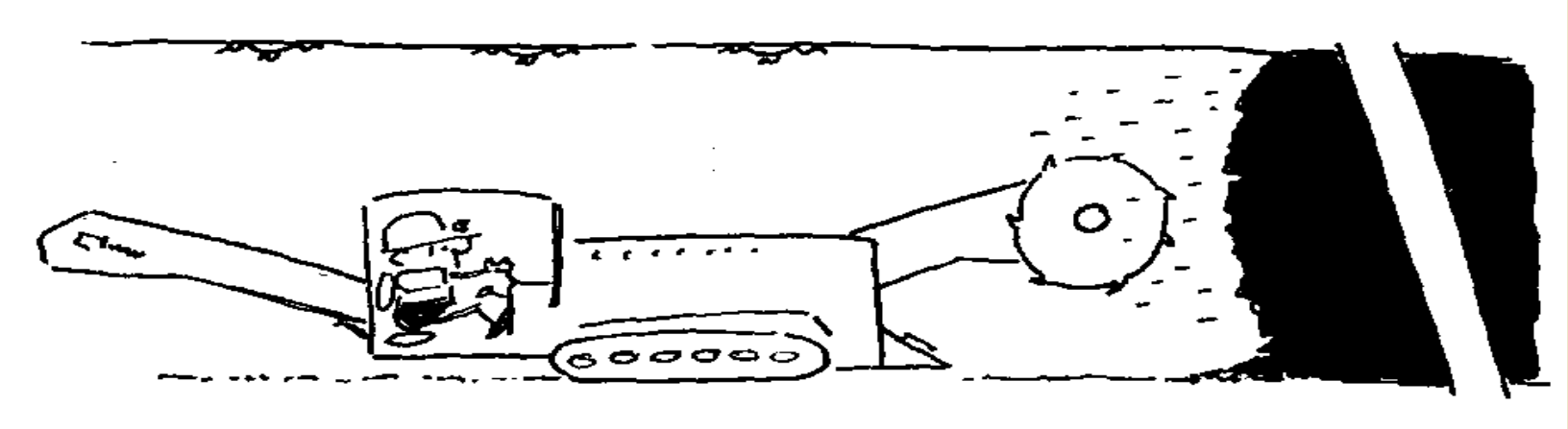
Operators Perspective on Managing Outbursts



Presented By
John Calleja
West Cliff Colliery

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What Is An Outburst?

Violent ejection of gas and/or coal or rock with the potential to cause injury or death through physical harm or irrespirable atmosphere.

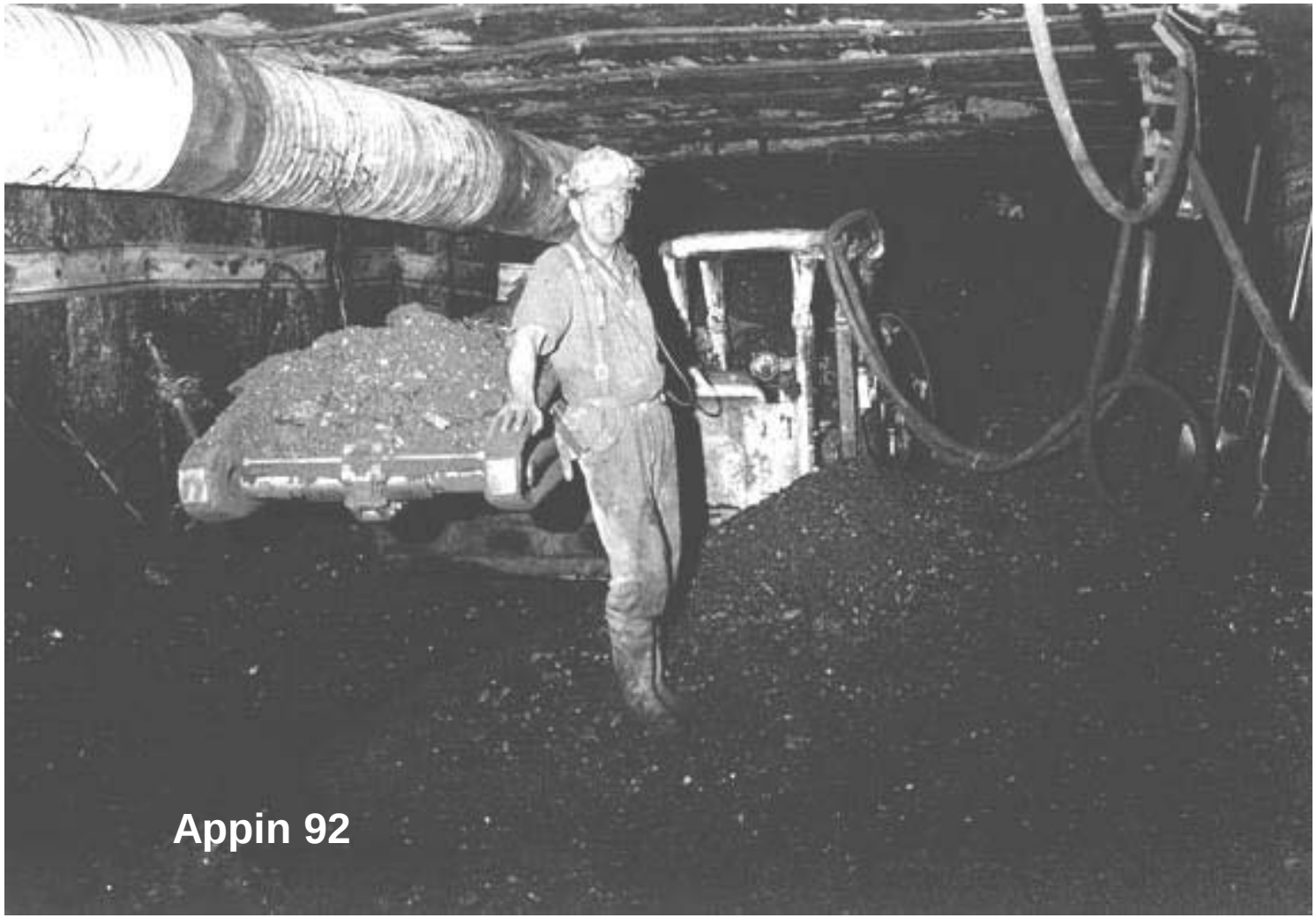
Outbursts

Colliery	No. of Outbursts	Size in tonnes	Gas	Geological Structure
Appin	22	2 - 88	mainly CH_4 & CO_2 on dykes.	Predominantly strike slip faults; mylonite zones.
Brimstone	2	30	CO_2	Mainly dyke related structures with strike slip movement.
Corrimal (closed)	4	12	CH_4 & CO_2	Sheer zone associated with minor faulting & dykes.
Kemira (closed)	2	60 - 100	CO_2	normal fault with mylonite.
Metropolitan	37	1 - 150	mainly $C0_2$ with minor amounts of CH_4	Predominantly with dykes & faults that exhibit slicken sides & mylonite.
South Bulli	7	1 - 300	mainly CO_2	Strike slip faults with mylonite; dyke zones & thrust faults.
Tahmoor	88	5 - 400	mainly CO_2	Mainly strike slip faults; with dykes (110° - 135°) & thrust faults: mylonite usually present.
Tower	19	1 - 80	mainly CH^4	Mainly strike slip faults with dykes.
West Cliff ★	250	4 - 350	mainly CH_4 with CO_2 to the NE development	Predominantly strike slip faults (100° - 110°) with slicken sides & mylonite; dykes and thrust faults have been associated with outbursts.

Fatal Outbursts

COLLIERY	DATE	No. KILLED	SIZE (tonnes)	GAS	STRUCTURE
Metropolitan	10 June 1896	3	Unknown	CO_2	Dyke and soft fault zone
Metropolitan	27 July 1926	2	140	CO_2	Fault with 5m throw
Metropolitan	2 December 1954	2	90	CO_2	Normal fault with 0.3m throw
Tahmoor	24 June 1985	1	400	CO_2	Behind a dyke associated with strike slip movement
South Bulli	25 July 1991	3	300	CO_2 & CH_4	Thrust fault with 35 cm of mylonitic coal; very high gas pressure.
West Cliff ★	25 January 1994	1	350	CO_2	Intersection of 2 strike slip structures; 30 cm of mylonitic coal.

Ejection of Coal or Rock



Ejection of Coal or Rock

Ejection of Coal or Rock

Cone Shaped Cavity

Cone Shaped Cavity

Mechanics of Outbursts

Factors Associated With Outbursts

- Gas
  - Pressure (mPa)
  - Content (m^3/tonne)
  - Composition (%CH_4 - %CO_2)
- Structure
- Stress
- Coal Strength

Outburst Warning Signs

Describe the warning signs in two words:

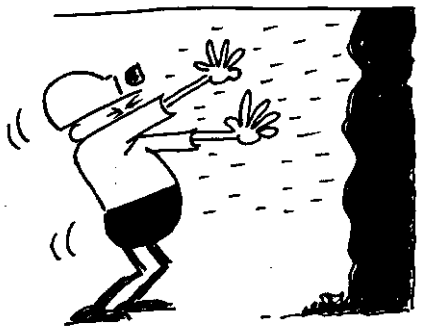
UNEXPECTED CHANGE!

Outburst Warning Signs

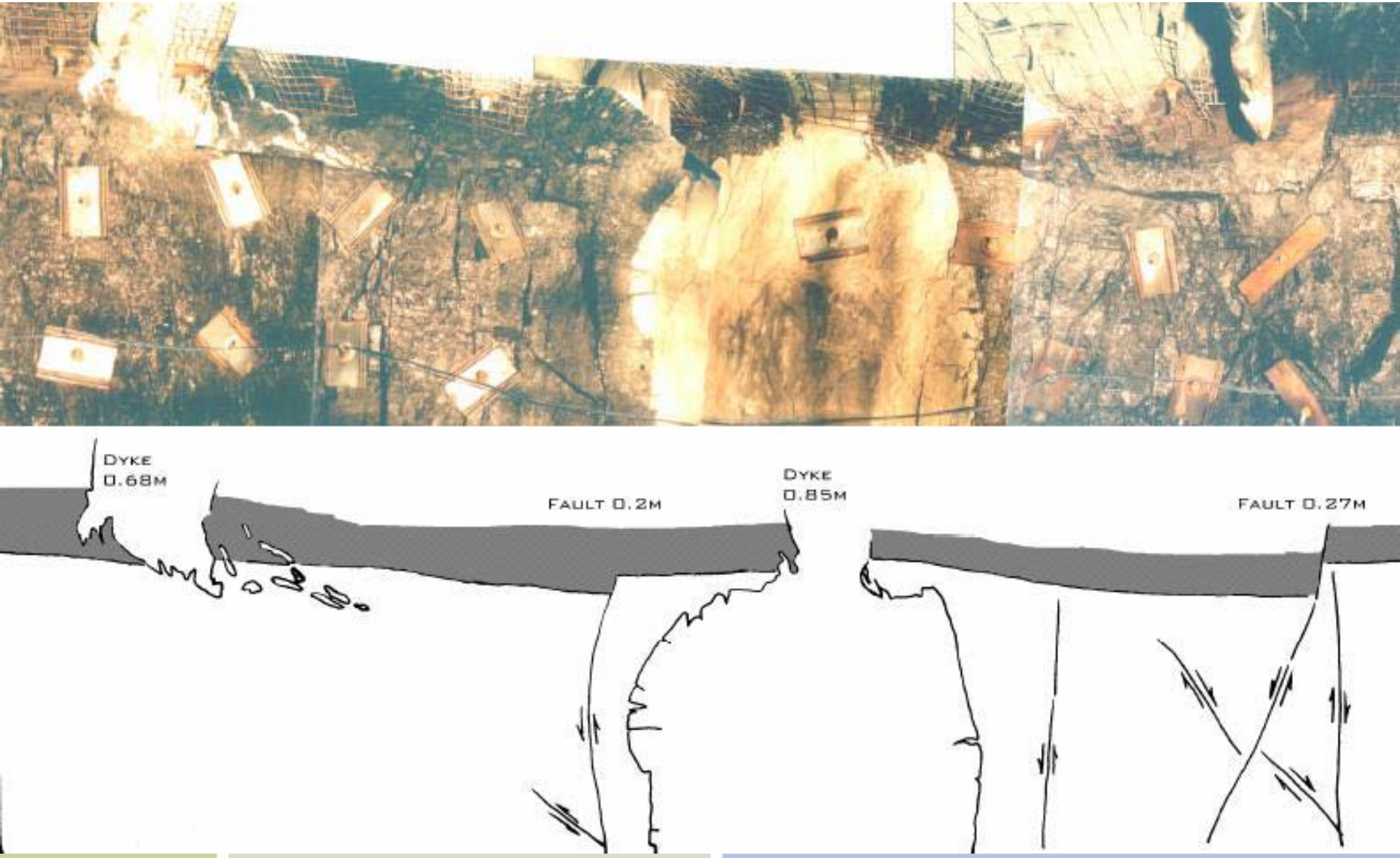
- More cutters than usual
- Change in direction of cutters
- Greasy backs
- Reddish brown tinge
- Poor roof or ribs
- Good roof or ribs
- Sudden seam dip
- Abnormally hard or soft face
- Chemicals being blown out from rib holes

Outburst Warning Signs

- Conical Cavity in the face or ribs. (small outburst)
- Mylonite zones
- Other geological features such as faults or dykes
- Calcite bands
- Marked increase or decrease in noise from the strata
- Gas
- Coal spitting from face or face bulging
- Wet ribs or face



Faults & Dykes

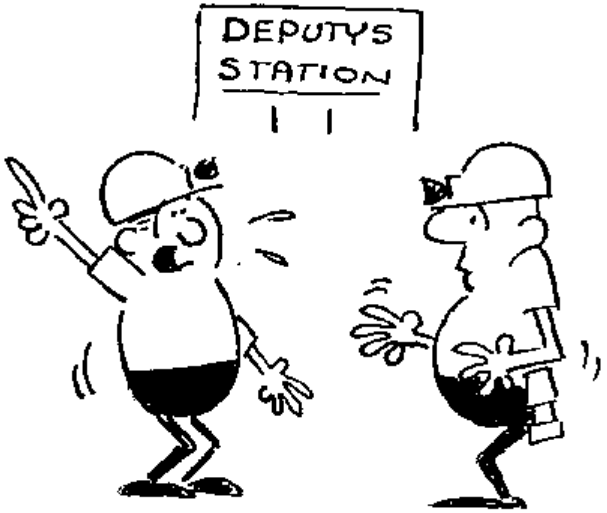


What to do If Warning Signs Are Noticed?

Outburst Warning Signs

- Unexpected changes in the mining environment may indicate the potential for an outburst to occur.
- If these warning signs are unexpected:

Stop Mining and Inform The Supervisor



The Outburst Management Plan - Protection

What happens when we "STOP and REPORT" outburst warning signs to the Section Supervisor ?

Procedure When Mining Has Ceased Due To Warning Signs

- Inspection by Mining Supervisor.
- Inspection by Undermanager if warranted.
- UMIC & Geologist investigate if warranted.
- Authority To Mine is revoked if Geologist is required.
- Outburst Risk Review Team considers Geologists findings.
- Outburst Risk Review Team may authorise normal mining *or other requirements such as further drilling.*

The Outburst Management Plan

What else will we find in the Outburst Management Plan?

The Outburst Management Plan

1. **Prediction**

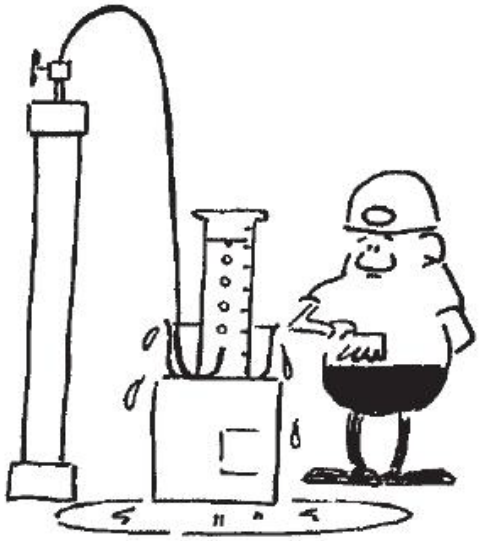
2. **Prevention**

3. **Protection**

The Outburst Management Plan - Prediction

Prediction

- Drill hole logs (from survey) used to identify and map structures.
- Core samples.
- Geological mapping.
- Surface 2D & 3D seismic.
- Outburst Risk Review Team meetings.

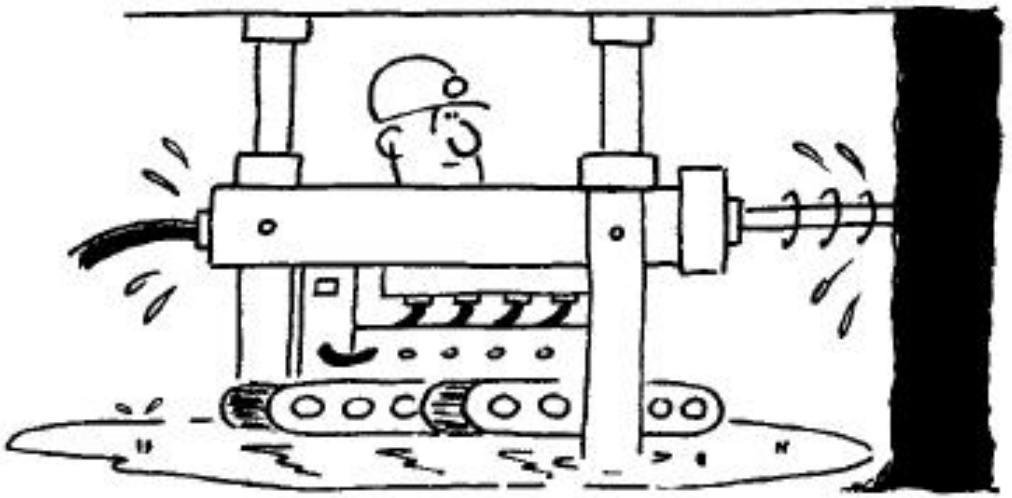


The Outburst Management Plan - Prevention

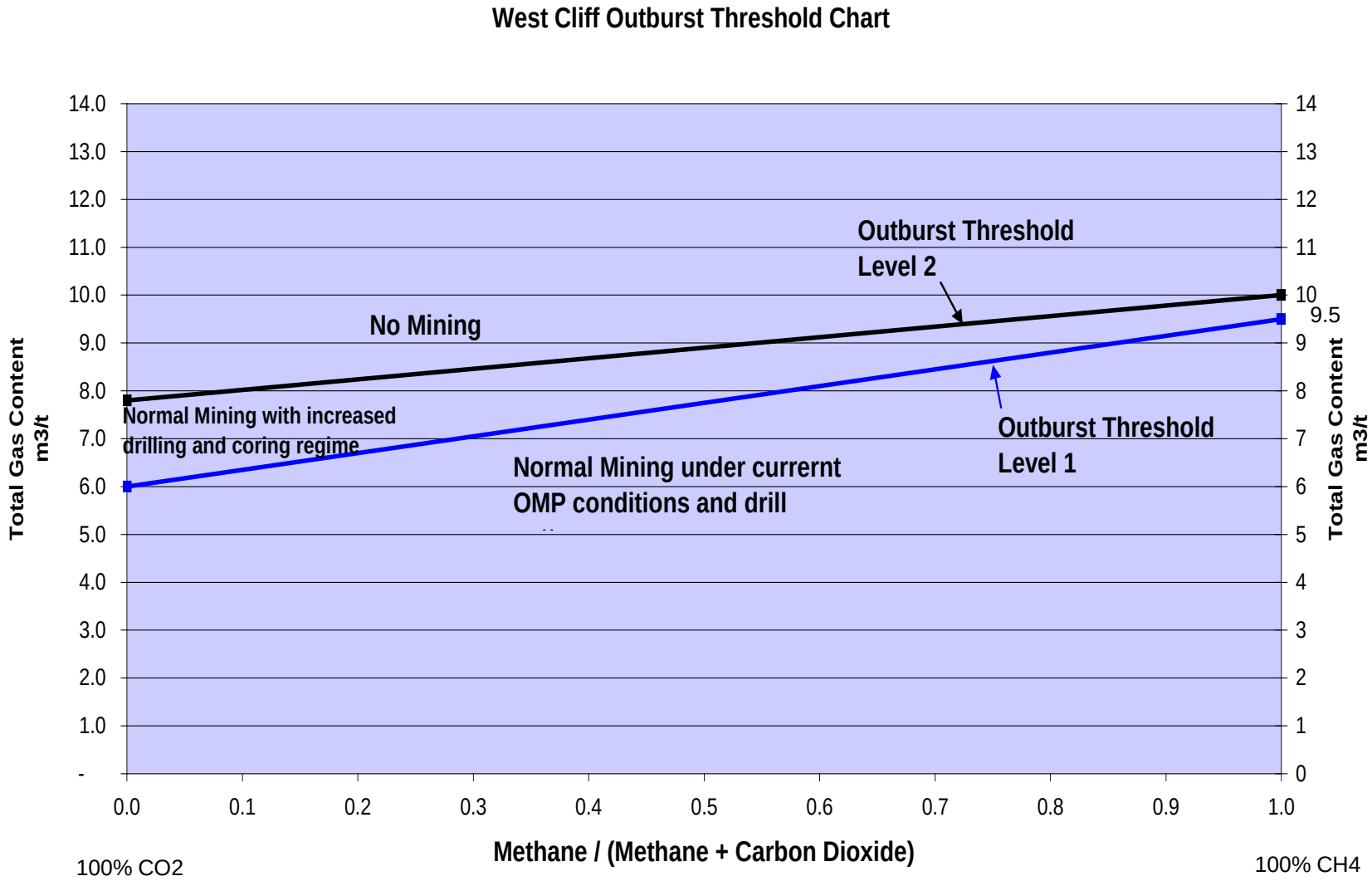
Prevention

- Drilling and Gas Drainage.
- Reduce gas content below Outburst Threshold Limits.

(Insufficient gas pressure left to generate an outburst.)



The Outburst Management Plan: Prevention- Threshold Chart



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Gas Drilling - Design Basis

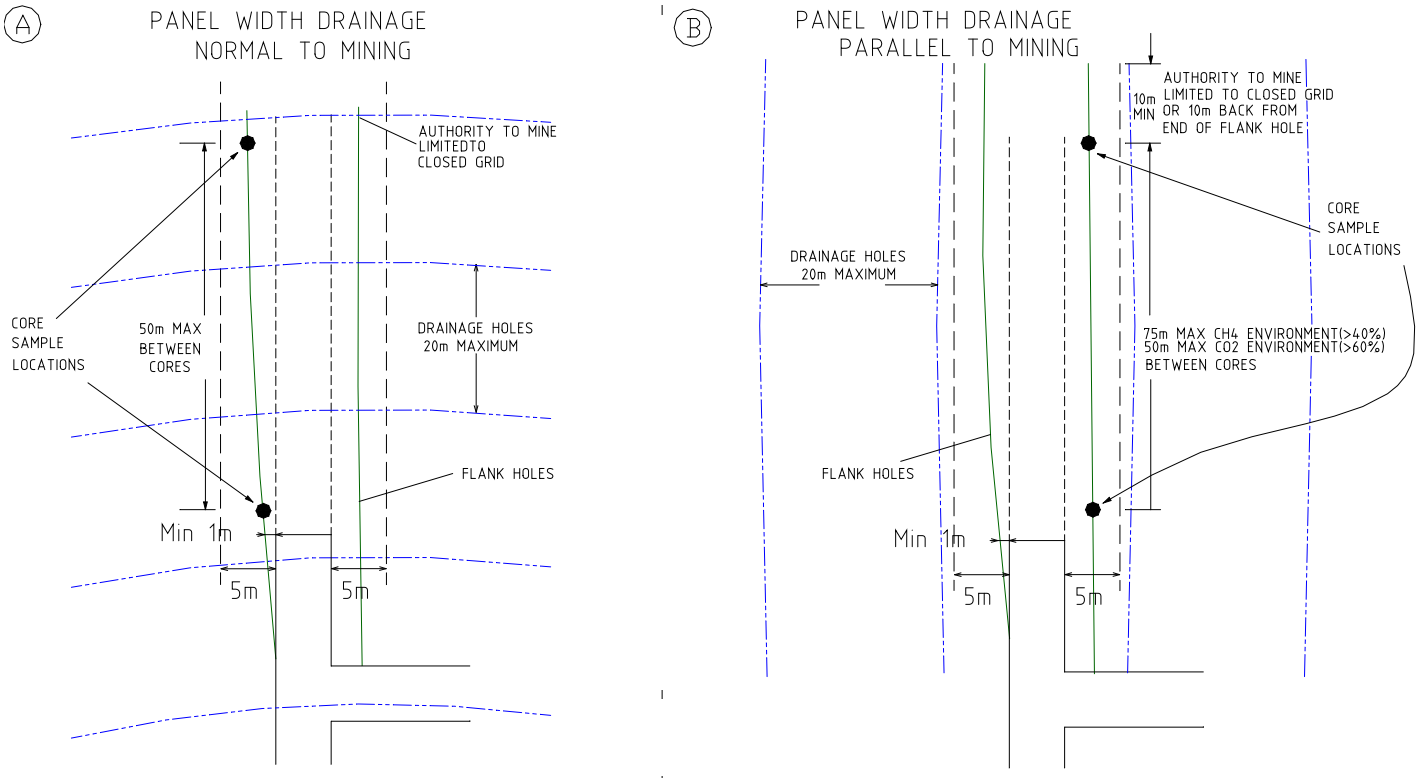
- When mining areas above Outburst Threshold level 1 but below Outburst Threshold Level 2, in a CO2 environment, the boreholes are spaced to a maximum of 20m and cover the entire area within that zone - with only one branch per hole.

Coring Design

	BELOW THRESHOLD LEVEL 1	BETWEEN THRESHOLD LEVEL 1 & 2
No Structure	**150m** spacing in a CH_4 environment and **100m** spacing in a CO_2 environment on the basis of worst case sampling	**75m spacing in a CH_4** environment and **50m spacing in a CO_2** environment on the basis of worst case sampling
Projected Structure (by geologist) not confirmed by drilling	Routine closely spaced samples as determined by the Outburst Risk Review Team	Within 10m either side of structure on both sides of the roadway in all roadways at 10m intervals, starting 10m before predicted zone.
Confirmed Structure	Maximum **10m** either side of structure for each road to be driven.	Within **10m** either side of structure on both sides of the roadway in all roadways.

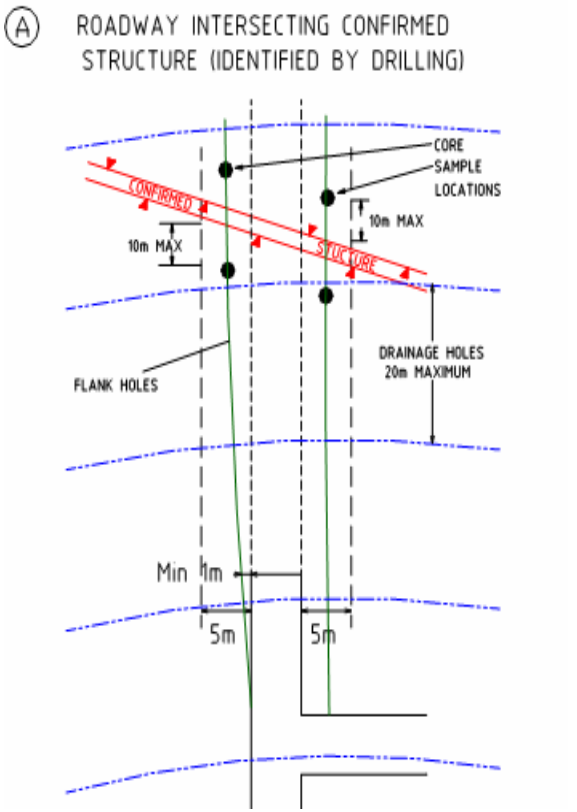
Drilling / Coring Plan – No Structure

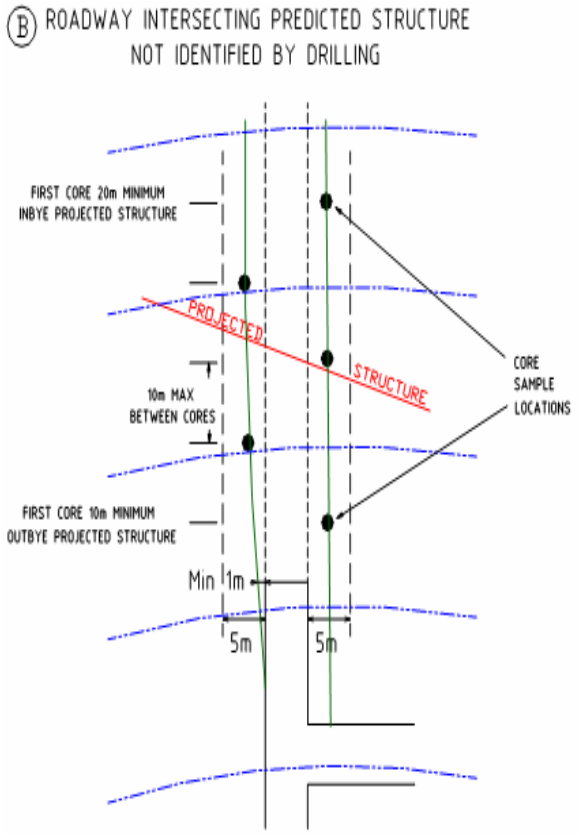
Core Locations – No Structures
(Above Threshold Level 1 & Below Level 2)



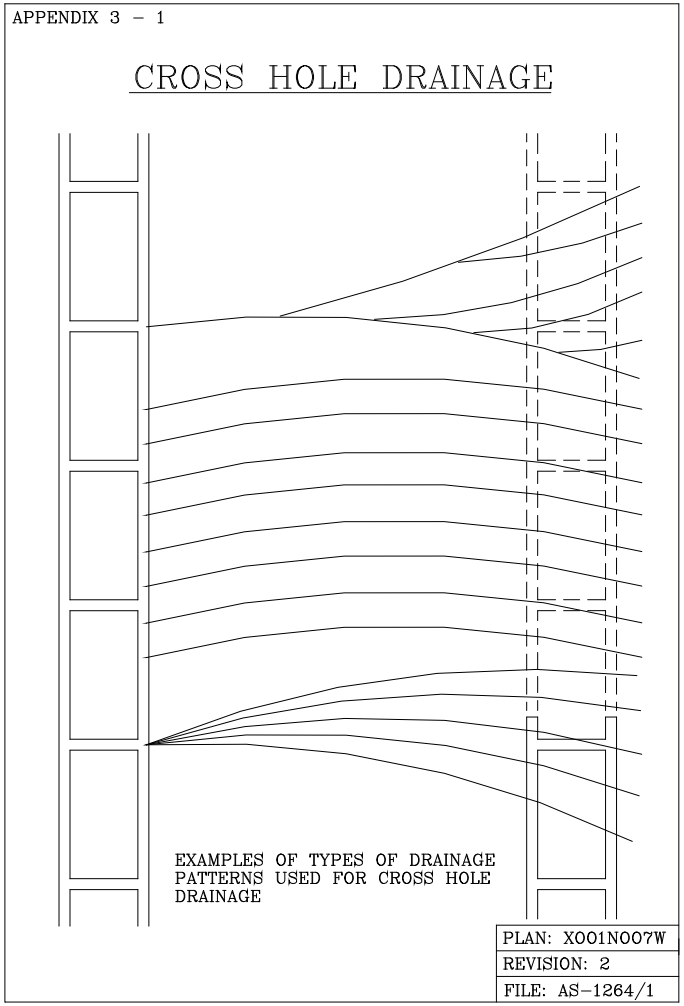
Drilling / Coring Plan – With Structures

Core Locations – **With Structures**
(Threshold Above Level 1 & Below Level 2)

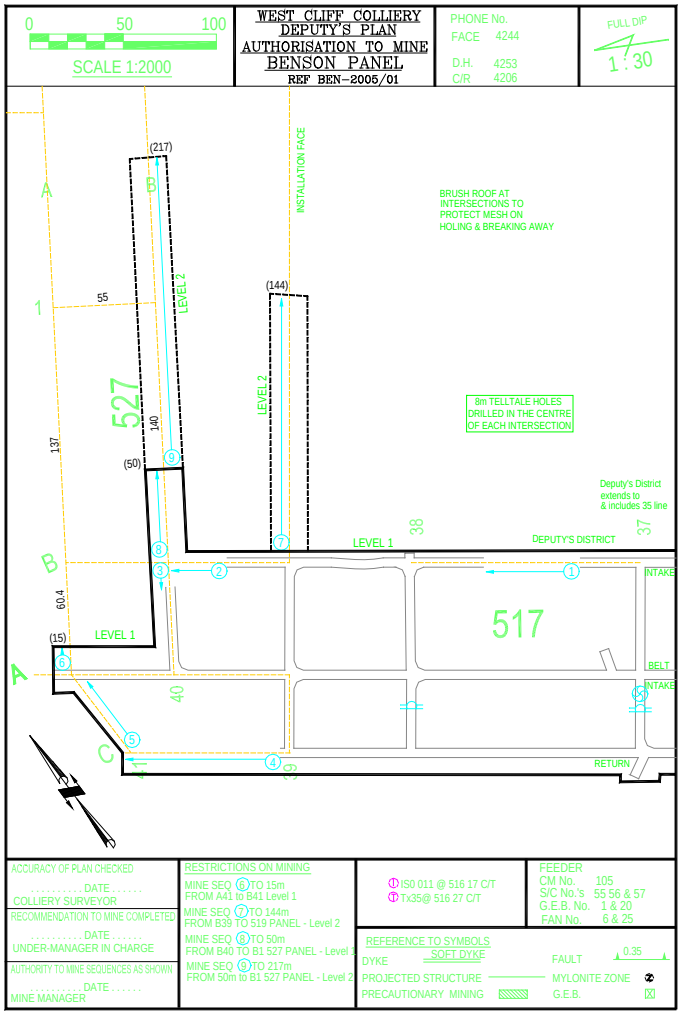


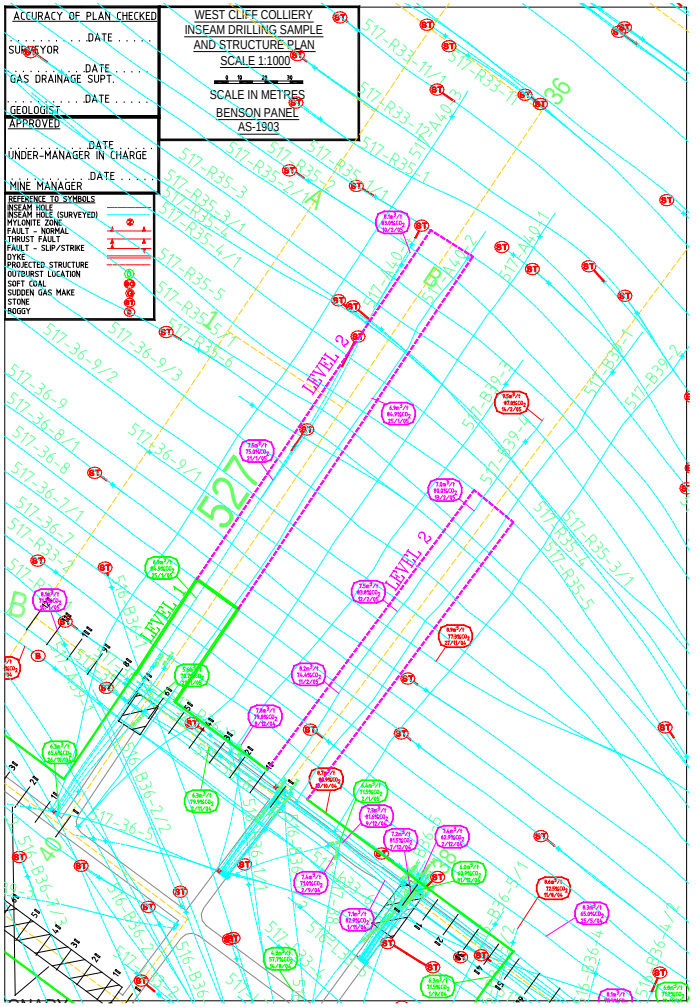


Typical drilling plans – drainage patterns



Prevention





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The Outburst Management Plan - Protection

- Routine training in Outburst Awareness
- The identification of outburst warning signs
- Use of First Response Rescue and Escape equipment
- The ability to suspend mining and initiate an inspection of the face area at any time should outburst warning signs be observed

What To Do If An Outburst Occurs

- **Self Escape**
  - Familiarity with equipment (SCSR)
  - Speed is critical
  - CO2 toxic to breathe @ 5-10%

- **Consider Rescue Options**
  - No one is required to perform a rescue
  - Risks must be considered
  - Leadership
  - Confidence
  - Have a plan
  - Where is a place of safety
  - Back up people required
  - Equipment required
  - Restore ventilation
  - Recovery of situation