author:

X Technical __Statistical __Editorial __Policy DUE DATE: 9 March 2007

TITLE: "Explosion Pressure Design Criteria for New Seals in U.S. Coal Mines"

AUTHOR(S): R. Karl Zipf, Jr., Michael J. Sapko and Jurgen F. Brune

ANTICIPATED JOURNAL: NIOSH numbered information circular

TECHNICAL REVIEW

Technical reviews are requested from persons known to be competent to appraise the scientific and technical quality of a manuscript. Any delegation of the review should be with the authors concurrence.

The purpose of the technical review is to review the technical validity of the information, and not matters of style or usage. If there are errors of fact, unsubstantiated claims, evidence of careless experimental work, inclusion of too much information already in the literature, or statements that are vague or ambiguous, these should be pointed out.

	YES	NO (explain below)
Does the abstract include the specific objective of the work, the techniques employed, and the significant results?	X	
Is the abstract clear and concise?	X	
Does the introduction explain the problem, outline earlier or concurrent work, and explain the author's approach?	X	
Are the methods adequately described?	X	
Are the conclusions supported by the data?	X	
In general, is the organization of the manuscript satisfactory?	X	
Are the tables clear and appropriate?	X	
Are the figures clear and understandable?	X	

Are there any technical errors in this manuscript?

X No errors G Minor technical errors G Major technical errors (please describe)

STATISTICAL REVIEW

The purpose of statistical review is to insure that proper statistical techniques were employed in the manuscript and that any statistical results given in the text are properly conveyed to the audience.

	YES	NO (explain below)
Is the experimental design adequately described?	N/A	
Are the statistical methods appropriate?	X	
Are the conclusions consistent with the statistical analysis?	X	

EDITORIAL REVIEW

The purpose of the editorial review is to insure that proper grammar and punctuation is used in the manuscript and that sentences in the manuscript are written clearly. Aspects elating to format and style should be left to the discretion of the author.

	YES	NO (explain below)
Is the manuscript organized appropriately?	X	
Is the language of the manuscript acceptable as written? If not, is the paper wordy?	X	

If not, are the editorial errors: Major X Minor

If the errors are major, should the paper be removed from the clearance process?

POLICY REVIEW

The purpose of policy review is to insure that manuscripts either do not contain any policy statements, that any policy statements in the manuscript are consistent with existing policy, or that any statements indicating possible changes to policy are approved.

YES NO (explain below)
Not Aware

Does the manuscript contain policy issues?
If yes, does the manuscript suggest a change in NIOSH policy?
If yes, does the manuscript recommend new NIOSH policy?
Should the manuscript be reviewed by the Director, NIOSH for policy issues?

What is your recommendation for this manuscript?

Approve X Approve after modification Not Approved

REVIEWER: A. D. Stewart Gillies

Signature: A Stewart Gillies DATE: March 2007

Reviewer Comments

The cover note by Dr Karl Zipf requesting technical review of this report states that it 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?

In addressing point 1 I am of the view that the authors have made a major contribution in logically approaching this questions and developing a rational approach. Following a comprehensive introduction covering the mining situation, approaches in other countries and basic pertinent science they have set down their three-tier explosion pressure approach. In covering the mine void geometry and the link to coal dust explosibility they answer many of the questions avoided by earlier researchers.

The authors identify seal applications dealt with for districts, panels and crosscuts. This is fine, however, the comment page 5 that crosscut seals "may be constructed if spontaneous combustion potential is high" is restrictive. They are used in other applications eg for reservoir containment of methane entering commerce or as demanded by regulations in some jurisdictions.

I find the authors approach to dealing with critical issue part 2 good in part but limited. The explanation given with the development of design charts from WAC or plug analysis to assist structural design is excellent. However for completeness two aspects warrant attention.
a) The theoretical approaches need testing. Many stoppings and seals have been tests at Lake Lynn Experimental mine (as discussed in literature by Eric Weiss and others). Tests have been undertaken elsewhere, eg at Testsafe Australia as discussed by R.D. Pearson, A.D.S. Gillies, A.R. Green, R. Day and P. Dux, 2000 *. How do these stand up to use of the new design charts?
b) It would make sense to recommend both a **location** and a structural design (thickness, material properties, etc) for seals. If we accept that seals must isolate panels and districts from Sub-mains and Mains respectively what is the situation with isolating the active panel from adjacent panels ie should all crosscuts between adjacent working panels and gobs need seals? There are often long sequences of gobs form worked out longwall panels. An explosion initiated in any one of these old gobs within the current mining sequence can devastate a mine if there is no means of sealing them from the rest of the mine. (I avoid commenting on the issue of what happens when an explosion is initiated within the gob of the current active mining panel).

The report contains various minor textual issues that I am sure will be picked up in editing. Conformity in use of metric units would assist. I also would point out that there are no Australian (federal) coal mine regulations, rather best to say Australian Queensland or Australian New South Wales regulations. Also the Tomlinson engine is fuelled by diesel not jet gasoline.

In conclusion this report has been researched well. It will in future be seen as having being pivotal in moving understanding of this very complex area forward. Before finalisation for topic completeness I recommend that the issue of seal location is adequately addressed.
Stewart Gillies
March 2007

* R.D. Pearson, A.D.S. Gillies, A.R. Green, R. Day and P. Dux. Evaluation of a full scale pressure test for ventilation control devices, *Australian Coal Association Research Program* Grant C8006, November 2000.

Λ Check here if you want to recieve a copy of the final manuscript: X