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Categorisation of Outburst Indicators for Prediction at Metropolitan Colliery

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Foreword

Opinions and conclusions expressed in this presentation are my own based on my research, and not those of Peabody Energy nor any Peabody employees

Background

Over 150 outbursts *(Harvey 2002)*

First outburst in 1895

Last in 2015

3 Fatal incidents (1896, 1925, 1954)

7 total fatalities

Current Management Approach

Outburst is managed in a controlled manner with contemporary methodologies

- Gas drainage & compliance coring
- Threshold criteria
- Geological assessment
- Roles and responsibilities
- Management Plans

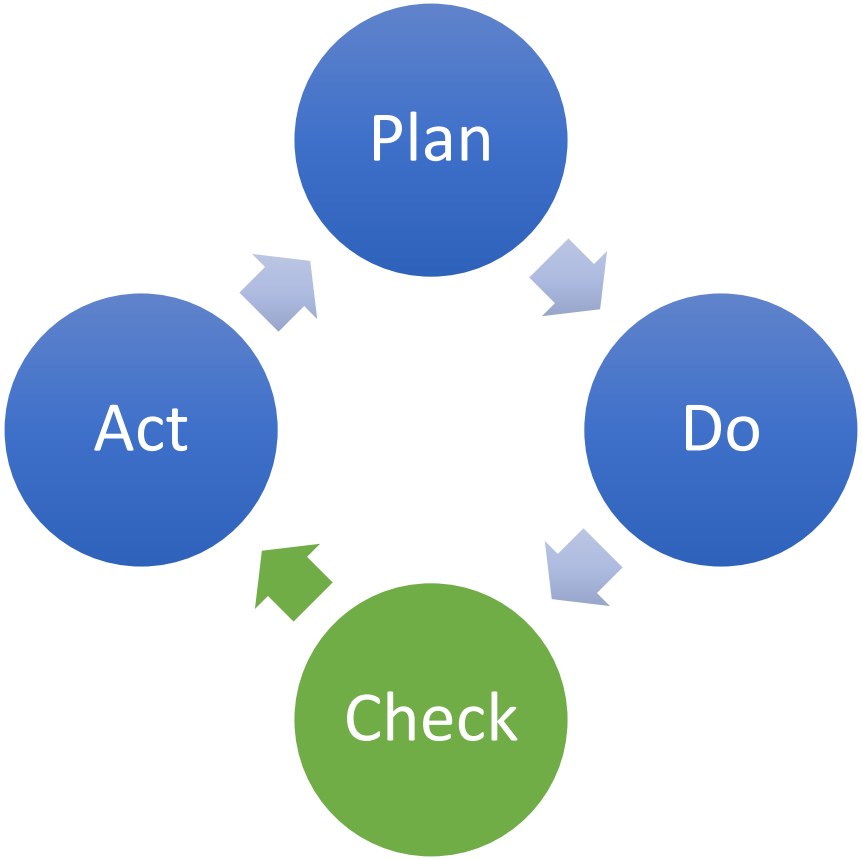
Overview

To identify factors that are predictive for outburst events at Metropolitan Colliery

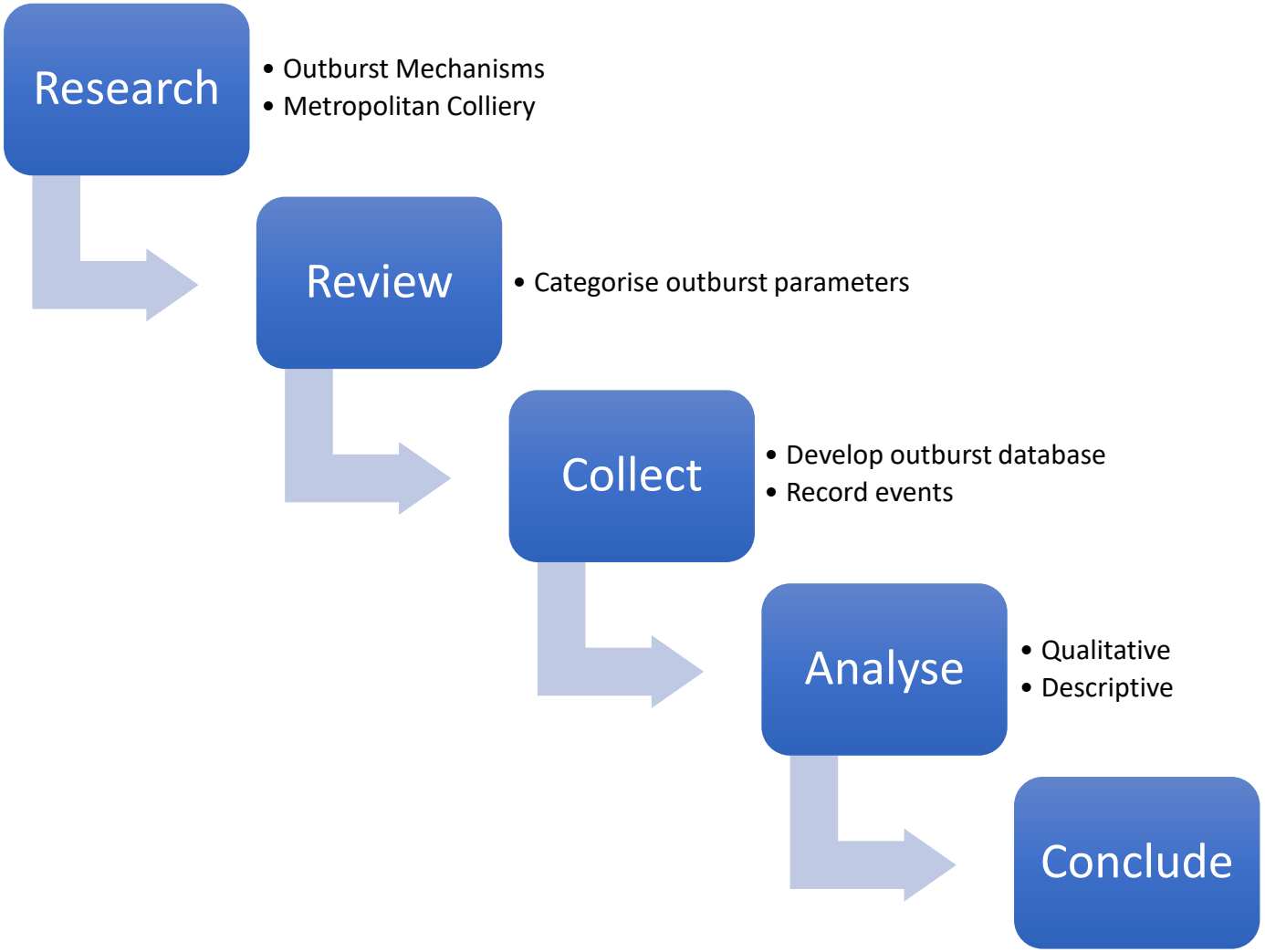
Including:

- Geotechnical
- Geological
- Operational

Overview



Methodology



Recorded Incidents

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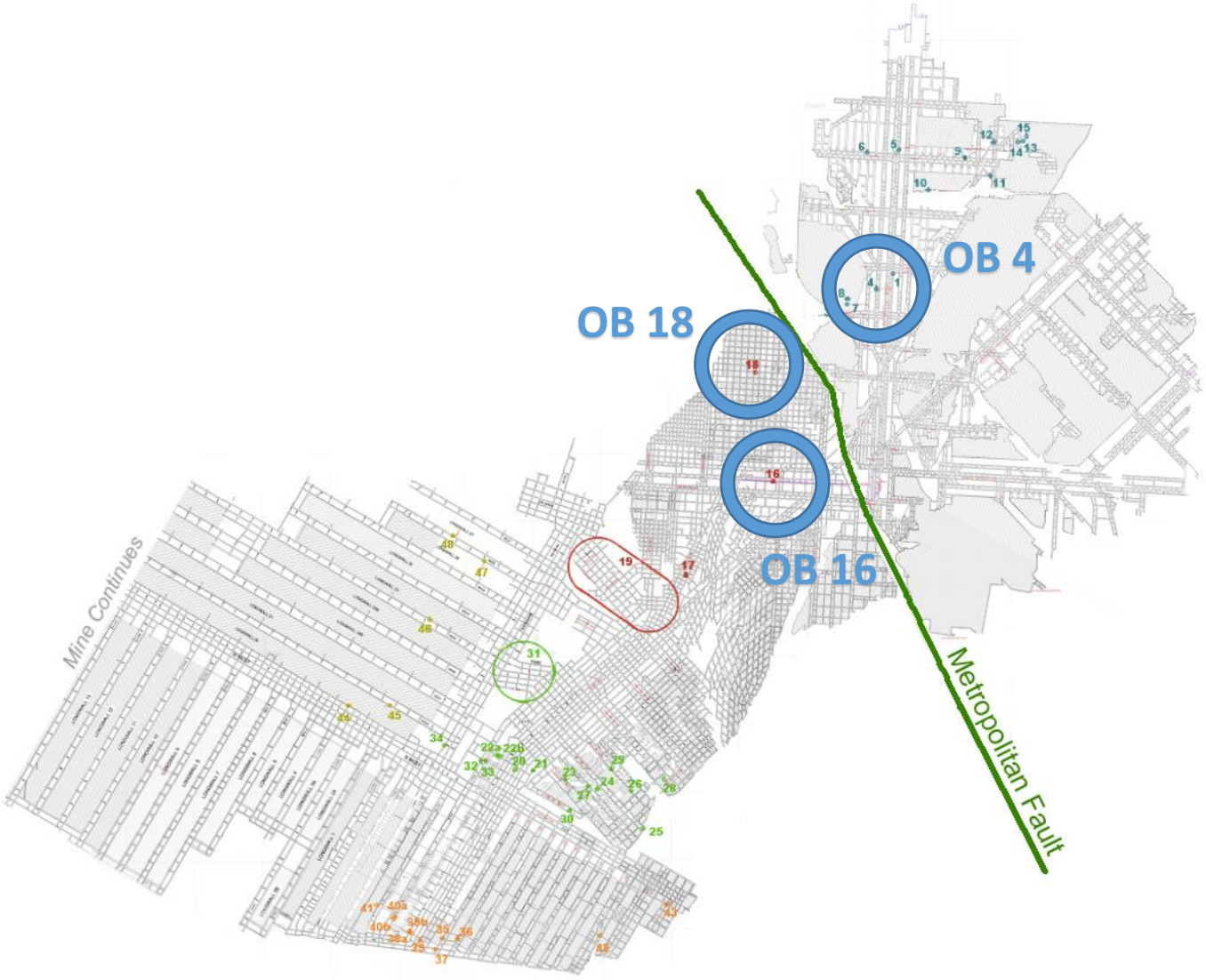

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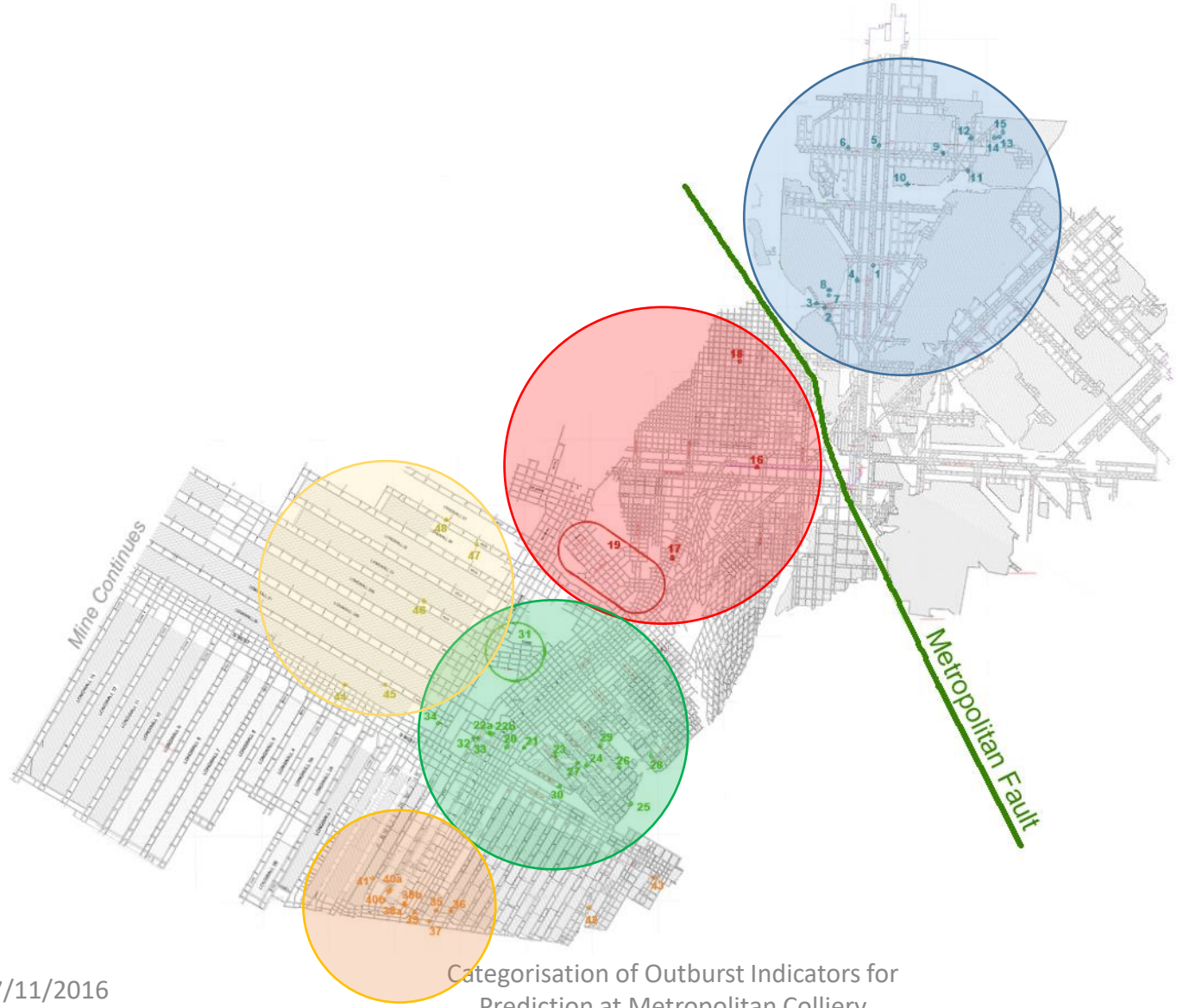
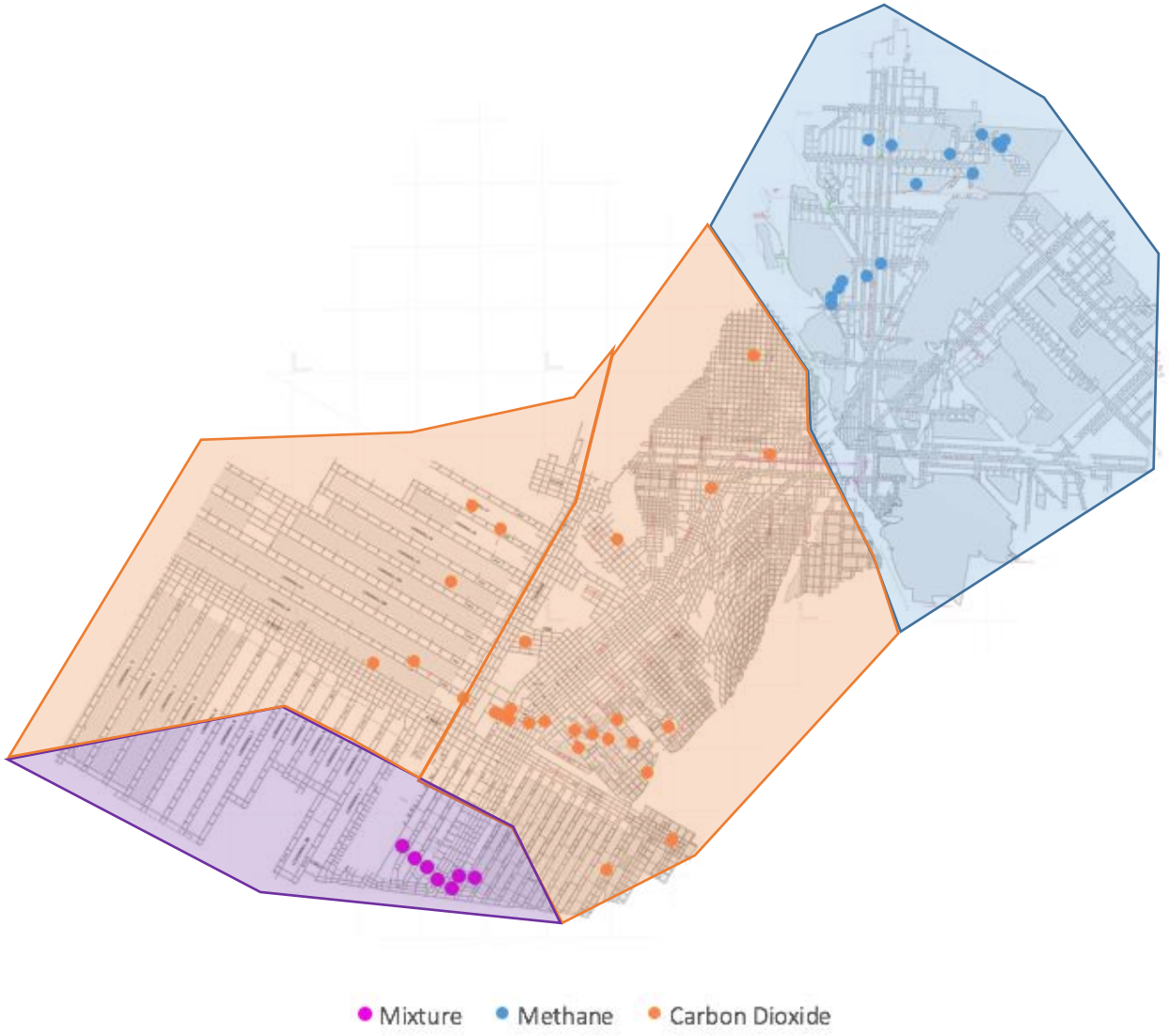


Analysis

Gas and Gas Drainage



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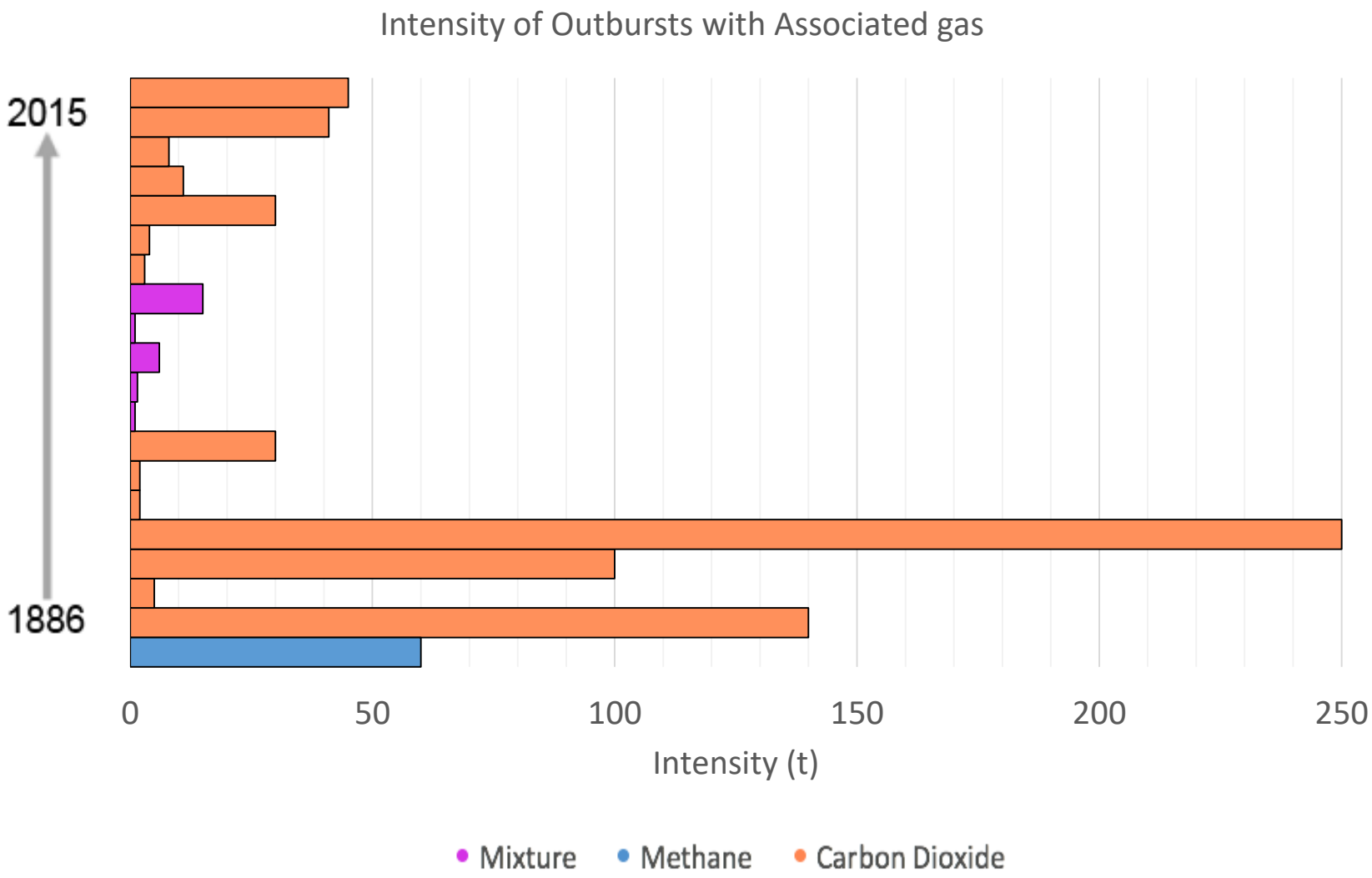

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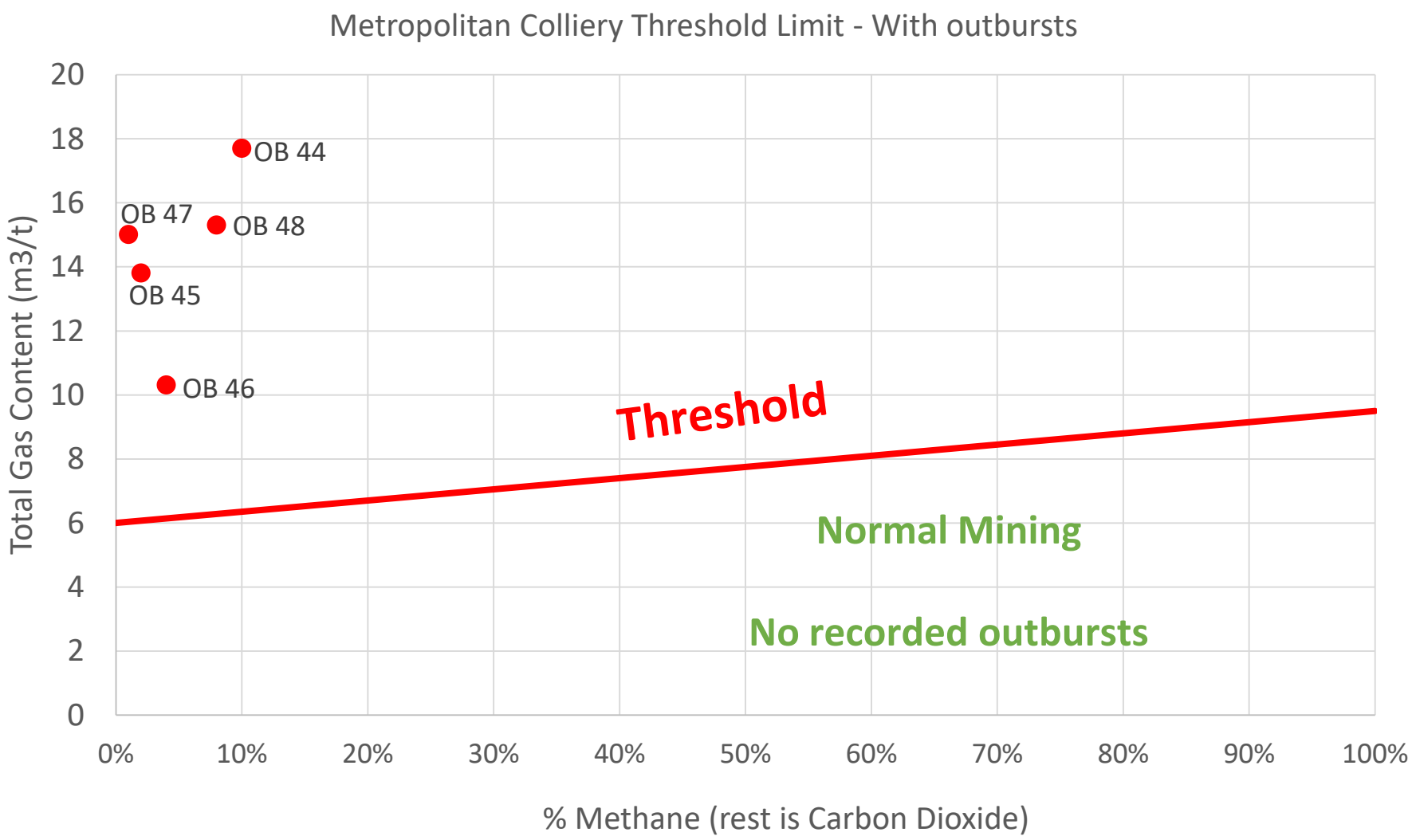

Analysis

Gas and Gas Drainage

Outburst ID	Maximum Core Sample at OB site (m^3/t)	Gas Drainage Summary
44 (1994)	17.7	Core sample drill holes not surveyed, actual core site 30 metres off centre

Analysis

Gas and Gas Drainage

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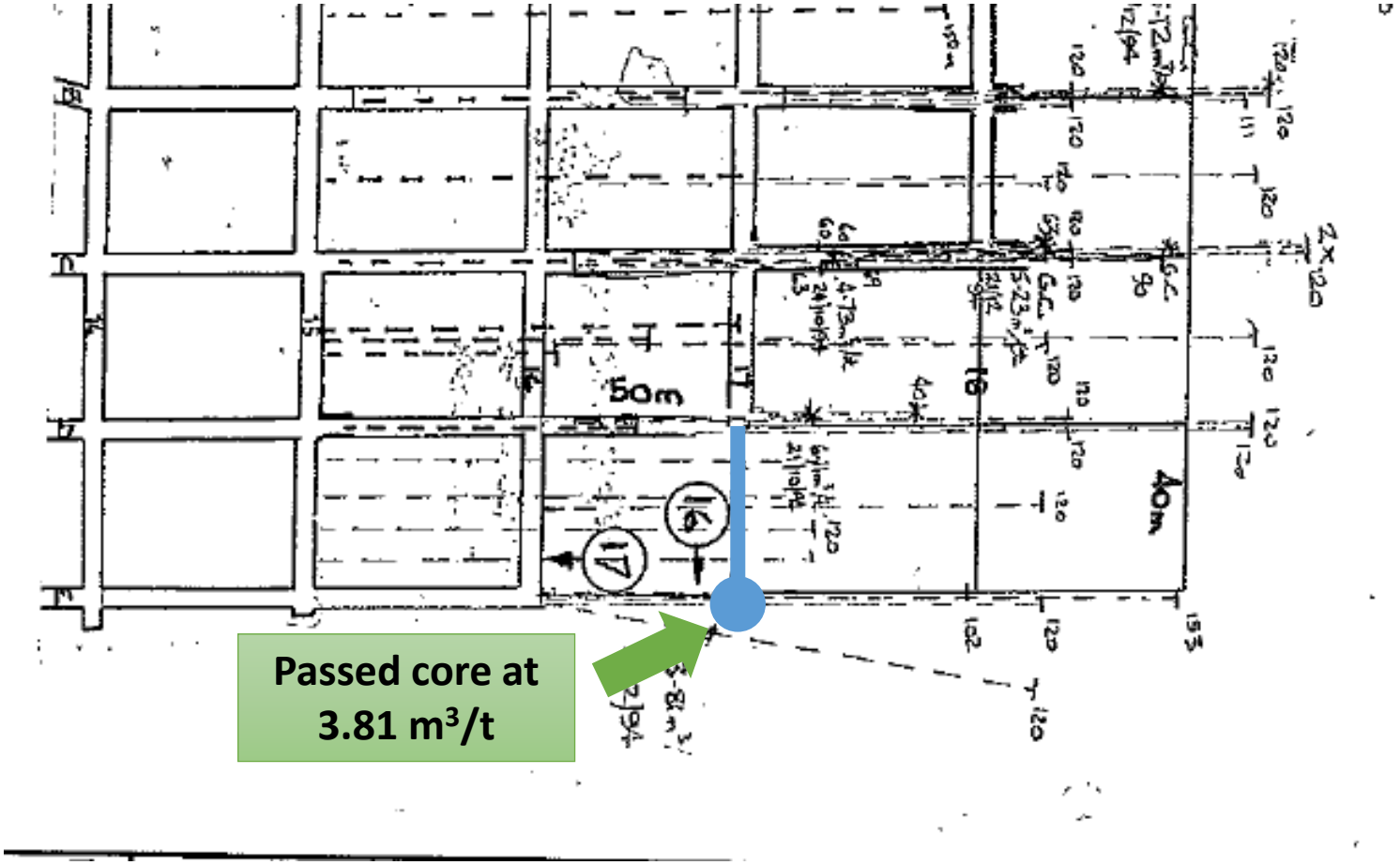
Outburst 44



Analysis

Gas and Gas Drainage

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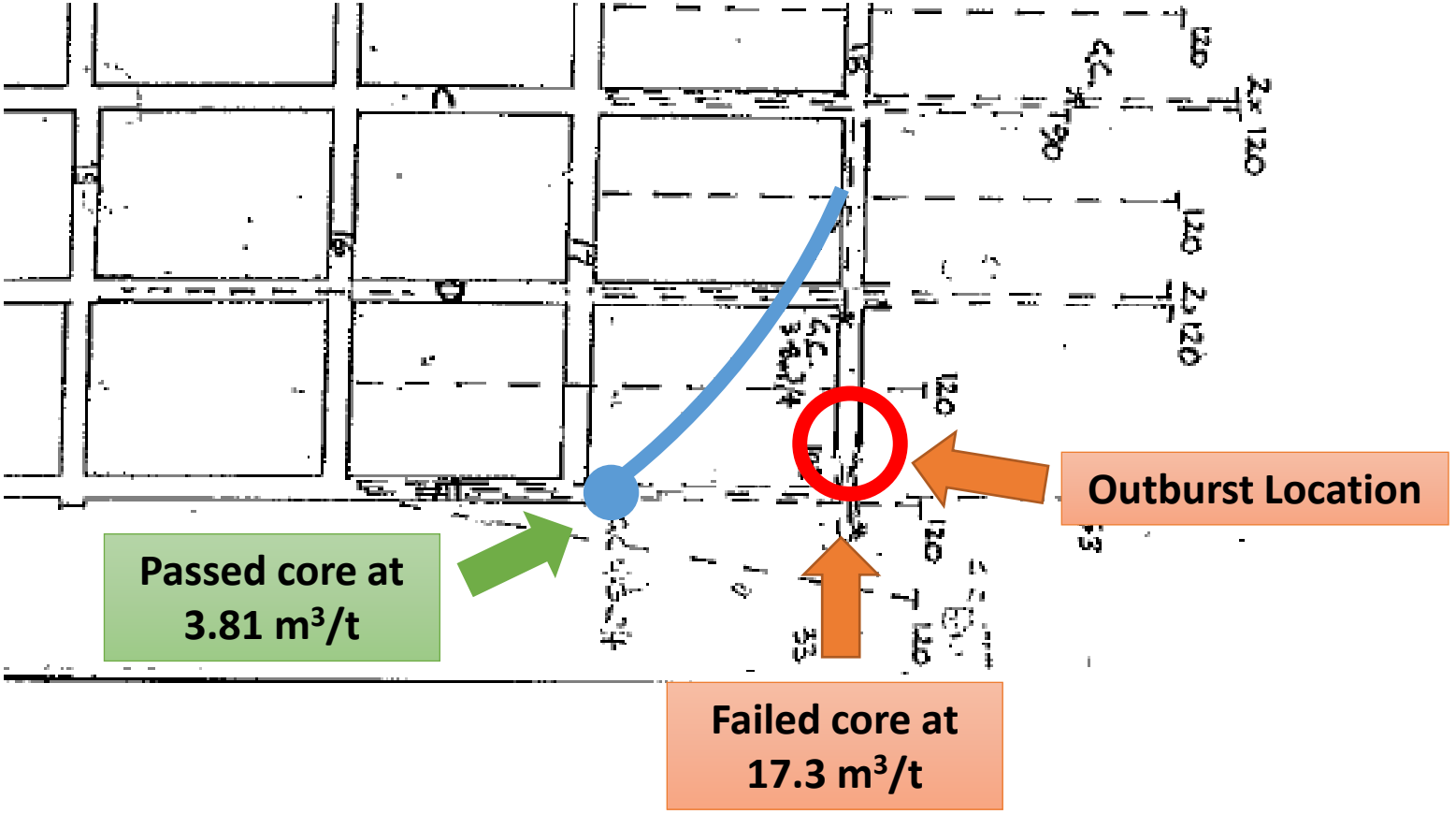
Outburst 44



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44 (1994)	17.7	Core sample drill holes not surveyed, actual core site 30 metres off centre
46 (2007)	13.07	Boggy hole prevented drainage where outburst occurred. Cores passed on right hand side

Analysis

Gas and Gas Drainage

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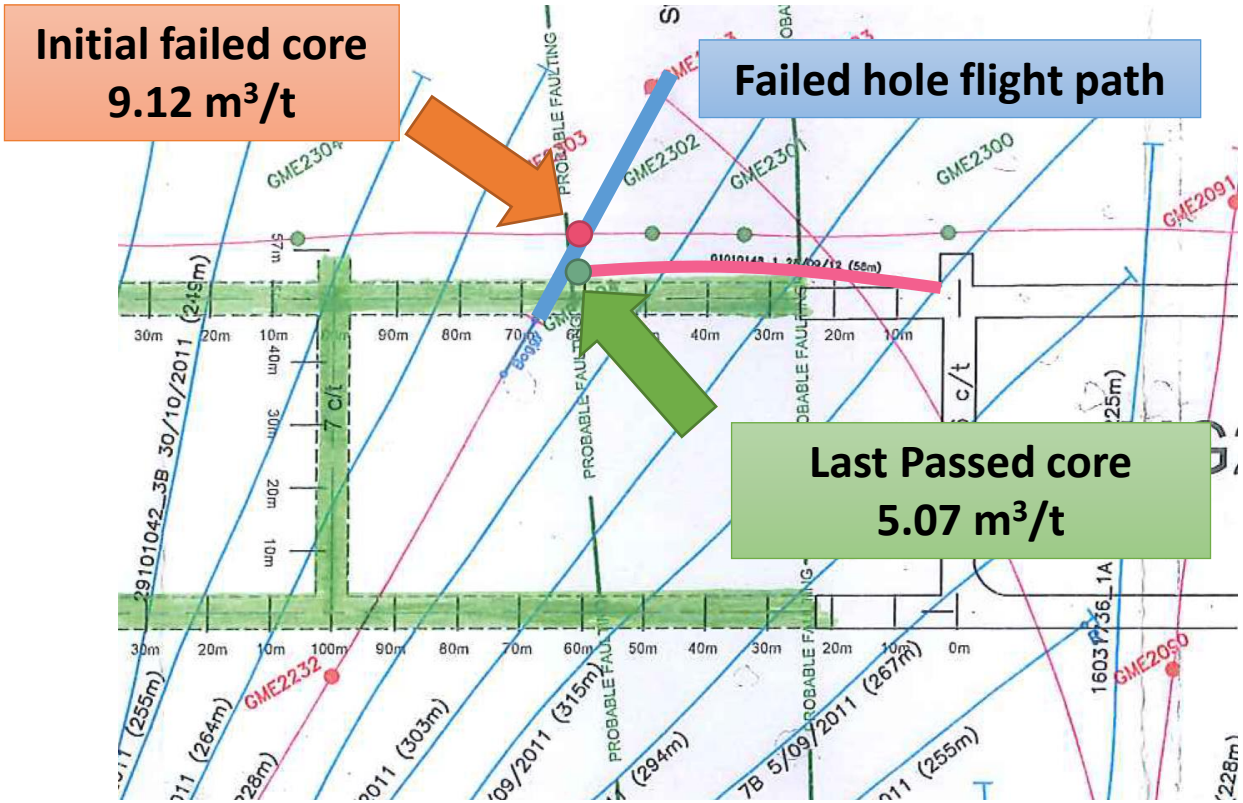
Outburst 46



Analysis

Gas and Gas Drainage

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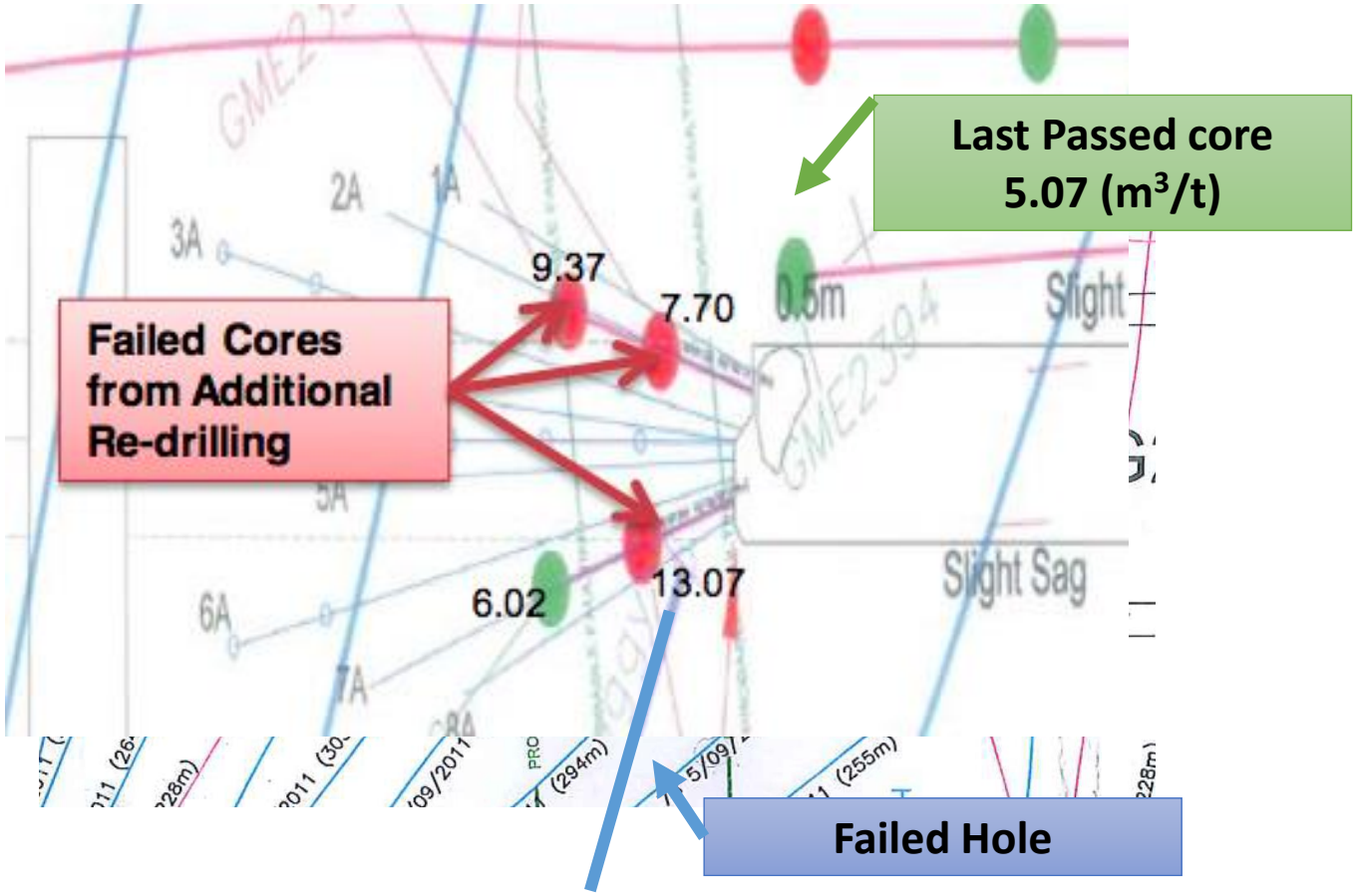
Outburst 46



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Gas and Gas Drainage

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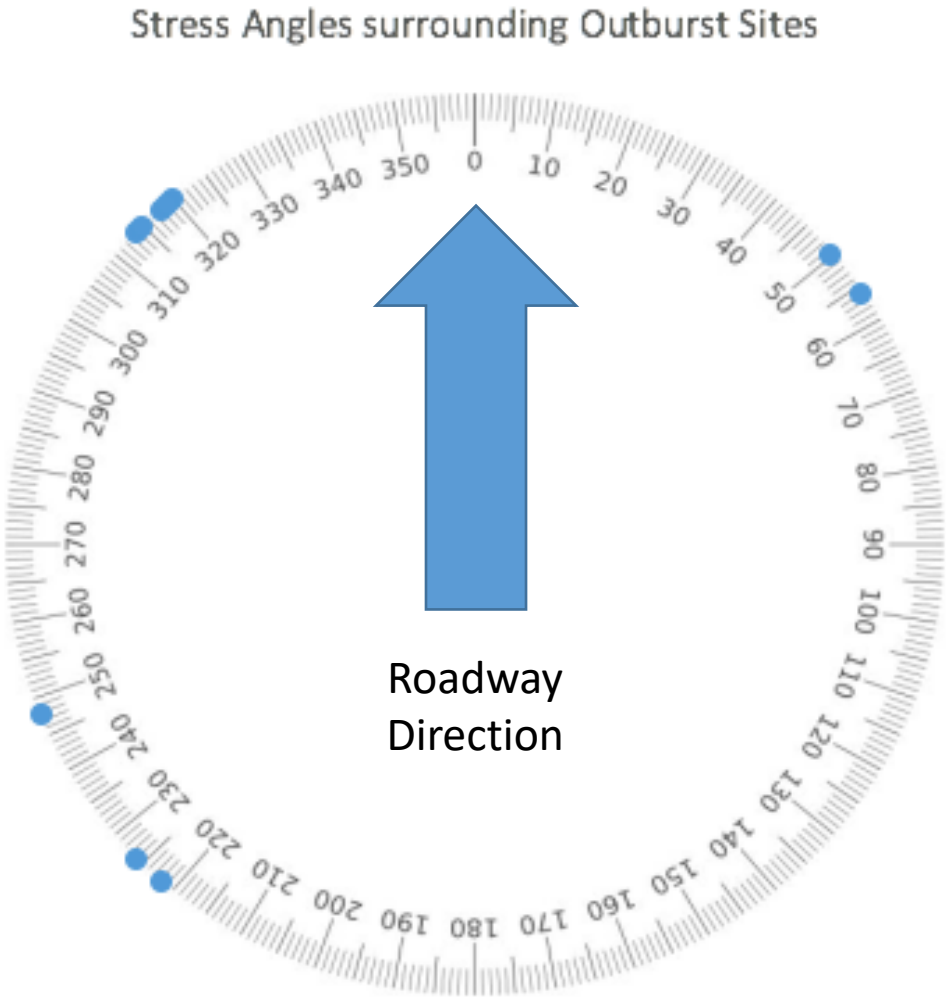
44 (1994)	17.7	Core sample drill holes not surveyed, actual core site 30 metres off centre
46 (2007)	13.07	Boggy hole prevented drainage where outburst occurred. Cores passed on right hand side
47 (2016)	8.34	Gas drainage unable to lower core content
48 (2016)	8.35	Gas drainage unable to lower core content on inbye side of structure, encountered boggy conditions whilst drilling

Analysis
Stress Distribution



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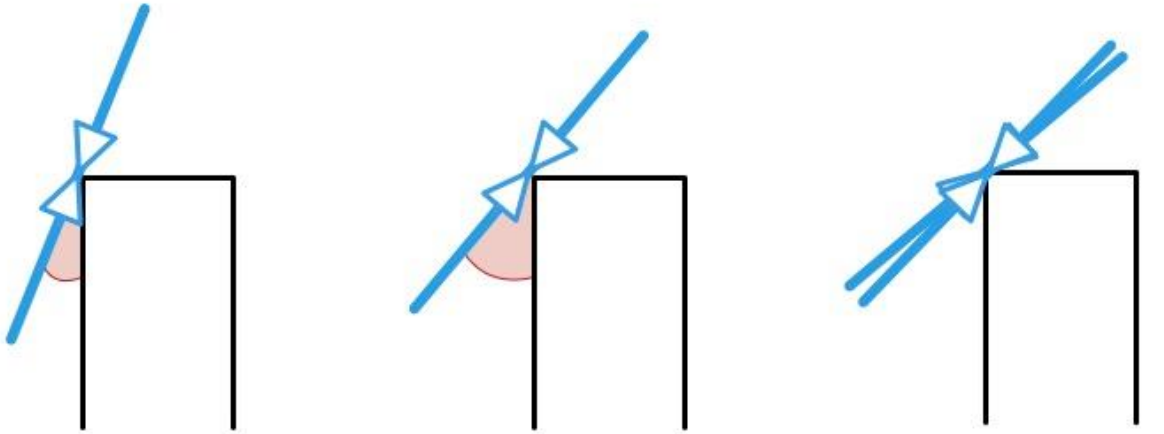

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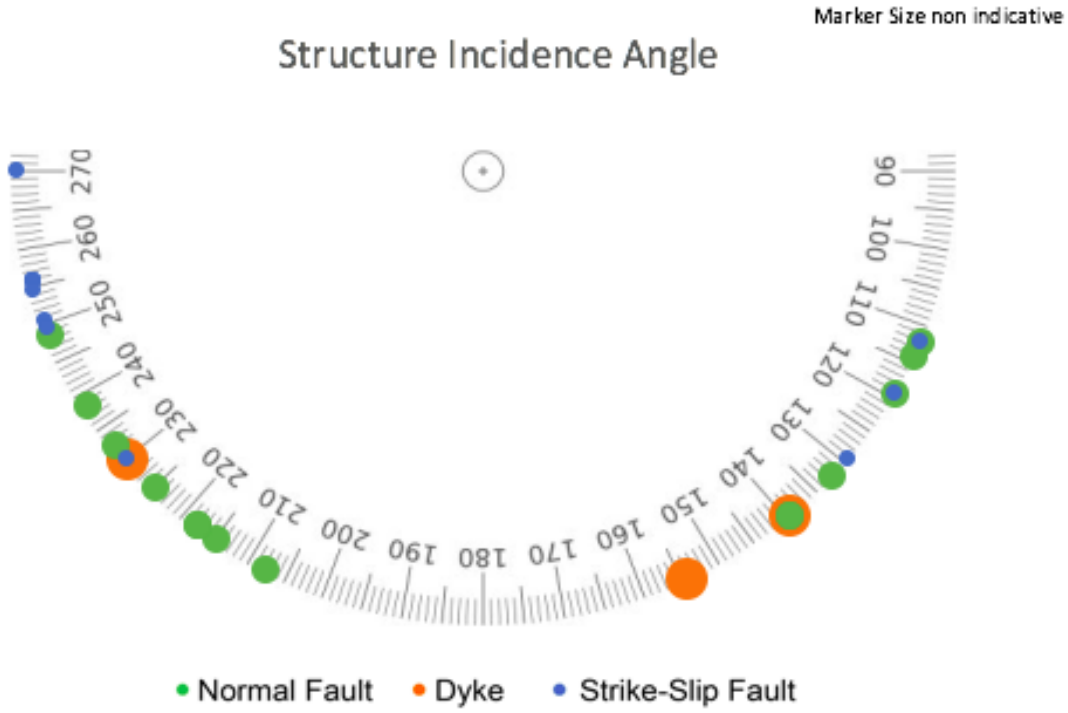

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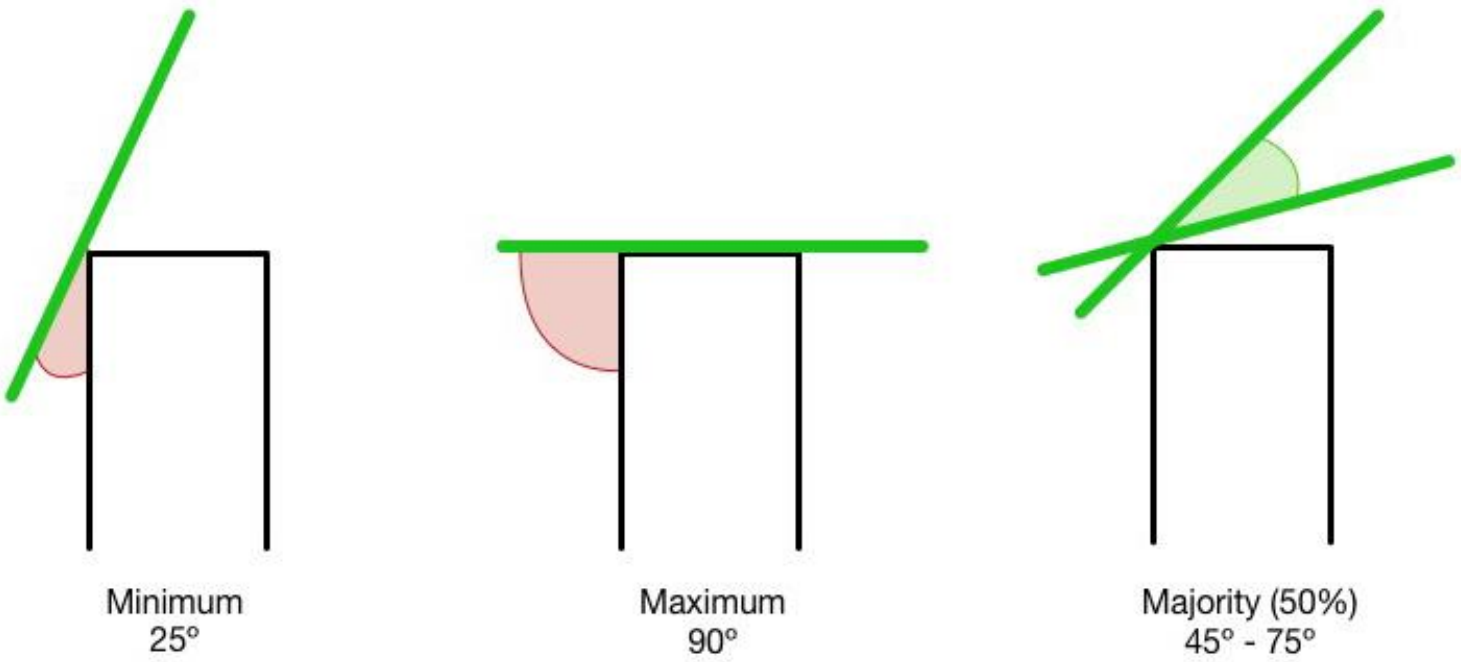

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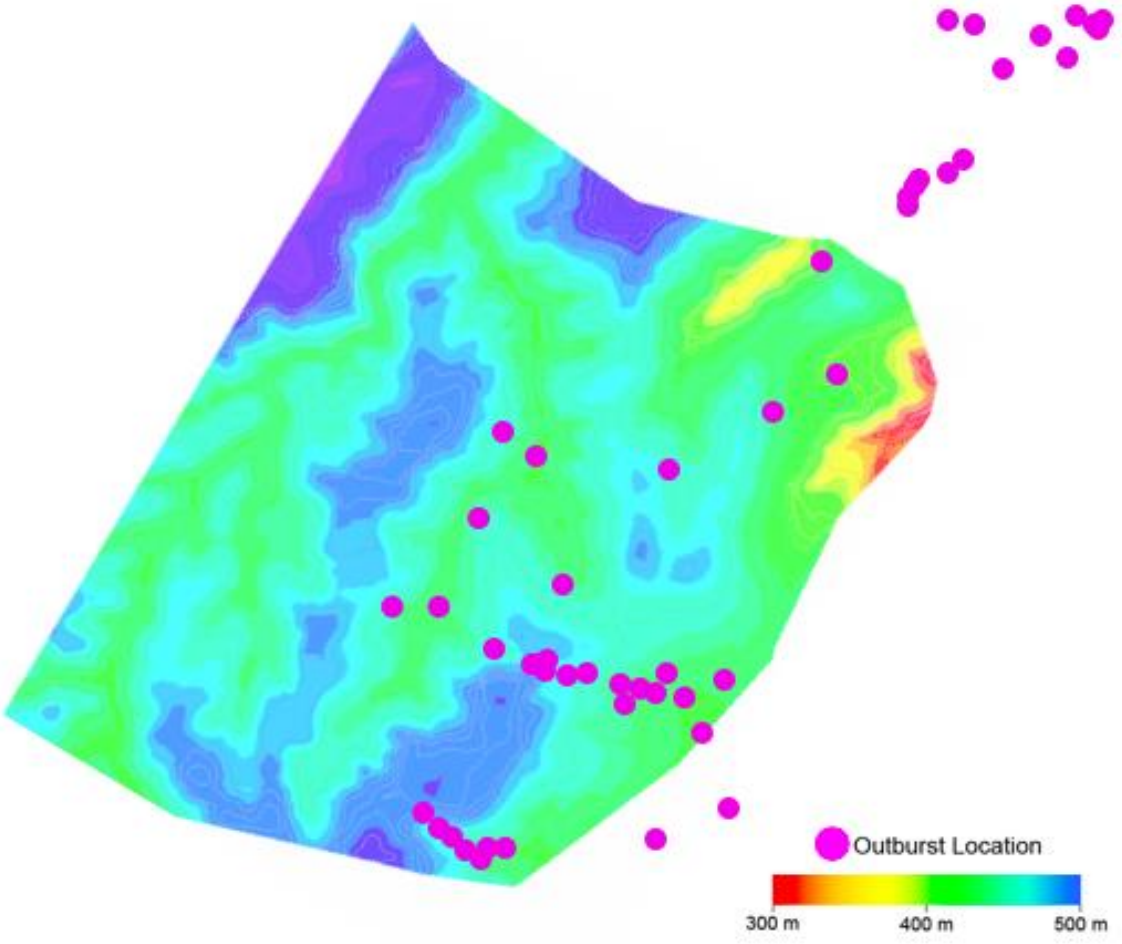

Analysis

Geological Disturbances

Analysis

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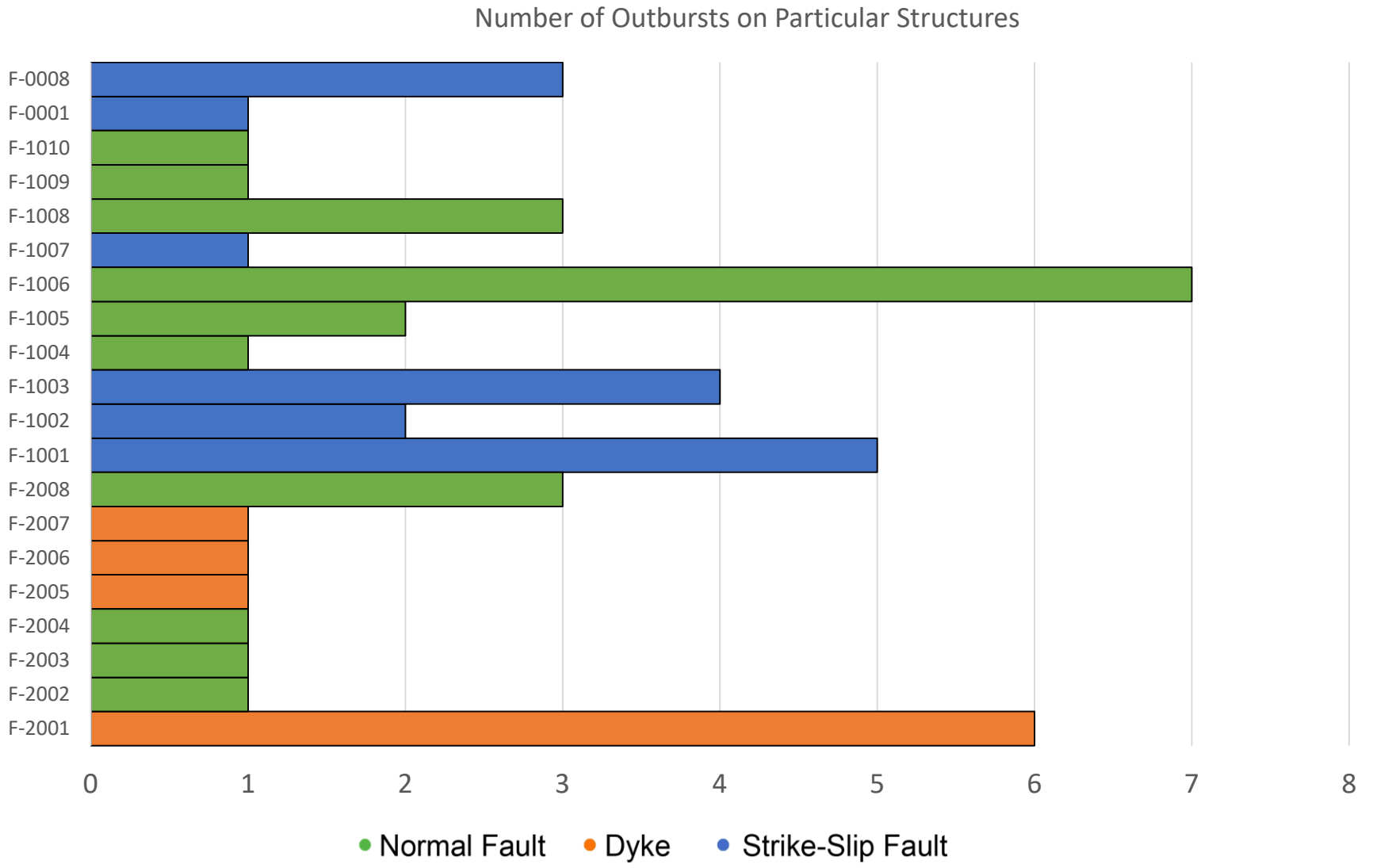


Analysis

Geological Disturbances

Outbursts consistent with disturbed zones

Includes soft coal, mylonite, crushed coal, intense jointing

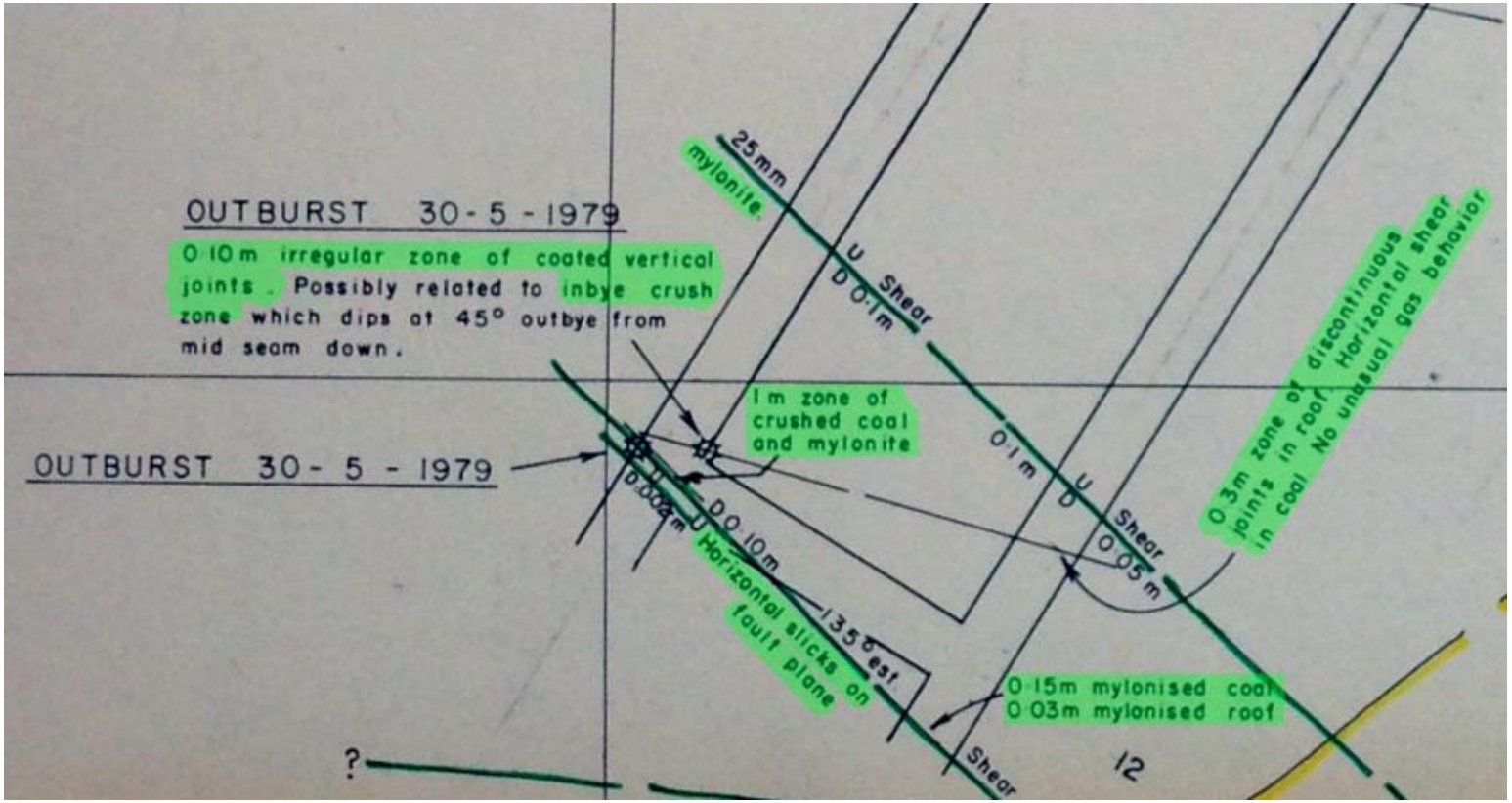
Caused by origin of fault

Influences gas environment

Analysis

Geological Disturbances

Analysis
Geological Disturbances



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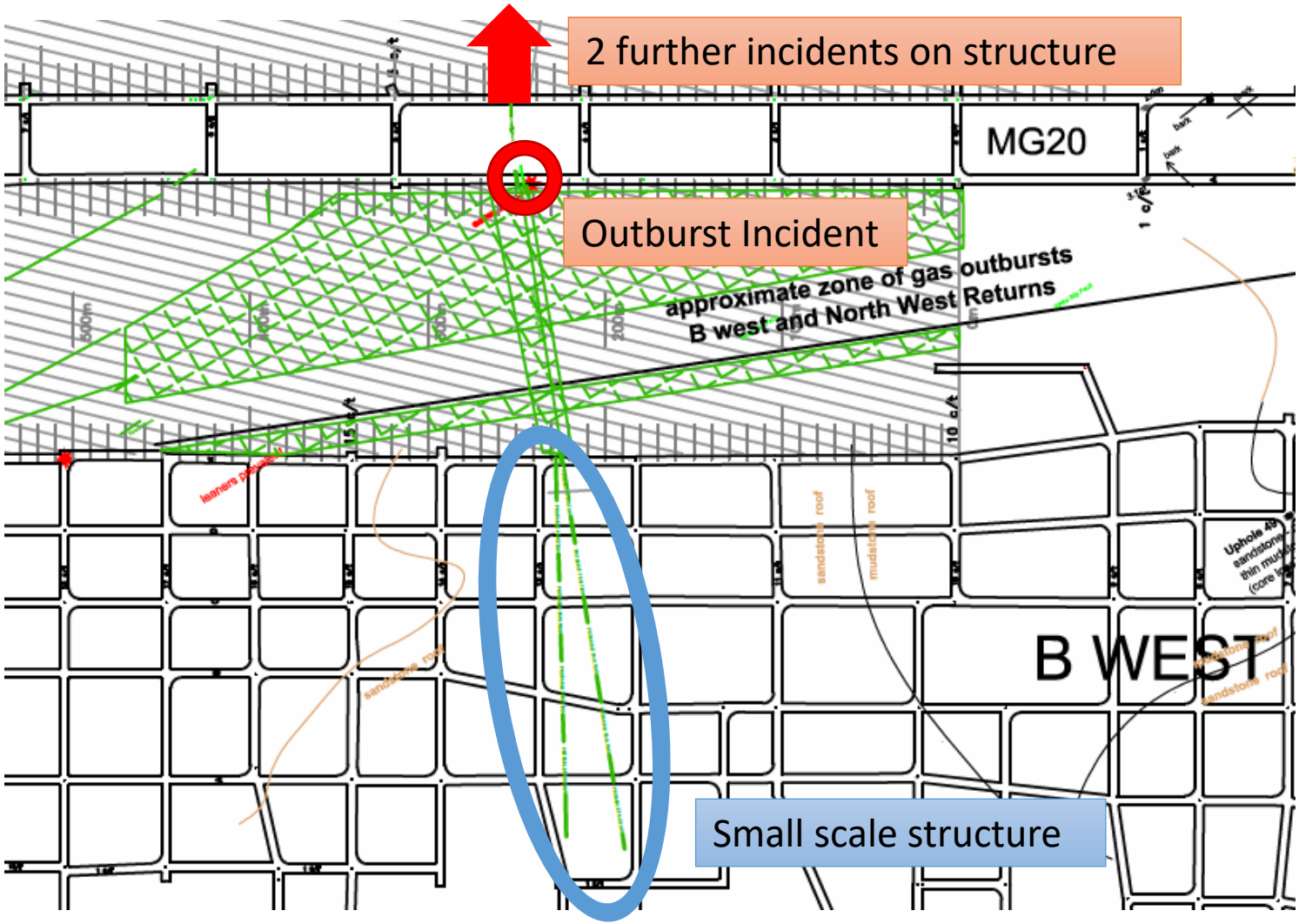

Analysis
Grunching

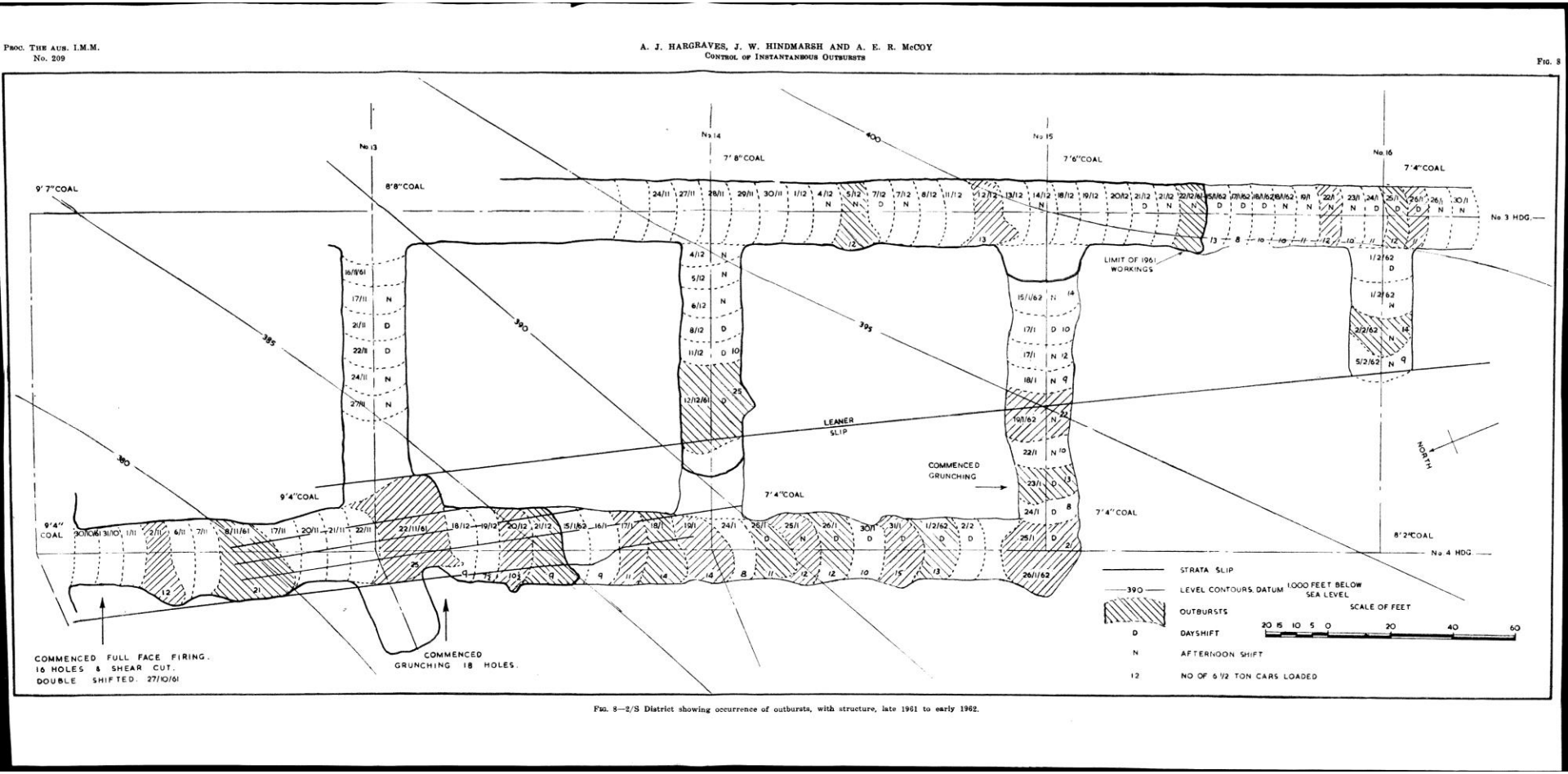

FIG. 8—2/S District showing occurrence of outbursts, with structure, late 1961 to early 1962.

Hargraves, Hindmarsh & McCoy (1964)

Analysis
Grunching

Causes:

Areas had high gas content

- Shimmering
- Charges blown out

Grunching procedure

Analysis
Grunching

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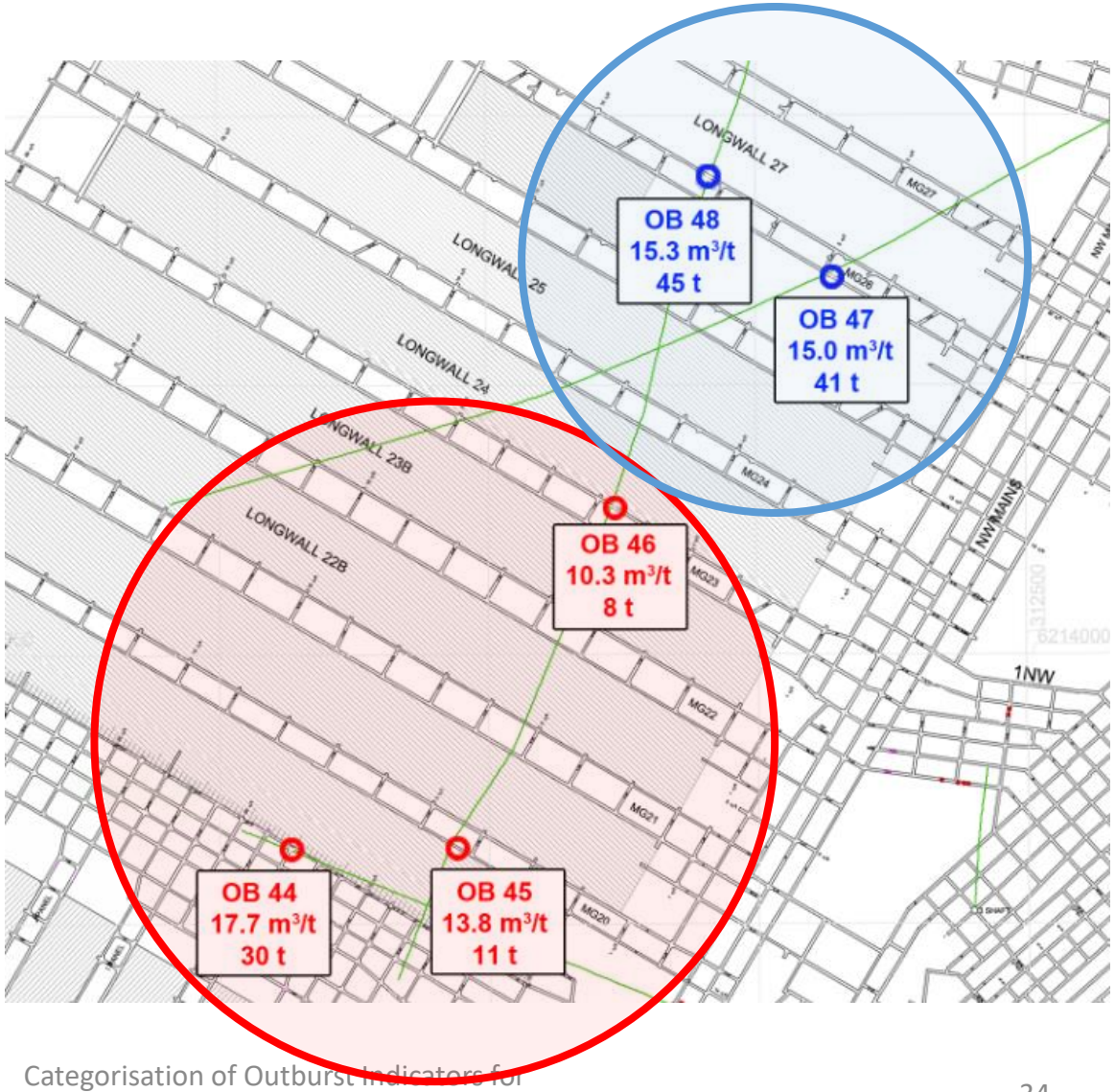
Grunching (structure)

Occurred due to problems with drainage

Grunching outbursts larger in size

Other outbursts reported as 'slumpings'



Conclusions

The influence of gas and the importance of minimising the effects of this hazard

- Gas quantities and TLV's are a critical parameter
- Quality, control and effectives of gas drainage is key to a successful management plan

Outbursts and structures

- Associated commonly with disturbed zone
- Ability of structure parameters to change

Distribution of stress and its interaction with outbursts

- Stress distribution more important than amount of stress

Grunching and its ability to influence outbursts

- Remains viable protection technique

Recommendation

Recording and Storing Data

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Documenting details

Maintaining systematic database

- Site specific
- Technical parameters
- Operational parameters

Manage and predict future outbursts

Recommendation

Recording and Storing Data

Information	Gas	Geological Disturbances	Cavity
Identification	Primary gas	Structure ID	Location (L/R/Face)
Date	Gas make (% CO_2)	Name	Volume (m^3)
	Gas quantity (in-seam)	Surface Lineament (Y/N, Name)	Description
Location		Structure Type	Cavity angles * (Acute/Obtus
Co-ordinates (MGA)	**Seam Structure**	Strike (ºGN)	
Mine location	Seam thickness (m)	Vertical Displacement (m)	**Pre-mining**
Mining direction (ºGN)	Depth of cover (m)	Dip (º)	Extraction method
	Roof strata	Distance to structure (m)	Changes to environment - Changes to strata conditions - Changes to gas release - Changes to noises - Changes to coal proper
Intensity	Floor strata	Angle of incidence * (º)	
Tonnes released (t)	Dip of roadway (º)	Structure Angle Side * (L/R)	
Gas released (m^3)	Coal Properties	Mylonite (Y/N, Thickness)	
Sound duration (s)	Major stress direction (ºGN)	Slickenslides (Y/N)	Hazard recognition - Gas Drainage - Coring - Structure prediction
Sound description	Stress Incidence * (º)	Zone thickness (m)	
For * ^ See notes on next page	Stress Angle Side * (L/R)	Properties	

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Questions?

References:

Harvey, C 2002, 'History of outbursts in Australia and current management controls', *Coal Operators' Conference,* pp 36-46.

Hargraves, A, Hindmarsh, J, & McCoy, A 1964, 'The control of intantaneous outbursts at Metropolitan Colliery, NSW