

Degasification & Ventilation  
of  
Super-wide Longwall Panels  
in  
The Pittsburgh Coal Seam

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# WORLD ENERGY RESOURCES & CONSUMPTION

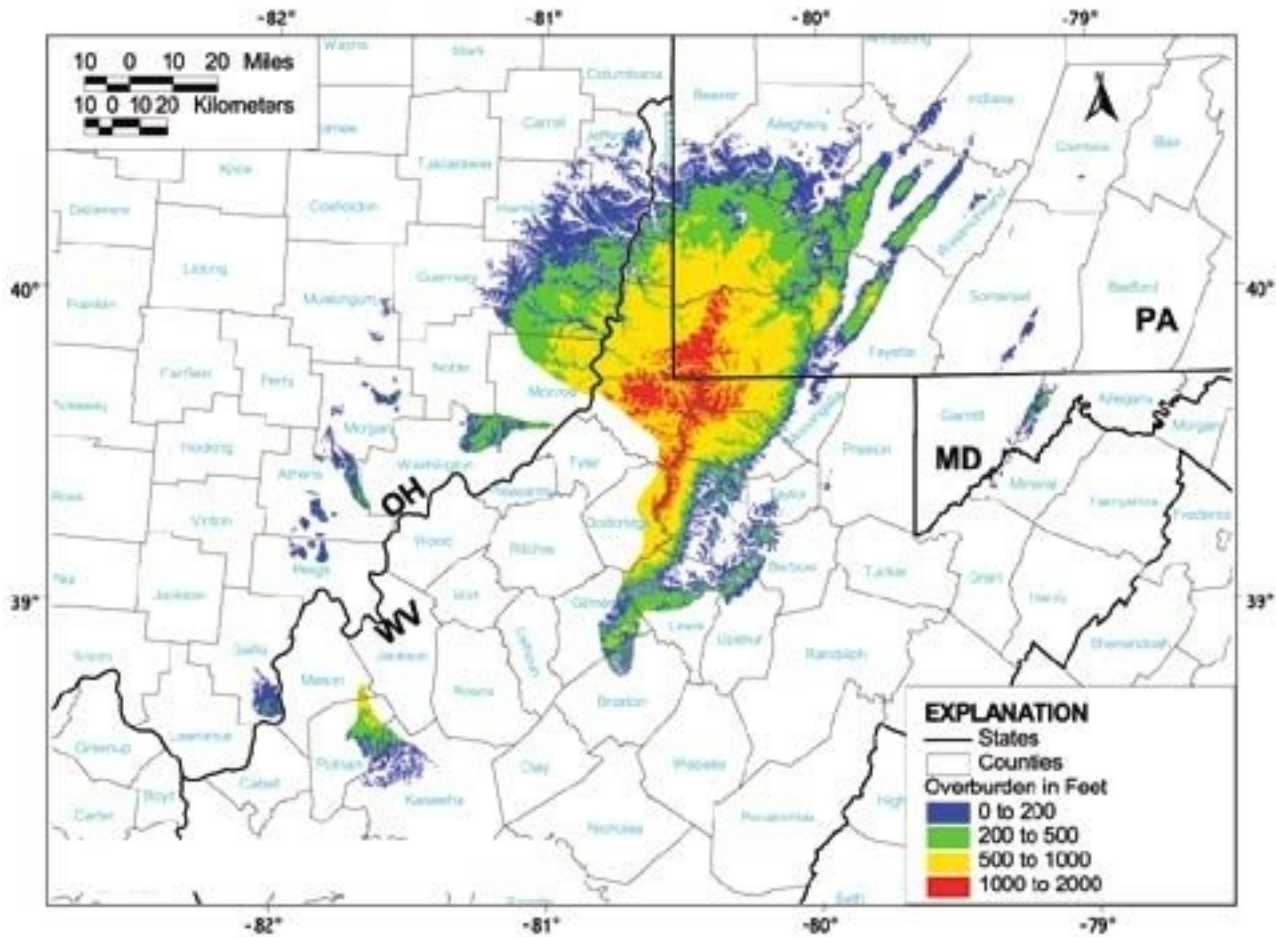
| Fuel Type   | Reserves (ZJ) | Annual Consumption EJ/y |
|-------------|---------------|-------------------------|
| Coal        | 290           | 120                     |
| Natural Gas | 15.7          | 110                     |
| Oil         | 18.4          | 180                     |
| Nuclear     | 2 – 17        | 30*                     |
| Hydro       | NA            | 30                      |
| All Others  | Uncertain     | 4                       |
|             |               |                         |

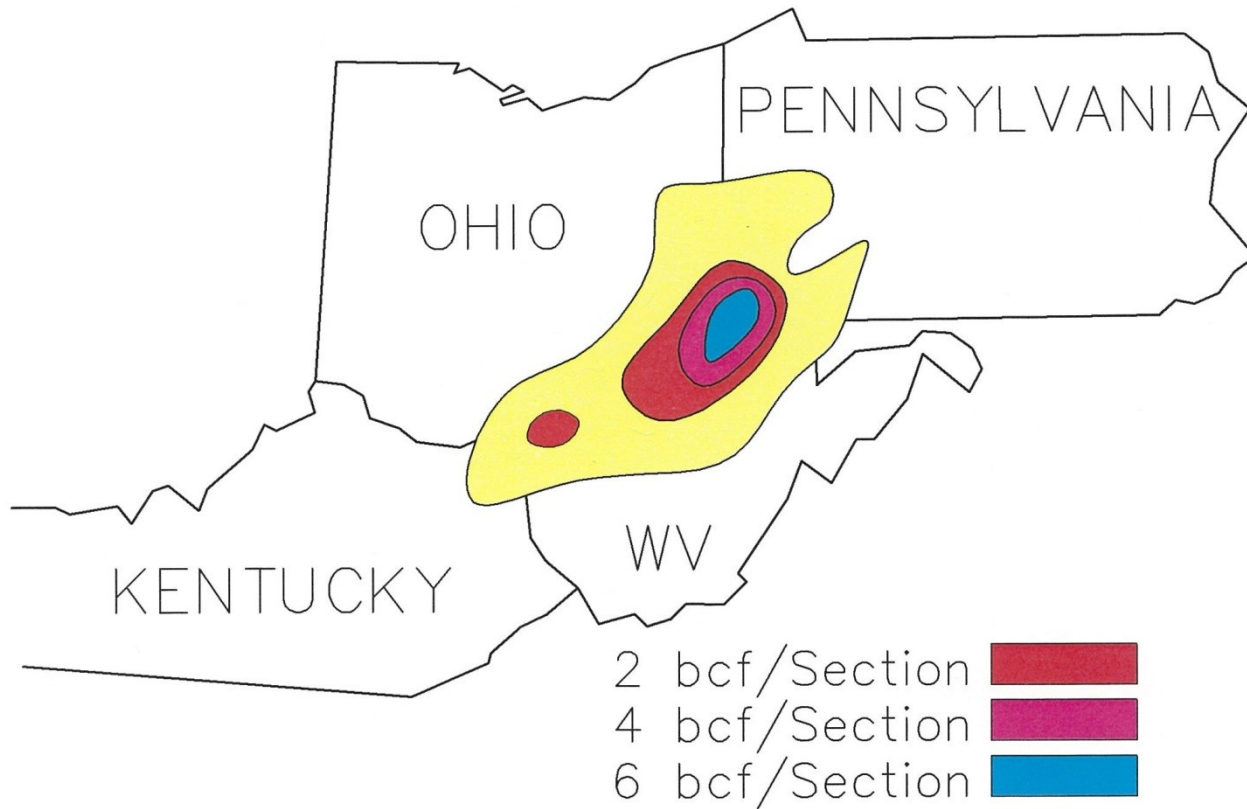
E =  $10^{18}$

Z =  $10^{21}$

\*Reprocessing not considered

# THE PITTSBURGH No.8 COAL SEAM





Total Gas In Place 7Tcf; 6,000 miles<sup>2</sup>; 40 Btons  
Contour Line In Bcf/Section (2 bcf /Section Interval)

| COMPANY       | AL | CO | IL | PA | UT | WV | OH | OTHER | TOTAL |
|---------------|----|----|----|----|----|----|----|-------|-------|
| Murray Energy |    |    | 6  |    | 1  | 6  | 2  |       | 15    |
| Consol Energy |    |    |    | 5  |    |    |    | 1     | 6     |
| Arch Coal     |    | 1  |    |    |    | 2  |    |       | 3     |
| Walter Energy | 3  |    |    |    |    |    |    |       | 3     |
| Others        | 2  | 3  |    | 3  | 2  | 5  |    | 5     | 20    |
| Total         | 5  | 4  | 6  | 8  | 3  | 13 | 2  | 6     | 47    |

**SAFEST**  
**LOWEST COST**  
**MOST EFFICIENT RECOVERY**

# ADVANTAGES OF SUPER WIDE LONGWALLS

- Improved longwall / development coal ratio
- Improved productivity and reduced cost/ton
- Fewer longwall moves – Improved safety
- More complete recovery of reserves
- Wider panels allow more time for gate development

# DISADVANTAGES OF SUPER WIDE LONGWALLS

- Adequate Ventilation air at tail difficult to maintain
- Pre-mining degasification needed
- Increased gob emissions and floor gas issues
- Hidden geologic anomalies; Faults, washouts, reduced seam height

# GASSINESS OF COAL

| CATEGORY         | GAS CONTENT (ft <sup>3</sup> /t) | DEPTH (ft)  |
|------------------|----------------------------------|-------------|
| MILDLY GASSY     | < 100                            | <600        |
| MODERATELY GASSY | 100 – 300                        | 600 – 1500  |
| HIGHLY GASSY     | 300 – 700                        | 1500 – 3000 |

Central core of Pittsburgh seam is moderately gassy:  
Outer rim is mildly gassy



# ALL COAL SEAMS ARE GASSY AND NEED SOME DEGASIFICATION\*

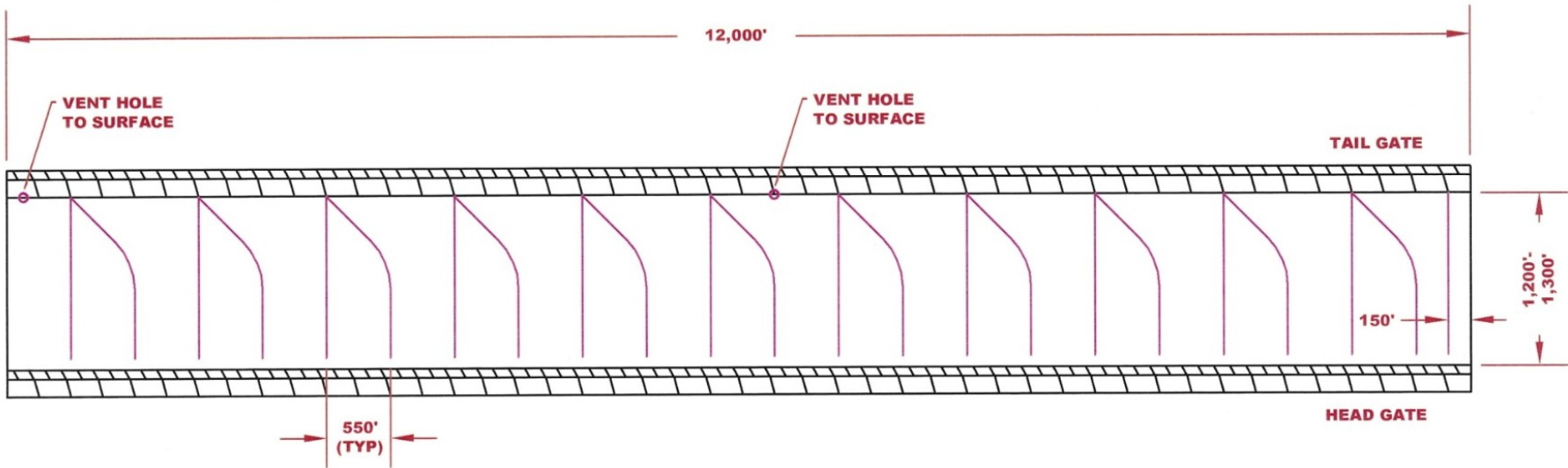
| CATEGORY                      | PRE-MINING   | POST MINING                 |
|-------------------------------|--|-----------------------------|
| MILDLY GASSY                  | NONE REQUIRED  | 2 GOB WELLS PER PANEL       |
| MODERATELY GASSY              | IN-MINE HORIZONTAL DRILLING                          | 5 – 6 GOB WELLS PER PANEL   |
| HIGHLY GASSY (750' X 10,000') | VERTICAL DRILLING WITH HYDROFRACING IN-MINE DRILLING | 20 – 40 GOB WELLS PER PANEL |

\* Assume the face will mine 400 – 500 ft/week

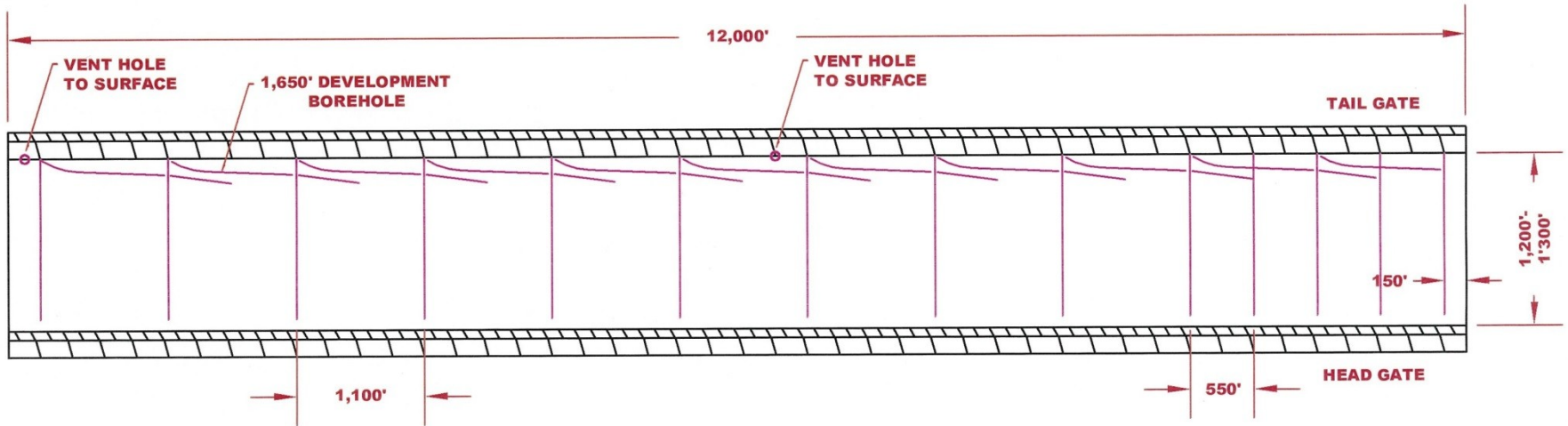
# PRE-MINING DEGASIFICATION

- Horizontal Drilling from Surface
- In-mine Horizontal Drilling
- Shallow Coal: High Permeability

# TYPICAL IN-MINE DRILLING PATTERNS



# TYPICAL IN-MINE DRILLING PATTERNS



- Nearly 50% of all in-situ gas can be drained in 6 – 18 months
- Low diffusivity of coal
- Takes 1000 days to release 65% of in-situ gas

# HORIZONTAL DRILL RIG





# TENDER UNIT



# DOWN HOLE SURVEYING TOOL

**INSTRUMENT**



**READ-OUT BOX**

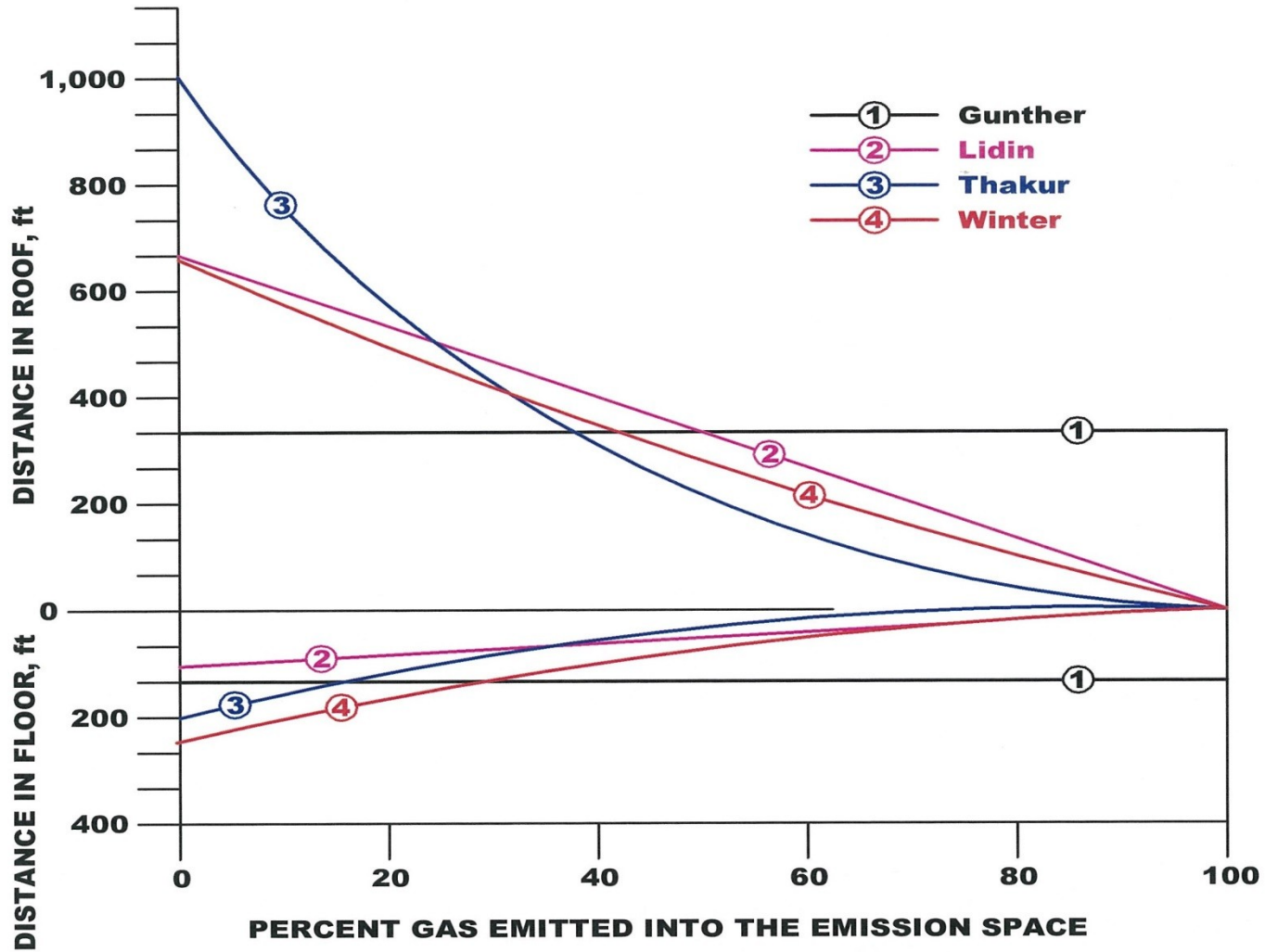




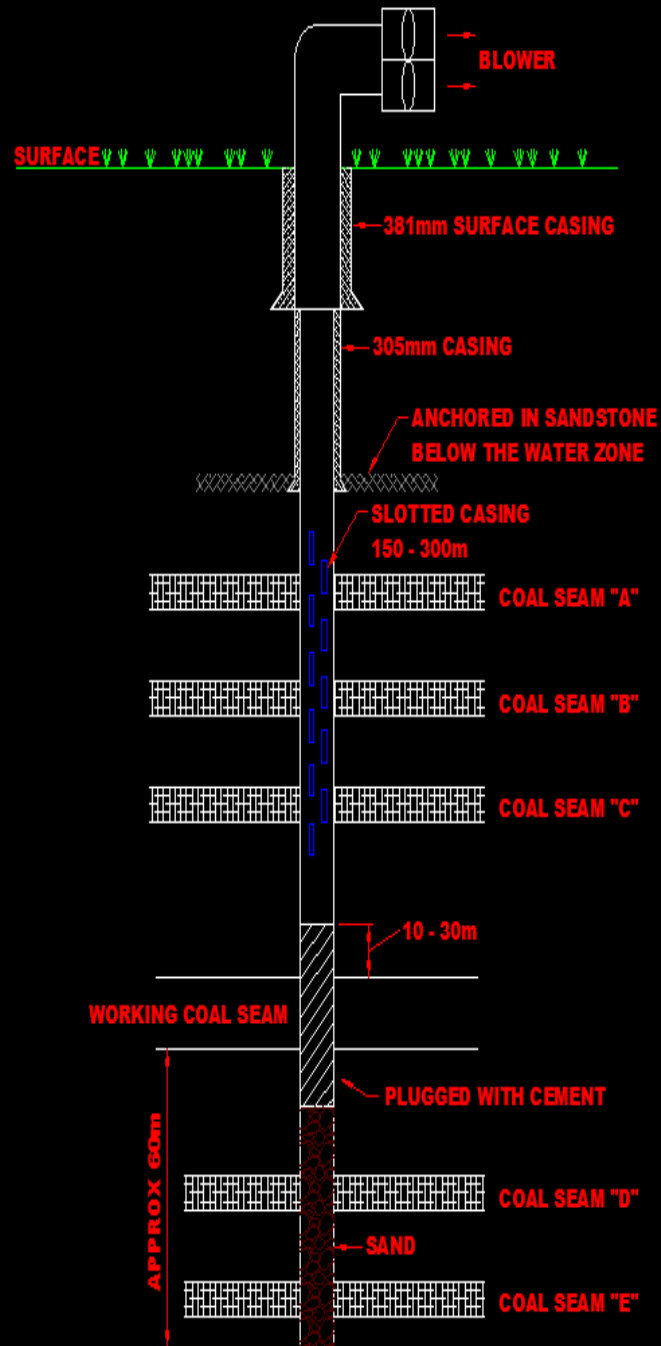
# POST-MINING DEGASIFICATION

- Vertical Gob Wells
- Cross-measure Boreholes

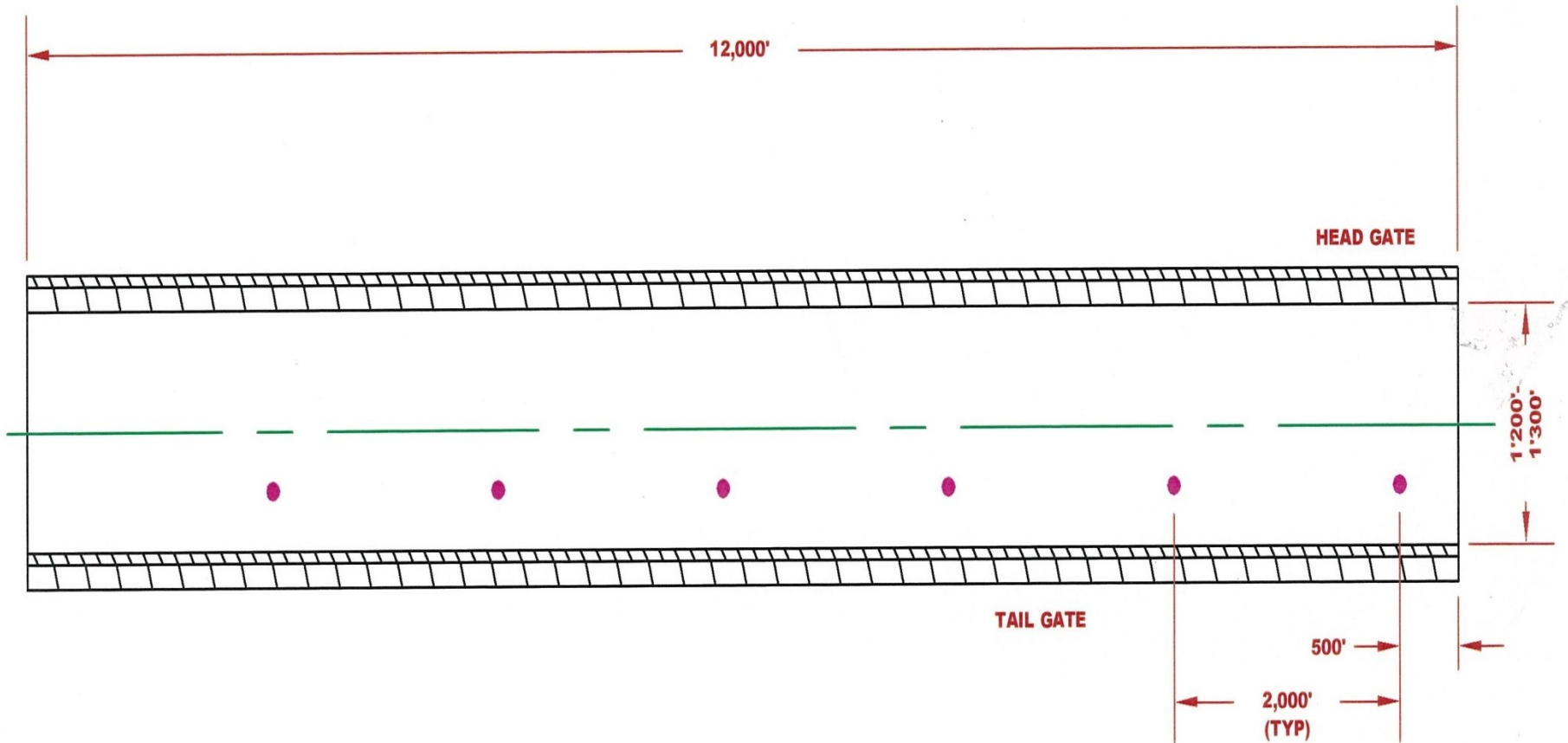
# VERTICAL EXTENT OF GAS EMISSION SPACE



# SECTION VIEW OF A TYPICAL GOB WELL



# POST MINING DEGASIFICATION



- 55 – 60% OF GOB GAS CAN BE CAPTURED
  - TYPICAL LONGWALL MAKES 8MCFD OF METHANE
  - BLEEDER AIR MUST HANDLE 3.2 – 4.4 MCFD
  - ASSUMING BLEEDERS KEPT BELOW 1.5%
- VENTILATION AIR NEEDED: 150,000 – 200,000 CFM

# GAS EMISSIONS ON THE LONGWALL FACE DEPENDS ON

- Gas content of de-gassed coal
- Rate of mining (70ft/day)

# CRITERIA FOR OPTIMUM FACE LENGTH (PANEL WIDTH)

- Total gas flow at the tailgate
- Ventilation air at the tailgate
- CH<sub>4</sub> concentration must be below 1% (0.8%)

# GAS LAYERING INDEX

- **GAS LAYERING NUMBER, GLN:**

$$\text{GLN} = \frac{6V}{(Q/D)^{1/3}} \geq 5$$

$$\text{minimum ventilation} = [V \cdot \text{Area}]$$

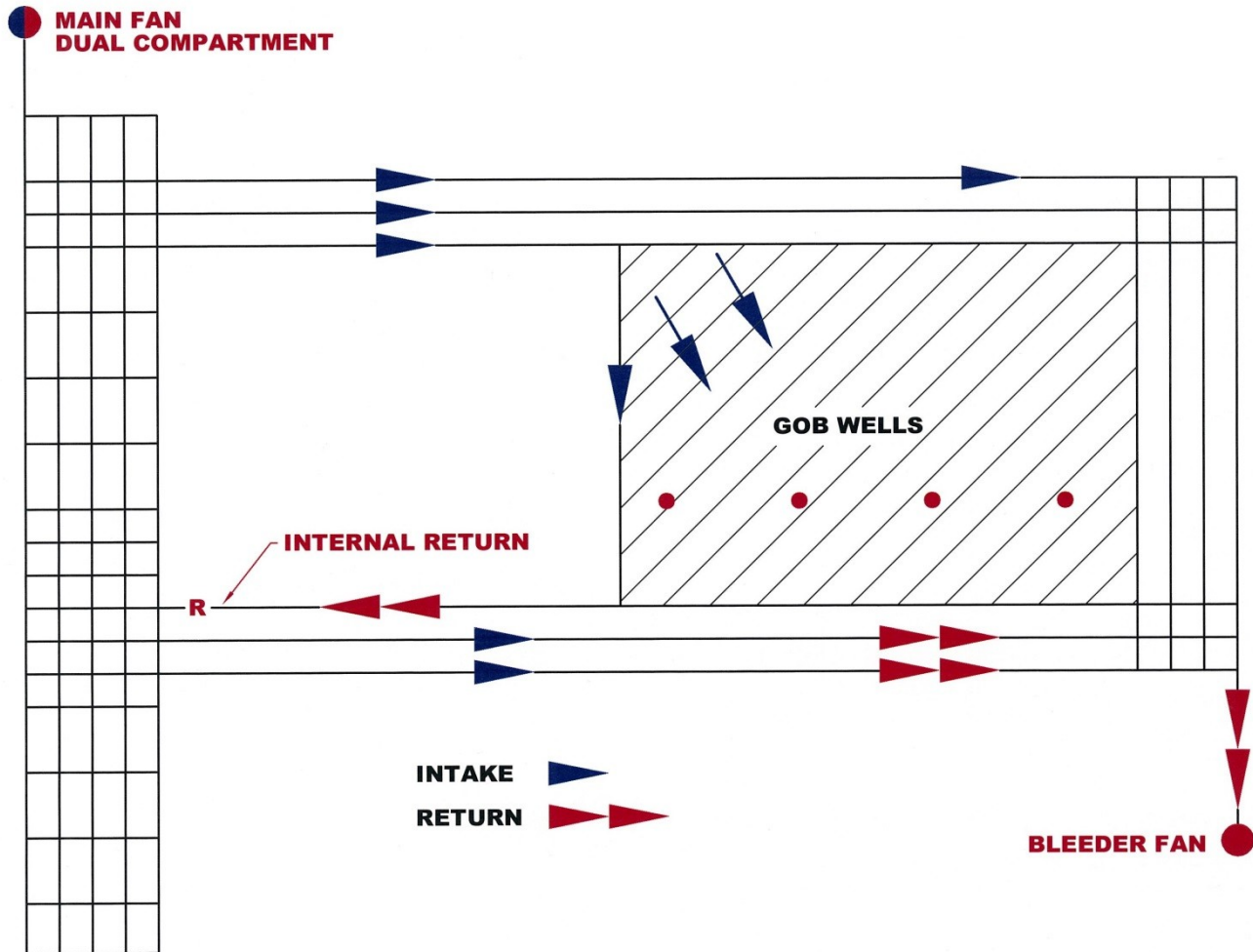
ASSUME: Q= 300cfm;  
D = 10ft

Ventilation Air Needed = 39,000cfm

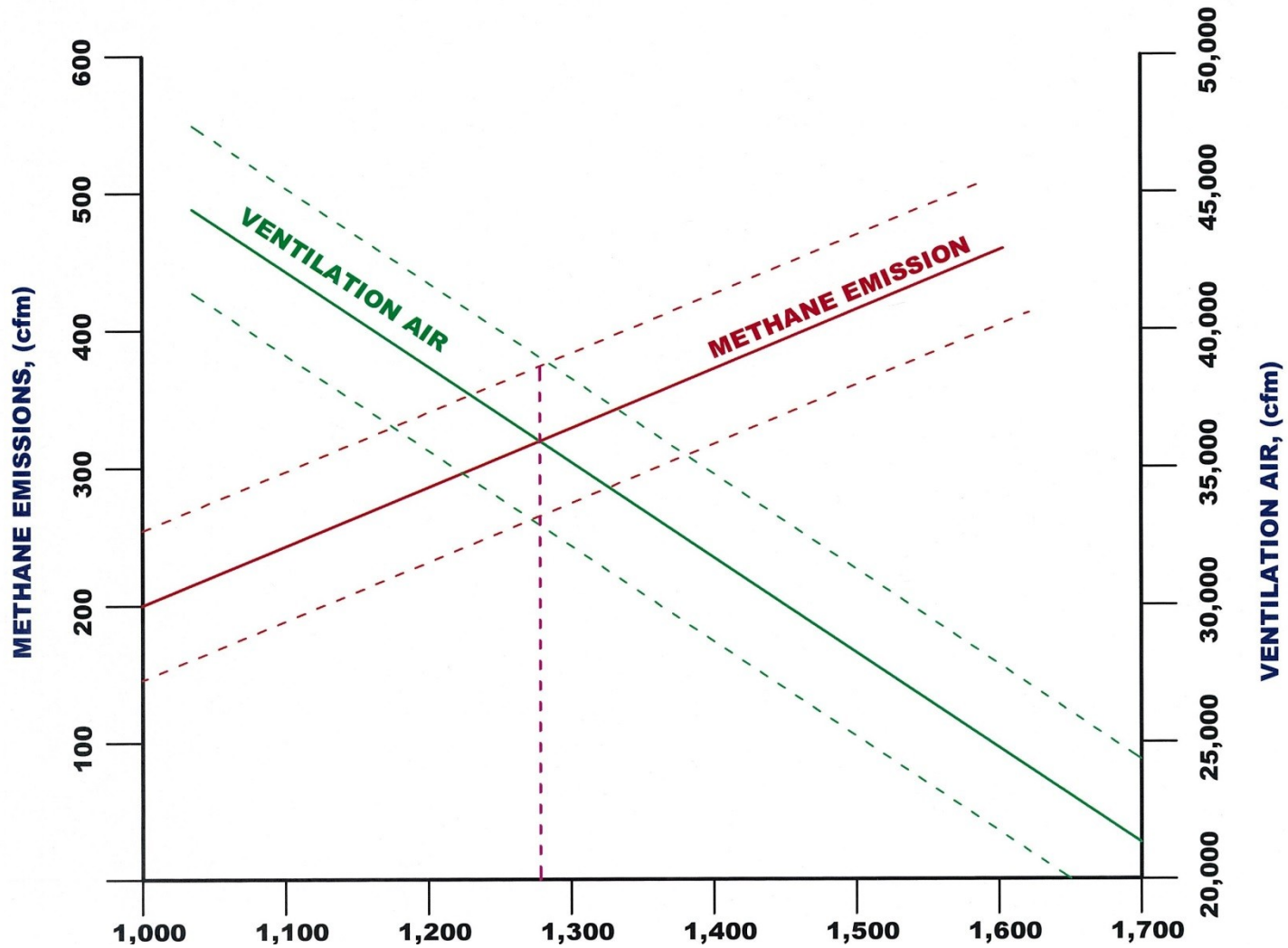


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# MODERATELY GASSY COAL SEAMS



# OPTIMUM WIDTH OF FACE IN PITTSBURGH SEAM



| GASSINESS        | OPTIMUM LENGTH OF FACE (ft) |
|------------------|-----------------------------|
| Highly Gassy     | 700 - 750                   |
| Moderately Gassy | 1250 - 1320                 |
| Mildly Gassy     | 1,500 +                     |