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Integrated gas management tools for improving gas control and reducing explosion risk in coal mines

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Reducing explosion risk – a combination of two tools

The tools are:

- The RA method which uses the “3T risk matrix” to evaluate effectiveness of controls, thus avoiding the complexity of probability

- The impact of RA on the workplace is assessed using a safety performance monitoring system (Elmeri) which yields a comparative index

The “3T” risk assessment matrix

Current level of prevention and control	Potential severity of injuries & diseases		
	Slight	**Serious**	**Major**
Control is sufficient and no problems apparent	**1:** Risk is Insignificant.	**1:** A slight risk. Keep observing the situation.	**2:** A small risk. Check that the problem remains under control.
Some controls need improvement and problems are apparent	**2:** A small risk. Keep observing the situation and carry out the easy measures.	**3:** An average risk. Plan and carry out suitable measures.	**4: A large risk. Plan and carry out the measures quickly.**
Considerable need for improvement and problems occur often	**3:** An average risk. Plan and carry out suitable measures.	**4: A large risk. Plan and carry out the measures quickly.**	**5: A major risk. Plan and carry out the 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

Example: 3T Risk Assessment check list - controlling gas emission hazards and mitigating explosion risk

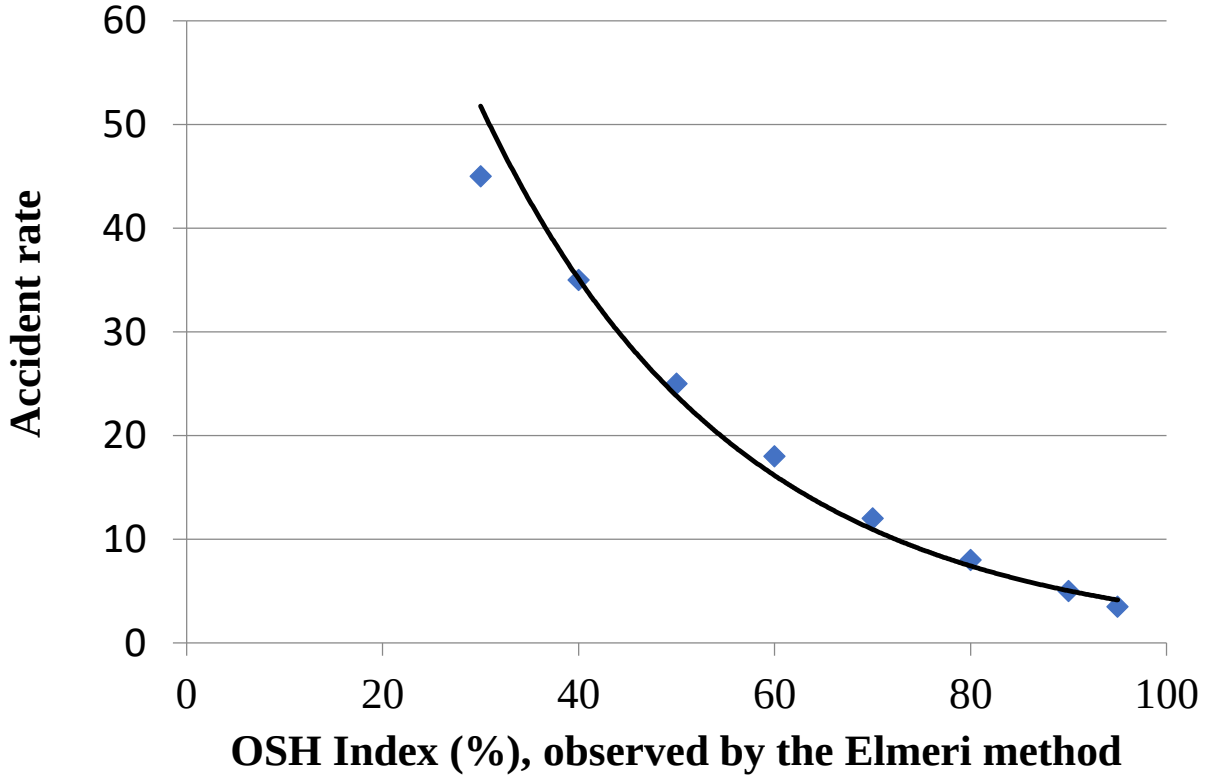
Item number	Hazard	Details of hazard	Control method	Remarks	3T risk score
1	Total gas emissions	Gas is released into the mine airways from all coal seams disturbed by mining activity and from worked out areas	Dilution to permissible concentration by main ventilation. Monitored methane concentrations should not have exceeded maximum permissible limits		
2	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		
3	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%		

OSH performance monitoring – need and method

- Need to know if application of RA is leading to continuing improvement in safety
- Accident statistics are a poor indicator and often incomplete
- Near-miss data are better but not sufficient
- The “Elmeri” system developed in Finland provides a suitable tool
  - Proved in industry in the EU
  - Adapted for mining and tested in a EU-China project on occupational health and safety in high risk sectors (EUCOSH)
  - Modified by UNECE for application to gas control and evaluated in a UNECE/GMI study in Shanxi

Standard observation is a valid indicator of the accident rate

Accident rate = lost time accident per million working hours



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UNECE Documentation

1. Manual
2. Interactive training courses
   - ❖ Risk Assessment - 6 modules
   - ❖ Performance Monitoring – 7 modules
   - ❖ Data analysis

Part 1: Risk Assessment Course content

- 1.1 Introductions
- 1.2 The RA and OSH tools and why they are needed
- 1.3 Basics of risk assessment
- 1.4 Best practice gas control and strategic risk assessment
- 1.5 Using the gas hazard work sheet
- 1.6 Risk assessment refresher

Part 2: OSH performance monitoring course content

- 2.1 Occupational Safety and Health indicators
- 2.2 Basics of the Elmeri observation system
- 2.3 Observation criteria for Elmeri
- 2.4 Observation sheet template for mines
- 2.5 Elmeri field exercise
- 2.6 Elmeri data analysis spreadsheet
- 2.7 Revision exercise

Trial application of the tools UNECE/GMI

3T Risk Assessment – Tenghui coal mine, Shanxi

1. Trainees worked in groups with a mine representative in each
2. Reasonably consistent results
3. Low concentration methane identified as high risk by most groups
4. 3T considered a useful tool and RA processes easily understood

Elmeri Performance Monitoring – Duerping CMM plant, Shanxi

1. First experience for trainees, inconsistent results and not well understood by all
2. Most correct - noise, air quality, ergonomics, safe access
3. Least correct - floor tidiness, electrical systems, gas control, first aid

Conclusion: Training in the understanding and application of both tools requires a minimum of 4 days, and later refreshers