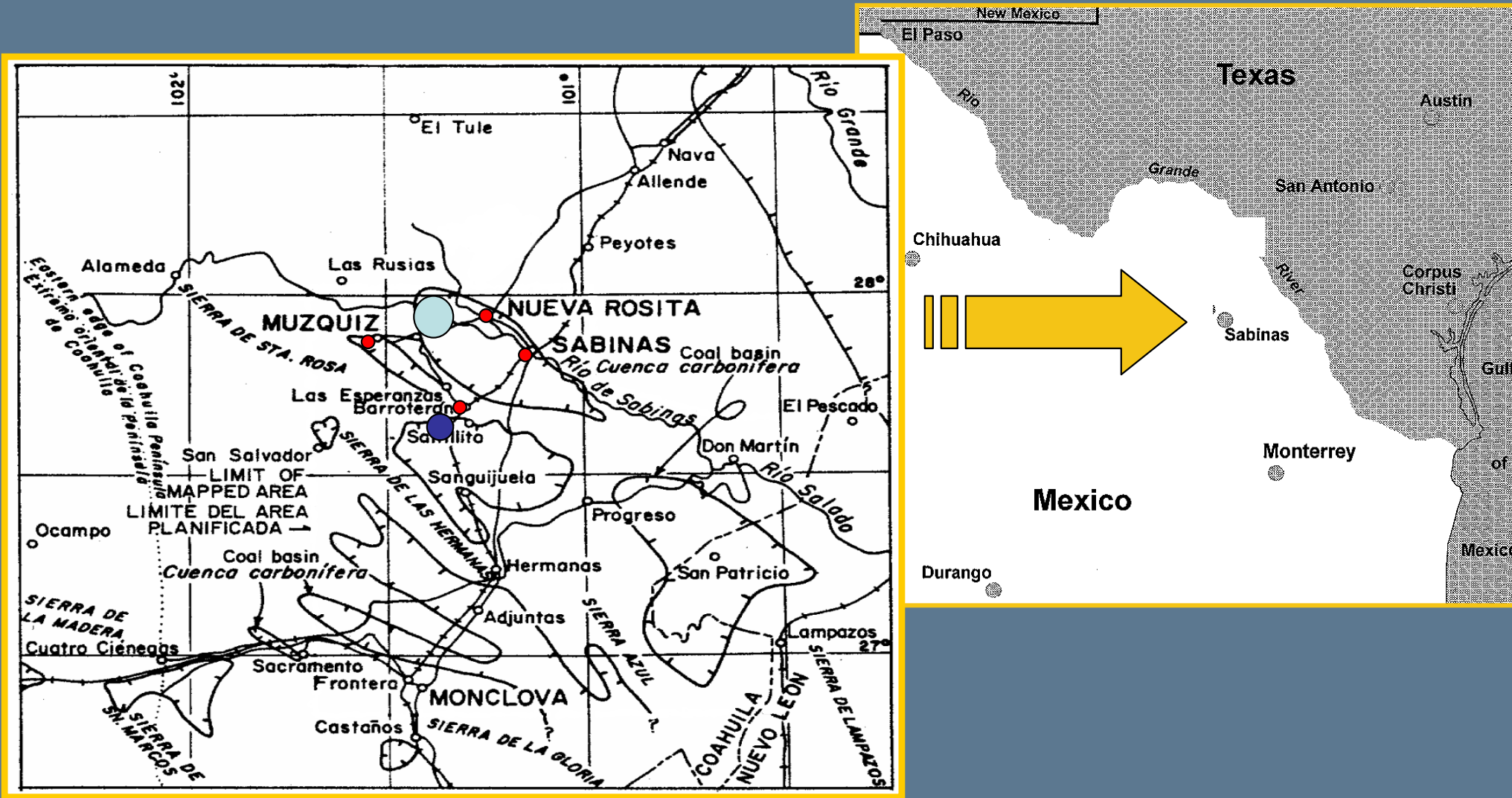


Minerales Monclova S.A. de C.V.

**Design, Operation, and Integration
of Methane Drainage Systems at
Minerales Monclova S.A. de C.V.'s
Underground Coal Mines in
Coahuilla, Mexico**

Methane to Markets Ministerial Meeting
November 15 – 17, 2004
Washington, DC

Minerales Monclova Operations



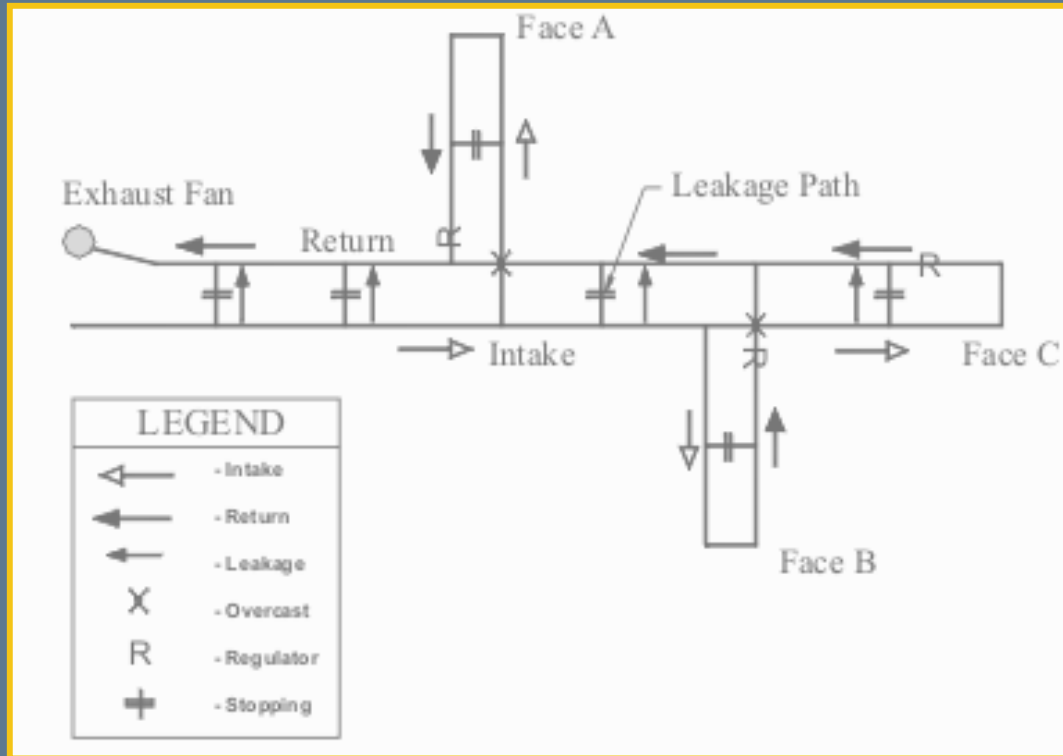
Minerales Monclova Operations

- **Minerales Monclova S.A. de C.V. (MIMOSA):**
 - **Coal Production:** 5 Mt per Year
 - **Product:** Metallurgical Coal
 - **Mining Method:** 4 Underground Longwall Mines
 - **Depths:** Less than 220 m
 - **Coal Seam:** Double Seam (Upper Cretaceous)
 - **Conditions:** Gassy (High Permeability, High GC)
 - **CH4 Control Systems:** Ventilation, Pre-Mining Degasification, and Gob Gas Drainage

Main Purpose of CMM Drainage:



Control Through Mine Ventilation

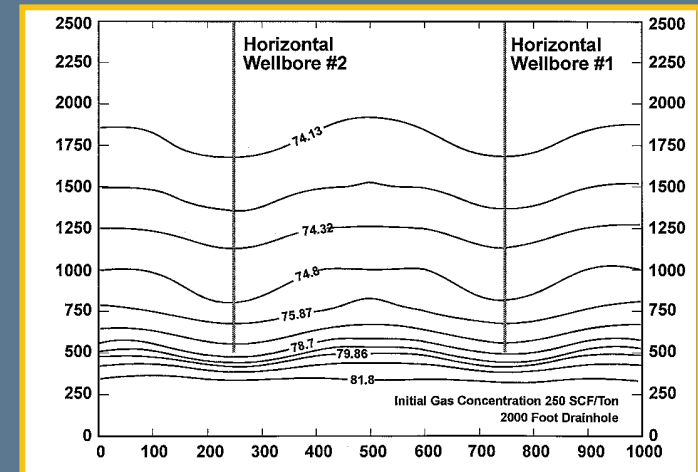
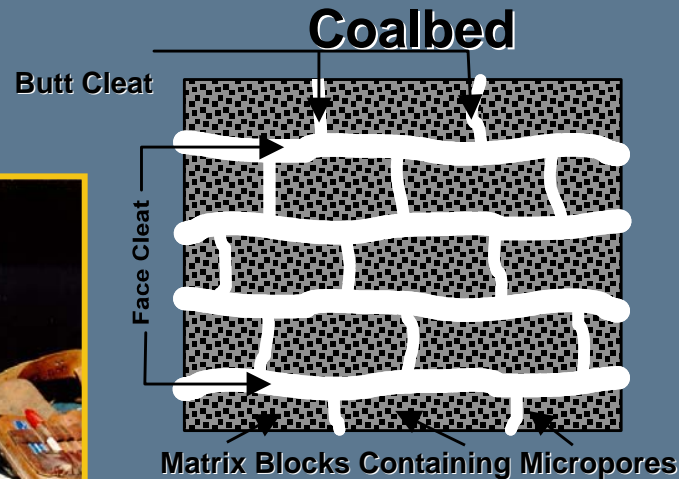
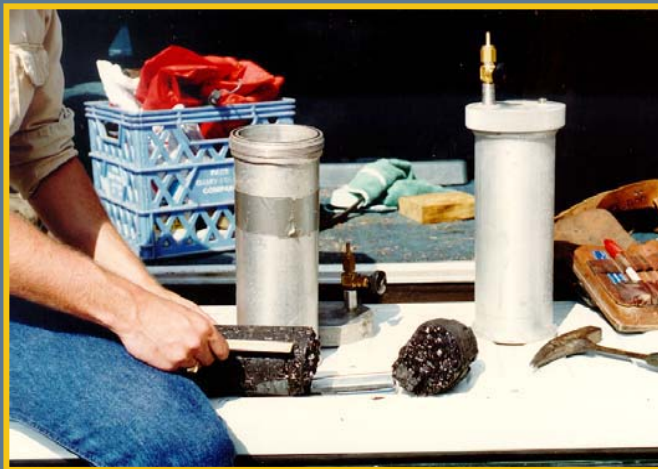


- Principal Means of Controlling Underground Emissions
- Exhausting Ventilation Systems at all Mines
- Dilutes Methane Concentrations to Permissible Limits (< 1% by volume)
- Ventilation Systems Liberate more than 80 Mm³ of Methane per Year
- Average Exhaust Methane Concentration: 0.5% Methane in Air

Methane Drainage Experience

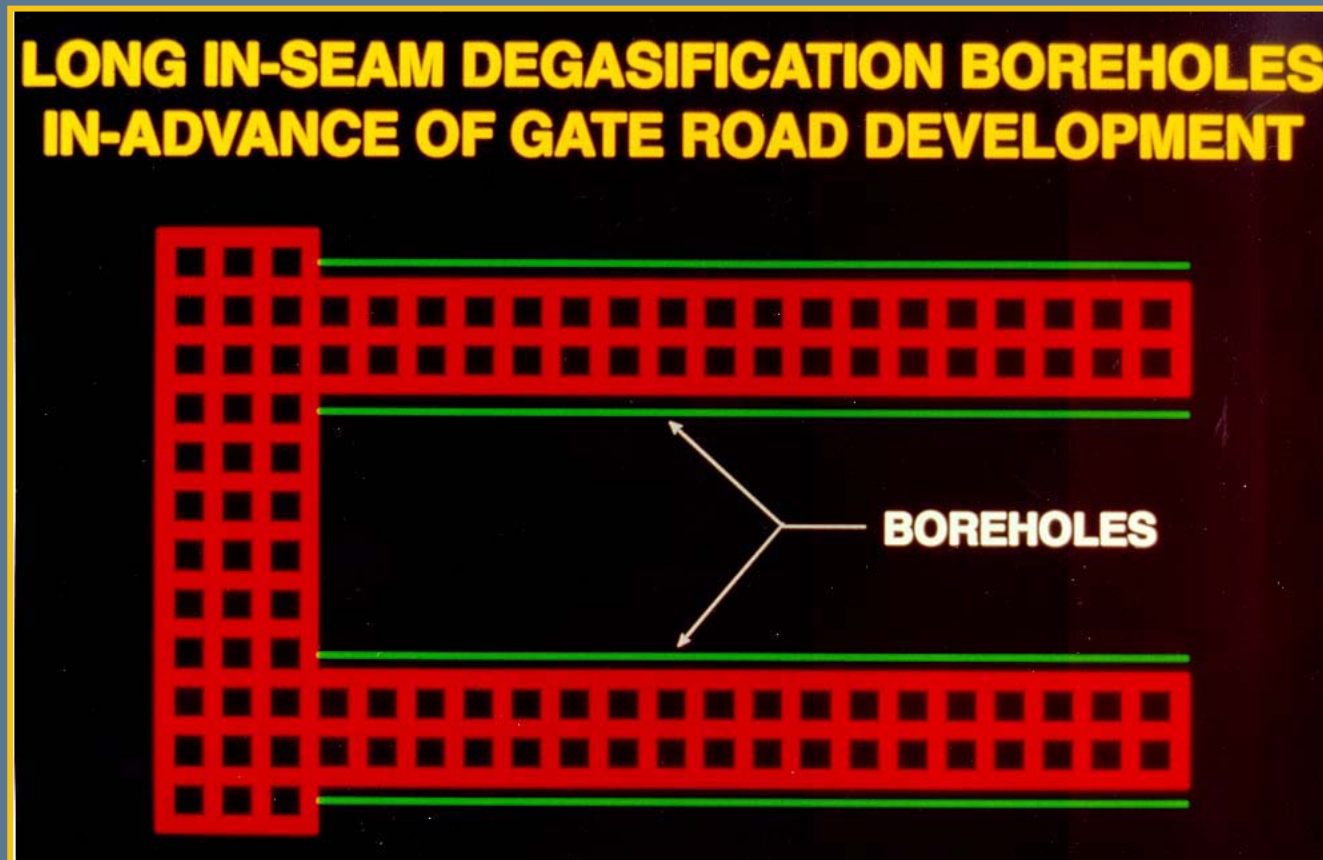
Reservoir Characterization and Numerical Models:

- Performed in 1989 on Adjacent Property by Resource Enterprises, Inc.
- Direct Gas Content Tests Show High GC ($>13 \text{ m}^3/\text{t}$)
- Injection Tests Indicate High Permeability ($>30 \text{ md}$, 180 meters depth)
- Numerical Modeling Indicates Benefits of In-Seam Boreholes Drilled in Advance of Mining
- Pressure Test with PEMEX (3.9 md, 300 meters depth)
- Modeling Projections: 50% Reduction in In-Situ Gas Content in 1 Year, real 48%.



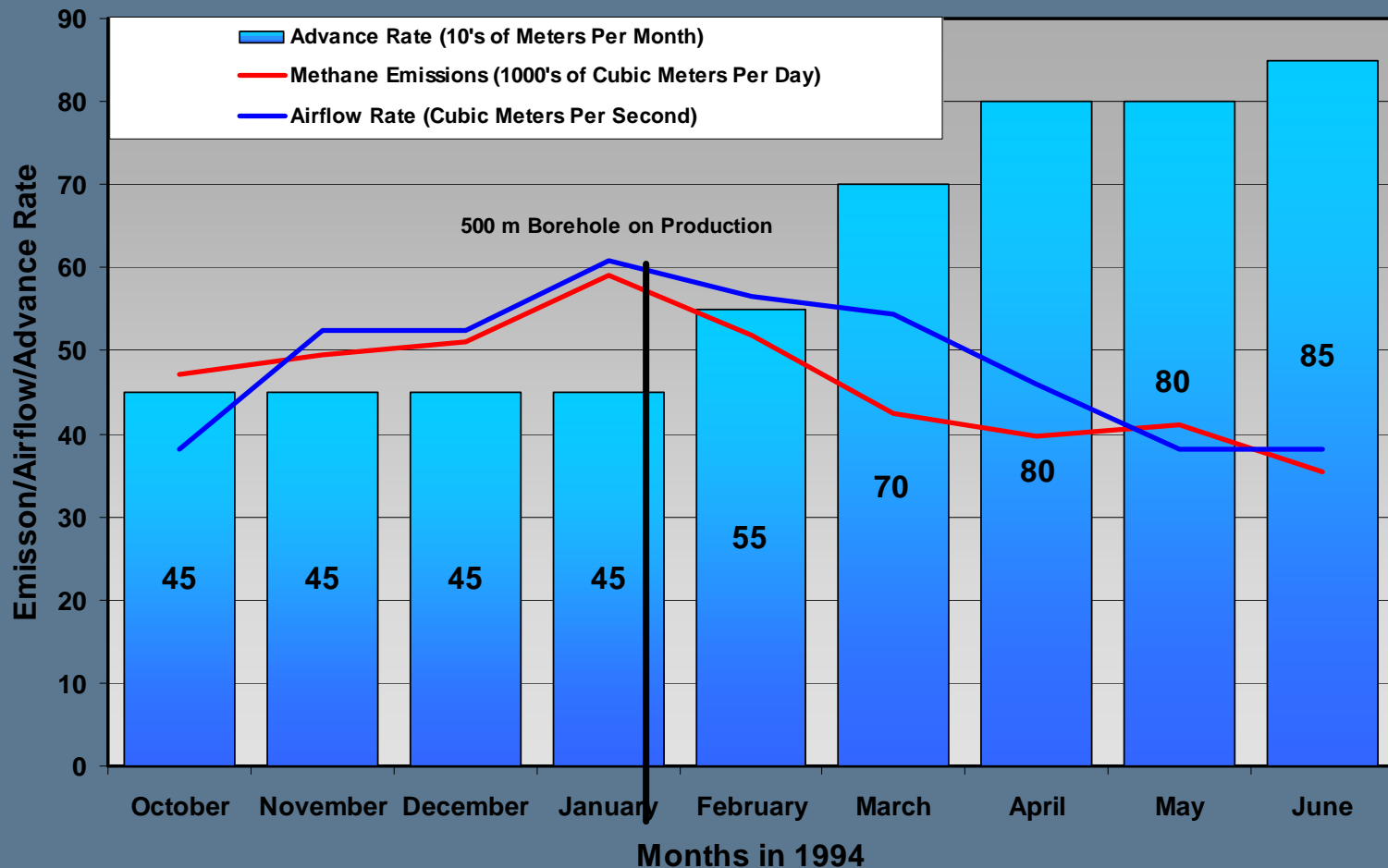
Methane Drainage Experience

- Degasification with Long In-Seam Boreholes in Advance of Mining:
 - Boreholes Reduce Gas Emissions During Gate Road Development



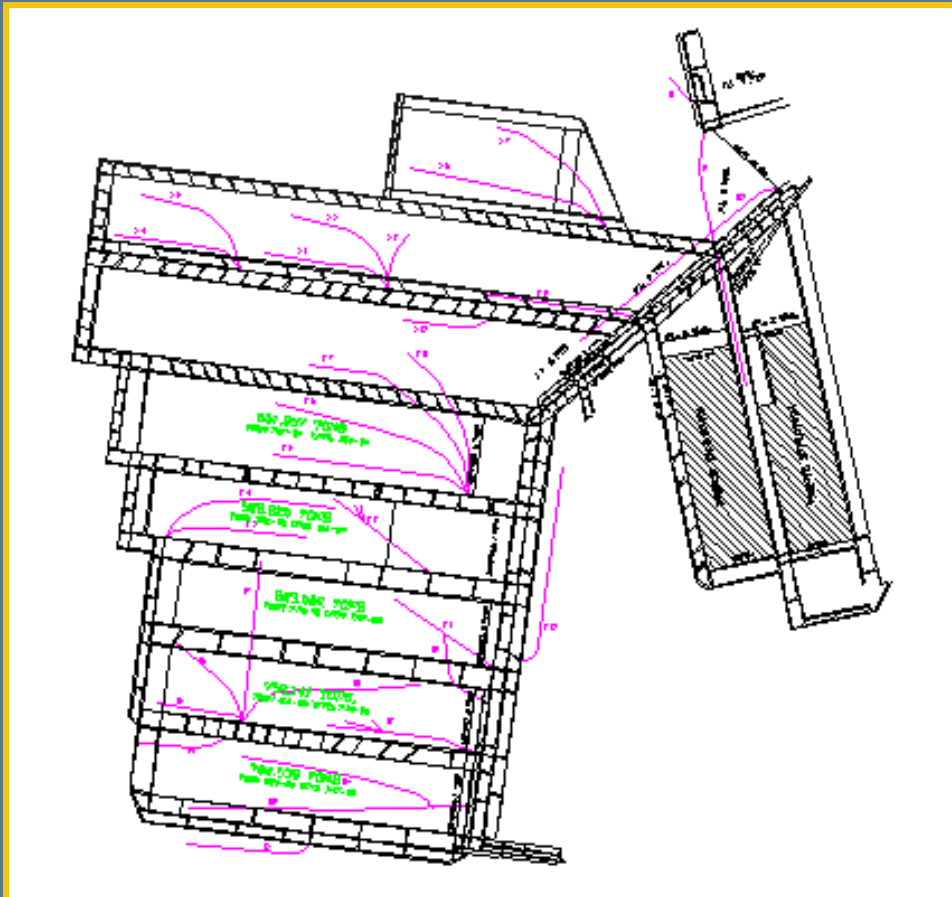
Methane Drainage Experience

- Degasification with Long In-Seam Boreholes in Advance of Mining:
 - Contractor Proves Benefit of Directionally Drilled Boreholes in Double Seam



Methane Drainage Experience

- Degasification with Long In-Seam Boreholes in Advance of Mining:
 - REI Drilling, Inc. Directionally Drills Over 26,000 m of In-Seam Boreholes in 4 Mines



- Gate Entry Shields
- Mine II: 1992-1998
- Lengths: 305 - 900m
- Spacing: 150m

Methane Drainage Experience

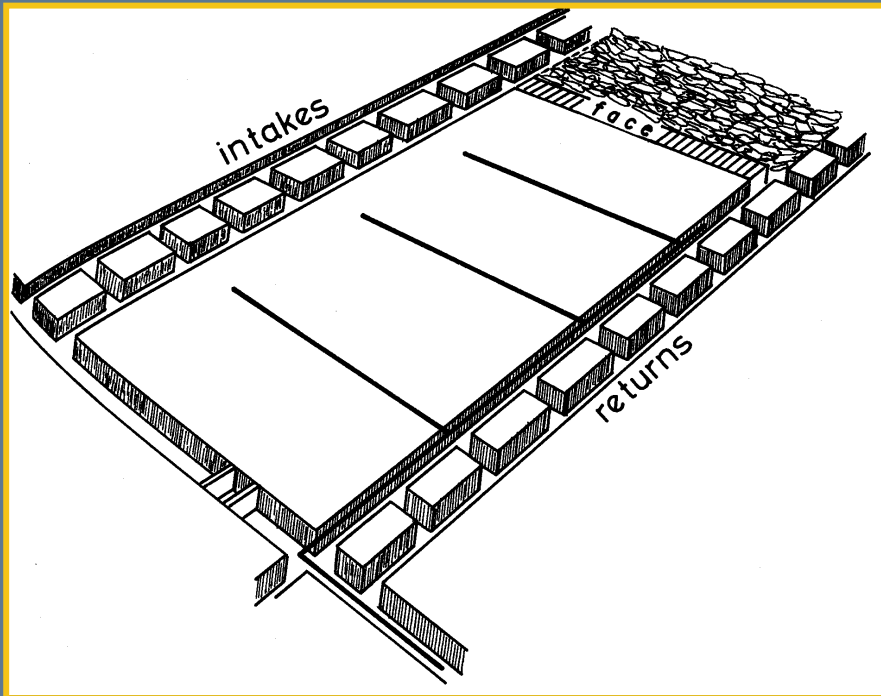
- **Underground Gas Collection:**
 - **Underground Pipelines Installed to Bring Gas to the Surface**
 - **Liquid Ring Vacuum Pumps Installed on Surface**
 - **Methane is Vented to the Atmosphere**



Methane Drainage Experience

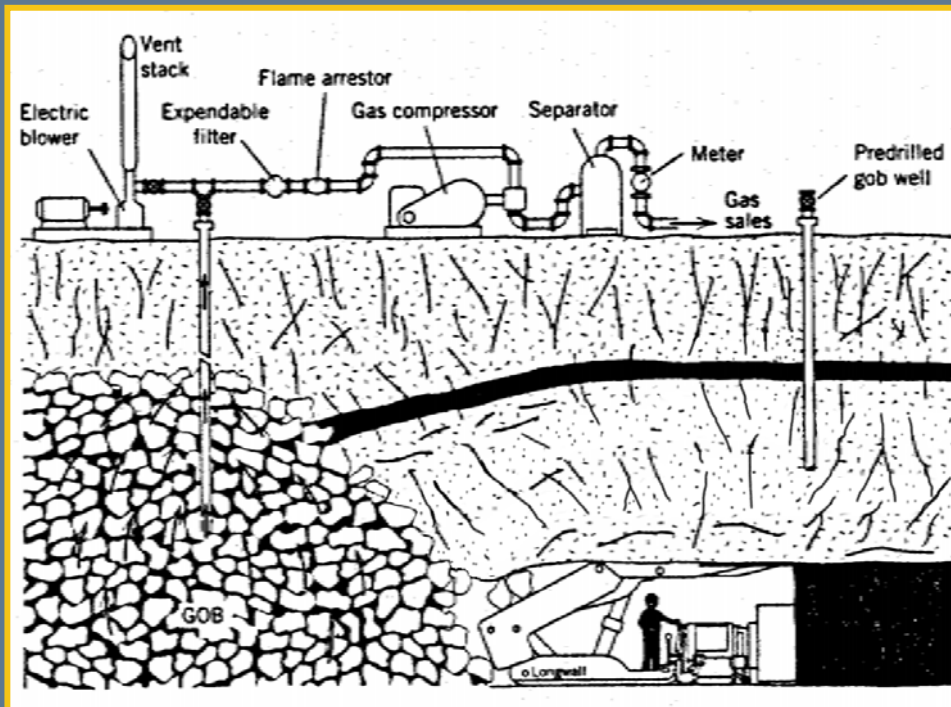
- Additional Developments:

- Underground In-Seam Cross-Panel Rotary Drilling Program with Acker Mid-John Drill



Methane Drainage Experience

- Additional Developments:
 - Successful Implementation of Vertical Gob Wells



Recent Developments

- In-House Directional Drilling:
 - Procured Refurbished Drill from REI Drilling, Inc. in 2004



- Acker Big John Drill, Capacity: 900 m *Minerales Monclova S.A. de C.V.*

Recent Developments

- In-House Directional Drilling:
 - REI Drilling, Inc. Provides Training to MIMOSA Engineers and Field Personnel Under Technology Transfer Program



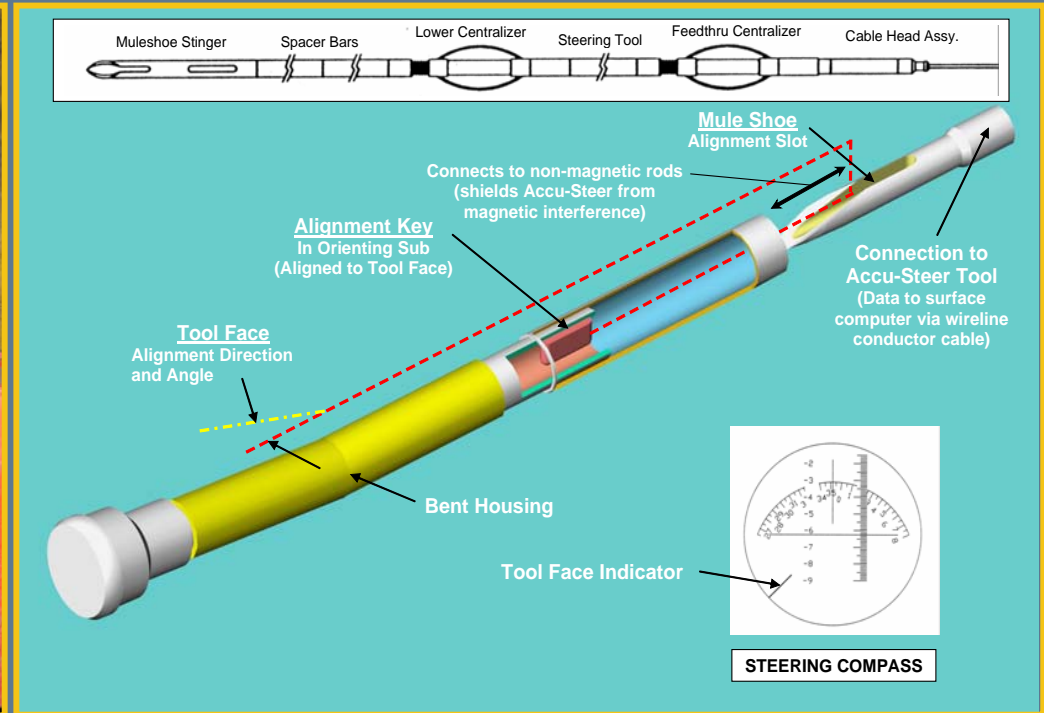
Recent Developments

- In-House Directional Drilling:
 - Wellhead Safety and Control, Drill Site Installation, Training



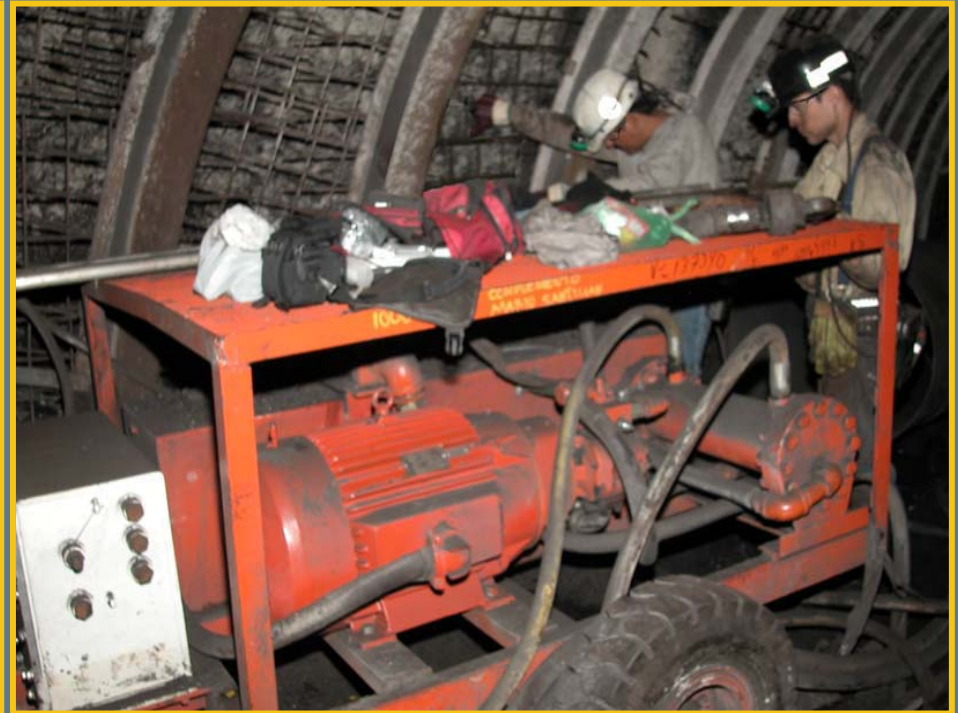
Recent Developments

- In-House Directional Drilling:
 - Drill Operation, Directional Control, and Borehole Surveying, Training



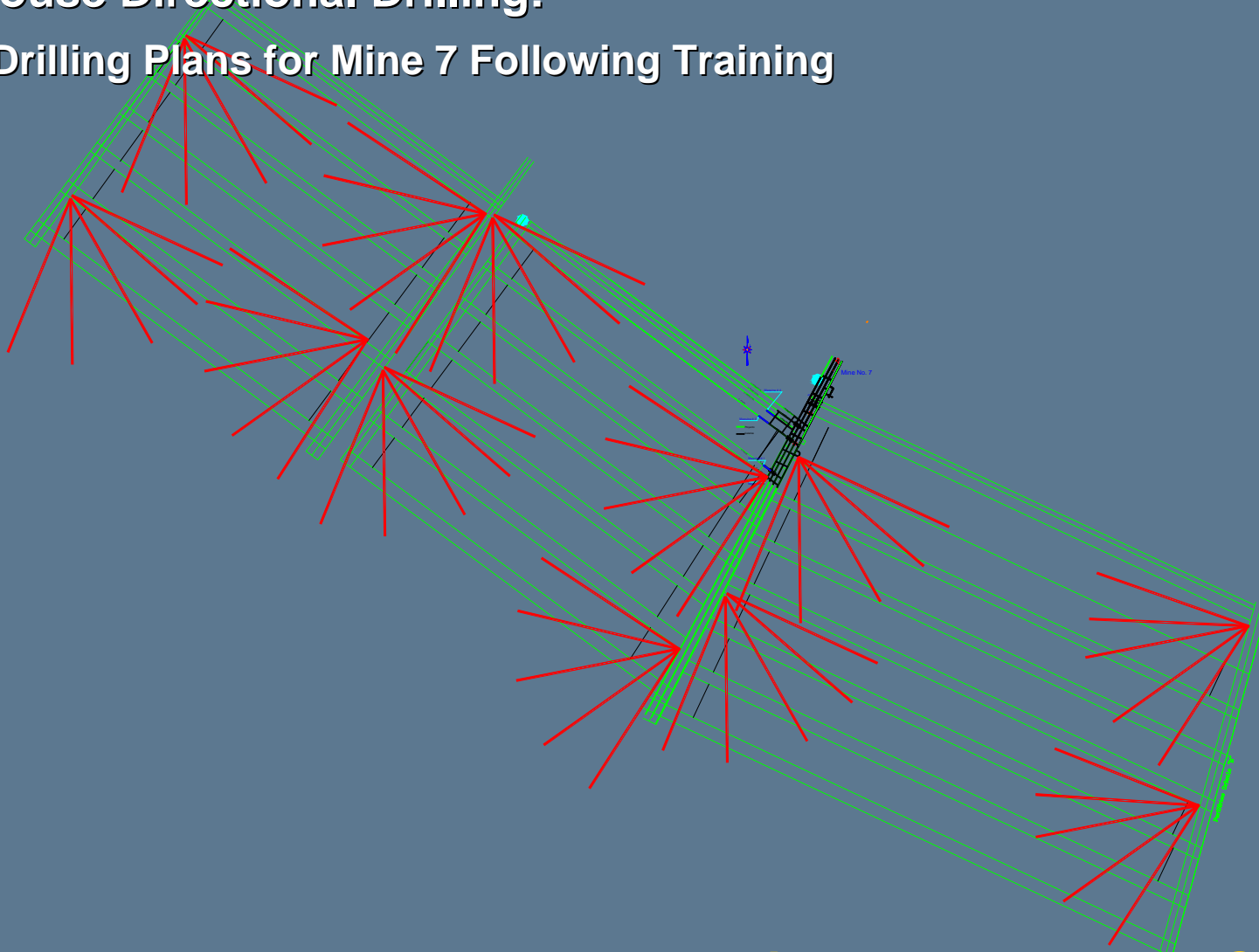
Recent Developments

- In-House Directional Drilling:
 - Downhole Tool and Drill Maintenance, Training



Recent Developments

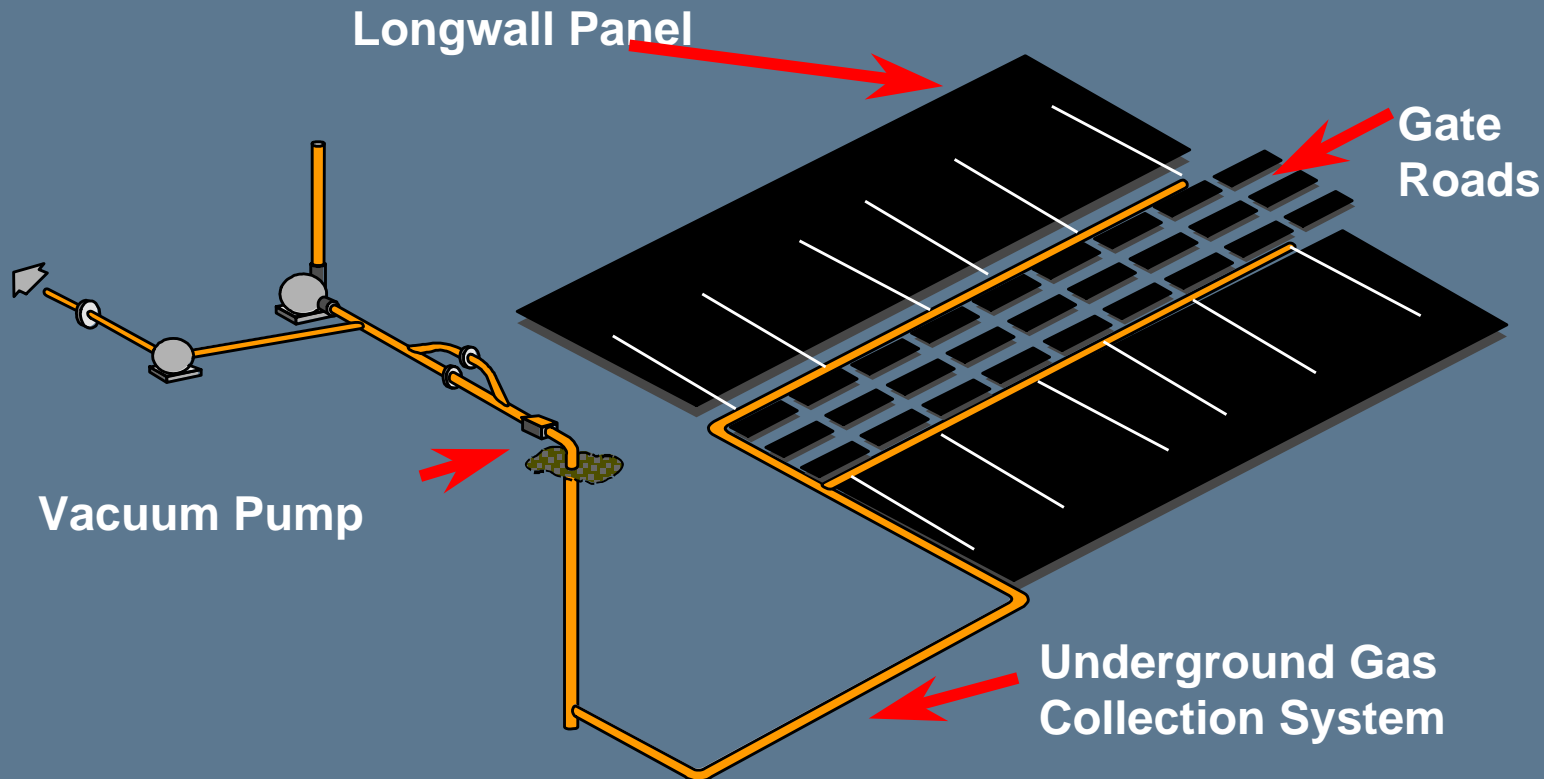
- In-House Directional Drilling:
 - Drilling Plans for Mine 7 Following Training



Recent Developments

- CMM Use:

- Volume Drained from Mine Esmeralda, Mine 6, 7, and 8



- Mines Drain currently over 5 Mm³ per year (70,000 TCO₂e)
- Average Concentration at Vacuum Pump is 60% Methane in Air

Recent Developments

- CMM Use:
 - Generation of Heat for Mine Esmeralda Bath House

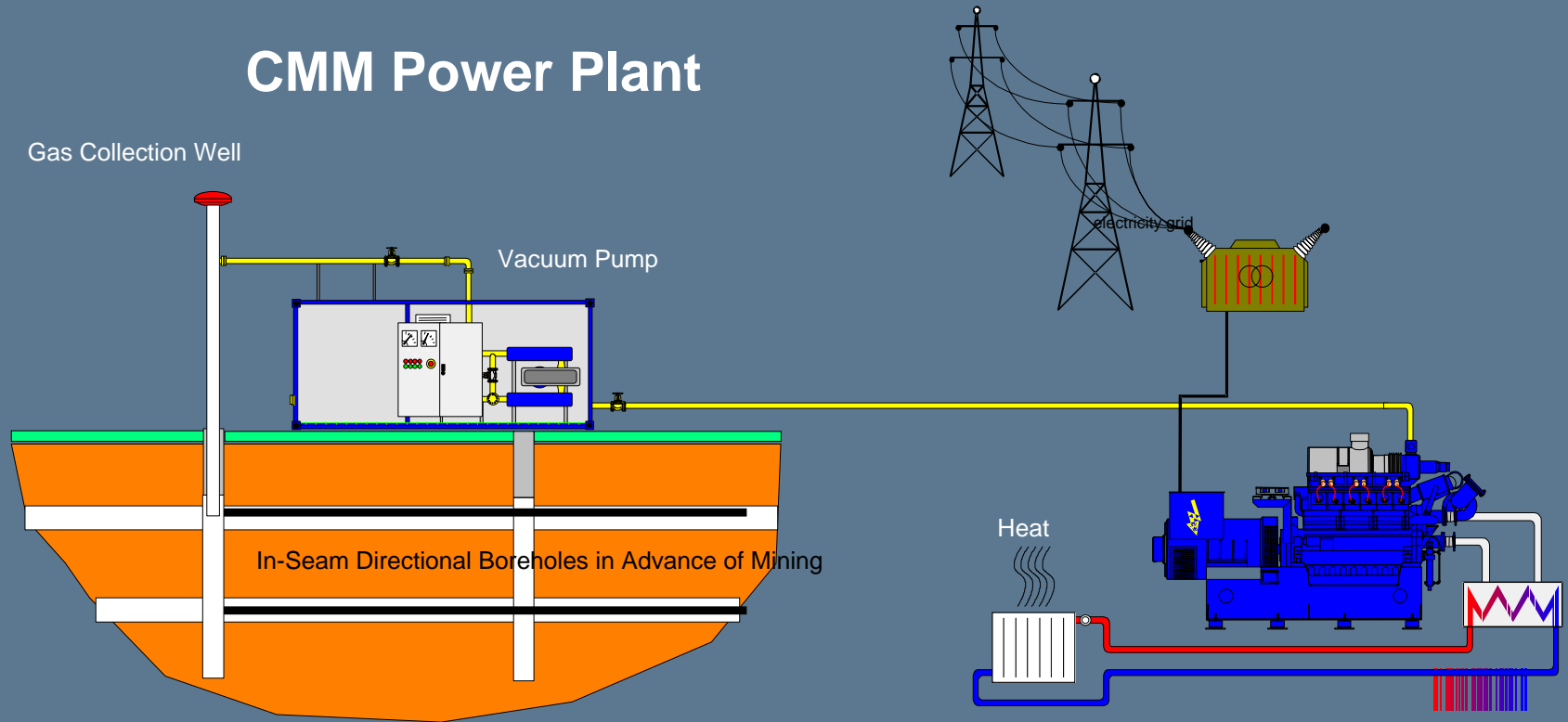


- 7.5 kW Wellsite Compressor Transports Gas to Boiler Via 38 mm Pipeline
- System Capacity is Approximately 1,440 m³/day of Methane

Minerales Monclova S.A. de C.V.

Methane Use Options at MIMOSA Mines

- Use of CMM from In-Seam Drainage and Gob Wells for Power Generation:



Courtesy of G.A.S. Energy

Minerales Monclova S.A. de C.V.

Methane Use Options at MIMOSA Mines

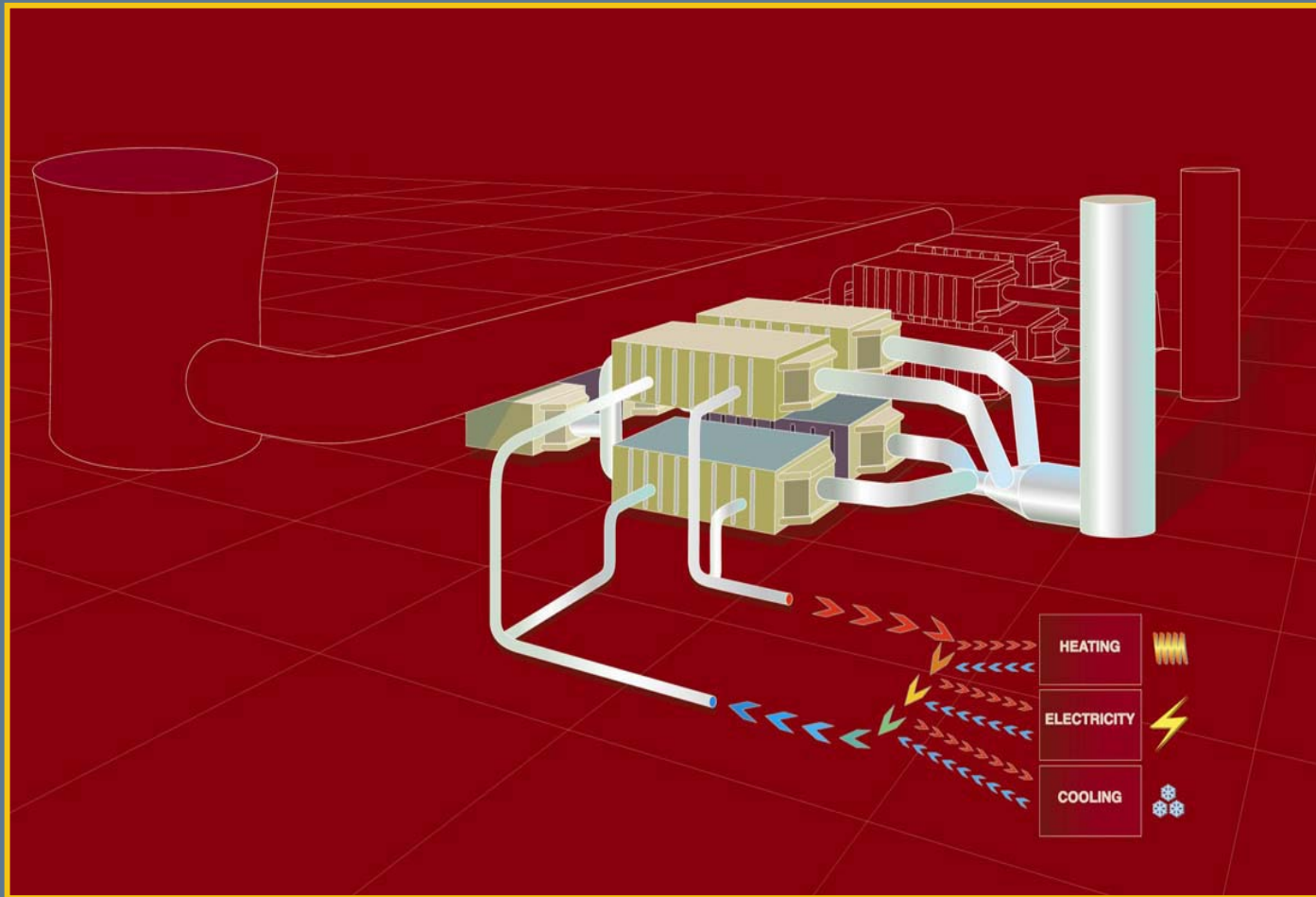
- The Potential of Using VAM at MIMOSA's Mines is High:

Country	Average Discharge Concentration (%)	Annual VAM Emissions Bm3 (2005)	Equivalent Annual MMT CO2 (2005)	Average Price of Power US\$/kWh
Mexico	0.5	0.2	2.2	0.0475
China	0.46	7.1	101.6	0.035
Russia	0.38	0.8	10.8	0.044
Germany	0.3	0.07	1.0	0.065
EUA	0.39	2.8	39.8	0.03
Ukraine	0.3	2.6	37.5	0.03
Australia	0.4	0.7	10.5	0.02
Czech Republic	0.259	0.05	0.8	0.0468
Poland	0.26	0.4	5.7	0.03
Kazakhstan	0.29	0.3	4.7	0.018
UK	N/A	0.1	2.1	0.03
India	0.1	0.3	4.5	0.07
South Africa	0.1	0.5	7.0	0.01

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Methane Use Options at MIMOSA Mines

- Use of VAM from Mine Ventilation Systems for Power Generation:



- Reactor Converts Low Quality Methane to Heat

Future Capacity CMM

- **Phased Project to Generate Power for Self Use:**

- Phase I:

- 1 – 1.3 MW Power Plant Fueled by CMM from the Esmeralda Mine

- Phase II:

- Expand Esmeralda Project by 1 – 1.3 MW

- 4 MW Power Plant Fueled by CMM from Mine 7

- 5 MW Power Plant Fueled by VAM from Mine 7

- Phase III:

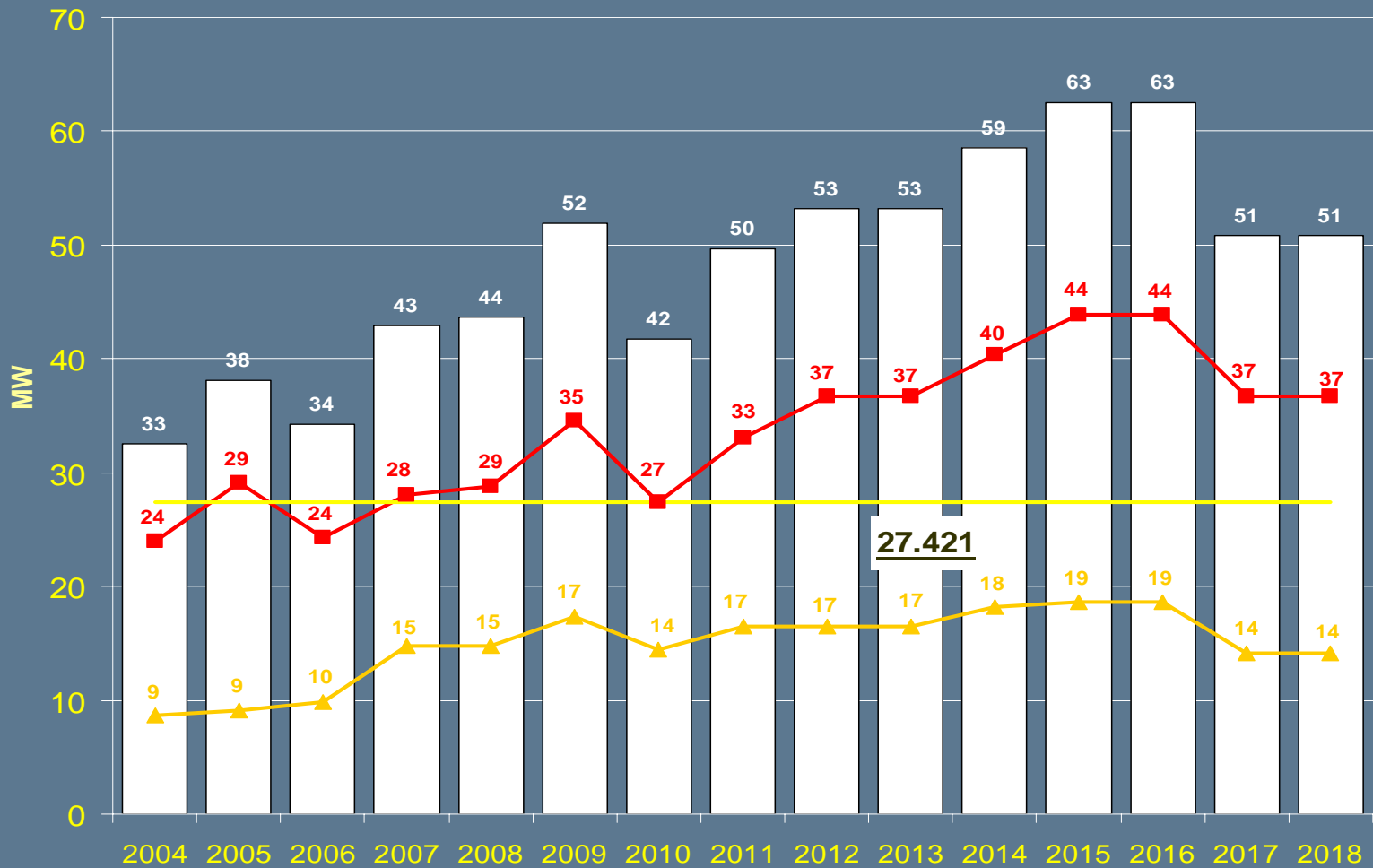
- 5 MW Power Plant Fueled by VAM for the Esmeralda Mine, 4 MW Power

- 4 MW Power Plant Fueled by CMM from Mine 8

- Expand Plants Based on Supply

Future Capacity CMM & VAM

- Power Generation Potential (CMM and VAM) of MIMOSA's Mines:



Key Barrier to Use of CMM in Mexico

- Drainage of the gas is only a technical issue, we are succeeding.
- In Mexico the state owns the gas (Arts. 27 & 28)
- Need to have government authorization to use the CMM & VAM.

Conclusions

- **The Use of Coal Mine Methane Liberated from Safety Systems Implemented at MIMOSA's Mines is a Priority for the Company**
- **Advanced Drilling Technology and Developments in CMM and VAM Use Technology will Lead to the Successful Use of this Greenhouse Gas**
- **MIMOSA, in Conjunction with Equipment Manufactures, have Investigated Methane Use Alternatives (Combustion Engines, Turbines, VAM Reactors, Etc.), Specifically Power Generation Options**
- **MIMOSA's CMM and VAM Resource has Tremendous Potential for Development for Years to Come**
- **MIMOSA can Partner with a Domestic or International Investor to Use this Low Quality Resource Currently Vented to the Environment**

Minerales Monclova S.A. de C.V.



Gracias!



● **Mimosa has to have degasification for safety, also to protect the environment**