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

**From:** Olav Roald Hansen [olav@gexcon.com]
**Sent:** Tuesday, February 27, 2007 5:35 AM
**To:** Zipf, Richard K. (Karl) (CDC/NIOSH/PRL)
**Subject:** Re: Report on seals

Dear Karl,

Thank you for sending the draft report, and sorry for not responding before.

Here everything is fine, life is busy, but very interesting.

I do not think I have any severe comments on your design recommendations. As we discussed at the meeting in Bergen, there will be a range of possible measures that can be taken to minimize the risk for major explosions, like installing numerous weak barriers (to limit the homogeneity of gas), various kinds of partial inerting etc.

Regarding the presentation of FLACS, I am not 100% satisfied (not sure if you directly see the reasons for this, I will explain). Like we discussed last fall, we simulated 6 different scenarios blind (even if we got a glimpse of the results before sending our predictions to you).
Through our discussions in the summer, I several times stated that calibration was not something we normally did when doing calculations with FLACS. All 6 scenarios were predicted within about +/- 10%, we were very happy with this.

In the report only one of these 6 "calibration" scenarios are shown, and our simulations are presented next to AutoReaGas simulations (AutoReaGas definitely needs calibration tests to produce reasonable results). So for the typical reader of the report, the efforts and predictions with FLACS may seem very comparable to that of AutoReagas. Only the critical reader will see that there is a significant quality difference between the FLACS predictions and the AutoReagas simulations (e.g. looking into multiple peak structures and 32m/160m predictions).

5-10 years ago in the UK, several companies decided to use AutoReaGas for their explosion work. Last year at least 4 companies that used AutoReaGas in the past started using FLACS instead (3 from UK, 1 from Canada). All of them clearly expressed how they could work more efficiently with FLACS, received competent support, and some of them also expressed that they enjoyed being able to trust results without the need for calibration.

What I fear is that based on your report, companies considering purchase of explosion software will consider FLACS and AutoReaGas for equals, and thus decide to use AutoReaGas since this tool is offered to a lower price.

Except for this, I enjoyed looking through your draft report.

Best regards

Olav Roald Hansen
GexCon

Zipf, Richard K. (Karl) (CDC/NIOSH/PRL) wrote:
> Dear Olav,
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> I hope all is well with you since our last communications several
> months ago. Jurgen and I have been very busy developing a report on seals.
>
> 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. I hope the fine work
> you did for NIOSH is reflected well in this 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.
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> If you have any thoughts on the report, please let me know.
>
> All the best,
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> Karl Zipf
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