OSRV/MSHA January 18, 2008

January 18, 2008

Mine Safety & Health Administration
Office of Standards, Regulations and Variances
1100 Wilson Boulevard, Room 2350
Arlington, VA 22209-3939

RE: RIN 1219-AB52 – Sealing of Abandoned Areas

Dear Ms. Silvey:

The National Mining Association (NMA) submits these supplemental comments in response to the reopening of the comment period for the Emergency Temporary Standard (ETS) on the sealing of abandoned areas of underground coal mines and on the U.S. Army Corps of Engineers' Draft Report "CFD [Computational Fluid Dynamics] Study and Structural Analysis of the Sago Mine Accident" (Report) published in the *Federal Register* on Dec. 19, 2007 (72 Fed. Reg. 71,791). NMA's underground coal producer members, who utilize seals extensively to control the atmosphere in abandoned areas as a means to enhance miner safety, appreciate the opportunity to provide these comments.

Our comments consist of two parts: first, a review of the report conducted for NMA by Baker Engineering and Risk Consultant, Inc, and second, a discussion of the actions required where explosive concentrations of methane are found behind a seal.

<u>The U.S Army Corps of Engineers Report</u>

In direct response to MSHA's request, we submit an evaluation of the Report prepared for NMA by Baker Engineering and Risk Consultants, Inc. Baker's in-depth review of the Report concludes:

> …the results obtained cannot be directly utilized to deduce the blast loads associated with the Sago mine accident with any reasonable degree of certainty.

More importantly, the Baker review goes on to conclude:

> …the ERDC draft report cannot be relied upon for decision-making regarding mine seal overpressure capacity due to uncertainties in critical input data utilized in the blast load analyses.

AB52-COMM-26(A)

As the agency is well aware, the inability to deduce the blast loads is directly related to uncertainty of the methane volume contained within the sealed area at the time of the explosion. Without this vital information the Report should be considered at best a hypothetical experiment that, while providing useful information for study purposes of the conditions modeled, cannot be considered definitive for regulatory purposes. Indeed, the Corps decision to conduct a CFD analysis using a presumed 9.5 percent methane-air stoichiometric mixture is not representative of the actual conditions encountered in underground coal mines and, as such, must be considered investigational in nature. In this regard we draw the agency's attention to and offer our support of the comments filed by Peabody Energy, which documents more than 15,000 sampling data points of atmospheres found at mines across the underground coal industry. Importantly, none of the samples were indicative of the environment modeled in the Report. Moreover, the model fails to consider the existence of other inerting gases within the sealed area. The value and necessity of considering the role other inerting gases has been long recognized and is contained in Bureau of Mines, Information Circular 7901, "Determining the Explosibility of Mine Atmospheres."

A second and equally compelling flaw of the Report involves the third and final run of the CFD model which was designed to present the most realistic representation of the atmosphere in the sealed area of the Sago mine. Again, the assumed homogenous mixture in the sealed area undermines the validity of the analysis and calls into question use of the findings for regulatory purposes. As noted in comments prepared for NMA by Packer Engineering, Inc. in response to the National Institute for Occupational Safety and Health (NIOSH) draft report, "Explosion Pressure Design Criteria for New Seals in U.S. Coal Mines" and on file with the Mine Safety and Health Administration (MSHA) in this proceeding:

> The NIOSH Report assumes that the methane filling process is homogeneous throughout the entire sealed area. This assumption is not valid as methane is less dense than air and will stratify in stagnant conditions, thus creating a vertical gradient within the sealed area.

This again points to the need to view the Report as experimental and not suited for regulatory purposes.

Lastly, it is important to note that even the authors of the Report recognized the limitations of the document. The caveats, listed below, from the Report's Executive Summary, page 4, are testament of the need to view it as not defining a specific regulatory (predictive) approach, but rather to be used as a tool to compare different assumed scenarios.

> "It is not possible to say with assurance at this time, that any particular configuration of methane concentration and location was present at the time of the explosion. Further analysis could

> establish the range of possible configuration and their effects on the seals."
>
> "The concentration and location of this methane in the sealed areas could dramatically affect the blast loads on the seals."

Actions Required Where Methane Samples Behind Seals Indicate Potentially Explosive Mixtures

Supplemental to the question of the criteria governing the design, construction and maintenance of seals is that of actions required when the atmosphere behind a seal is found to contain a methane-air mixture that, when exposed to an ignition source, can become explosive.

In the ETS published on May 22, 2007, and which by its very nature become effective upon publication, the agency in 75.335 (B)(4)(i) & (ii) requires operators where concentrations are found to be in the explosive range to: "(1) implement an action plan to remedy the situation; or (2) withdraw persons from the **affected area**." (emphasis added)

In commenting on the ETS the industry's recognized the utility of an "action plan" to address the potential hazards that might arise where an explosive mix is identified behind a seal(s). NMA's previous comments urged the agency to recognize the necessity to delineate the "affected area" by more than a generalized cookbook formula so that individualized mitigating systems could be deployed to minimize and/or eliminate the potential hazard. We recognized, as did the underlying ETS that mine design and planning are integral considerations when defining the "affected area."

Today the vast majority of required "action plans" having been submitted to the agency for approval lie dormant in the district offices while inconsistent agency actions have caused mine operators to withdraw all persons from the mine. The predicate of the ETS is that operators could design "action plans" to best meet the needs of their workforce and the unique geology of the particular mine and that the agency would validate or invalidate the approach contained in such plan. Unfortunately, while the industry has fulfilled its regulatory burden, the agencies inaction is nothing short of being arbitrary and capricious.

On July 10, 2007 the Pennsylvania Coal Association (PCA) in testimony on the ETS expressed concern that the agency had begun to advance a troubling principal, namely designating "the presence of methane behind seals in the explosive range as an imminent danger." PCA's comments highlighted the concern that the agency's policy represented an expansion of the provisions in Section 107(a) of the Mine Act and a weakening of the burden it places on MSHA to actually establish that an imminent danger existing before issuing a withdrawal order. While some discounted this as being needlessly worrisome, unfortunately, today's reality is eerily reflective of the concerns expressed earlier by industry representatives.

In two recent cases before the Federal Mine Safety and Health Review (decisions attached), *Jim Walter Resources, Inc v. Secretary of Labor, Mine Safety and Health Administration*, Docket No. SE 2007-307-R (Nov. 16, 2007) and *Consol of Kentucky, Inc. v. Secretary of Labor, Mine Safety and Health Administration*, Docket No. Kent 2007-351-R (Jan. 10, 2008), respectively, the agency has advanced the proposition that an explosive mixture behind a seal is per se an imminent danger warranting withdrawal of all persons from the mine. In upholding the contestants the commission has, in both instances, concluded that the mere existence of an explosive range behind a seal is not sufficient to justify the issuance of an imminent danger withdrawal order. As noted in the consol decision, the agency's burden extends beyond a "theoretical possibility" to support the issuance of a section 107(a) imminent danger order.

These decisions are the last in a long line of cases to come before the commission regarding whether the accumulation of methane presents an imminent danger. Indeed, an earlier case the secretary conceded that explosive accumulations of methane in longwall gobs would be considered an imminent danger only if an ignition source was present and presented a significant danger. *Island Creek Coal Co*., 15 FMSHRC 339 (March 1993)

Contrasted to the recent approach advanced in certain enforcement actions, we again reiterate our support for the approach contained in the ETS. We believe the interest of miner safety will be best served by the agency expediting its review of the pending "action plans" and the finalization of regulatory language defining "affected area" to recognize the need to permit operators to design remediation programs geared to their unique conditions.

NMA appreciates the opportunity to provide these supplemental comments and stands prepared to work with MSHA to develop appropriate standards.

Sincerely,

Bruce Watzman
Vice President, Safety, Health and Human Resources

Baker Engineering and Risk Consultants, Inc.

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January 18, 2008

Bruce Watzman
Vice President, Safety, Health & H.R.
National Mining Association
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Washington, D.C. 20001

Subject: Review of U.S. Army Corp of Engineers Draft Report on Sago Mine Accident BakerRisk Project No. 01-2049-001-07

Dear Mr. Watzman:

Baker Engineering and Risk Consultants, Inc. (BakerRisk) has performed a high level review of the evaluation performed by the U.S. Army Corp of Engineers (Geotechnical and Structures Laboratory at the Engineer Research and Development Center, ERDC) on the blast and structural aspects of the Sago mine accident.[1] The ERDC evaluation was performed in support of the Mine Safety and Health Administration (MSHA, U.S. Department of Labor). This technical memorandum provides the conclusions from our review of the ERDC report.

This review was performed by Drs. J. Geng, J.K. Thomas, and R.H. Bennett. Drs. Geng and Thomas performed the review of the blast load evaluations, and Dr. Bennett performed the review of the structural evaluations.

Executive Summary

The MSHA Technical Support office concluded that the results provided in the ERDC draft report cannot be relied upon for decision-making regarding mine seal overpressure capacity requirements due to uncertainties in critical input data utilized in the blast load analyses.[2] MSHA noted that the predictions of the models employed did not match factual observations

1) McMahon, G.W., J.R. Britt, J.L. O'Daniel, L.K. Davis and R.E. Walker (2007) CFD Study and Structural Analysis of the Sago Mine Accident, U.S. Army Corp of Engineers, Engineer Research and Development Center, ERDC/GSL TR-06-X, Final Draft, May 2007.
2) Zeiler, L.F. (2007) "U.S. Army Corp of Engineers Draft Report: CFD Study and Structural Analysis of the Sago Mine Accident," U.S. Department of Labor, Mine Safety and Health Administration, memorandum for file, 12/7/07.

from the Sago mine site. BakerRisk concurs that the conditions specified for the ERDC analyses probably do not represent those present during the Sago mine accident, and hence the blast loads and structural response predicted by these analyses are probably not in good agreement with those that occurred during the accident.

In addition, the computational fluid dynamics (CFD) code used to perform the blast load evaluation is not well-suited to modeling the turbulent combustion process associated with a methane-air vapor cloud explosion[3] (VCE). While the CFD code employed is sophisticated and was implemented in a careful manner, it does not directly model the turbulent combustion processes that drive the blast loads developed in a VCE. The code employed is fully capable of tracking the propagation and interaction of blast waves within the mine, and great care was taken to model the mine layout in sufficient detail to ensure this behavior would be accurately captured. However, even if the conditions present during the accident could be specified, it is expected that the blast load analyses would not provide a good match to the actual accident.

The ERDC draft report recommended that additional methane-air mine explosion testing be performed to develop a better understanding of the blast loads that can be developed in such an explosion and to provide data for the improvement and validation of blast load prediction codes. BakerRisk concurs with this recommendation. A CFD code used to predict blast loads for the purposes of developing mine seal overpressure capacity requirements must be validated against a wider set of directly applicable test data in order to provide an acceptable level of confidence in the code predictions.

The structural analyses discussed in the ERDC draft report appear to be generally sound. However, the results of these analyses are compromised to some extent since, as noted in the ERDC report, the blast loading is uncertain and the pre-incident state of the components analyzed is unknown. Hence, irrespective of any issues with the structural analyses performed, the results obtained cannot be directly utilized to deduce the blast loads associated with the Sago mine accident with any reasonable degree of certainty.

The discussion given below covers the major points identified with the ERDC draft report as a result of this review. The ERDC report discussed the blast load and structural evaluations separately, and the discussion given below follows this organization. Additional comments and technical points are provided as an attachment to this technical memorandum.

Discussion – Blast Load Evaluation

ERDC Blast Load Evaluation

The ERDC blast load evaluations utilized the SAGE (SAIC Adaptive Gridding Eulerian) computational fluid dynamics (CFD) computer code. SAGE is a sophisticated CFD code and great care was taken to develop an accurate model of the mine layout. A detailed 3-D contour

3) `Note the term "vapor cloud explosion" or VCE is used within this memorandum in relation to a methane-air explosion within the confined environment of an underground mine. It is recognized that the mining industry may not generally utilize the term "VCE" to refer to such an explosion.

survey of the sealed area of the mine was used to develop the geometric model which included most, if not all, of the mine features. The simulations of the Sago mine utilized up to nearly 60 million computational cells, which requires extensive computational effort.

An Arrhenius burn model was used with the SAGE code for the Sago analyses, so that the combustion rate was taken to be an exponential function of the local temperature. The model parameters were selected to match reported linear combustion rates reported from specific tests conducted at the Lake Lynn Experimental Mine (LLEM) facility (i.e., 14 m/s from 0 to 4 meters and 100 m/s from 4 to 26 meters). This model does not directly model the effect of turbulence on combustion rate. The turbulent combustion rate depends not only on the composition, density, temperature and pressure of the unburned fuel-air mixture, but also on turbulent parameters (e.g., intensity and length scale).

A VCE is the direct result of turbulent combustion. The mechanism of the flame acceleration, and hence blast load production, is primarily controlled by turbulent combustion. Gas (i.e., unburned fuel-air mixture) is pushed ahead of the flame by the expanding combustion products and interacts with obstacles and confining surfaces. This interaction produces turbulence and this turbulence increases the combustion rate. As the flame propagates away from the ignition source into a region containing features that will produce such turbulence, a positive feedback mechanism is set up whereby the increasing combustion rate produces higher levels of turbulence ahead of the flame, which in turn acts to increase the combustion rate. The flame accelerates until a balance is reached and a steady-state flame speed results. The flame will de-accelerate in a region where a reduced level of turbulence is established. Under sufficiently severe combinations of congestion and confinement and with a sufficiently reactive fuel-oxidant mixture, a deflagration-to-detonation transition (DDT) may occur. The turbulent combustion process must therefore be properly modeled in order to accurately capture the blast loads resulting from a VCE.

The Arrhenius burn model was used in the SAGE code to predict the combustion rate is a two-parameter model (Z and E*) that does not directly account for the effect of turbulence on combustion rate. The values of these parameters were set by comparing with a pair of tests conducted in the LLEM facility. However, it is judged unlikely that the parameter set values determined in this manner would also be applicable to a different geometry (e.g., the Sago second left mains) and a larger methane-air mixture volume (e.g., that considered in the Sago event). The ERDC report noted that the combustion rate model parameter values were dependent on the size of the computational mesh employed, which indicates that this may not be a robust modeling approach. The ERDC evaluation has attempted to deal with the details of the turbulent combustion phenomena associated with a VCE by calibrating the combustion rate parameters in the SAGE model to several LLEM tests. However, it is our judgment that modeling the combustion rate in this manner is not the correct approach and will not yield accurate flame speeds and blast loads when applied to mine geometries and flammable gas distributions that do not closely match the LLEM tests.

To illustrate the absence of turbulent combustion considerations in the SAGE analysis, the ERDC evaluation treated the cribbing by modeling a solid column with an equivalent wood volume due to resolution limits. However, the cribbing will act to induce turbulence in the gas flow ahead of the flame well beyond that imposed by an equivalent volume wood column. Treating the cribbing in this manner cannot yield the correct turbulence levels behind the cribbing as the flame approaches, and hence cannot yield the correct combustion rate when the flame reaches this area. Similarly, the impact of the large-scale roughness of the mine surfaces was not considered, and this will affect the level of turbulence in the gas flow ahead of the flame. If turbulence-inducing features cannot be explicitly modeled due to grid size limitations, they must be accounted for in another manner (e.g., via correlations implemented at the sub-grid level). Furthermore, neglecting the large-scale surface roughness will significantly limit the accuracy of the flow field predictions near the surface, and such predictions were used in the ERDC structural analyses.

It should be noted that the SAGE code is well-suited for modeling the propagation of the blast wave outside of the combustion zone. Coupled with the detailed mine geometry layout implemented by ERDC, it is expected that main features of the blast wave propagation were properly and accurately modeled. However, neglecting the large-scale surface roughness may impact the accuracy of the flow field calculations near the wall surfaces, and hence the accuracy of the structural calculations utilizing this information, as noted in the discussion of the structural evaluation.

Other Considerations Relative to the Blast Load Evaluation

It is also noted that the methane distribution assumptions specified for the ERDC analyses do not in all likelihood represent those present during the Sago mine accident. This point was specifically recognized by MSHA in its review of the ERDC draft report[2] and acknowledged within the ERDC report. Hence, even if the CFD code used in the ERDC analysis was capable of accurately predicting the blast loads from a methane-air VCE, it is expected that the blast loads predicted by these analyses would not be in good agreement with those that occurred during the accident.

Last, the ERDC draft report did not discuss the potential contribution of coal dust to the explosion blast loads. Coal dust, particularly outside of the region occupied by the methane-air fuel mixture, could contribute to the total explosion energy and hence the resultant blast loads. It is recognized that, for the particular accidental explosion event considered in this evaluation, the coal dust was in all likelihood sufficiently inerted such that it did not play any role whatsoever in the explosion. It is also understood the U.S. mining practices are intended to ensure that the dust present in a mine environment is inert. It is also recognized that the ERDC evaluation may have explicitly considered this factor, but did not include a discussion regarding it in the report.

Discussion – Structural Evaluations

The structural analyses discussed in the ERDC draft report appear to be generally sound. However, the results of these analyses are compromised to some extent since, as noted in the ERDC report, the blast loading is uncertain and the pre-incident state of the components analyzed is unknown. The report specifically notes (on p.115) that:

> "*Specific correlation of the FE results with the responses seen in Sago is difficult since the exact loading on each structural component within the mine is unknown and the pre-incident state of the components is also unknown (bent before the incident?)*"

A limited suite of high fidelity calculations was performed by ERDC with large uncertainties in the input. It is expected that a more extensive suite of simplified calculations assessing structural response under a variety of possible blast loading conditions would likely yield a better understanding of the blast loads actually developed in the Sago explosion. The primary damage indicators used in the analysis are the belt hangers, pie plates and rock bolts. The belt hangers and pie plates are within the boundary layer of a non-uniform rough surface and this is not discussed in the report. The use of the bent rock bolts as a damage indicator is questionable. The rock bolts would have been initially fully embedded in the mine roof. If they were exposed prior to the explosion it would have been a result of remining or rockfalls. Alternatively, the rock bolts may have become exposed as a result of localized material being torn loose during the explosion. In either case the rockbolts would most likely been deformed by forces in addition to the dynamic pressures resulting from the explosion. The flow field would include dust (e.g., non-combustible particles entrained in the flow field) that could significantly increase the loading on drag sensitive targets; this was also not addressed in the report. Potential debris impact on targets was also not addressed.

A set of specific technical comments regarding the structural analyses provided in the ERDC draft report is provided as Attachment A to this technical memorandum.

<u>Closure</u>

We appreciate the opportunity to perform this review. Should you have any questions regarding this report or our calculations, please contact me at (210) 824-5960 or by email at KThomas@BakerRisk.com.

Sincerely,

J. Kelly Thomas, Ph.D.
Manager, Blast Effects

Approval:

Quentin A. Baker, P.E.
President

cc: Vivian Johnson, BakerRisk
R.H. Bennett, Ph.D., P.E., BakerRisk
J. Geng, Ph.D., BakerRisk

Notice

Baker Engineering and Risk Consultants, Inc. (BakerRisk) made every reasonable effort to perform the work contained herein in a manner consistent with high professional standards.

The work was conducted on the basis of information made available by the client or others to BakerRisk. Neither BakerRisk nor any person acting on its behalf makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information provided. All observations, conclusions and recommendations contained herein are relevant only to the project, and should not be applied to any other facility or operation.

Any third party use of this Report or any information or conclusions contained therein shall be at the user's sole risk. Such use shall constitute an agreement by the user to release, defend and indemnify BakerRisk from and against any and all liability in connection therewith (including any liability for special, indirect, incidental or consequential damages), regardless of how such liability may arise.

BakerRisk regards the work that it has done as being advisory in nature. The responsibility for use and implementation of the conclusions and recommendations contained herein rests entirely with the client.

Attachment A - Additional Technical Points

1. Pages 87-88. The authors state that "an average unconfined compressive strength was used for the Omega Block material, since the existing test data showed considerable scatter in the data." The authors do not state the actual value used. The FEA material model plotted in Figure 77b indicates the ERDC used an unconfined compressive strength (f_c') of 148 psi. This is significantly higher than the 70 psi to 110 psi compressive strength reported by MSHA[4]. What is the basis for using the higher value?

2. Page 90. The "Yield Surface Plot For Omega Block Material" shown on Figure 77b (page 90) indicates a very good correlation with "scaled test data." The authors do not identify the source of this data or if the tests were performed on Omega Block or foam (cellular) concrete. It appears to be foam concrete data that has been scaled to represent Omega Block based on the value of f_c'. If this is the case, there is no indication that the material model used in the subsequent FEA calculations actually mimics the performance of the Omega Blocks. Has the ERDC performed any large deformation tests on the Omega Block and then tried to replicate the test results using the material model used in the Sago mine calculations? Does the material model used accurately reflect the shear capacities of the Omega Blocks?

3. Page 94. The authors indicate that only the drag phase portion of the loading was applied to the damage indicators (Equation 8). During the actual explosion, the roof support plates would also be subject to very high lift forces wherever the plates were not in contact with the roof. Given the surface irregularities present on a mined roof, gaps between the edges of the plate and the roof were almost certainly present prior to the explosion.

4. Page 95. The model for the roof support plate considers the flexibility of the plate and the effects of plate distortion on the applied load. The model does not address the fact that these plates would have been exposed to a very turbulent flow field caused by the boundary layer at the surfaces of the tunnel.

5. Page 96. Since the calculations were only carried out for 15 msec after the blast wave struck the plate, and the plate had not yet reached its peak deformation, comparison to the photographs of the damaged plates from the LLEM test is somewhat misleading. The drag loading will continue significantly beyond 15 msec and additional deformations will occur.

6. Page 101. The analysis of the belt hangers appears to assume that the hangers are perpendicular to the flow field. These hangers project 4 inches from the mine roof and are thus within the boundary layer. This does not appear to have been addressed. The analysis is based on the case where the blast loading was bending the belt hangers in the opposite direction as they were formed. Since a considerable calculation effort was made

4) Mine Safety and Health Administration, Guide for Existing Seals (Alternative Seals Built Prior to the Issuance of Program Information Bulletin (PIB) No. P06-16, Dated July 19, 2006), October 2006 (p.23).

to address the plastic strains resulting from the forming process (pages 101-103), the influence of loading direction should be addressed. The belt hangers may also have been deformed as a result of the service loads (especially when the belts were removed and there would be no reason to protect the hangers).

7. Page 106. The analysis of the rockbolts implies that the initial position of the bolts was straight and true. The use of the bent rock bolts as a damage indicator is questionable. The rock bolts would have been initially fully embedded in the mine roof. If they were exposed prior to the explosion it would have been a result of remining or rockfalls. Alternatively, the rock bolts may have become exposed as a result of localized material being torn loose during the explosion. In either case the rockbolts would most likely been deformed by forces in addition to the dynamic pressures resulting from the explosion. The flow field would include dust that could significantly increase the loading on drag sensitive targets; this was also not addressed in the report. Potential debris impact was also not addressed.

8. Pages 106-107. The analysis of the seals did not account for any type of imperfect bond between the blocks and the mortar. Rather, a perfect connection was modeled. Given that mine seal construction is performed in less than ideal conditions, the assumption of a perfect bond does not appear to be warranted. However, given the significant overloading of the capacity of the system, this is not expected to change the results at the pressures analyzed.

9. Page 114. Comments on Significant Findings:

    a. Finding – "*Seal calculations were able to capture the failure mode of the Sago Mine Seals, which were predominantly a shear failure around the seal perimeter*."
        i. Comment –Even with the very large uncertainties in seal strength that were not addressed, the analysis indicates that the seals would fail under the postulated Sago Mine explosion pressures. The mine seals were completely destroyed in both the incident and the analysis. Stating the calculations captured the right failure mode is overstating the case for the model, but a shear failure whether initiated at the seal-wall interface or within the seal would be the expected failure mode.
    b. Finding – "*Belt hanger calculations show the load required to initiate bending of the belt hangers was approximately 150 psi.*"
        i. Comment – The 150 psi value appears to be based on the initial development of plastic behavior. The value shown on Figure 106 for the development of a plastic hinge in the SDOF model is 190 psi. A simple cantilever beam analysis indicates the load required to develop a full plastic hinge in the hanger could be as low as 135 psi based on a static analysis with no pre-existing plastic strains. Given the variance in plastic strain, a reasonable estimate of the capacity of the hangers is probably between 120 psi and 190 psi. These are uniformly applied loads on the

hangers, and the calculation back to a dynamic pressure is dependent on the assumed drag coefficient and the turbulence in the boundary layer. The use of these damage indicators to estimate the strength of the explosion should consider these other factors. However, even if the loading mechanism was known precisely, the initial condition of the belt hangers is not available.

c. Finding – "*A resistance function for use in the SDOF analysis was generated for the belt hangers.*"
    i. Comment – It is not clear if the resistance function used in the SDOF analysis was based on the Corps static analysis or the FE analysis, both are shown on Fig 106.
d. Finding – "*Spider plate and Pie pan calculations provided insight into the failure mechanism, time of response, and directionality of the damage.*"
    i. Comment – Disagree with finding. Given that the analysis did not address the turbulence present in the boundary layer, any pre-existing damage caused by the tightening of the rock bolts, or the presence of a free edge subject to lift forces, it is difficult to extrapolate any directionality. Since the calculations were for only a short period of time as compared to the loading, all that can be said is that the objects were damaged very quickly.
e. Finding – "*Rock bolt calculations captured the responses similar to those documented in damage surveys.*"
    i. Comment – The authors provide no data or comparisons to support this assertion. See comment 7 regarding page 106 above.
f. Finding – "*Specific correlation of the FE results with the responses seen in Sago is difficult since the exact loading on each structural component within the mine is unknown and the pre-incident state of the components is also unknown (bent before the incident?)*"
    i. Comment – Agree completely.
g. Finding – "*Seal calculations compared well against LLEM test 504, and 506.*"
    i. Comment – Concur.
h. Finding – "*General failure of the seal seemed to be captured well by the models.*"
    i. Comment – Unfortunately the comparisons could only be made for the cases where the seal was expected to survive (LLEM 504), and where it was totally destroyed (LLEM 506). Thus the applicability of the analysis to estimate the true strength of the seals is limited.
i. Finding – "*CFD Loads produced extreme failure and propelled the debris at high velocities away from the original seal location.*"
    i. Comment - Concur.

10. Pages 116 – 128. The SDOF analysis could have been used to address many of the uncertainties identified in the comments above. Using the SDOF analyses in a parametric fashion would have provided more information on the magnitude of the Sago explosion than the FE analysis did. The Corps did use the SDOF model for the rockbolts to back calculate the loading required to get the rock bolt deformations observed. However, they did not vary the duration, effective fluid density, or load shape in any of these analyses.

January 10, 2008

CONSOL OF KENTUCKY, INC.	:	CONTEST PROCEEDING
Contestant	:	
v.	:	Docket No. KENT 2007-351-R
	:	Order No. 6643961; 06/25/2007
	:	
SECRETARY OF LABOR,	:	
MINE SAFETY AND HEALTH	:	Mine: Jones Fork E-3
ADMINISTRATION, (MSHA),	:	Mine ID 15-18589
Respondent	:	

DECISION

Appearances: R. Henry Moore, Esq., Jackson Kelly, PLLC, Pittsburgh, Pennsylvania, on behalf of the Contestant;
Mary Sue Taylor, Esq., Office of the Solicitor, U.S. Department of Labor, Nashville, Tennessee, on behalf of the Respondent.

Before: Judge Melick

This case is before me pursuant to section 107(e)(1) of the Federal Mine Safety and Health Act of 1977, 30 U.S.C. § 801 et seq., the "Act," upon the contest by Consol of Kentucky, Inc., (Consol) of "imminent danger" withdrawal Order No. 6643961 issued to Consol, pursuant to section 107(a) of the Act. [1] The order alleges as follows:

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[1] Section 107(a) provides as follows:

> If, upon any inspection or investigation of a coal or other mine which is subject to this Act, an authorized representative of the Secretary finds that an imminent danger exists, such representative shall determine the extent of the area of such mine throughout which the danger exists, and issue an order requiring the operator of such mine to cause all persons, except those referred to in section 104(c), to be withdrawn from, and to be prohibited from entering, such area until an authorized representative of the Secretary determines that such imminent danger and the conditions or practices which caused such imminent danger no longer exist. The issuance of an order under this subsection shall not preclude the issuance of a citation under section 104 or the proposing of a penalty under section110.

An explosive atmosphere exists inby 3 North Seals (Seal Set 8), the oxygen content is between 15.1-16.5 percent and methane between 10-12 percent. The 3 North Seals are adjacent to the primary and secondary escapeways for active MMU 002-0 and 004.0 sections. An oral 107(a) imminent danger order was issued to Freddie Crockett, foreman, at 1500 hours on this date.

Randy Newsome, an inspector for the Department of Labor's Mine Safety and Health Administration (MSHA), issued the subject order on June 25, 2007. Newsome is a registered professional mine engineer and has industry experience in underground mining as a section boss and project engineer. Newsome was directed by his supervisor, Garrett Robinson, to perform a spot inspection of the seals at the subject mine. The inspection was the result of an emergency temporary standard (ETS) issued by MSHA. [2]

The particular issue herein involves seal set No. 8. The No. 8 set is one of three sets of seals that separate part of the northern portion of the mine from the active workings of the mine. There are six seals in the set. One of the seals has a sampling pipe that extends 15 feet behind the seal. These seals were built in June 2006 under 30 C.F.R. 75.335(a) (2006). Once an area is sealed no ventilation is provided to that area. It is expected that the atmosphere behind the seals will become inert as methane levels rise above the explosive range and oxygen levels fall below that range. However, the area immediately inby the seals may, on occasion, contain lower levels of methane than generally present throughout the sealed area because of leakage across the seals from the active areas.

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[2] Following the Sago and Darby mine disasters, where miners were killed as a result of methane explosions originating in sealed areas of mines, MSHA acted to require mine operators to monitor the atmosphere in such areas and to address potentially hazardous conditions. MSHA issued Program Policy Bulletin No. P06, on July 19, 2006, which required operators to assess the atmosphere behind alternative seals, and to take remedial action if concentrations of methane from 3 percent to 20 percent were present. On May 22, 2007, MSHA issued an ETS, pursuant to section 101(b) of the Act. 72 FR 28796-28817 (May 22, 2007). The ETS, which became effective upon publication, amended 30 C.F.R. § 75.335, by increasing strength requirements for newly constructed seals. It also required mine operators to develop and submit for approval protocols for monitoring and maintaining inert the atmosphere in sealed areas where the seals were not constructed to withstand 120 psi of overpressure.

The ETS further provided:

(4) When oxygen concentrations are 10.0 percent or greater and methane concentrations are from 3.0 percent to 20.0 percent in a sealed area, the mine operator shall take two additional gas samples at one-hour intervals. If the two additional gas samples are from 3.0 percent to 20.0 percent and oxygen is 10.0 percent or greater – (i) The mine operator shall implement the action plan in the protocol; or (ii) Persons shall be withdrawn from the affected area, except those persons referred to in section 104(c) of the Act.

The Jones Fork Mine at issue liberates approximately 1.4 million cubic feet of methane per day. Without ventilation in the sealed area, the methane levels in the sealed area continue to rise above the upper explosive limit and the oxygen levels decrease past levels that would support an ignition of methane. The explosive range of methane in a normal atmosphere is 5-15%. Above 15% methane is not explosive in a normal atmosphere containing 20.5% oxygen. The level of oxygen necessary to support a methane ignition is 12%. As methane approaches the upper explosive limit and oxygen approaches the 12% level, the mixture of air becomes less susceptible to ignition.

The seals that were constructed in the No. 8 set are solid concrete block seals known as Mitchell-Barrett seals. They are "hitched" into the ribs and floor in that a notch is cut into the ribs and into the floor to increase the perimeter strength of the seal. There are two cribs in front of and behind each seal in the No. 8 set to provide additional roof support in the areas of the seals. Each seal also has a pilaster, which provides support in the middle of the seal. The seals were built in June 2006, following an incident involving a set of alternative omega block seals at a different location in the mine. Once those damaged seals were replaced, Consol constructed new Mitchell-Barrett seals at the Nos. 6,7, and 8 locations consistent with guidelines developed by MSHA expert Clete Stephan.

As previously noted, one seal in each set is required to have a sampling pipe that extends 15 feet into the sealed area. At the No. 8 set, the sampling pipe is at the No. 1 seal. In June 2007, Consol and other operators were required to begin sampling through this pipe behind each set of seals. Leakage at seals may occur through the seals and the surrounding strata. Depending on the barometric pressure as well as other factors in the mine, seals may "ingas" or "outgas." If the seal is ingassing, air from the active portion of the mine leaks into the sealed area. If the seal is outgassing, air from the sealed area leaks into the active portion of the mine.

The ETS requires operators to take samples through the sampling pipe to establish a 14-day baseline. If the seals are ingassing, sampling is not required. The No. 8 seals were outgassing. The results of the baseline sampling for the No. 8 set of seals indicated that the atmosphere immediately behind the seals contained methane above 5% and below 15% and oxygen above 12%. The No. 7 set of seals were ingassing. The methane levels at the No. 8 set of seals were apparently affected by the leakage at the No. 7 set of seals. A thin layer of the leaked air would travel across the most southern of the entries in the sealed area. The rest of the sealed area would remain inert.

Upon arriving at the mine, Inspector Newsome initially met with Mine Superintendent Lloyd Shomo. He informed Mr. Shomo that he would be checking the atmosphere behind the seals. Newsome then reviewed the baseline and seal sampling records from June 15-22, 2007. He observed that on June 18, the No. 8 seals had a methane level of 17% and an oxygen level of 12.4%. These levels fell within the "action range," defined by the ETS as between 3% and 20% for methane and above 10% oxygen. Inspector Newsome discussed this situation with his supervisor, Garrett Robinson, before he went underground. He also informed Mr. Shomo that if his inspection produced results similar to the levels reported on June 18, Shomo would have to withdraw people from the mine or he would issue a "Section 107(a)" order.

Inspector Newsome went to the No. 8 seals, accompanied by Shomo. Chief engineer Jon Hale, engineer Steve Hicks, and mine examiner Joey Sammons were present when Inspector Newsome and Shomo arrived at the No. 8 seals. Between the time Inspector Newsome took his second and third samples, mine foreman Freddie Crockett arrived. Upon arriving at the No. 8 seals on June 25, 2007, Inspector Newsome noted that they were outgassing. He took samples at the sampling pipe with an ATX620 gas detector. He also took a "bag sample" which was sent to MSHA's laboratory for more precise analysis. Newsome observed initial readings from the gas detector at 1:00 p.m. of 11% methane and 16.5% oxygen.

Under the ETS, he was required to take two additional samples, for a total of three, spaced an hour apart, to confirm his initial readings. The samples at around 2:00 p.m. indicated 11% methane and 15.8% oxygen. The samples at around 3:00 p.m. were 12% methane and 15.1% oxygen. Based on these results, Inspector Newsome verbally issued a "Section 107(a)" order. The written order followed and is at issue herein. In concluding that an imminent danger existed, Inspector Newsome testified that he considered the readings indicating what he believed was an explosive mixture of methane and oxygen behind seal set No. 8, that there had been nearby roof falls, that the area behind the No. 8 set of seals was pillared and that there had been lightning the day before somewhere in eastern Kentucky and he speculated that the weather could produce lightning at any time. Newsome also speculated, as part of his rationale, as to the possibility that electrical equipment and cables could have been left in the sealed area and the effect of "human error" in situations involving explosive mixtures.

Section 3(j) of the Act defines "imminent danger" as the "existence of any condition or practice in a coal or other mine which could reasonably be expected to cause death or serious physical harm before such condition or practice can be abated." As previously noted, Section 107(a) of the Act provides for the issuance of an order requiring the withdrawal of persons in areas of a mine who are exposed to such an imminent danger. "Imminent danger orders permit an inspector to remove miners immediately from a dangerous situation, without affording the operator the right of prior review, even where the mine operator did not create the danger and where the danger does not violate the Act or the Secretary's regulations. This is an extraordinary power that is available only when the 'seriousness of the situation demands such immediate action.'" *Utah Power & Light Co.*, 13 FMSHRC 1617, 1622 (October 1991) (quoting from the legislative history of the Federal Coal Mine Health and Safety Act of 1969, the predecessor to the 1977 Act).

An imminent danger exists "when the condition or practice observed could reasonably be expected to cause death or serious physical harm to a miner if normal mining operations were permitted to proceed in the area before the dangerous condition is eliminated." *Wyoming Fuel Co.*, 14 FMSHRC 1282, 1290 (August 1992) (quoting from *Rochester & Pittsburgh Coal Co.*, 11 FMSHRC 2159, 2163 (November 1989). While the concept of imminent danger is not limited to hazards that pose an immediate danger, "an inspector must 'find that the hazardous condition has a reasonable potential to cause death or serious injury within a short period of time.' *Cumberland Coal Resources, LP*, 28 FMSHRC 545, 555 (August 2006). Inspectors must determine whether a hazard presents an imminent danger without delay, and a find of an imminent danger must be supported "unless there is evidence that [the inspector] had abused his discretion or authority." *Rochester & Pittsburgh Coal Co.*, 11 FMSHRC at 2164.

While an inspector has considerable discretion in determining whether an imminent danger exists, that discretion is not without limits. An inspector must make a reasonable investigation of the facts, under the circumstances, and must make his determination on the basis of the facts known, or reasonably available to him. As the Commission explained in *Island Creek Coal Co.*, 15 FMSHRC 339, 346-347 (March 1993):

> While the crucial question in imminent danger cases is whether the inspector abused his discretion or authority, the judge is not required to accept an inspector's subjective "perception" that an imminent danger existed. Rather, the judge must evaluate whether, given the particular circumstances, it was reasonable for the inspector to conclude that an imminent danger existed. The Secretary still bears the burden of proving [her] case by a preponderance of the evidence. Although an inspector is granted wide discretion because he must act quickly to remove miners from a situation that he believes to be hazardous, the reasonableness of an inspector's imminent danger finding is subject to subsequent examination at the evidentiary hearing.

An inspector "abuses his discretion...when he orders the immediate withdrawal of miners under section 107(a) in circumstances where there is not an imminent threat to miners." *Utah, Power & Light Co.*, 13 FMSHRC at 1622-23.

The critical question in determining whether an accumulation of methane presents an imminent danger is whether there is a ignition source that might reasonably be expected to cause an explosion resulting in death or serious injury within a short period of time. In *Island Creek*, the Secretary conceded that explosive accumulations of methane in a longwall gob would create an imminent danger only if an ignition source presented a significant danger. 15 FMSHRC at 347. Similarly, on the related question of whether a methane accumulation hazard presented a reasonable likelihood of an injury causing event, the Commission has focused on the presence of an ignition source. *Texasgulf, Inc.*, 10 FMSHRC 498, 501 (April 1988) (critical question for significant and substantial determination is likelihood of explosive concentrations of methane coming into contact with an ignition source). The Commission has held that statements that certain events "could" occur, are not sufficient to support a finding that there was a reasonable likelihood of an ignition of methane for a significant and substantial determination. *Zeigler Coal Co.*, 15 FMSHRC 949, 953-54 (June 1993).

Within the above framework of law and the evidence of record, I am constrained to find that an imminent danger did not exist and that the issuing inspector abused his discretion in issuing the order at bar considering the facts known, or reasonably available, to him. Indeed, the Secretary's own expert in explosions and ignitions, Clete Stephan, opined based on the facts presented at hearings by Inspector Newsome, that the potential for an explosion behind the seals was "unlikely" (Tr. 209). Consol's experts, Mssrs. Fertall and Mucho agreed with Stephan. Specifically, when asked his opinion of the conditions behind the No. 8 seals, Mr. Stephan testified as follows:

> Well, I believe that based on the information [Inspector Newsome] had, that he - he could have correctly made the assumption that an explosive mixture - to what extent he didn't know, but an explosive mixture existed behind those seals. And that just in the unlikely event that those explosive mixtures would have - would have exploded they could have easily compromised the seals (Tr. 209; emphasis added)

Aside from the Secretary's own principal expert witness opining that an ignition was an "unlikely" event, the uncontradicted evidence which should have been known to the issuing inspector, or was reasonably available to him, fully corroborates that opinion. The issuing inspector herein cited several potential sources of methane ignition including lightning and roof falls. As for lightning being a potential source of ignition MSHA's Bleeder and Gob Manual states that from 1959-1994, lightning has been determined to be an ignition source in only two mine explosions (Exh. R-28 p.23). Mr. Stephan also noted that before the Sago mine accident in January 2006, all explosions in sealed areas attributed to lightning had the commonality of having a conduit into the sealed area. Inspector Newsome could not identify any such conduit at the Jones Fork mine. In other words, prior to the Sago accident, there had never been an explosion caused by lightning without a conduit - - and the Jones Fork mine had no conduit to the sealed area.

As for roof falls being a potential source of ignition, the MSHA training manual developed by its experts states that only 0.7% of methane ignitions and explosions in United States mines between 1959 and 1994 could be attributable to roof falls (Exh. R-28 p. 23).[3] The training manual concludes that "[c]onsidering that thousands of roof falls occur annually in the United States, the ignition of methane caused by roof falls is unlikely" (Exh. R-28, p. 23). The issuing inspector had been trained on this information and the subject manual was available in his office. Consol's expert, Mr. Mucho, also testified that, historically, roof falls have proven to be highly unlikely sources of ignition. This was especially true according to Mucho where the roof consists of shale as in the sealed areas of the Jones Fork mine

While Inspector Newsome also speculated as potential ignition sources the possible failure of roof supports, the possibility that electrical equipment and cables could have been left in the sealed area and human error, the credible record evidence does not support this speculation. No one was working in the sealed area and speculation that "human error" could cause an imminent danger is so vague as to be without probative value. Moreover, no authoritative studies were presented to support his opinion that roof supports could be a source of ignition of methane. Indeed, according to Mr. Stephan, laboratory testing by the Bureau of Mines would not support such a conclusion. Moreover, Consol's expert, Thomas Mucho, explained that the most recent research showed that the failure of roof support materials in fact cannot generate enough heat to cause an ignition. Finally, there is no credible evidence that any electrical equipment or cables were left in the sealed areas. The only evidence in this regard was from mine Foreman Crockett that, indeed, no electrical equipment was left behind when the areas were sealed. In any event, as previously noted, the Commission has held that such speculative statements that certain events "could" occur are not sufficient to even support a finding that there was a reasonable likelihood of an ignition of methane. *Ziegler,* 15 FMSHRC at 933-4.

Under all the circumstances it is apparent that an actual ignition of the explosive atmosphere behind the seals at issue was, at best, a theoretical possibility. The evidence clearly does not support the issuance of a "section 107(a)" imminent danger order.

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[3] In a recent case, an MSHA ventilation expert also essentially conceded that a roof fall was an unlikely ignition source. *Cumberland Coal Resources, LP*, 27 FMSHRC 295, 319-20 (March 2005)(ALJ) (aff'd in part rev. in part, 28 FMSHRC 545 (August 2006).

ORDER

Order No. 6643961 is hereby vacated.

Gary Melick
Administrative Law Judge
(202) 434-9977

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FEDERAL MINE SAFETY AND HEALTH REVIEW COMMISSION

OFFICE OF ADMINISTRATIVE LAW JUDGES
601 New Jersey Avenue, N.W., Suite 9500
Washington, D.C. 20001

OSRV/MSHA January 18,2008

November 16, 2007

JIM WALTER RESOURCES, INC.,	:	CONTEST PROCEEDING
Contestant	:	
	:	Docket No. SE 2007-307-R
	:	Order No. 7692770; 06/25/2007
v.	:	
	:	
SECRETARY OF LABOR,	:	
MINE SAFETY AND HEALTH	:	No. 4 Mine
ADMINISTRATION, (MSHA),	:	Mine ID 01-01247
Respondent	:	

ORDER GRANTING CONTESTANT'S MOTION FOR SUMMARY DECISION

Before: Judge Zielinski

This case is before me on a Notice of Contest filed by Jim Walter Resources, Incorporated ("JWR") pursuant to section 107(e) of the Federal Mine Safety and Health Act of 1977 ("Act"), 30 U.S.C. § 817(e). JWR seeks vacation of Order No. 7692770, an imminent danger order issued pursuant to section 107(a) of the Act. JWR has moved for summary decision. The Secretary has opposed the motion, contending that JWR has failed to establish that there are no material facts in dispute or that it is entitled to summary decision as a matter of law. For the reasons set forth below, the motion is granted.

Facts

Following the Sago and Darby mine disasters, where miners were killed as a result of a methane explosions originating in sealed areas of mines, the Secretary's Mine Safety and Health Administration ("MSHA") took action to require mine operators to monitor the atmosphere in such areas and to address potentially hazardous conditions. MSHA issued Program Policy Bulletin No. P06-16, on July 19, 2006, which required operators to assess the atmosphere behind alternative seals, and to take remedial action if concentrations of methane from 3 percent to 20 percent were present. On May 22, 2007, MSHA issued an Emergency Temporary Standard ("ETS"), pursuant to section 101(b) of the Act. 72 FR 28796-28817 (May 22, 2007). The ETS, which became effective upon publication, amended 30 C.F.R. § 75.335, by increasing strength requirements for newly constructed seals. It also required mine operators to develop and submit for approval protocols for monitoring and maintaining inert the atmosphere in sealed areas, where the seals were not constructed to withstand 120 psi of overpressure. The ETS further provided:

> (4) When oxygen concentrations are 10.0 percent or greater and methane concentrations are from 3.0 percent to 20.0 percent in a sealed area, the mine operator shall take two additional gas samples at one-hour intervals. If the two additional gas samples are from 3.0 percent to 20.0 percent and oxygen is 10.0 percent or greater —
> (I) The mine operator shall implement the action plan in the protocol; or

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(ii) Persons shall be withdrawn from the affected area, except those persons referred to in section 104(c) of the Act.

30 C.F.R. § 75.335(b)(4).

On June 25, 2007, Danny Crumpton, an MSHA inspector, began a quarterly inspection of JWR's No. 4 Mine. He reviewed seal examination records required to be kept under the ETS, and noted several entries reporting levels of methane within the action range specified in the ETS. He called the MSHA District 11 office, and spoke with Johnny Calhoun, the head of the ventilation division, and with Gary Wirth, the assistant district manager. He reported the seal examination record entries and told them he would take gas readings at the seals, which he proceeded to do. Readings at several seals were unremarkable. However, at 11:23 a.m., he conducted a test at seal 31, and measured methane at 10.0 percent and oxygen at 12.6 percent. He took a bottle sample, and waited to take the additional hourly measurements referenced in the ETS. Danny Aldrich, JWR's outby coordinator, who accompanied Crumpton, called for foam packs as a means to abate the condition. Crumpton took another measurement at 12:27 p.m., and obtained the same result as the first test. At 1:27 p.m., Crumpton took the third measurement required by the ETS, and found that the methane concentration was 8.0 percent, and the oxygen concentration was 12.7 percent.

The three successive measurements within the specified ranges satisfied the ETS's requirement for remedial action. Because JWR's protocol/action plan had not yet been approved, the action required by the ETS was withdrawal of persons from the affected area. Crumpton took no immediate action. He continued his inspection, and proceeded to the next seal, seal 24. At 1:50 p.m., Crumpton took a measurement at seal 24, and detected 14.0 percent methane and
10.5 percent oxygen. He then proceeded to the nearest phone, called Wirth, and reported the results of his measurements. Wirth instructed Crumpton to issue an imminent danger withdrawal order at 2:20 p.m.

Crumpton issued Order No. 7692770, as directed by Wirth, relying upon Wirth's judgment. Throughout the course of these events, Crumpton did not conclude that there was, or was not, an imminent danger. Contestant's Statement of Undisputed Facts, #11. The possibility that a roof fall might ignite the gas detected by Crumpton was the only potential ignition source considered by Wirth in making the decision to have Crumpton issue the 107(a) order. *Id.* #13. At no time did Crumpton note any indications that a roof fall was imminent, behind or near seal 31, or in any other area. Nor did he note any other roof hazards. *Id.* #14.

Analysis

Commission Procedural Rule 67, 29 C.F.R. § 2700.67, states that a motion for summary decision shall be granted if there is "no genuine issue as to any material fact" and that "the moving party is entitled to summary decision as a matter of law." 29 C.F.R. § 2700.67(b). The Secretary argues that there are material facts in dispute, specifically denying item #9 in JWR's statement of undisputed facts, which reads: "The decision to issue 107(a) Order 7692770 was based solely upon the concentrations of methane and oxygen measured at seal 31." The Secretary maintains that Wirth's decision also rested upon a "consideration of roof falls as a possible ignition source." Sec'y Op. at 5. However, in item #13 of its statement JWR asserted: "The possibility that a roof fall might ignite the gas detected by Inspector Crumpton was the only potential ignition source considered by Assistant Director Wirth, in making the decision to have Inspector Crumpton issue 107(a) Order 7692770." While factual statement #9 omits the critical ignition source information, when read together with item #13, the Secretary's objection is obviated. I find that there is no dispute as to any fact material to the issues raised by JWR's motion.

Section 3(j) of the Act defines "imminent danger" as the "existence of any condition or practice in a coal or other mine which could reasonably be expected to cause death or serious physical harm before such condition or practice can be abated." 30 U.S.C. § 802(j). Section 107(a) of the Act provides, in pertinent part:

> If, upon any inspection or investigation of a coal or other mine which is subject to this Act, an authorized representative of the Secretary finds that an imminent danger exists, such representative shall determine the extent of the area of such mine throughout which the danger exists, and issue an order requiring the operator of such mine to cause all persons, except those referred to in section 104(c), to be withdrawn from, and to be prohibited from entering, such area until an authorized representative of the Secretary determines that such imminent danger and the conditions or practices which caused such imminent danger no longer exist.

30 U.S.C. § 817(a).

"Imminent danger orders permit an inspector to remove miners immediately from a dangerous situation, without affording the operator the right of prior review, even where the mine operator did not create the danger and where the danger does not violate the Mine Act or the Secretary's regulations. This is an extraordinary power that is available only when the 'seriousness of the situation demands such immediate action.'" *Utah Power & Light Co.*, 13 FMSHRC 1617, 1622 (Oct. 1991) ("*Utah*") (quoting from the legislative history of the Federal Coal Mine Health and Safety Act of 1969, the predecessor to the 1977 Act). An imminent danger exists "when the condition or practice observed could reasonably be expected to cause death or serious physical harm to a miner if normal mining operations were permitted to proceed in the area before the dangerous condition is eliminated." *Wyoming Fuel Co.*, 14 FMSHRC 1282, 1290 (Aug. 1992) (quoting from *Rochester & Pittsburgh Coal Co.*, 11 FMSHRC 2159, 2163 (Nov. 1989) ("*R&P*")). While the concept of imminent danger is not limited to hazards that pose an immediate danger, "an inspector must 'find that the hazardous condition has a reasonable potential to cause death or serious injury within a short period of time.'" *Cumberland Coal Resources, LP*, 28 FMSHRC 545, 555 (Aug. 2006) (*quoting from Utah*, 13 FMSHRC at 1622). Inspectors must determine whether a hazard presents an imminent danger without delay, and a finding of an imminent danger must be supported "unless there is evidence that [the inspector] had abused his discretion or authority." *R&P*, 11 FMSHRC at 2164.

While an inspector has considerable discretion in determining whether an imminent danger exists, that discretion is not without limits. An inspector must make a reasonable investigation of the facts, under the circumstances, and must make his determination on the basis of the facts known, or reasonably available to him. As the Commission explained in *Island Creek Coal Co.*, 15 FMSHRC 339, 346-347 (Mar. 1993):

> While the crucial question in imminent danger cases is whether the inspector abused his discretion or authority, the judge is not required to accept an inspector's subjective "perception" that an imminent danger existed. Rather, the judge must evaluate whether, given the particular circumstances, it was reasonable for the inspector to conclude that an imminent danger existed. The Secretary still bears the burden of proving [her] case by a preponderance of the evidence. Although an inspector is granted wide discretion because

he must act quickly to remove miners from a situation that he believes to be hazardous, the reasonableness of an inspector's imminent danger finding is subject to subsequent examination at the evidentiary hearing.

An inspector "abuses his discretion . . . when he orders the immediate withdrawal of miners under section 107(a) in circumstances where there is not an imminent threat to miners." *Utah*, 13 FMSHRC at 1622-23.

The critical question in determining whether an accumulation of methane presented an imminent danger is whether there was an ignition source that might reasonably have been expected to cause an explosion resulting in death or serious injury within a short period of time. In *Island Creek*, the Secretary conceded that explosive accumulations of methane in a longwall gob would create an imminent danger only if an ignition source presented a significant danger. 15 FMSHRC at 347. Similarly, on the related question of whether a methane accumulation hazard presented a reasonable likelihood of an injury causing event, the Commission has focused on the presence of an ignition source. *Texasgulf, Inc.*, 10 FMSHRC 498, 501 (Apr. 1988) (critical question for significant and substantial determination is likelihood of explosive concentrations of methane coming into contact with an ignition source). The Commission has held that statements that certain events "could" occur, are not sufficient to support a finding that there was a reasonable likelihood of an ignition of methane for a significant and substantial determination. *Zeigler Coal Co.*, 15 FMSHRC 949, 953-54 (June 1993).

JWR's motion challenged Crumpton's decision to issue the order, and the fact that he, admittedly, had not made a determination that an imminent danger existed. The Secretary countered that it was Wirth, who is also an authorized agent of the Secretary, who made the determination to issue the order, and that his exercise of discretion should be sustained. In its reply to the opposition, JWR does not dispute the fact that Wirth made the decision, and that he did not have to be present at the scene to have done so. However, it contends that Wirth must be held to the same "abuse of discretion" standard that would apply had he been on the scene, and that he clearly abused his discretion in this case.

The alleged imminent danger condition, an explosive level of methane in the atmosphere behind seal 31, was confirmed by Crumpton no later than 11:23 a.m. Crumpton was an experienced inspector who had made determinations on issuance of imminent danger orders in the past. He was aware of potential ignition sources in the sealed area, namely roof falls and electromagnetic field changes. Yet he made no determination that an imminent danger existed at that time. Nor did he make a determination that an imminent danger existed when he confirmed the readings at 12:27 p.m., re-confirmed them at 1:27 p.m., or found similar readings at seal 24 at 1:50 p.m. At 2:20 p.m., when he talked to Wirth, he still had not made a determination that an imminent danger existed.

It is extremely doubtful that Wirth could have been in a better position than Crumpton to assess whether conditions at the mine presented an imminent danger. Crumpton, who was on the scene, had not identified any roof hazards, and never concluded that a roof fall was imminent in the sealed area, or in any other area of the mine. Wirth testified during his deposition that the only potential ignition source that he considered was a roof fall. However, he admitted that, because of "the unknown composition of the atmosphere and the unknown nature of the composition of the rock" in JWR's mine, it would have been pure conjecture to specify a probability for an ignition from a roof fall. Cont. ex. 3 at 76. It is clear that he did not instruct Crumpton to issue the order based upon an assessment of the likelihood of a roof fall resulting in an ignition. He testified that he was applying an unwritten rule, or policy, subscribed to by unnamed MSHA officials, to the effect that "atmosphere readings that fell within the ETS numbers of 4.5 to 17 [percent methane], and above 10 percent oxygen, constituted an imminent danger." *Id.* at 72-73.

The Commission has criticized situations in which an inspector's exercise of discretion in determining whether an imminent danger exists had been "constrained" by instructions issued by MSHA officials, which "precluded the inspector from conducting a requisite reasonable investigation of the facts and exercising his discretion." *Cumberland Coal Resources, LP*, 28 FMSHRC 545, 555-56 (Aug. 2006). It also found "particularly appropriate" an MSHA policy prohibiting the use of section 107(a) orders for control purposes, where the instructions removed the inspector's independent judgment in issuing imminent danger orders. 28 FMSHRC 556, n. 14.

Wirth does not appear to have been acting in conformance with instructions from a supervisor. Rather, he decided to adopt a position held by some other MSHA officials. Nevertheless, he was, in essence, using the section 107(a) order for control purposes, i.e., to enforce the withdrawal provision of the ETS.

Under the authorities cited above, it is clear that an actual ignition of the explosive atmosphere behind the seals was, at best, a theoretical possibility, and that issuance of the imminent danger order was not justified. It is apparent that Wirth was enforcing the ETS, rather than making a discretionary determination that an imminent danger existed. The ETS was issued upon a determination by the Secretary that miners face a grave danger when underground seals separating abandoned areas from active workings fail. 72 FR at 28796. While that determination supports the issuance of the ETS, it does not override the requirements for issuance of an imminent danger order pursuant to section 107(a) of the Act. Moreover, the structure of the ETS, which requires action if concentrations of methane and oxygen that are not necessarily explosive exist for a period of two hours, is inconsistent with the concept of an imminent danger.

ORDER

Based upon the foregoing, Contestant's motion for summary decision is hereby **GRANTED**. JWR's contest of Order No. 7692770 is **SUSTAINED**, and Order No. 7692770 is hereby **VACATED**.

Michael E. Zielinski
Administrative Law Judge

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RAYMOND H. BENNETT, Ph.D., P.E.

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B.S., Civil Engineering, University of Virginia
M.E., Civil Engineering, Structures, University of Virginia
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Dr. Bennett is a Registered Professional Engineer with over twenty years of experience in explosives effects, risk assessment, and systems analysis. He is familiar with all aspects of structural dynamics including blast and seismic load and response analysis as well as testing using actual and simulated loads. He has extensive experience in Department of Energy (DOE) and Department of Defense (DoD) safety and protective structures programs. Dr. Bennett's dissertation research was in the area of computing probabilities of failure under dynamic loads. He has applied risk assessment techniques to the performance evaluation of environmental containment facilities as well.

Dr. Bennett has managed test programs for both conventional and nuclear weapons effects. He managed the construction of one of the world's largest shock tube testing facilities as well as numerous tests using the High Explosive Simulation Technique (HEST) to represent nuclear waveforms. Dr. Bennett has served as a consultant to the Air Force Safety Center for the testing of high explosive storage concepts. He recently supported the Air Force in the assessment of explosive test and training range sustainability requirements.

Dr. Bennett has performed analysis of numerous shallow buried as well as above ground structures. Analysis has included both seismic and blast response under both the Tri-service Design Manual TM 5-1300, and DOE Order 5480.23 Nuclear Safety Analysis Reports. Analysis included the effects of internal and external blast as well as seismic, tornado, and aircraft impact effects. Dr. Bennett developed simplified models for key parameters that were accepted by the Defense Nuclear Facilities Safety Board.

Dr. Bennett has presented the results of safety studies to agencies at the federal, state, and local levels. He performed a probabilistic risk analysis for the failure of a buried pipeline that included definition of a maximum credible accident and consequence analysis. Dr. Bennett has performed similar analyses for the consequences of an aircraft impact into an explosives storage facility for the DOE and the fatigue failure of critical vehicle components for one of the nations largest public transportation authorities. He has made presentations at both closed sessions and at public hearings.

Dr. Bennett also has an extensive environmental background and developed guidelines for groundwater restoration projects at numerous sites, as well as reviewed disposal cell plans for radioactive contaminated soils for the DOE. He has provided engineering and environmental support to private oil companies including the installation of new tanks, environmental compliance and restoration.

Dr. Bennett is keenly aware of the need to fully understand the regulatory requirements governing a project. He received the US DOE's Award of Excellence for Quality Assurance.

Professional Chronology: Virginia Department of Highways and Transportation (Graduate Engineering Assistant 1978-1979); U.S. Air Force, Civil Engineering Research Division (Research Engineer, 1979-1982, Doctoral Student Civilian Institutes Program, 1982-1985, Project Manager and Chief of Structural Response Section, 1985-1989, Branch Technical Advisor, 1989-1990); Jacobs Engineering Group, Inc. (Senior Civil Engineer, 1990-1991, Engineering Manager, 1991-1993, Manager of Technical Services, 1993-1995, Quality Manager 1995-1997); Maxim Technologies, Inc. (Branch Manager, 1997-2000); MELE Associates, Inc. (Senior Project Manager, 2000-April 2001); Baker Engineering and Risk Consultants, Inc. (Senior Engineer, 2001-2003; Manager, Protective Structures, 2003-present).

Professional Registrations: Registered Professional Engineer (Texas, Oregon and New Mexico)

Memberships: Society of Automotive Engineers

Oct. 2003

BAKERRISK BAKER ENGINEERING AND RISK CONSULTANTS, INC.

JIHUI GENG, Ph.D.

Senior Scientist
Baker Engineering and Risk Consultants, Inc.

B. Eng., Mechanical Eng., National University of Defense Technology, China
M. Eng., Mechanical Eng., Univ. of Science and Technology of China, China
Ph.D., Chemical Eng., Nanjing Univ. of Science and Technology, China

Dr. Geng joined Baker Engineering and Risk Consultants, Inc. in 2003 to perform research and development of 3-D CFD code and visualization systems capable of simulating generation and propagation of blast and shock waves and their interaction with structures or buildings.

Prior to joining BakerRisk, Dr. Geng was a Professor at Nanjing University of Science and Technology where he managed a number of projects, focusing on the simulation of unsteady flows with moving components. He developed object-oriented 3D and 2D codes and visualization systems for application to flow-structure interactions, industrial explosions, detonation phenomena, and thermal and multiphase reacting flows. He taught several mechanical engineering courses in the areas of gas dynamics, computational fluid dynamics and combustion.

As an AvH (Alexander von Humboldt) research fellow at the Aachen University of Technology in Germany, Dr. Geng managed a project and conducted research in the field of multiphase reacting flow.

Professional Chronology: AvH Research Fellow, Aachen University of Technology, 1995-1997; Associate Professor, Nanjing Univ of Science and Technology, 1998-2000; Professor, Nanjing Univ of Science and Technology, 2001-2003; Baker Engineering & Risk Consultants, Inc., 2003-present

Memberships: Member of AvH (Alexander von Humboldt) Foundation, Germany; Committee member in Division of Shock Wave and Shock Tube, The Chinese Society of Mechanics

July 2006

J. KELLY THOMAS, Ph.D.

Manager, Blast Effects Section
Baker Engineering and Risk Consultants, Inc.

B.S., Nuclear Engineering, Texas A&M University
M.S., Nuclear Engineering, Texas A&M University
Ph.D., Nuclear Engineering, Texas A&M University

Dr. Thomas' current activities are focused on the development and application of empirical, analytical and numerical models and codes for the characterization of flammability and explosion phenomena. Dr. Thomas is also actively involved in the investigation of accidental industrial explosions, including vapor cloud explosions, bursting pressure vessels, runaway reactions, and internal explosions. Dr. Thomas's other activities include experimental investigations, explosion hazard evaluations, vented deflagration assessments, and the development of siting studies for petroleum and chemical processing plants.

Dr. Thomas has a broad range of experience in the safety analysis area, focusing on the development of phenomenological models to support consequence assessments, with the primary focus on explosions and energetic events modeling. Dr. Thomas developed numerous methods to calculate the potential for and consequences of gas-phase explosions involving radioactive liquid waste storage transport and processing facilities. The phenomena addressed by these methods include flammability criteria, peak deflagration pressure, deflagration source terms, and the potential for detonation. He wrote the explosion phenomena section for the Savannah River Site methodology manual, served on a panel which defined methodologies for explosion related phenomena to be used within the DOE complex, developed and taught a short course on explosion source term modeling, and has served on expert panels examining flammable gas issues at the Hanford DOE site. Dr. Thomas has also participated in the development of models for combustible gas transport and mixing in waste tanks and process vessels.

Dr. Thomas has also participated in evaluations of other technical areas in support of facility safety analyses. He led or participated in the development of accident scenarios, accident modeling, and quantification of resulting source terms for numerous DOE facilities. He developed operating parameter envelopes used to govern startup and test operations, and participated in the development of plant control and safety strategies for a radioactive liquid waste processing facility. Dr. Thomas has developed specifications for waste tank backup inerting, waste drum purge, and hydrogen bus venting systems, and participated in the development of vessel ventilation and purge system design modifications to enhance plant safety. He also participated in hazard and frequency evaluations for radioactive liquid waste storage, transport and processing facilities, and for hydrogen powered bus and mining vehicles.

Dr. Thomas has also managed and participated in projects dealing with the behavior of nuclear reactor materials and reactor systems integrity analysis, including: response of reactor core components to severe accidents, oxidation and emittance of reactor materials, irradiated steel mechanical properties, and reactor system structural integrity. In addition, Dr. Thomas led a nuclear fuels and materials research group at Texas A&M prior to beginning work in the safety analysis area. He directly participated in projects dealing with: fuel element thermal and mechanical analysis, space reactor design, development of a nitride fuels irradiation performance data base and associated correlations, validation and verification of fuel performance models and codes, space reactor material property correlations, and radioisotopic space power system design.

Professional Chronology: Texas A&M University (1986-90, Research Associate); Westinghouse Savannah River Company (Principal Engineer, 1995-98; Senior Engineer, 1990-95); Westinghouse Safety Management Solutions (1998-99, Principal Engineer); Baker Engineering and Risk Consultants, Inc. (Senior Engineer 1999-2000; Manager 2000-present).

Professional Registrations/Certifications: Certified Fire and Explosion Investigator (CFEI)

Professional Memberships: National Association of Fire Investigators (NAFI)

April 2004