

BEST PRACTICES

Bleederless Ventilation Systems

Spontaneous Combustion



Stumpy – the Four-Legged Duck

Spon-Com plans not strange ducks

2 Bleederless Ventilation Plans

Numerous plans where spontaneous combustion is addressed to some extent

Additional plans are expected to be submitted to MSHA for approval



Fires from 1990 to 1999

87 Reportable Underground Mine Fires

15 Spontaneous Combustion
identified as ignition source

17 %

“Chain Reaction”

Oxidation of coal at low temperature, area of low air flow

Heat of combustion not dissipated, but oxygen supply sufficient to maintain combustion

Oxidation temperature rises

Flaming occurs

Factors

- Physical and Chemical Properties of Coal
- Air flow rate
 - “Catch 22”
 - Air movement removes heat of combustion
 - ← Oxygen supports combustion

§ 75.334(f) Option

Replacing § 334 (a) and (b)

- For mines with a demonstrated history of spontaneous combustion, or
- Are located in a coal seam determined to be susceptible to spontaneous combustion, the approved ventilation plan shall specify the following:

§ 75.334(f)

Ventilation Plan Requirements

1. Specify measures to detect methane, oxygen and carbon monoxide.

While section does not require other gases to be detected, should consider other fire gases such as carbon dioxide, hydrogen, ethylene, acetylene.

“...MSHA would not discourage operators from incorporating, as part of the mine ventilation plan, any or all of these methods as well as other appropriate methods to aid in the early detection of spontaneous combustion.”

Preamble 1996 Ventilation Rule

§ 75.334(f)(2)

2. Specify actions to protect miners from the hazards of spontaneous combustion

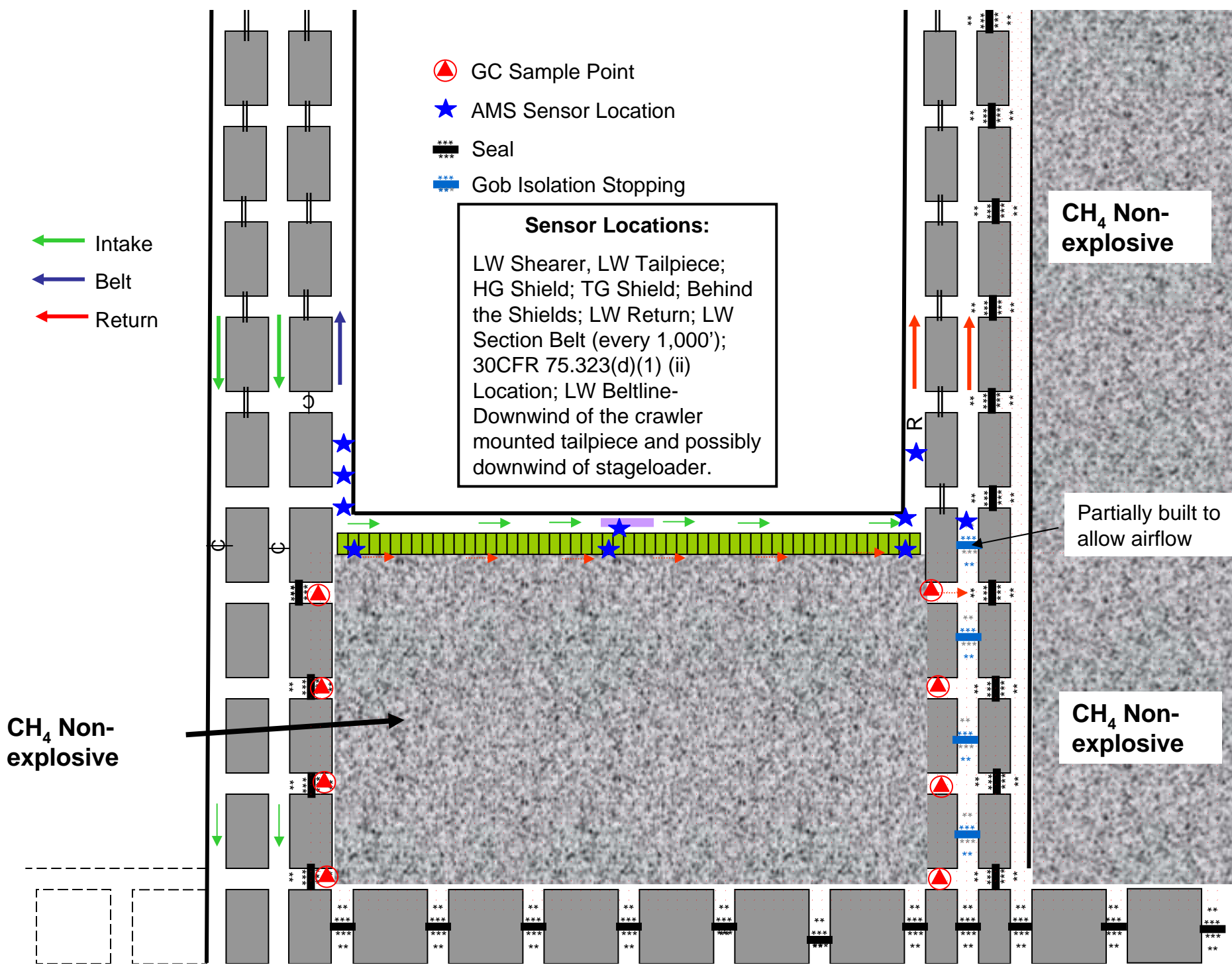
- ✓ Continuous monitoring of fire gases at strategic locations
- ✓ Increased air sampling and analyses
- ✓ Trending of gas sampling data
- ✓ Increased examinations
- ✓ Pressure balancing

§ 75.334(f)

Ventilation Plan Requirements

3. If a bleeder system is not used, specify methods to control in worked-out areas:

- spontaneous combustion
- accumulations of methane-air mixtures and other gases, dusts and fumes



- ⬆ GC Sample Point
- ★ AMS Sensor Location
- ***** Seal
- *** Gob Isolation Stopping

Sensor Locations:

LW Shearer, LW Tailpiece;
 HG Shield; TG Shield; Behind
 the Shields; LW Return; LW
 Section Belt (every 1,000');
 30CFR 75.323(d)(1) (ii)
 Location; LW Beltline-
 Downwind of the crawler
 mounted tailpiece and possibly
 downwind of stageloader.

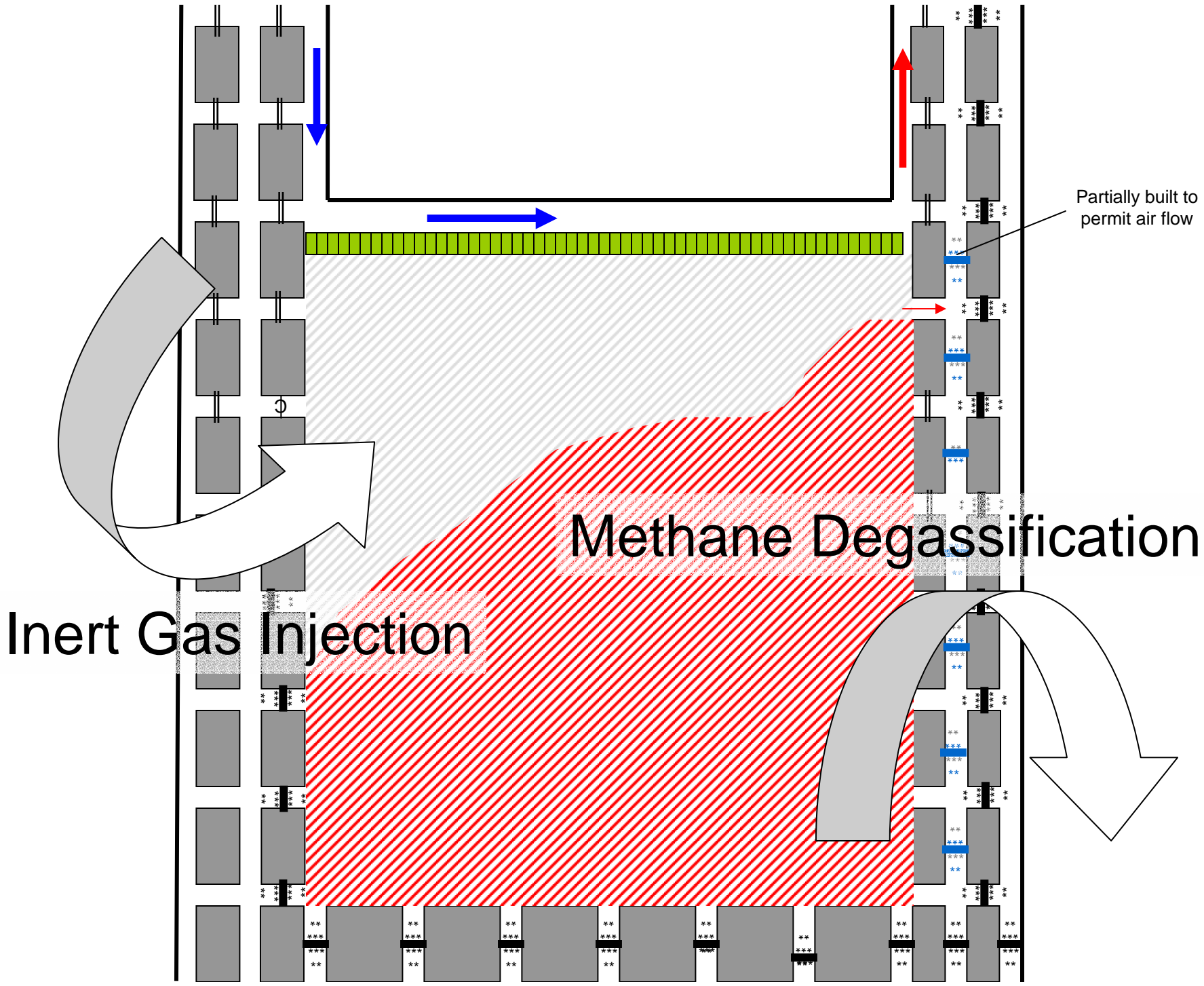
- ← Intake
- ← Belt
- ← Return

CH₄ Non-explosive

Partially built to allow airflow

CH₄ Non-explosive

CH₄ Non-explosive



Inert Gas Injection

Methane Degassification

Partially built to permit air flow

Measures to detect CH₄, CO, & O₂

Mine Atmosphere Monitoring

Gas Chromatograph (GC)

Periodic analysis of gob atmosphere samples at various locations

Atmospheric Monitoring System (AMS)

Continuous monitoring using sensors located along longwall face and in return entries

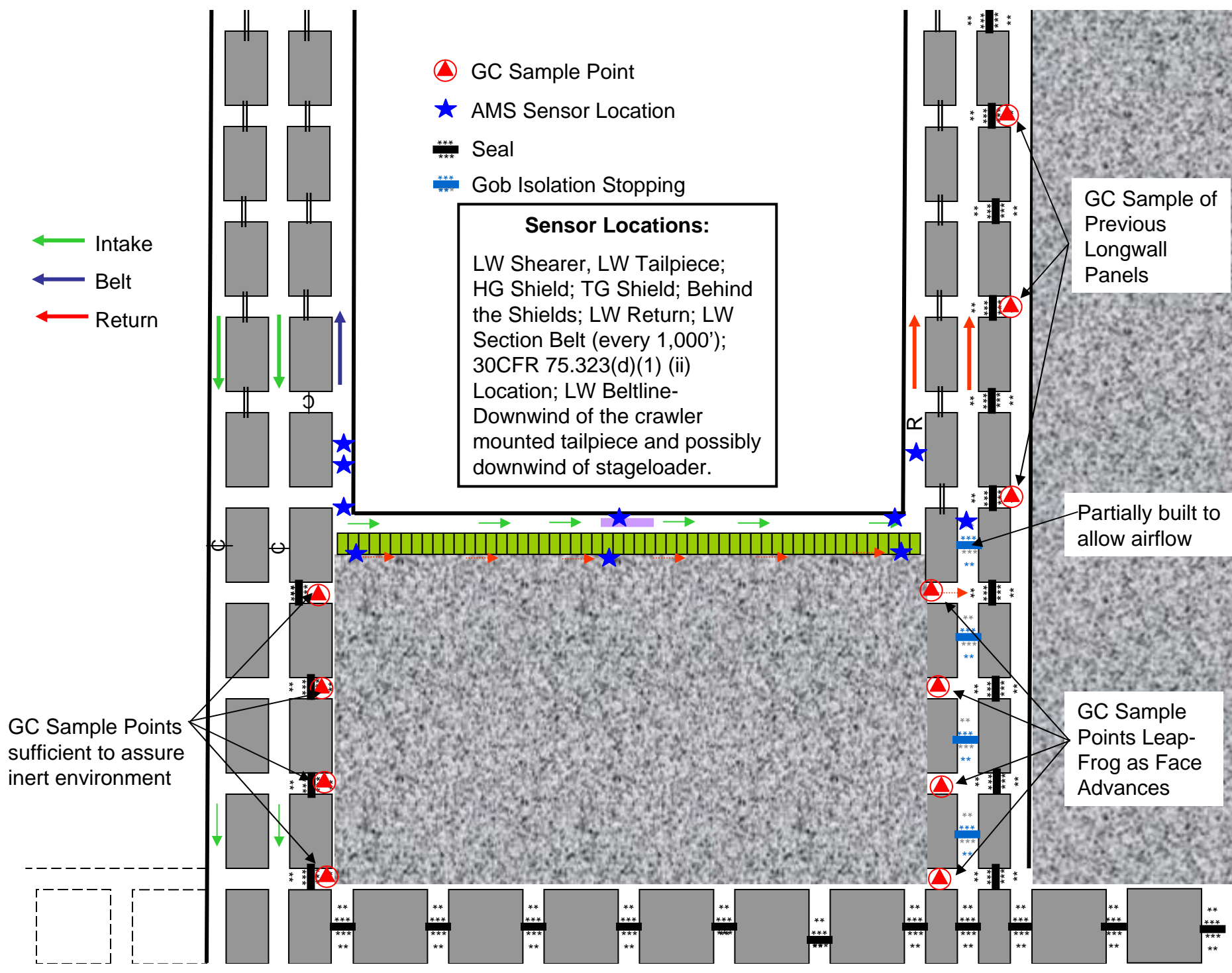
Human Examinations and Observations

Actions that will be taken to protect miners from hazards of spontaneous combustion

Based on Gas Monitoring Results

Action Plan based on carbon monoxide and other gases sampling results

Inert gas injection at critical locations and effective evaluation of inertization



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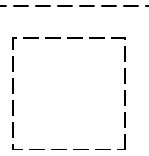
- ← Intake
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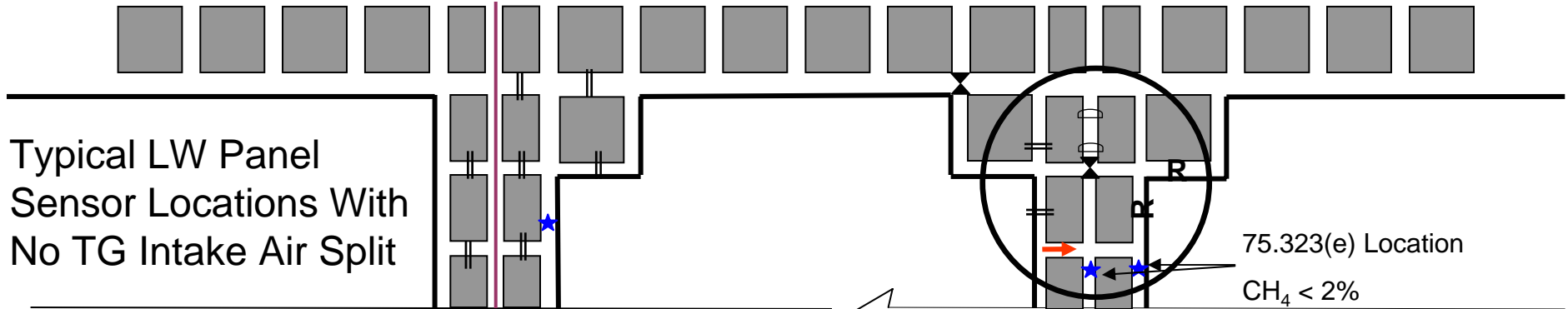
GC Sample of
 Previous
 Longwall
 Panels

Partially built to
 allow airflow

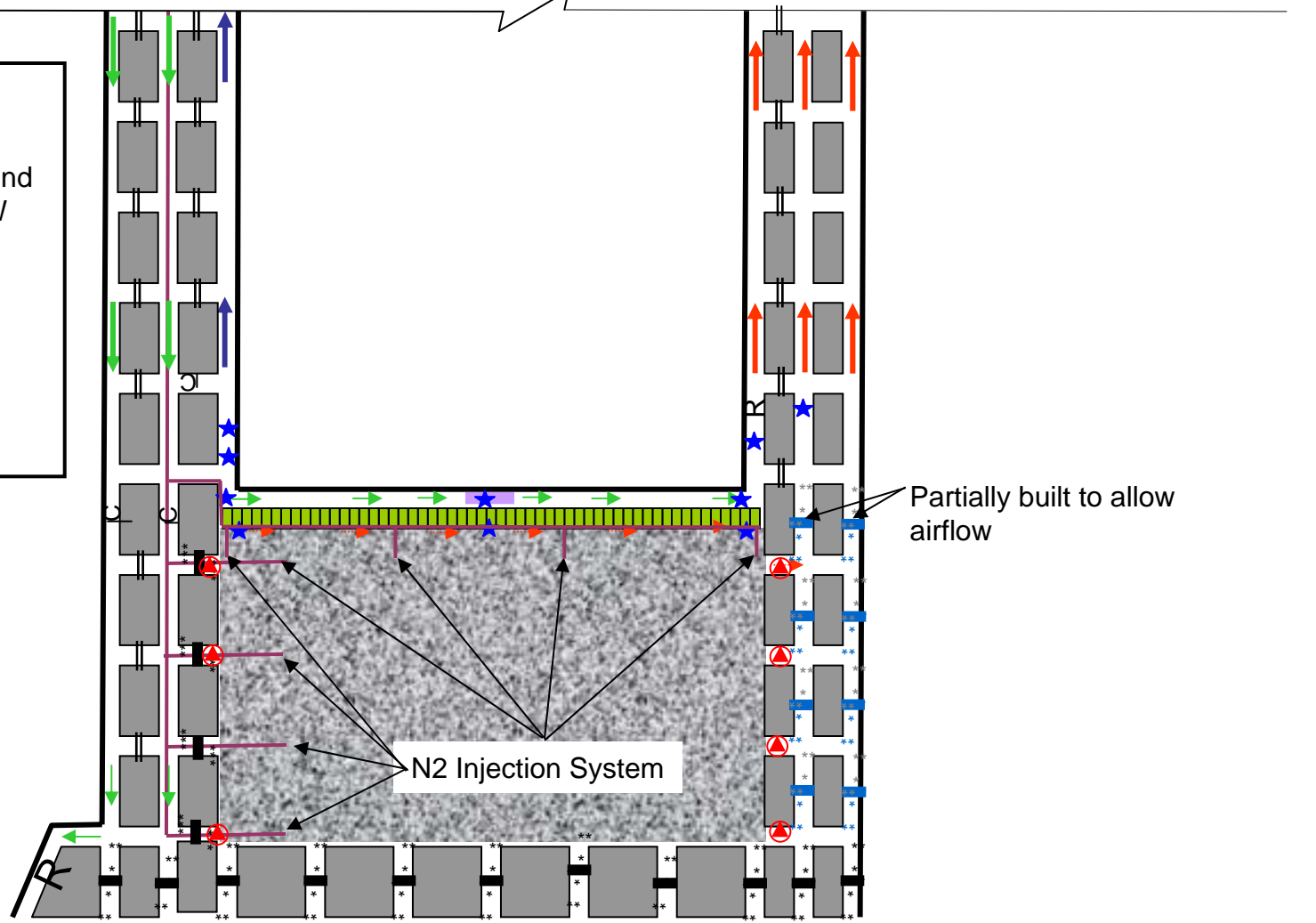
GC Sample Points
 sufficient to assure
 inert environment

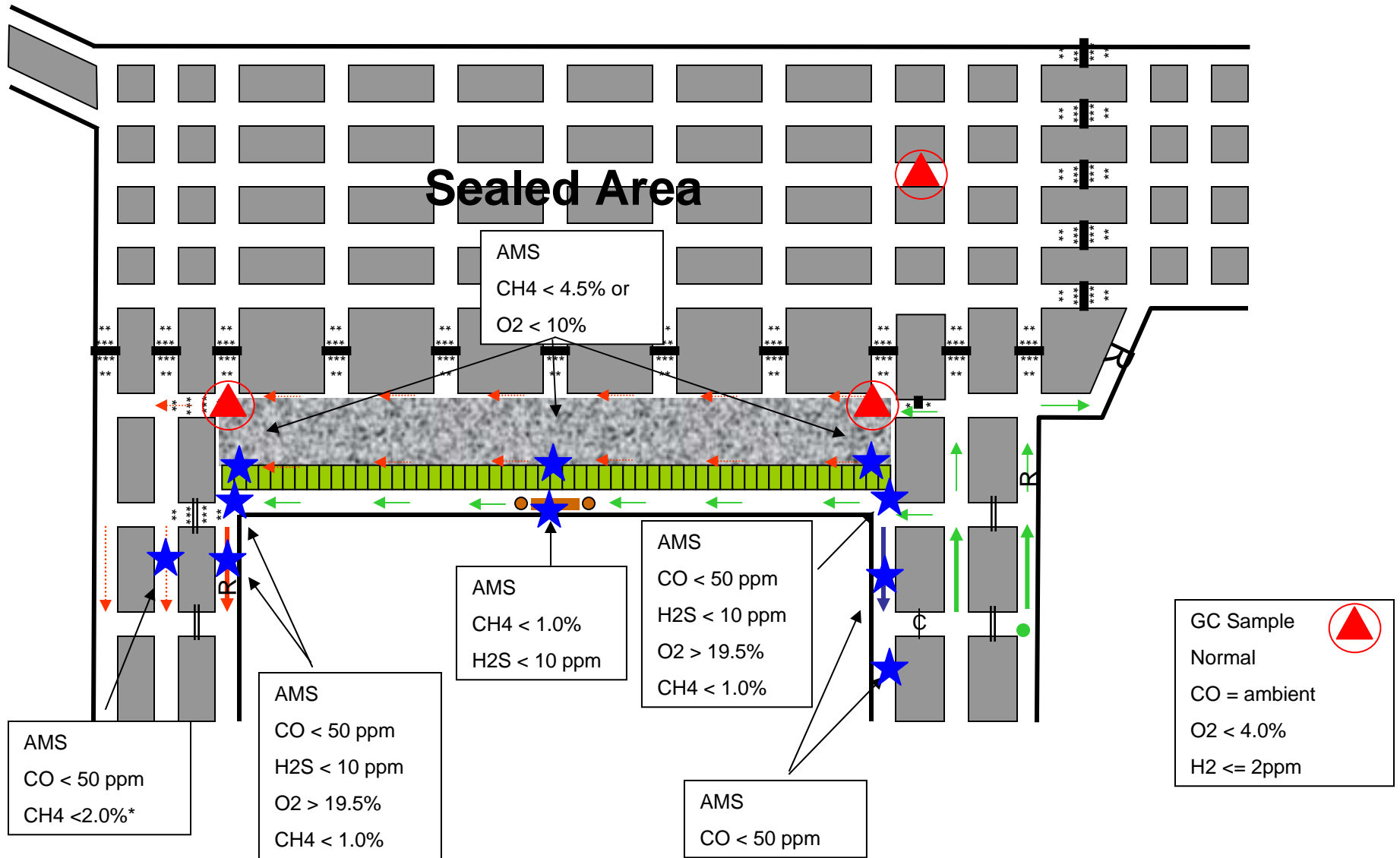
GC Sample
 Points Leap-
 Frog as Face
 Advances





Sensor Locations:
 LW Shearer, LW Tailpiece;
 HG Shield; TG Shield; Behind
 the Shields; LW Return; LW
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 Location; LW Beltline-
 Downwind of the crawler
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 stageloader.





* From a practical standpoint, methane cannot be greater than 2% at this location because there is no other split of air from the gob to reduce it to 2% prior to entering another split of air

Gob Gas Actions

- Depressed oxygen levels needed to prevent spontaneous combustion.
- CO levels based on history of coal seam.
- Methane-air mixtures non-explosive.
- Hydrogen levels in conjunction with CO to indicate potential heating.

Carbon Monoxide and Hydrogen

- CO = Ambient – Normal
- CO > Ambient – triggers more frequent sampling
- CO > Ambient with H₂ – triggers inert gas injection
- CO & H₂ continuously increasing – longwall ceasing production
- CO & H₂ indicates heating (sealing of gob)

General Considerations

- **Blowing ventilation system to maintain positive pressure on the gob; backup fan to maintain pressure against gob during fan stoppage.**
- **Methane drainage and degassification systems designed for methane liberation rate.**
- **Inert gas injection system to reduce oxygen levels as necessary.**
- **Barometric pressure changes**

Methane drainage on falling barometer; Inert injection on rising barometer

General Considerations

- **Eliminate cutting and welding on face**
- **Maintain trend analyses of fire gas concentrations and calculated indices to provide early prediction of spontaneous combustion.**
- **Enhanced examinations**
- **Enhanced face ventilation**
- **De-energize electrical equipment when methane levels reach action levels.**

Mine with demonstrated history or potential of spontaneous combustion

The mine should consider a spontaneous combustion plan

Partial or minimal ventilation may not be an effective means to control spontaneous combustion and may not meet the intent of the regulations

Mine with no demonstrated history of spontaneous combustion



VENTILATE



EXAMINE



EVALUATE



MEET ALL THE REGULATORY
REQUIREMENTS INCLUDING 75.334,
75.364, AND 75.323(e)