Outburst Research Needs

Hanes ACARP Workshop

DMR Wollongong

12th February 2003

Ray Williams

GeoGAS

Issues

- Mechanism
- Thresholds
  - Circumstance (structure/mining)
  - Target outcome
  - Types
  - Values, Reliability, <u>Practicality</u>
  - Combinations
- Barrier
- Sample Frequency

Current Basis for Outburst Alleviation

- If the gas content is low enough, an outburst will not occur regardless of the state of other contributing factors.
- While outbursts almost always occur on geological structures, <u>at this stage</u> it has not been proven that such structures cannot be adequately predicted.
- The gas content must be reduced to below the defined threshold value (DTV) within the roadway to be driven and including a barrier surrounding that roadway.
- The DTV is designed such that no uncontrolled rapid gas emissions occur, regardless of whether they are outbursts or GDI's.

A Couple of Quandaries

- What gas pressure are we talking about?
- Is CO2 more outburst prone than CH4 or not?

Disturbed and Normal Coal

- Hard to drain zones have low permeability, due to:
  - stress effects associated with a structure (high outburst proneness), inability to drill, hole collapse, or
  - an almost total lack of structure (eg much of Tahmoor Colliery's hard to drain zones).
- Define unstructured coal with high level of certainty (borehole to borehole RIM) as a means of applying a higher gas content threshold.

In applying thresholds what are we aiming to achieve?

First Barrier is Zero Initiation

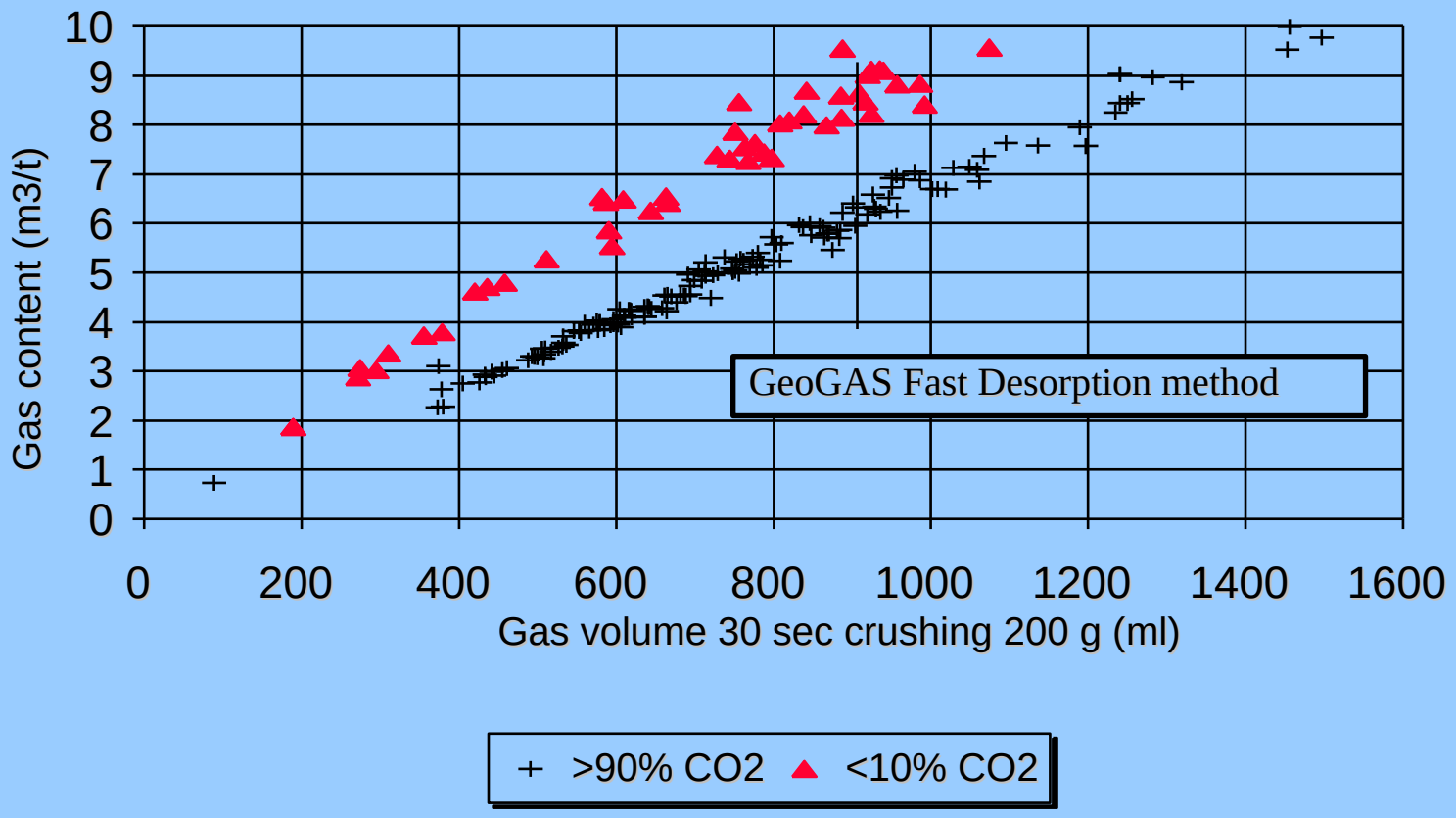
- Initiation involves -
  - Sudden failure of a barrier and reduction in pore pressure
- Consequences
  - Gas and coal are projected into the working place
  - Gas type (effect on humans)

Desorption Rate and Gas Content Threshold

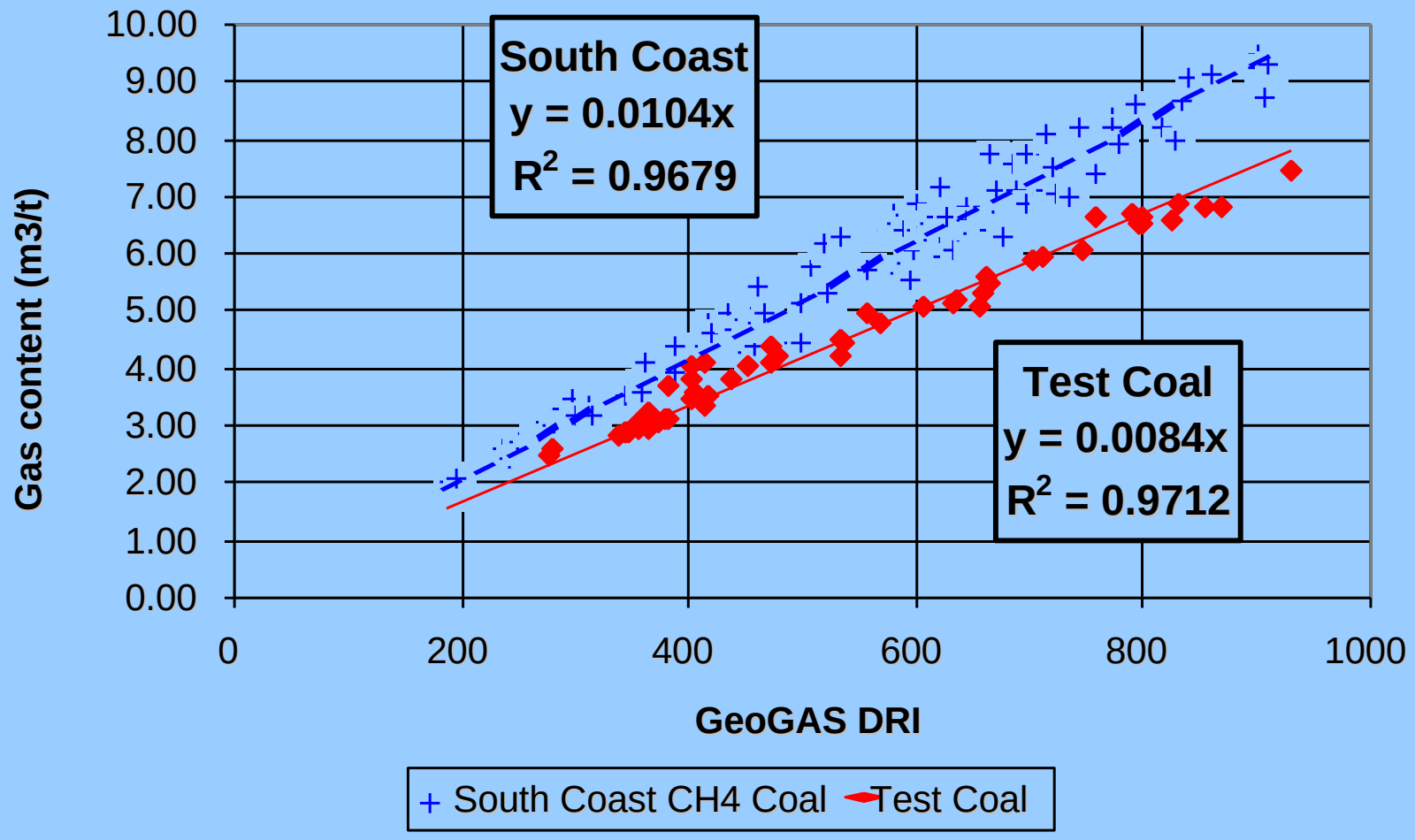
GeoGAS Desorption Rate Index

- *The GeoGAS DRI is calculated from the quantity of gas desorbed after 30 seconds of crushing a 200 g sample*

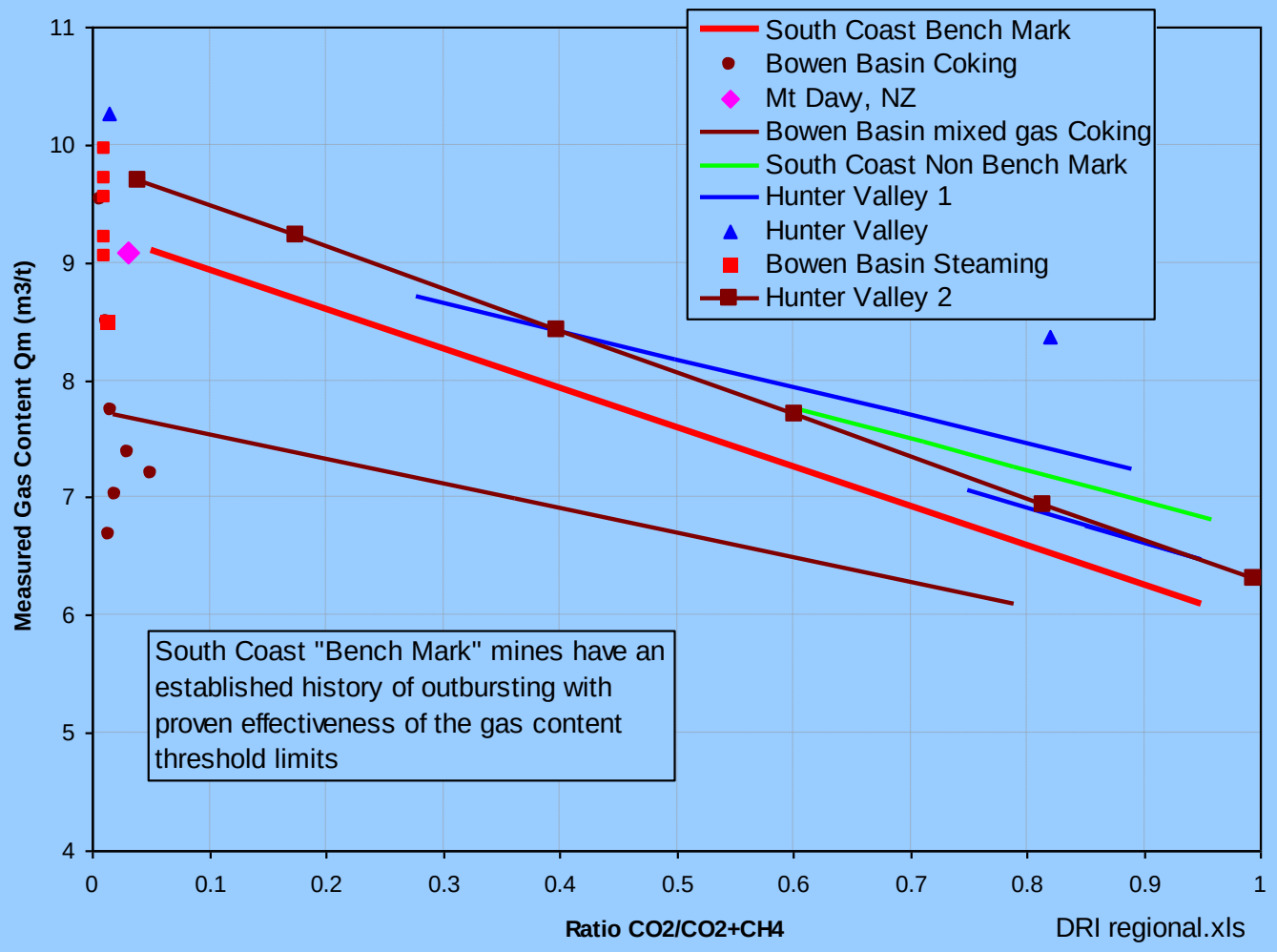
Desorption Rate Bench Mark Coals



Comparison Test Coal with Bench Mark Coal



Comparison of Gas Content Values for a Desorption Rate Index of 900

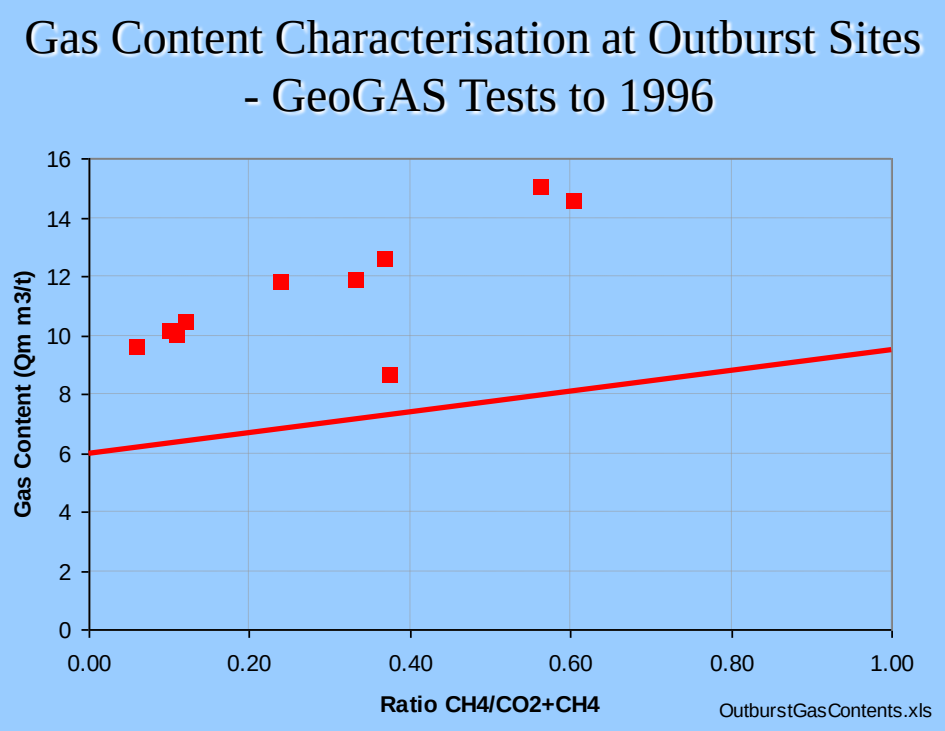


Weaknesses in the Desorption Rate "Bench Mark" Approach

- Assumes that other than desorption rate, all other factors are equal - which is not the case.
  - Eg for equivalent types of faulting, higher strength Hunter Valley coals would be less mylonitised than South Coast coals.
  - No account taken of differences in seam thickness, stress, permeability differences, gas sorption capacities.

So…Is CO2 more outburst prone than CH4?

- Measurement errors in CO2 coals - experience at Collinsville
- CO2 versus CH4 experience in Poland
- Confusion in the literature, especially basing comparisons on equivalent desorption pressures.



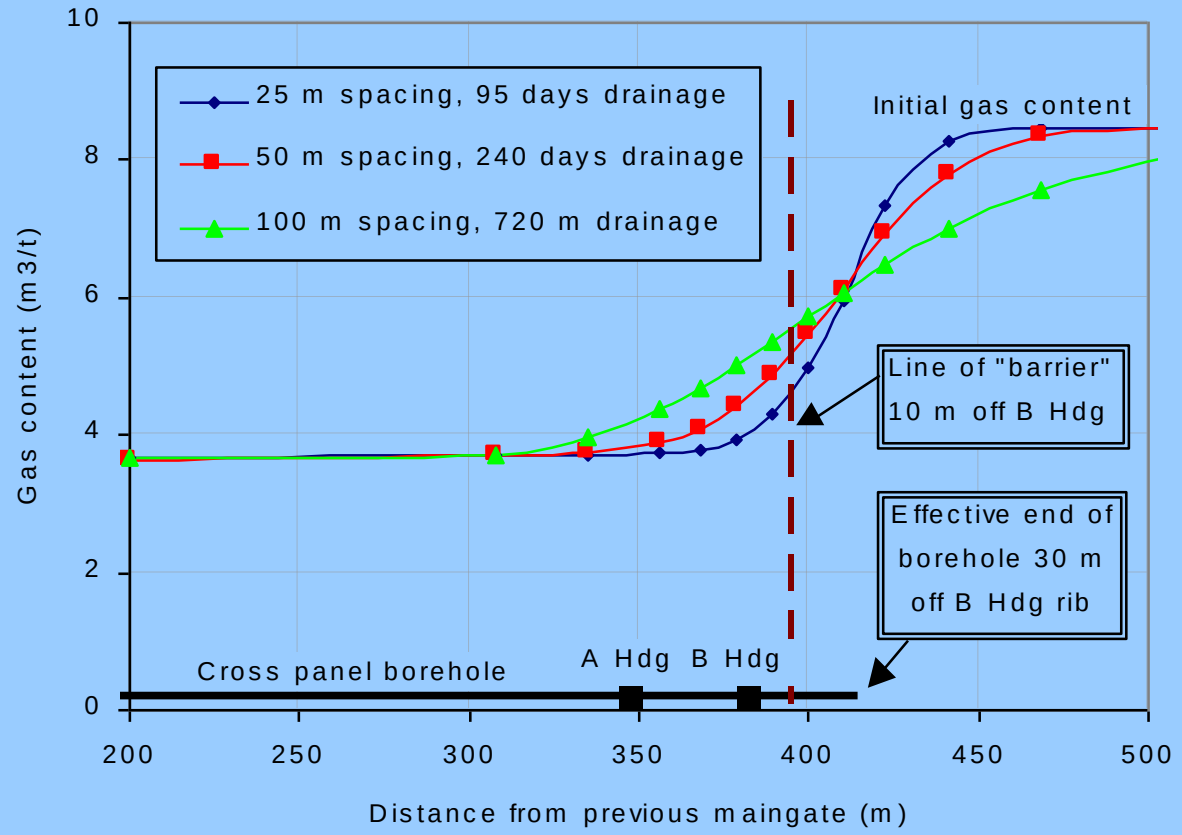
Gas Content Sample - LOCATION

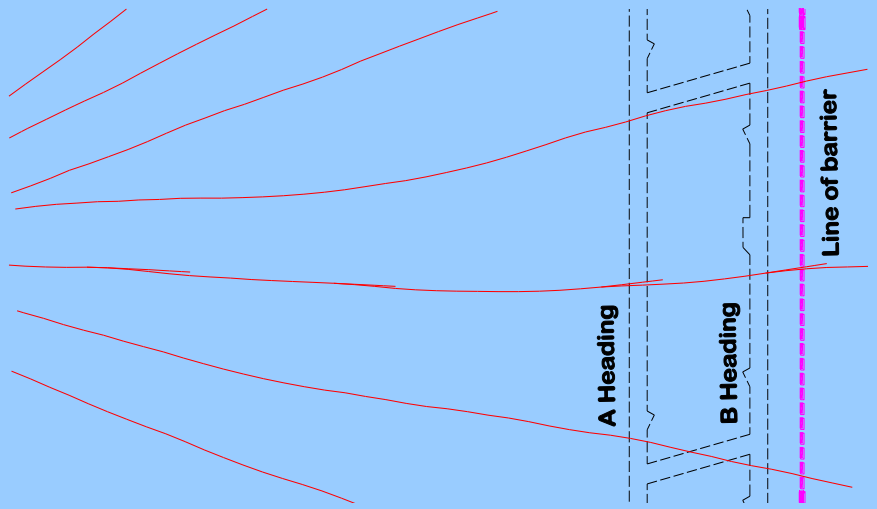
- Where gas content is likely to be the highest

Minimum operator discretion

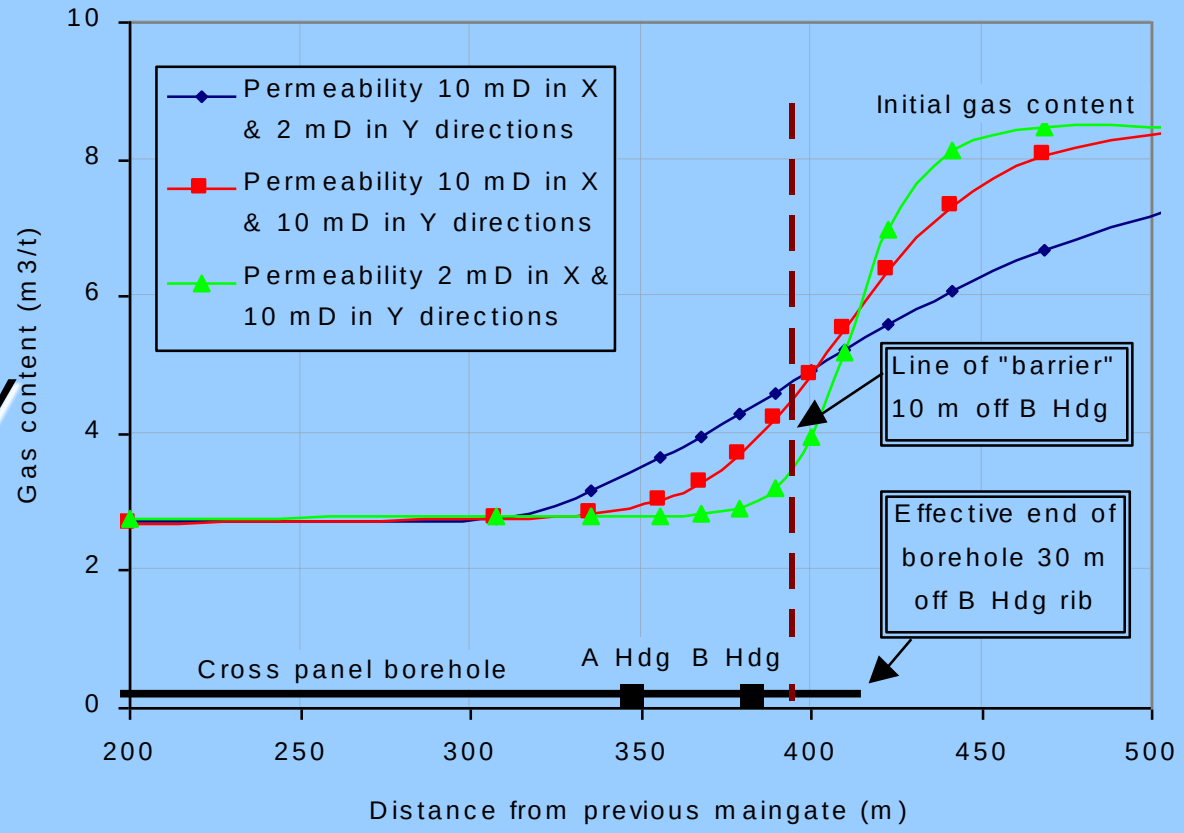
Gas drainage efficiency diminishes toward the end of boreholes,
Not from the end…

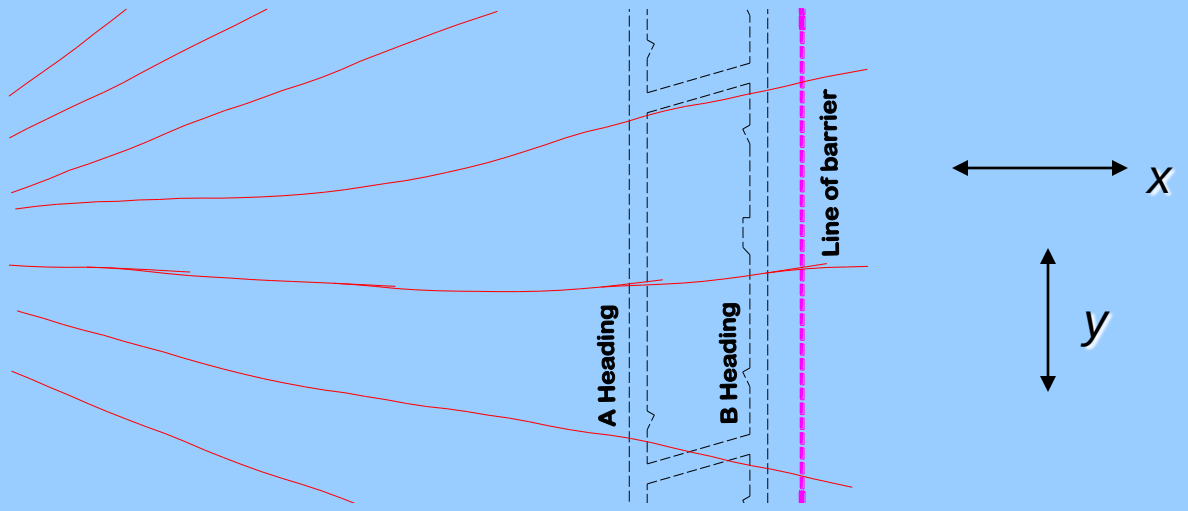
Effect Of Hole Spacing



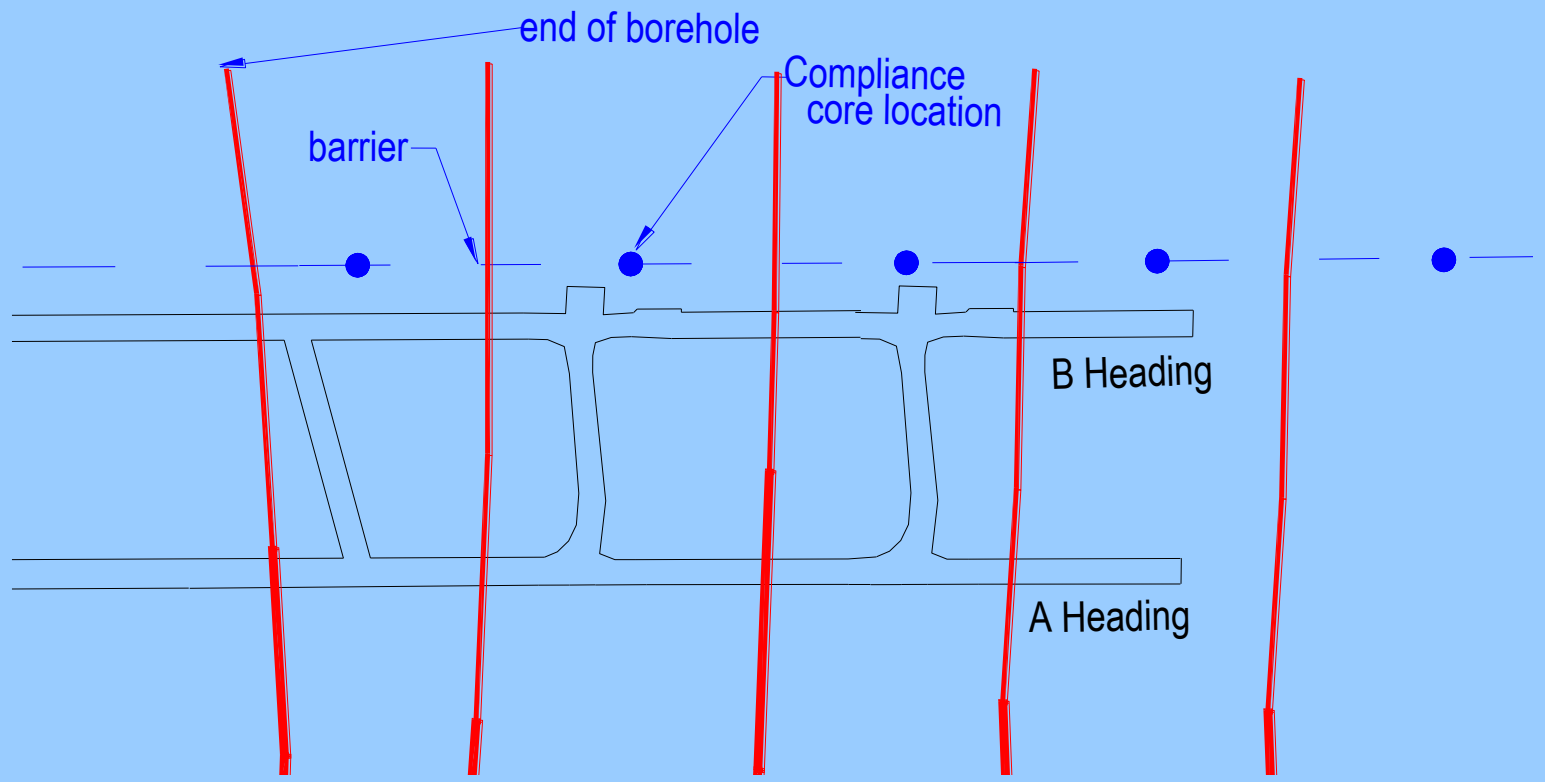


Effect Of Directional Permeability





Compliance core location



Design length of borehole over-drill according to:

- Barrier width
- Borehole “end effect”
  - Directional permeability
  - Hole spacing and orientation
  - Gas content magnitude
- Hole sump/dewatering tube
- What you are trying to achieve

Gas Content Sample - FREQUENCY

- Sufficient to prevent inadvertent mining into coal above the threshold

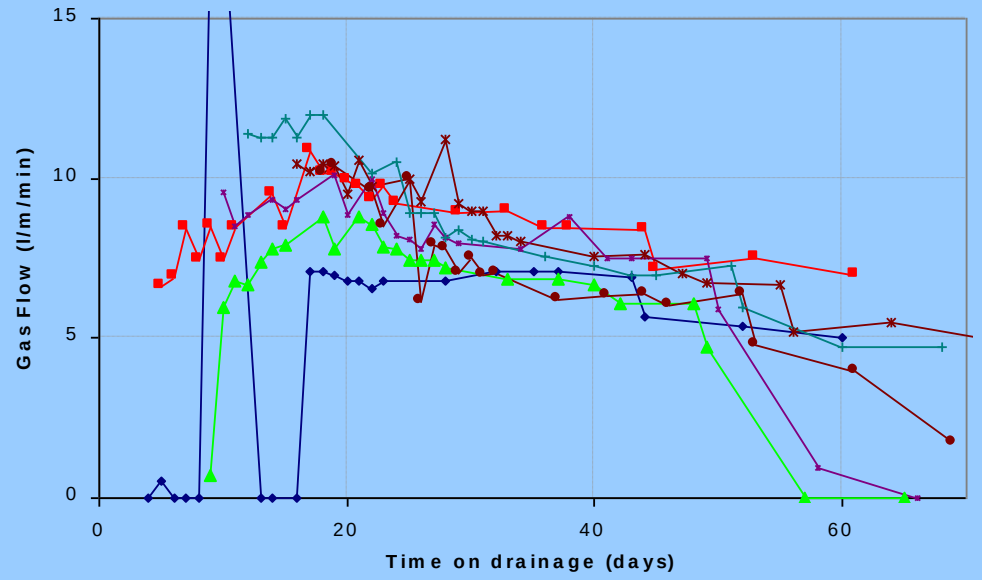
Minimum operator discretion

Considerations…

- Examine past history
- Uniformity of results
- Closeness to threshold
- Abnormalities (drilling, geology, drainage)
- Familiarity and understanding

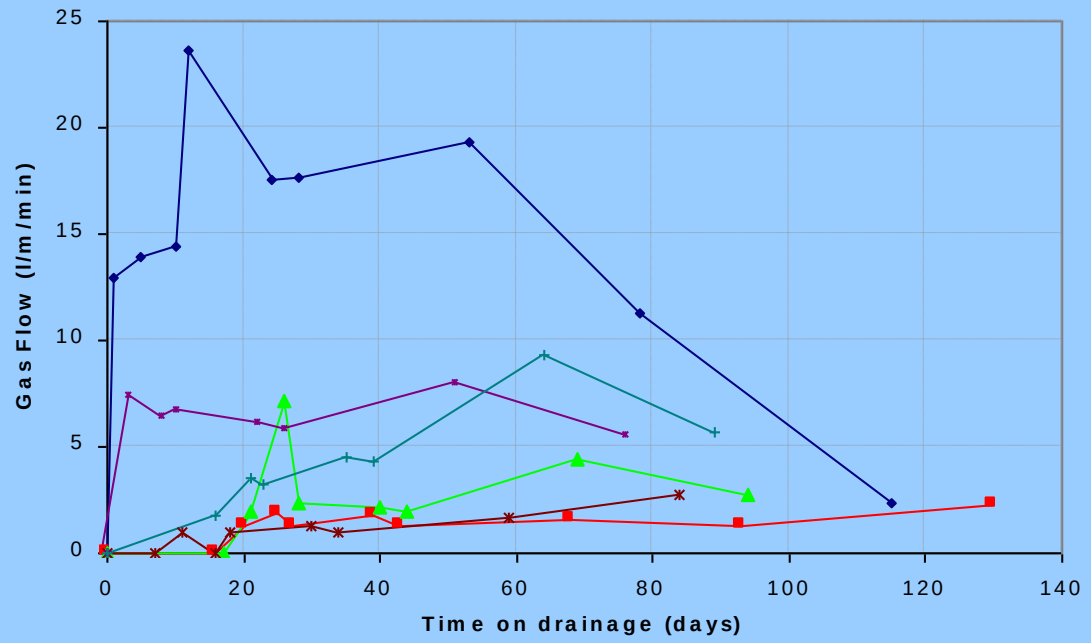
Define triggers for increasing frequency

Eg Uniformity



Regular flow

Irregular flow



Some Points to Remember -

- Don’t argue over definition. Uncontrolled gas events require careful consideration.
- The biggest outburst you have had is not the biggest outburst you will ever have.
- When using gas content data, make sure it is Measured Gas Content (Qm) calculated to 20°C and 101.3kPa.
- The rate of increase in gas pressure is the key ingredient, governed by desorption pressure, desorption rate and permeability.

Some Key Points (cont)

- Reduce the gas content low enough (threshold) and outbursts will not occur, regardless of other conditions.
- You can’t define geological structures with the required degree of certainty.
- Drilling conditions are a highly important but fallible means of indicating outburst proneness.
- Gas drainage is least effective in outburst prone coal

Some Key Points (cont)

- Coring for gas content testing is difficult or impossible in outburst prone coal.
- Maximise gas drainage time.
- Keep on top of gas drainage, by knowing how the system is performing.
- It's a big mistake to think that because gas emission is low, or you are getting low gas flows from boreholes, that the gas content is low and therefore the risk of outbursts is low.
- Investigate abnormal results.

Suggested Research Priorities

- Define geological structures with high level of certainty.
- Rational design of barrier widths.
- Provide a better means of quantifying outburst risk in coals of differing properties. Challenge is to be both reliable and practical.
- Sample location and frequency issues.
- Early identification of hard to drain coal.
- Methods of mining in undrainable coal.
- Be able to tell the difference between normal and abnormal – challenges for Queensland (RTMS?).
- Reduction in operator discretion in setting minimum standards for sample location and frequency