

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

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**From:** bessinger@hughes.net  
**Sent:** Monday, March 12, 2007 8:32 AM  
**To:** Zipf, Richard K. (Karl) (CDC/NIOSH/PRL); Zipf, Richard K. (Karl) (CDC/NIOSH/PRL)  
**Cc:** bessinger@hughes.net  
**Subject:** ReviewCommentForm  
**Importance:** High  
**Attachments:** ReviewCommentForm.doc; SLB Comments for NIOSH 031107.doc

Karl,  
Comments attached. Please consider them a draft if time deadlines permit review and revision, or final if not.  
Thanks,  
Steve

The document appropriately reflects the physical phenomena being investigated. The bounding cases of explosion pressure are properly described based on experimental and anecdotal evidence as well as theoretical analysis. If this is the limit of the scope of the investigation, the report is effectively complete. However, even though the authors may have envisioned a limited scope, the practical reality is different.

Because of an extreme need for business continuity by mine operators and approval guidelines by regulatory officials, this report will probably be the defining descriptive and design guideline with respect to explosion pressures and design of blast resistant mine seals. There is also a year-end deadline for the emplacement of mandated regulations. All of these factors considered, the scope of this document should be expanded to include at least minimal discussion of factors relevant to end-users. It is also important that the authors elaborate on their thinking in the development of the design examples, as interpretation by less informed parties will fill the gaps, errantly in some cases and with excess conservatism in other cases.

Although the authors correctly identify that this analysis describes the upper limit of explosion pressures, it should be emphasized as such. The authors acknowledge that various factors exist that can diminish the pressure pulse to be resisted by the mine-seals, but do not develop the subject in detail. It is an **imperative** to discuss, at least conceptually, how the governing parameters can interact to yield diminished explosion pulse pressures in the 95-percentile of actual or potential explosion events underground. The 90-percentile or 95-percentile limit would more correctly describe the required design pressure for a seal. This must be conceptually correct, since there are 10,000s to 100,000s of seal-years of acceptable performance from seals nominally designed to 20 psi, and often performing at lesser levels. It is not likely that this largely acceptable performance is attributable to the absence of gob-explosions. With a largely acceptable performance history, there needs to be a societal cost-benefit analysis (CBA) to justify much higher design standards and the companion costs to mine operators and altered hazard exposure to miners. This type of CBA is a well established principle by the FAA, DOT, and other regulatory organizations. It often yields statistical assessments as suggested above, and phased solutions over time instead of a step-change in requirements with mandates for immediate implementation on an industry-wide basis. Although the authors do not create or implement regulations, they must recognize their importance as inputs to the process.

For operators and regulators to achieve their individual and mutual needs, a number of details need to be described in some detail by the authors.

- What design pressure pulse is required for the various conditions? (Pressure vs. Time)
- If balance chambers with inert gas are used, what explosion pressure pulse is required? In concept, no oxygen can be introduced through "in-gassing".
- What design benefit can be assigned to monitoring of gob atmospheres?
- What method or frequency of monitoring is acceptable to define safely inert gob atmospheres?
- What monitoring point location should be defined to safely removed explosive compositions away from seals?
- Should samples be cross-sectional, roof-floor, or point samples near the roof?
- What response should arise from the detection of explosive compositions behind approved seals, un-approved seals?
- Can recirculated coal mine methane be used to maintain inert atmospheres? Initial inertization with methane is not possible.
- What physical performance defines acceptable explosion resistance to a structure? I believe that 100 cfm through the structure, at 1 in. water gauge pressure differential across the structure, was defined as acceptable by past investigators.
- What pressure differential for designs is required from mine-to-gob, and gob-to-mine for each mine scenario? 20 psi mine-gob and 50 psi-650 psi gob-mine?
- If 100 cfm flow after an event is acceptable, what failure mechanisms must be considered?
- Is keying structures into the roof necessary? What about floor and/or ribs?
- What options are available if shear-connection is required?
- What analysis method and boundary conditions are appropriate for design purposes?
- Can other geometric shapes than a straight wall be used?
- What efficient design considerations can be recommended?
- What design verification testing is appropriate? Suggested method, ie. Air-over water static or dynamic pressure pulse?

- Are in-situ underground and/or laboratory experimental demonstrations acceptable for design validation or in-lieu of design analysis, particularly where significant analyst judgment must be invoked to facilitate the analysis? (Analyst judgment is often a source of contention between designers and reviewers, and can be difficult to objectively resolve)
- Must the prevention of projectiles be integrated into structures that are determined to acceptably sustain the prescribed pressure pulse? Such a capability seems un-necessary.
- What factor of safety is required for design purposes? Can this be based on statistical process analysis of materials and construction methods to yield a minimum structural outcome from field construction. (FS= 1.0+ for field outcomes)
- What consideration should be made for site convergence at seals to prevent damage?
- Can roof-support such as "cans" or cribs be used to shield seals from blast damage?
- Is it possible to have a simple robust rule-of-thumb design as one alternative and rigorous independent as another route to acceptable designs? Some operators cannot support significant engineering design efforts, and others would seek customized designs.
- Should potential ignition sources be addressed? Lightning, spontaneous combustion, etc.

If the authors address these concerns, and others from additional stakeholders, this complicated subject may find successful resolution in the near-term. If these concerns cannot be addressed, inappropriate regulations are likely to be promulgated by regulatory agencies leading to un-necessary adverse impacts to mine-operators, mine-workers, and the public which depends on coal mining to fuel electricity generation.

For, my part, I thank the authors for their diligent and rigorous work on this important matter and for offering me the opportunity to participate as a reviewer.

Stephen L. Bessinger, Ph.D., P.E.  
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# NIOSH MANUSCRIPT REVIEW FORM

Reviewer: Stephen L. Bessinger

Affiliation: \_\_\_\_\_

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

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?		
No errors            X Minor technical errors            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?		
Are the statistical methods appropriate?		
Are the conclusions consistent with the statistical analysis?		

### 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 relating to format and style should be left to the discretion of the author.

	YES	NO (explain below)
Is the manuscript organized appropriately?	G	G
Is the language of the manuscript acceptable as written?	G	G
If not, is the paper wordy?	G	G
If not, are the editorial errors:	G Major	G Minor
If the errors are major, should the paper be removed from the clearance process?	G	G

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

What is your recommendation for this manuscript?

G Approve      G Approve after modification      G Not Approved

REVIEWER: \_\_\_\_\_

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Large empty rectangular box for providing detailed comments or explanations.

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Reviewer Comments