



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

Best practice explosion prevention



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1. Introduction

The aim of this presentation is to introduce the UN “best practice” guidance document and focus on explosion prevention and gas control.

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

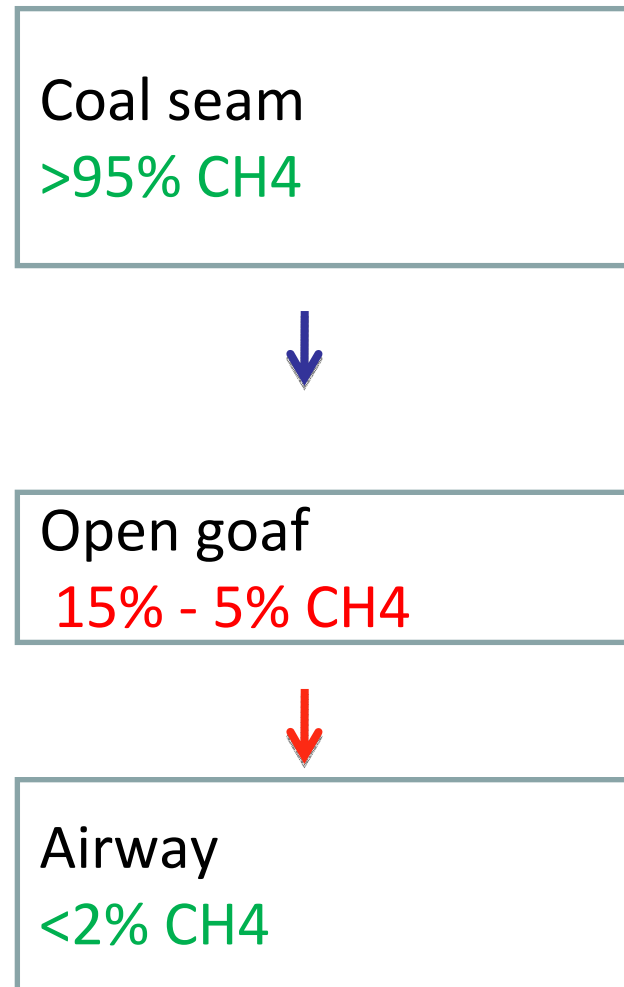
- Sponsored by the UNECE, the Global Methane Initiative and industry contributors
- Aimed at mine owners and operators, Government regulators and policymakers
- Encourage safer mining practices to reduce fatalities, injuries, and property losses associated with methane
- Enhance the sustainability and long-term financial position of coal mines in a carbon-constrained world
- “Principles-based” and not a technical manual

Explosive mixtures are unavoidable

In situ coal seam gas usually comprises high purity methane.

Flammable gases are only produced once a coal seam is disturbed by mining and the released gas mixes with air.

Mixing of air and methane occurs in the open goaf behind the coalface. Before the gas is diluted to safe concentrations it will inevitably pass through the explosive range.



2. Explosion prevention – technical principles

Explosive mixtures will always occur in gassy mines but this does not mean explosions must happen.

Fundamental physical explosion prevention principles

- a) Minimise flammable gas accumulations
- b) Minimise potential sources of ignition
- c) Maintain spatial separation between gas accumulations and ignition risks where practical
- d) In designing gas control measures, apply factors of safety large enough to accommodate observed variations – mandatory limits may not be sufficient.

a) Minimise flammable gas accumulations

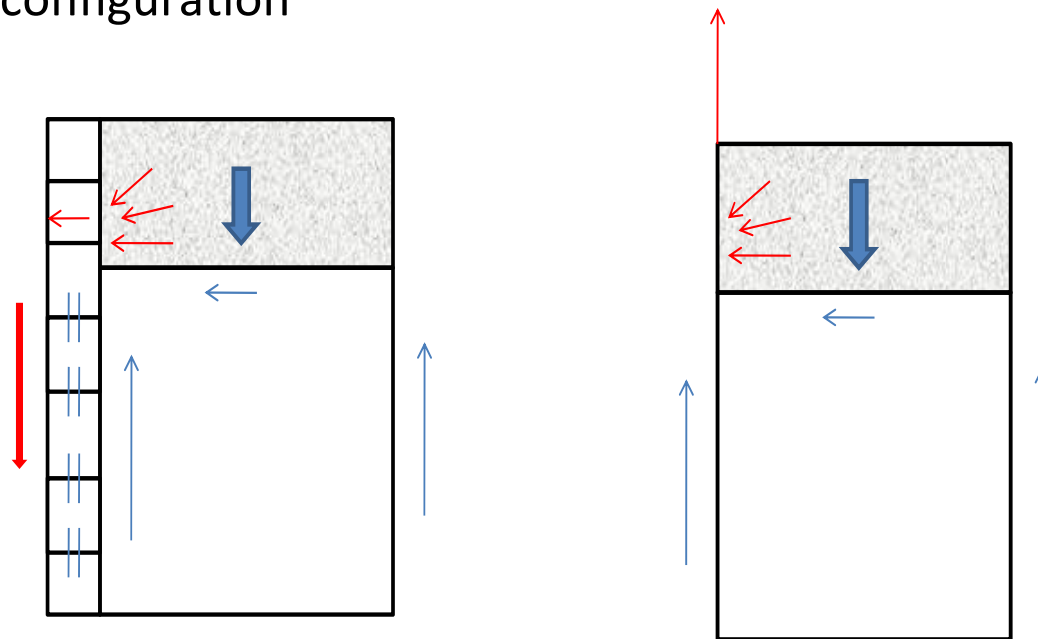
- Maintain good ventilation standards – main and auxiliary
- Use methane drainage to reduce the inflow of gas into working areas
- Dilute flammable gas emitted into airways or open goaf rapidly to safe concentrations with ventilation air
- Use machine ventilation devices to rapidly dilute gases emitted in the cutting zone of coalface shearers, continuous miners and heading machines

b) Minimise potential sources of ignition

- Regularly inspect and maintain electrical equipment, flame proof enclosures, protection systems, connectors and cabling. Isolate faulty equipment immediately.
- Zero tolerance to contraband especially smoking materials
- Water sprays behind cutting picks and proprietary machine ventilation devices to prevent frictional ignitions
- Careful management of blasting materials and their application

c) Maintain separation between gas accumulations and ignition risks

Divert gas away from working areas and potential ignition sources by selection of suitable ventilation configuration



3-road ventilation system

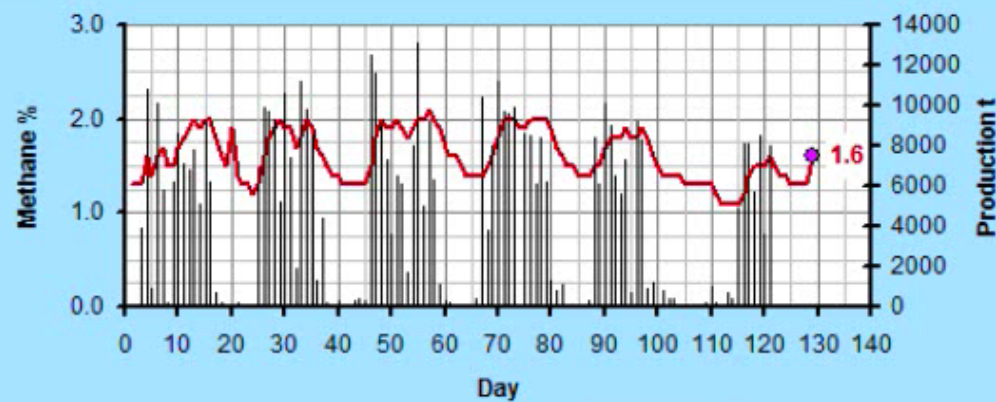
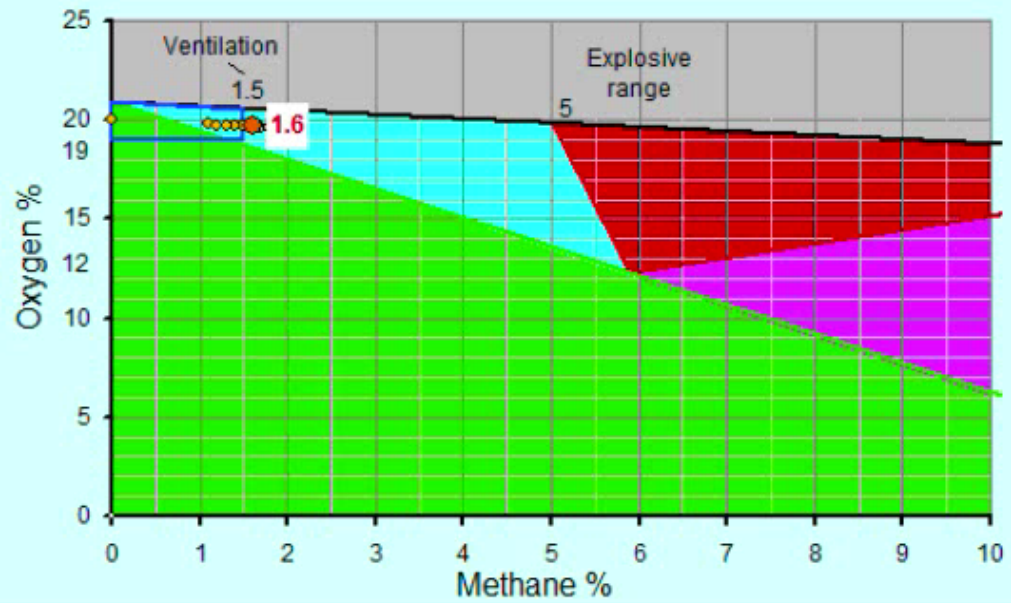
Y-type ventilation system

d) Factors of safety

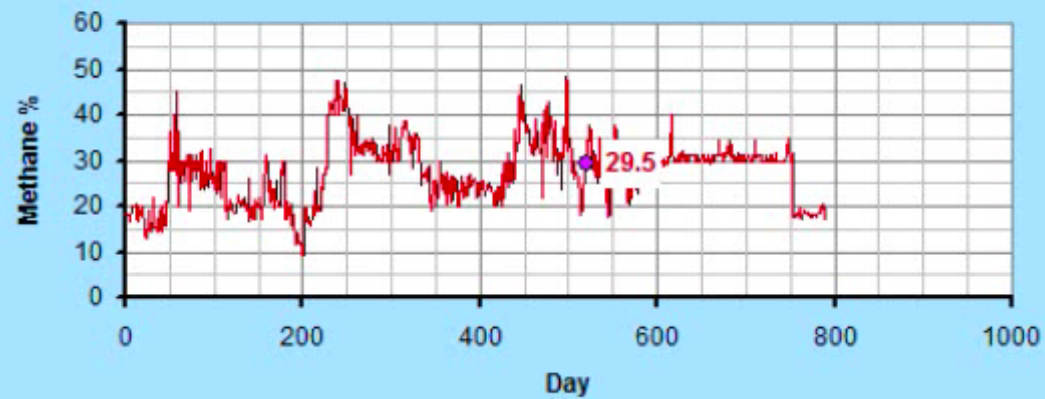
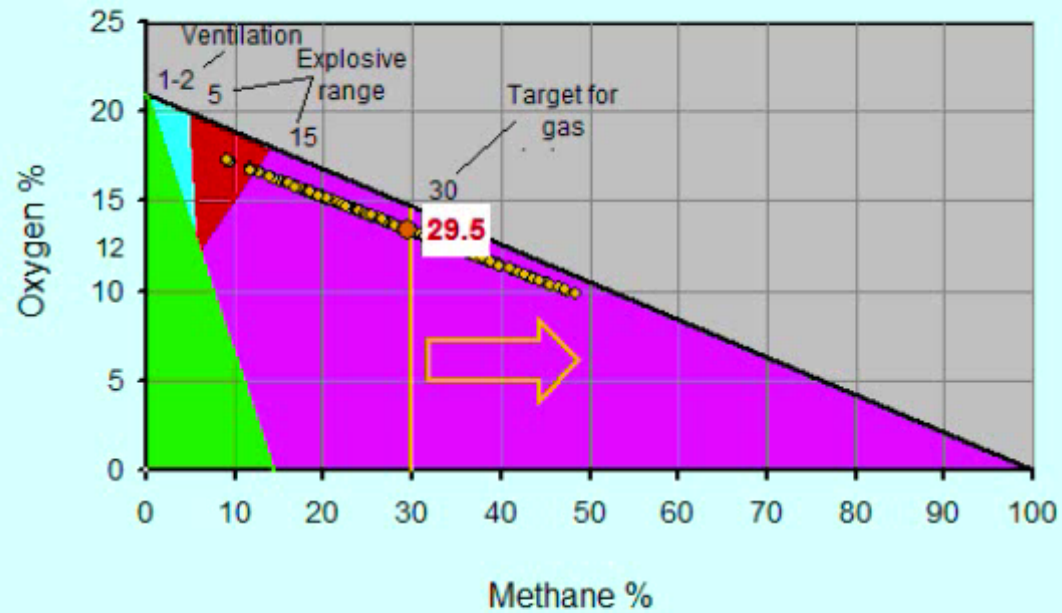
Flammable gas concentration limits

	Activity/location	Range CH4 %	Factor of safety
Above upper explosive limit of 15% CH4	Transport of drained gas in pipeline	Min 22- 40	1.5-2.7
	Utilisation	Min 25-40	1.7-2.7
Below lower explosive limit of 5% CH4	General airway	Max 1.0-1.4	3.6-5.0
	Return airway	Max 0.75-2.0	2.5-6.7

Factor of safety allows for CH₄ variation in longwall return airways



Factor of safety allows for CH₄ variation in drained gas



3. Summary of basic gas control principles

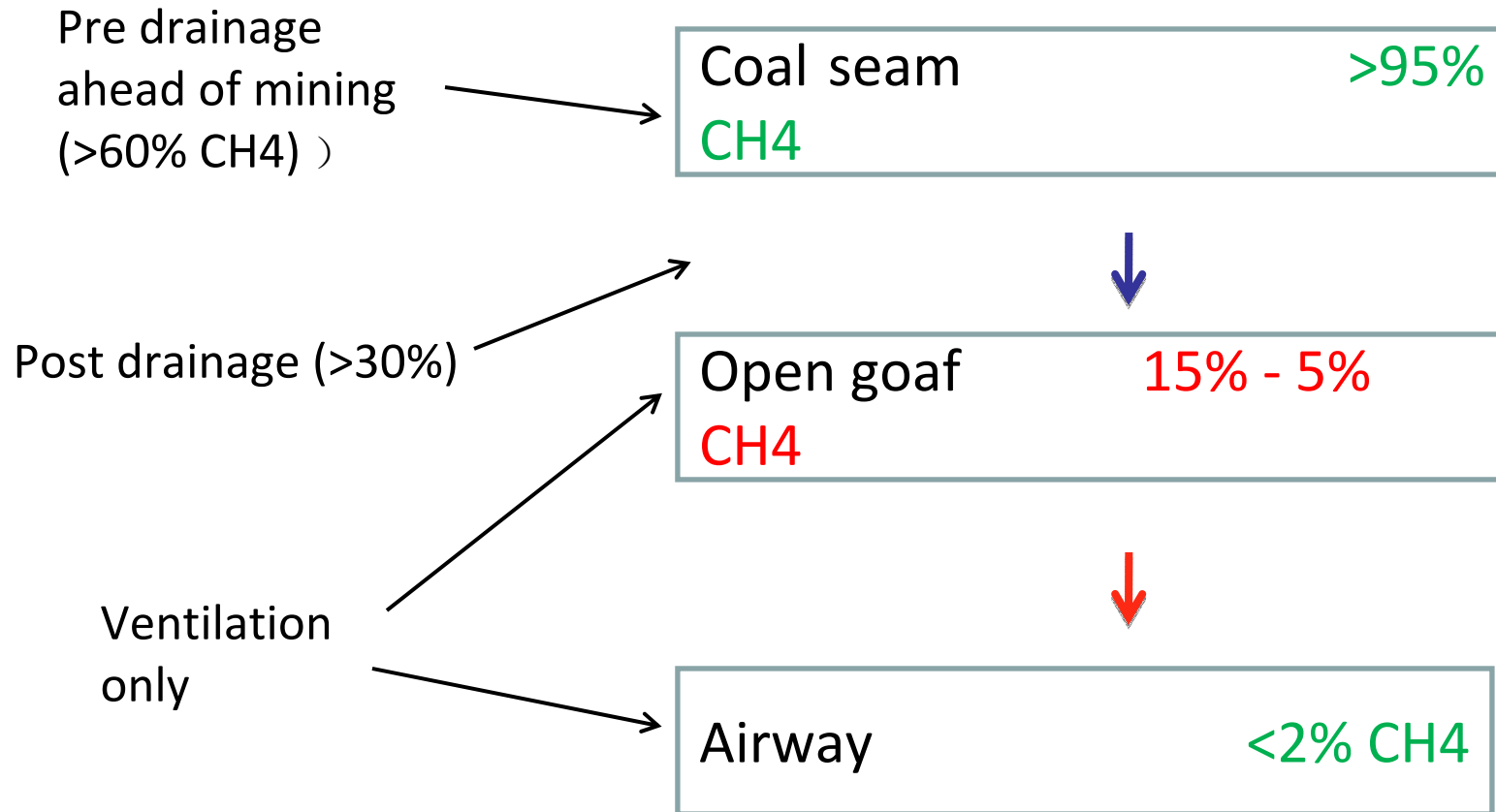
Gas control reduces explosion risks by

- Diluting gas, that cannot be captured at medium to high concentration, rapidly to safe concentrations with ventilation air
- Using proprietary devices to ventilate coal-cutting machines to ensure the gas released is diluted below the explosive range as quickly as possible
- Capturing gas in boreholes or drainage galleries before it can enter mine airways or open goaf
- Drainage of sealed areas to mitigate effects of falling barometric pressure
- Preventing excessive dilution of drained methane so it can be transported and used safely

Methane drainage basics

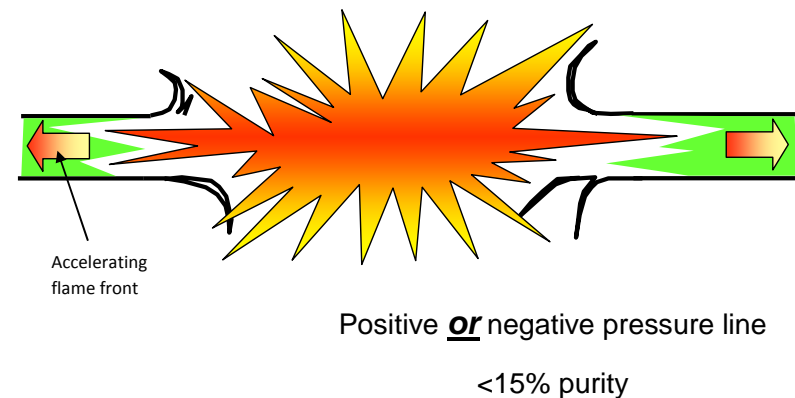
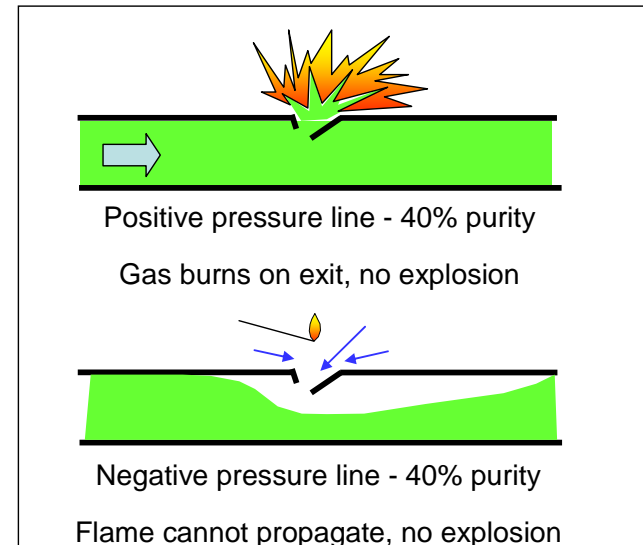
- The purpose of methane drainage is to capture high-purity gas at source before it can enter mine airways
- Choice of drainage method depends on mining method, production rate, gas content, depth of working, geology, permeability, flexibility and need for redundancy
- Post-drainage systems, which capture CMM at low purity (due to excessive air drawn into the system) are highly inefficient, encourage accumulation of explosive gas mixtures in the goaf and should be avoided
- Effective gas drainage systems have continuous, high quality monitoring and management

Gas control by ventilation and CH4 drainage



Pipeline transport of drained gas in the mine

- Underground pipe systems are vulnerable to damage from mine vehicles, transport systems and their loads, blasting activities, strata movement and roof collapse
- There is a finite risk of integrity failure
- Gas mixtures in or near the explosive range should not be transported



4. Explosion prevention – technology is not enough

How can explosions really be prevented?

- Strong regulatory, inspection and enforcement system – experienced inspectors with the authority to halt the mine if operations are unsafe but also willing to offer guidance to mine managers
- Safety focused management – safety first without compromise; zero tolerance of unsafe practices
- Worker participation – the main stakeholder in underground safety; risk assessment trained, able to report dangers and refuse unsafe work without fear of reprisals
- Education and training – to understand, assess and control risks

Note: Arguably, the underlying cause which led to the tragic Nov 2010 coal mine explosions in New Zealand was a seriously weakened inspection and regulatory system

5. Conclusions

Safer gassy mines

- A risk assessment approach to minimising explosion risks should be combined with strong enforcement of safety regulations to prevent accidents (and not wait for an accident precedent to be established)
- Safe working conditions in gassy mine environments cannot be achieved solely through legislation or even the most advanced technology
- Management, organisational structure, worker participation, training, and regulatory and enforcement systems are all essential components of an effective risk management process
- Improvements to methane drainage systems can often provide a more rapid and cost-effective solution to mine gas problems than simply increasing the mine's air supply
- Transporting methane-air mixtures at concentrations in or near the explosive range in coal mines is a dangerous practice and should be prohibited

Acknowledgements

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