Best Practice Guidance for Effective Methane Drainage and Use in Coal Mines

Introduction to a practical risk assessment tool for explosion prevention

Dr. David Creedy

- Sindicatum Sustainable Resources
- Group of Experts on Coal Mine Methane, Sustainable Energy Division, UNECE

UNECE Best practice guidance: Mine worker safety is paramount and should not be compromised

"Safer mining by managing methane to mitigate against explosion risk – achieve through implementation of risk-based management techniques in an effective regulatory environment"

- The UNECE best practice guidance stresses the importance of mineworker safety as a priority – as do many nations in their mining laws. However, serious gas-accidents continue to occur

- Mine management, regulators and law-makers do not always learn until after an accident event which is too late

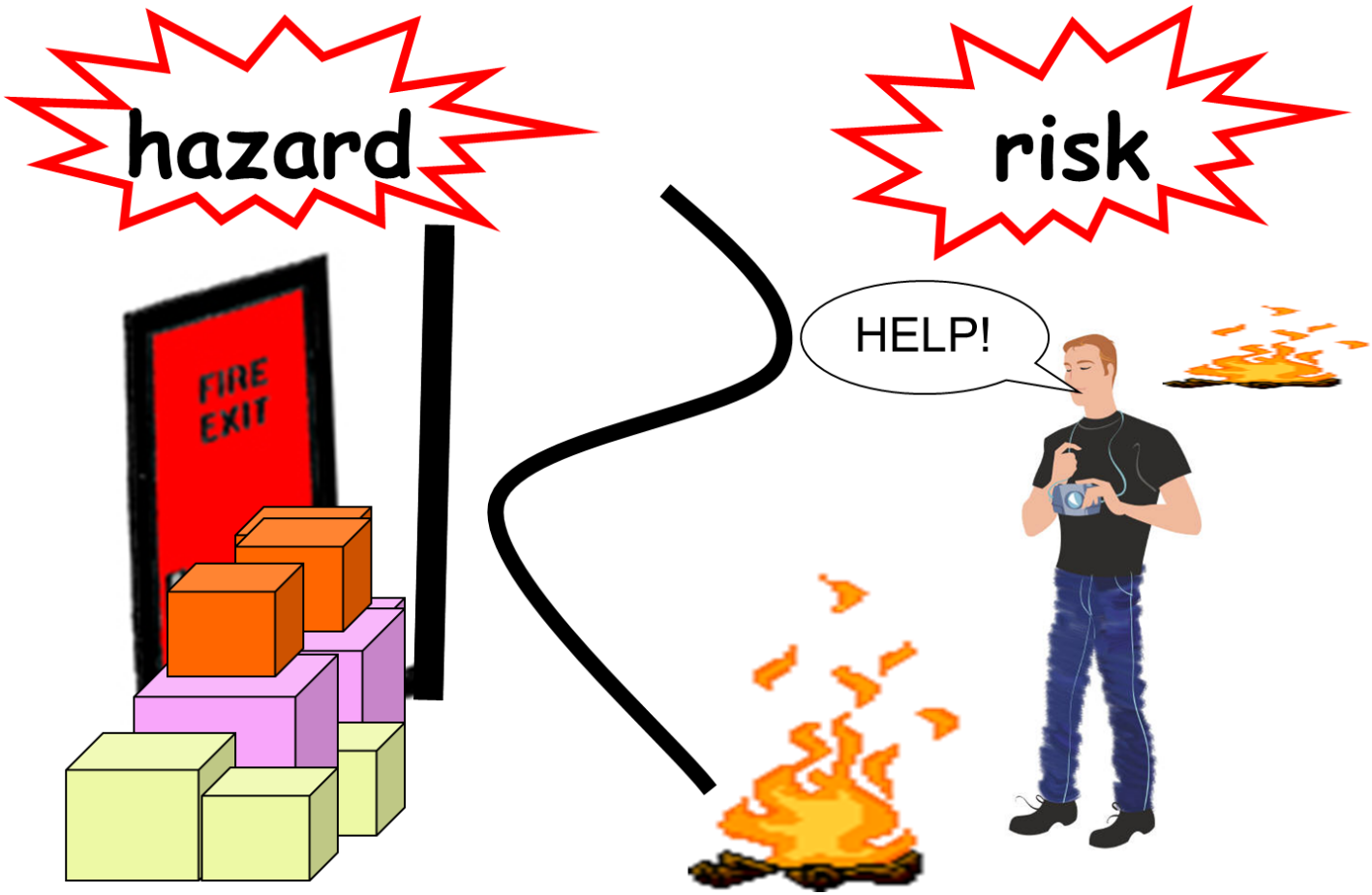
- Increasing the number and complexity of regulations is not a complete solution

- Risk assessment techniques are an essential tool in ensuring effective pre-emptive action

What is risk?

- Risk is the likelihood that a hazard will cause harm together with a measure of the severity of the harm
- There are risks associated with **everything** we do
- We only survive everyday life by managing risk e.g., crossing a busy road
- Risk can be quantified in terms of probability but there is rarely sufficient statistical data to achieve this, especially in the workplace

Understanding hazard and risk



What is the hazard? What could happen and how serious might it be? Can the particular hazard be removed or controlled and how?

Now analyse this situation

How is risk assessment (RA) applied effectively in the workplace?

- RA is a fundamental, operational Occupational Safety & Health (OSH) management tool used in countries that have goal-based OSH legislation
- RA is a tool for preventing accidents and preventing loss of production - safe mines are invariably the most profitable
- RA is only effectively implemented where management are involved
- Third party RA is ineffective – the opportunity to learn while undertaking RA is missed and reports are often filed away and forgotten
- Effective RA tools are simple to apply

The 3T Risk Assessment Method

**** EPA/GMI does not specifically endorse any particular risk assessment method***

Principle of the 3T Risk Assessment method

- A simple and practical RA method has been developed in Finland and adapted and tested for mining applications – the “3T Method”.
- The focus of the 3T method is not on preparing paper reports but removing and controlling the hazards in practice
- The RA process involves a hazard and control check list with the results evaluated using a simple risk matrix
- The difficulty of quantitative evaluation of probability is avoided by using a risk matrix which evaluates the effectiveness of current controls

The 3T risk assessment matrix tool

Current level of prevention and control	Potential severity of injuries & diseases		
	Slight	**Serious**	**Major**
Control is sufficient, no problems apparent	**1:** Risk is Insignificant.	**1:** A slight risk. Keep observing the situation.	**2:** Low risk. Check that the problem remains under control.
Some controls need improvement, problems have arisen	**2:** A low risk. Keep observing the situation and carry out easy to implement measures.	**3:** Medium risk. Plan and carry out suitable measures.	**4: High risk. Plan and carry out corrective measures quickly.**
Considerable need for improvement, frequent problems	**3:** Medium risk. Plan and carry out suitable measures.	**4: High risk. Plan and carry out corrective measures quickly.**	**5: A major risk. Plan and carry out corrective measures immediately.**

Control is sufficient, when:
a) machines, tools and structures comply with law and standards
b) work is designed and organised to be safe and healthy
c) employees are trained, and they actually use correct (safe) working practices

Developing the gas hazard RA check list

- **Identify gas related hazards**
- **List controls for each hazard**
- **Assess the effectiveness of each control**
  - Is the control performing as designed?
  - Do monitoring results confirm its effectiveness ?
  - Is the equipment fit for purpose?
  - Is equipment being maintained?
  - What is the potential impact if the control fails
- **Apply the risk matrix and record the risk factor for each control**

  Recommend measures to improve controls with risk factors 3 – 5
- **Identify the manager responsible for action and the date for improvements to be completed**

Extract from the gas hazard RA check list

Item	Hazard	Details of hazard	Control method	Remarks	3T risk score
G1	Total gas emission	Gas is released into the mine airways from all coal seams disturbed by mining activity and from worked out areas	Dilution to permissible concentration by main ventilation. Monitored methane concentrations should not have exceeded maximum permissible limits	No high methane concentrations recorded	**2**
G2	Gas not captured by methane drainage	Gas not captured by pre or post drainage is emitted into the mine airways during production	Gas drainage capture sufficient to allow planned production. Monitored methane concentrations should not have exceeded maximum permissible limits in the longwall return airway	Quality of captured gas variable, control could be improved. No stoppages for gas	**3**
G3	Explosive gas mixture in gas drainage pipes	Explosive mixtures arise when too much air is drawn into the methane drainage system	Design and regulate the gas capture and drainage system to ensure methane concentration >30%	Gas in drainage system within explosive range	**5**
G4	Methane layering in blind headings	Methane emitted into the roof of mine roadways forms a low density layer if not mixed and dispersed using ventilation air. A methane layer can transmit a flame long distances	Sufficient quantity and velocity of auxiliary ventilation to dilute gas to permissible concentrations and disperse any methane layers	No layering detected. Good auxiliary ventilation standards	**2**

There are 14 categories in the full table and more can be added

Determining the Safety Index for a particular mining panel

1. Examine each hazard in the check list and assess the effectiveness of the control on the basis of observations, monitoring, experience and common-sense.

2. Assign a risk factor using the 3T matrix; the presence of a control is not sufficient justification for assigning a risk score of 1 (no problems exist).

3. A safety index for the overall assessment is calculated as:

   [100 – ((total risk score/maximum risk score) x 100)] %

Note that the safety index only applies to a particular check list – it is not a generic index. For the 14 categories in the full table the maximum risk score = 5 x 14 = 70. The lowest achievable risk score is 1 x 14 = 14 so the best possible safety index = 80%

Application of the RA method

- Assessments are undertaken by discussions with management, specialist staff, supervisors and workers, and through site visits
- Risks are evaluated in brainstorming sessions; scores are allocated using the 3T risk matrix
- Corrective measures are determined and responsibilities and timescale for implementation assigned
- The assessment is reviewed annually or after major changes

The next step

Having implemented gas hazard Risk Assessment at a gassy coal mine, the next step is to introduce an observational or inspection tool for monitoring gas-safety performance.

That is another story…..

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Contact Information

Dr. David Creedy

Managing Director, CMM&VAM

Sindicatum Sustainable Resources

david.creedy@sindicatum.com

www.sindicatum.com