



# Trigger Action Response Plans in Underground Coal Mines Tips, Tricks and Pitfalls

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# Typical TARP

- Level 1 - Normal
- Level 2 - Abnormal – tell Mgt
- Level 3 - really abnormal – tell Mgt
- Level 4 - Oops ! - Evacuate

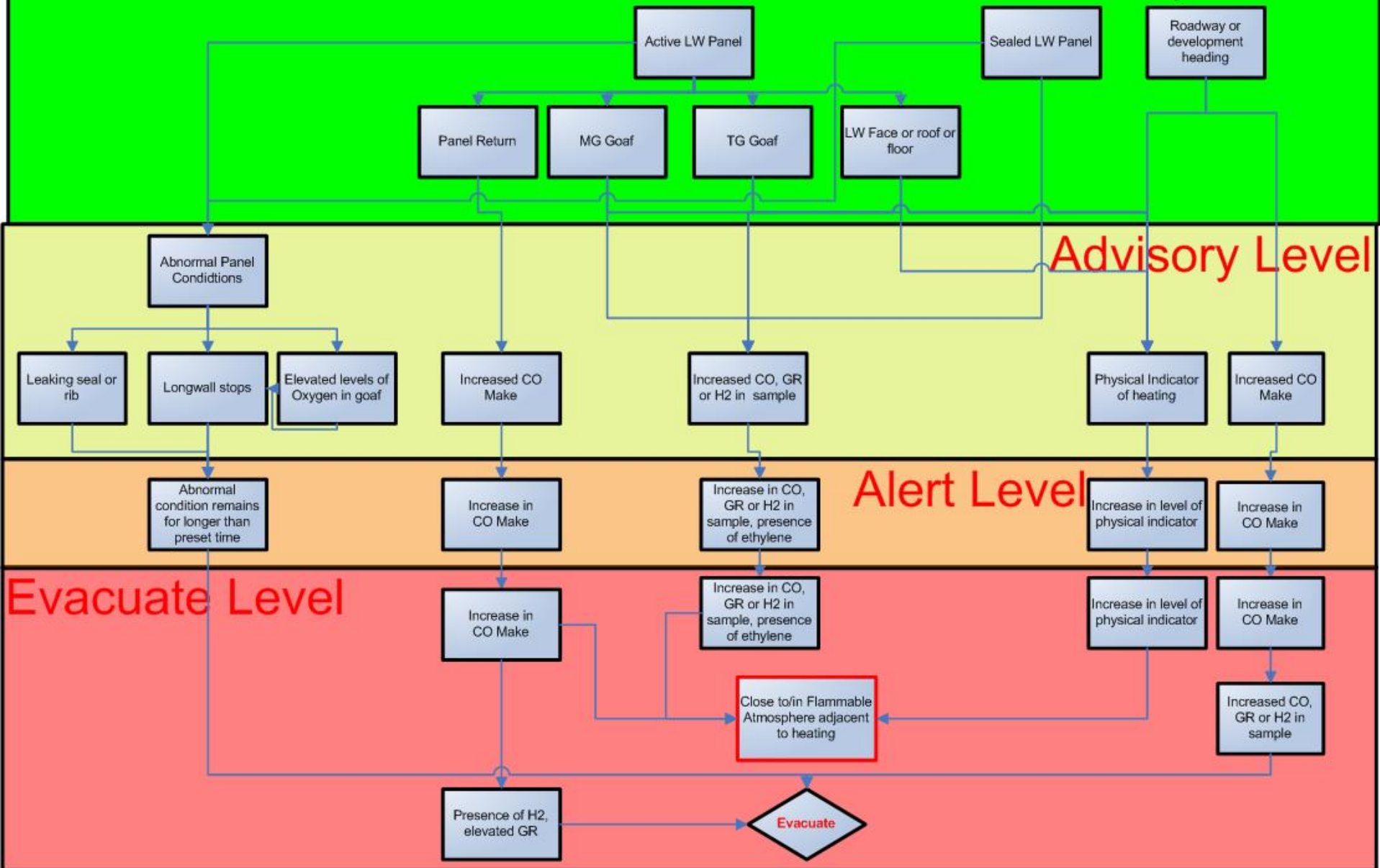


# Fundamental principles

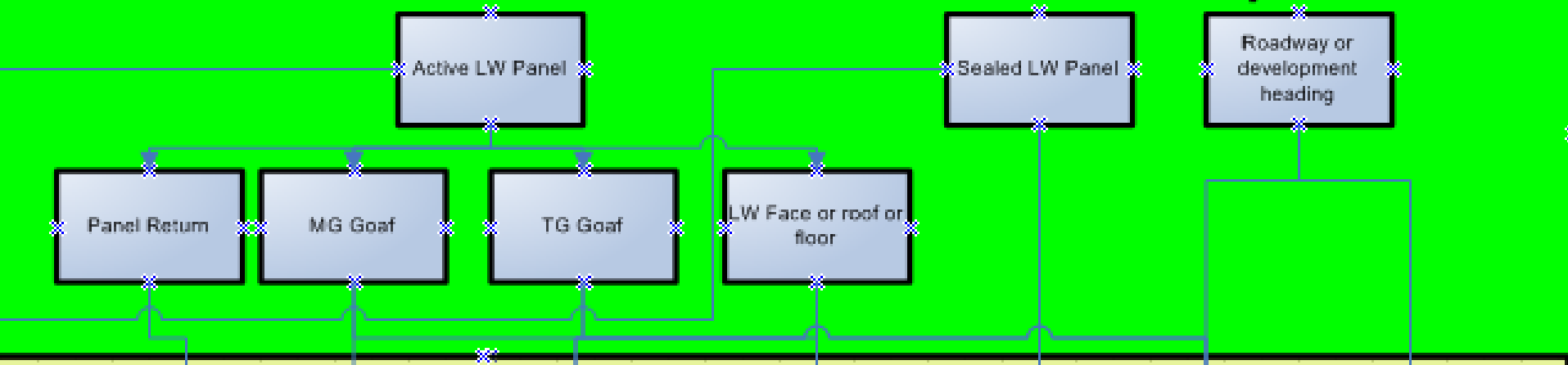
- ❑ Simple and Robust
- ❑ Adequately resourced – personnel and equipment
- ❑ Focus on prevention and early detection - validation, clarification and remediation
- ❑ Requires detailed knowledge of normality
- ❑ Triggers not set in stone should be reviewed and revised as experience grows or conditions change
- ❑ High quality mine monitoring information
- ❑ Do not be afraid to ask for advice
- ❑ If the TARP mandates an action it must be carried out promptly



# Normal operations



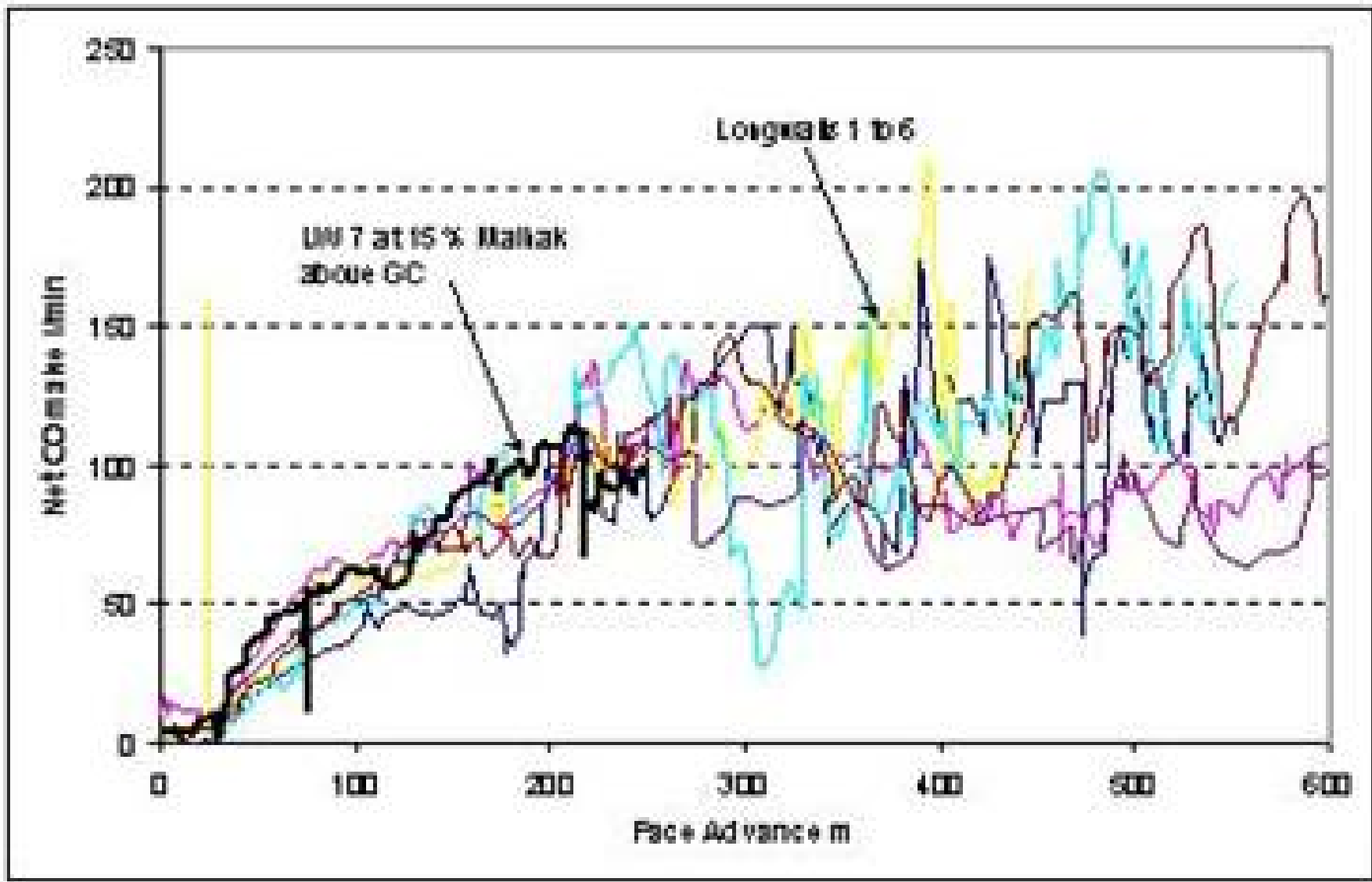
# Normal operations



- Establish range of normal values
- Establish normal time dependence of concentrations and other indicators
- Different norms for different circumstances and environments eg CO make vs retreat rate or face ventilation Q



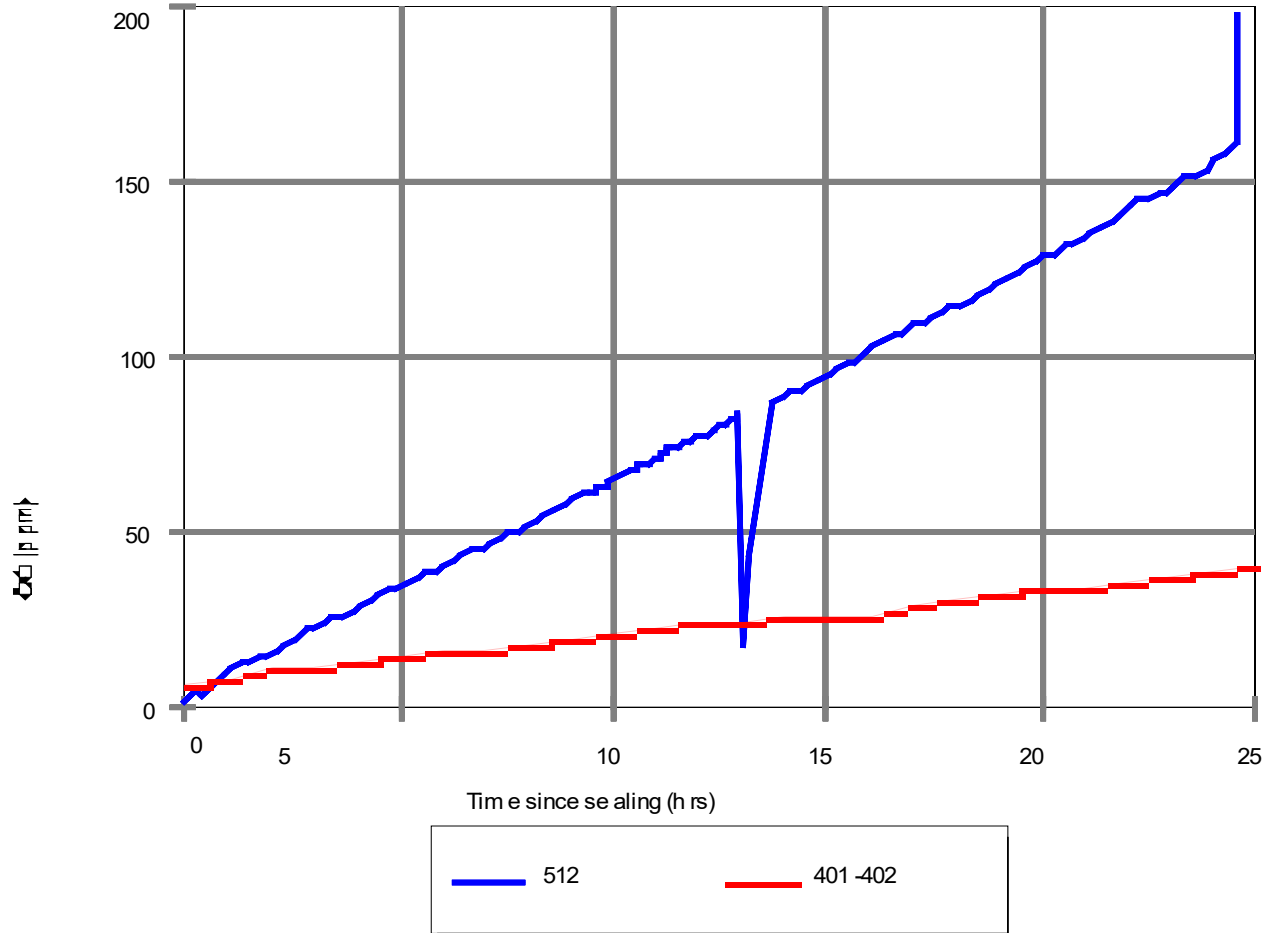
# CO Make vs face advance





# Moura

## 512 vs 401-402

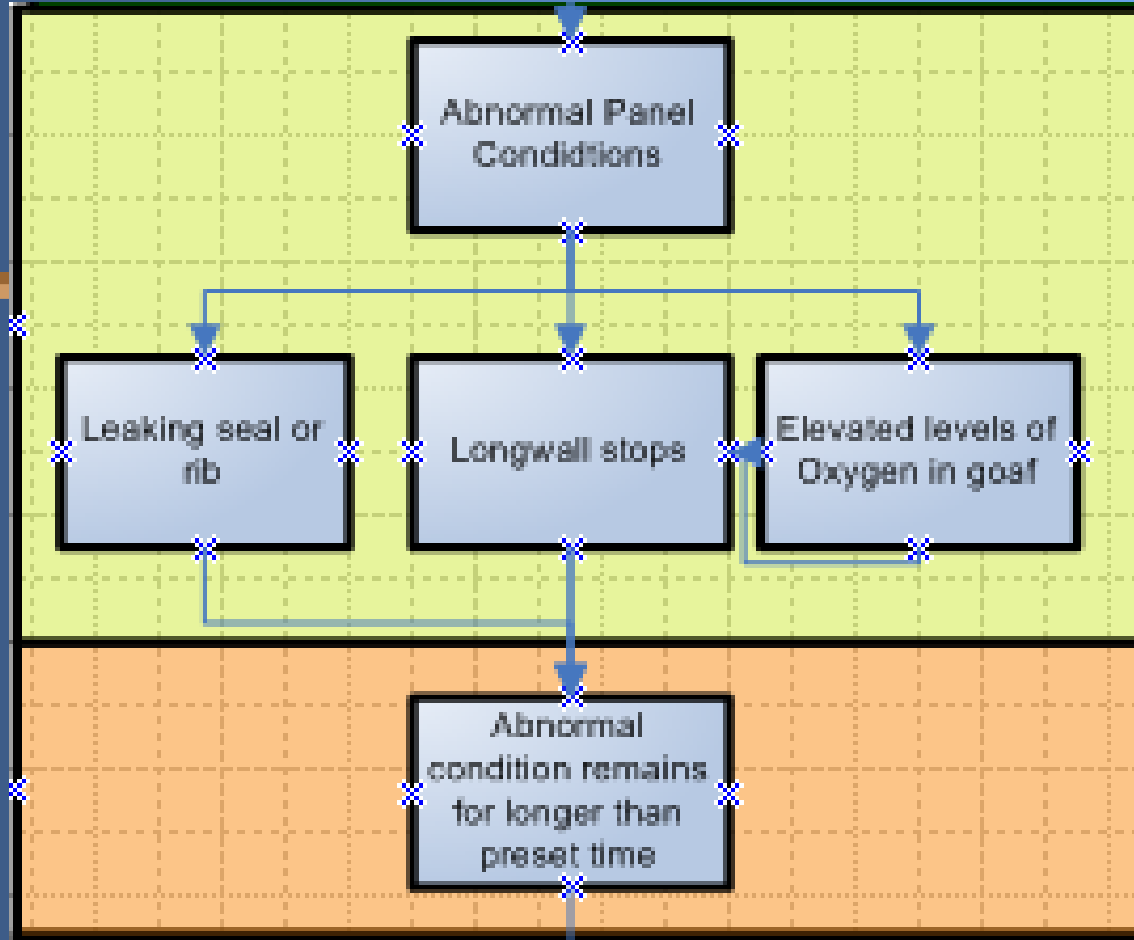




# Advisory Level

- Action by ventilation officer and technical services personnel + inspections
- Validation of readings
- Extension of monitoring to other locations, increase frequency and complexity
- Inspection of area for leakage and other abnormality
- Prepare for inertisation or other control action eg fly ash injection
- Seek external advice as necessary
- Monitor rate of change with time





**Recent episodes have been catalysed by the prolonged presence of oxygen in goaf areas where normally it would not be were it not for mining problems.**



# Alert level

- ❑ Advise mine management of potential for evacuation
- ❑ Initiate control measures such as inertisation
- ❑ Prepare for evacuation
  - ❑ No unnecessary work underground
  - ❑ Prepare for quick sealing of area of concern
  - ❑ People to stay in close contact with surface
- ❑ Monitoring frequency adjusted to rate of change of atmosphere.
- ❑ Monitoring analysis needs to allow for any control measure effects – gas displacement or dilution



# Evacuation level

- Orderly evacuation
- Key criteria is the potential for harm to the workforce
- Timed to allow protection of equipment, maintenance pumps etc
- Emergency sealing carried out if necessary



# Re-entry criteria

- Conditions established objectively prior to incident – eg by risk assessment
- May be modified based upon risk assessment
- Criteria for limited re-entry may be different to those for return of work-force underground.
- Inertisation and other controls may mask behaviour without necessarily controlling the incident.



# TARP actions

- ❑ For all mandatory actions within TARPS there must be close out by a specified time.
- ❑ Actions should not be just :
  - ❑ Tell VO of gas concentrations – no other action required by VO
  - ❑ Mine Manager notified- no other action required
- ❑ Need audit of actions
- ❑ Proper record keeping



# TARP criteria

- Values not set in stone – should be regularly reviewed
  - Minimum at end of each longwall block or extraction area.
  - If situation stabilises without getting worse consider revising advisory/alert TARPs.
  - Avoid glib explanations and production driven demand to change TARPs.
  - Changes to TARPS should be documented and justified.
  - Changes may be up as well as down.



# TARP criteria

- Basis for action should be severity of incident
- First level trigger is abnormality – significantly above background level
- Second level trigger is significant and worsening abnormality – not necessarily twice background level
- Third level trigger is where there is real risk to personnel underground – not necessarily three times background level
- Triggers vary from location to location and over time



# Panel returns

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- Large air flow quantity
- Close to fresh air
- Unreliable deficiency ratios
- Absolute concentrations low and air flow dependant
- Only reliable indicator – CO make





# Physical Indicators

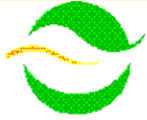
- May be more sensitive than gas measurement to identify abnormality and locate emission points.
- Must be supported by gas measurement
- Change from normal is the detection criterion



# Areas of low or no airflow

- Need norms to compare concentrations/indicators with.
- Can use concentrations and ratios within limits of accuracy
- Do not use text book triggers or norms established under different mining conditions or locations eg MG vs TG.

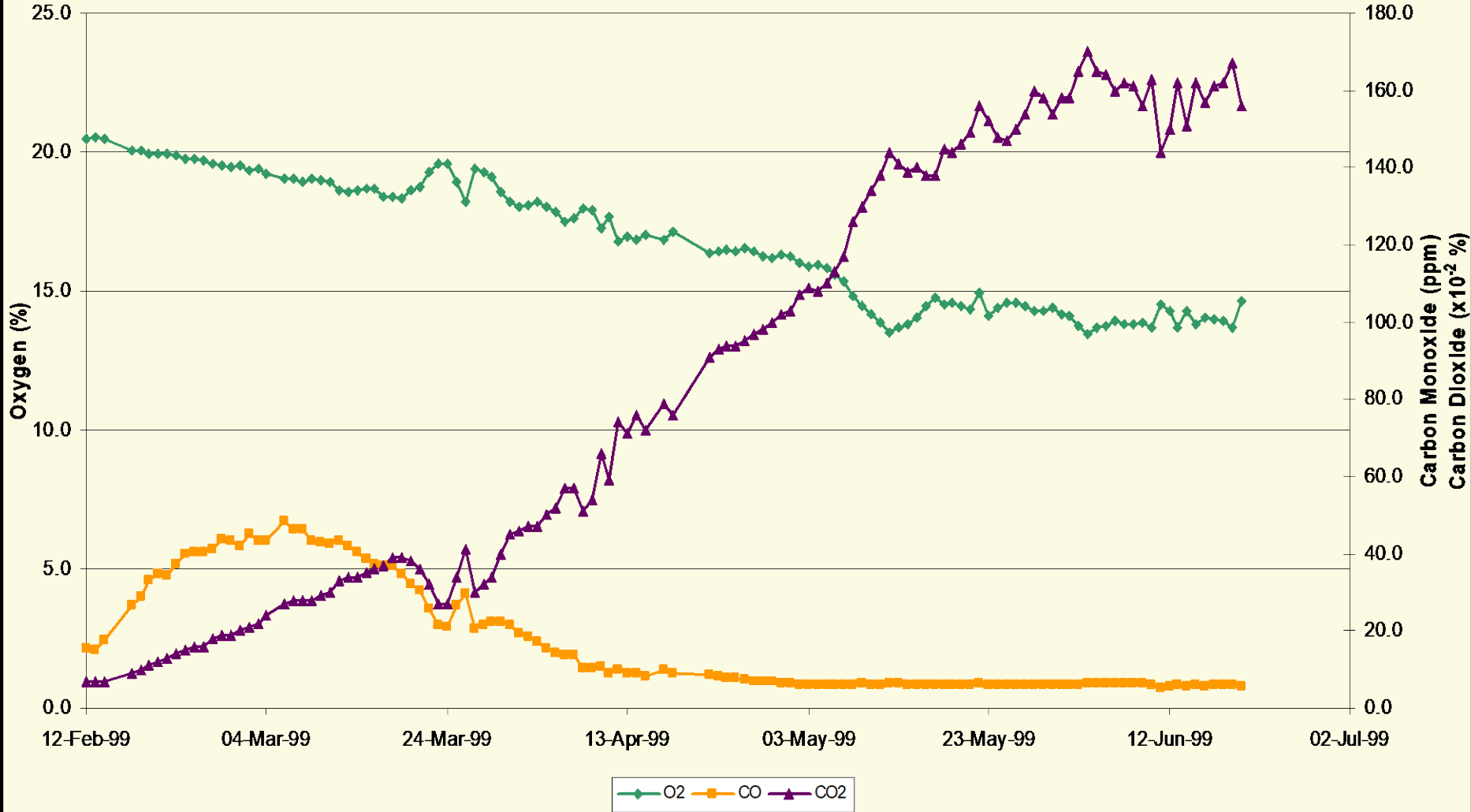




# LW101 Goaf Tube Bundle Sample Point Gas Trend

Tube 18 - 49 c/t MG Seal

Moranbah North Coal





# Indicators in areas of no air flow

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**Most ratios are measures of the conversion efficiency of oxygen to products of oxidation and are therefore essentially equivalent.**



# Ratios

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Therefore no need to use a multitude of deficiency ratios as they should all tell the same story.

Other ratios can be used to assist investigation not part of formal plan.

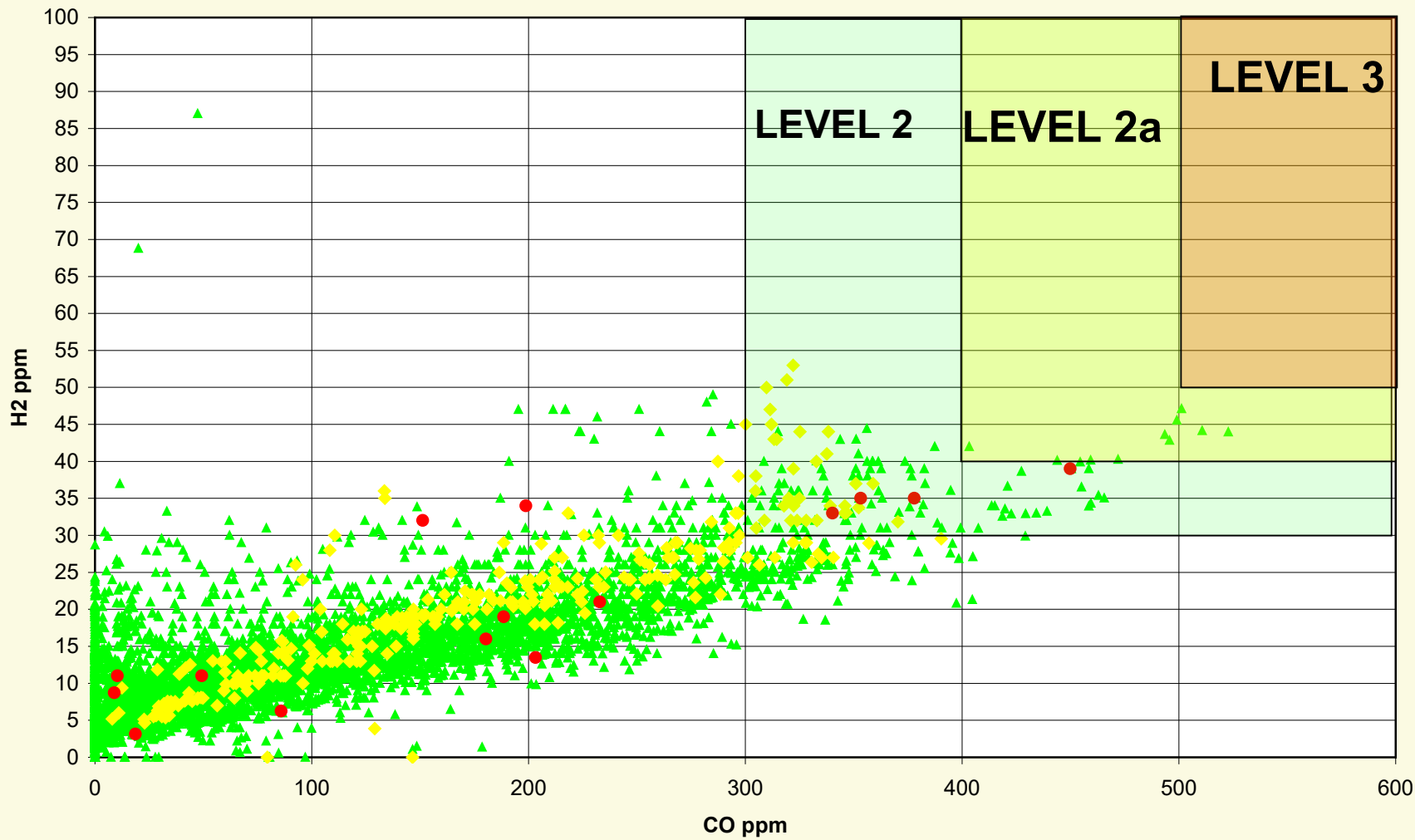


# Site specific indicators

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These are ratios or formulae involving various gas concentrations that have been shown to be a sensitive indicator of deviations from normal. E.g.  $H_2$  to  $CO$  ratio or  $CH_4$  to  $CO_2$ .

# TARP review data



- ▲ GR < 0.5
- ◆ GR > 0.5
- GR > 0.7

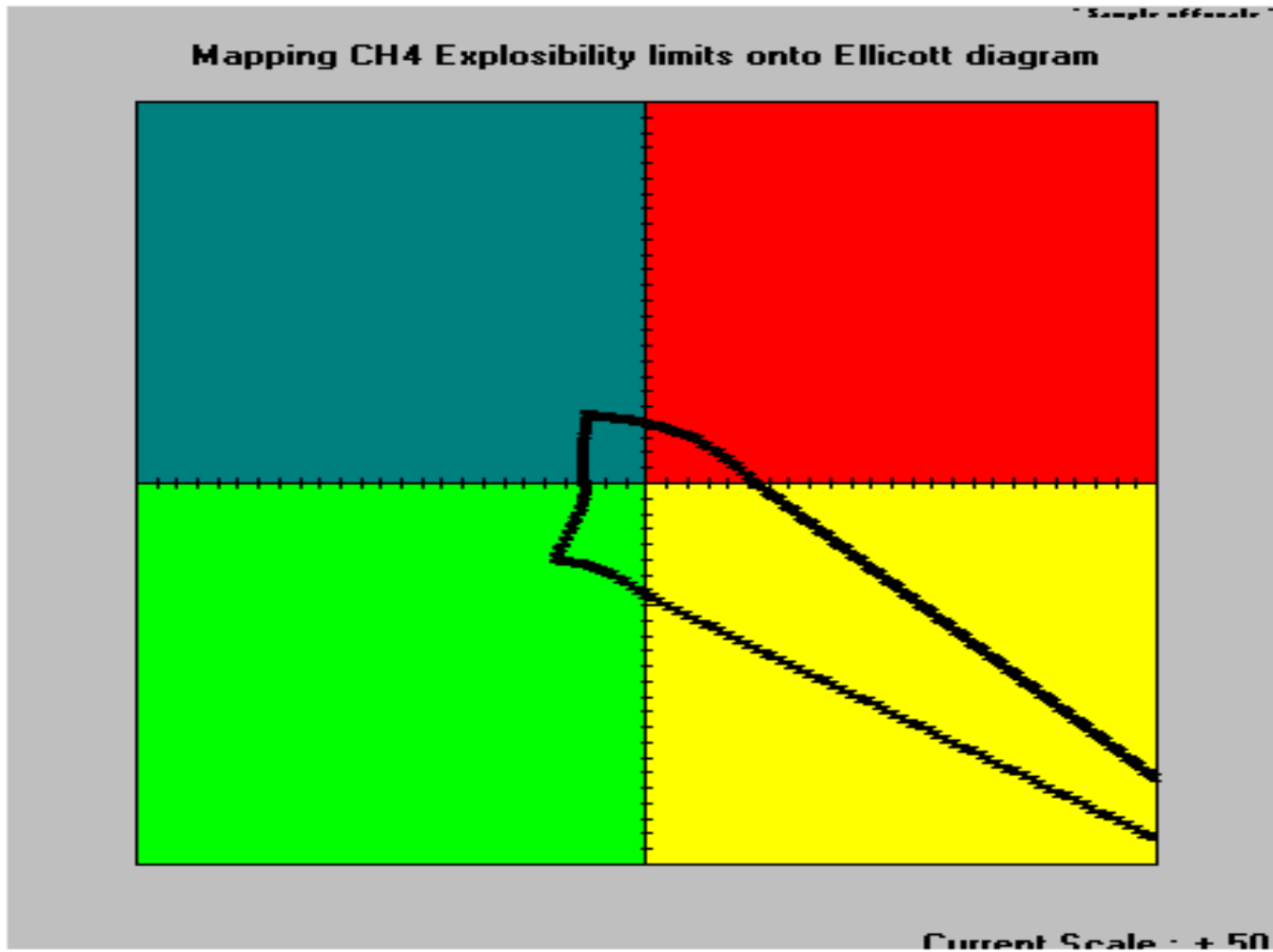


# Quantify TARPS

- Do not use adjectives or verbs to describe TARP
  - “presence” or “trace” of ethylene
  - “significant” concentration of hydrogen
  - “abnormal” Graham’s ratio
- Use numbers eg
  - >10 ppm ethylene
  - > 50 ppm hydrogen
  - > 0.8 Graham’s ratio



# Know your indicators





# Fundamental principles

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