Coal Mine Methane Drainage Considerations

for the

Sabinas Basin, Coahuila Mexico

Presented to:
M2M Technical Workshop
Monterrey, Mexico

Presented by:
Jeff Schwoebel
REI Drilling, Inc.

January 28, 2009
Presentation Outline

• Background
• Geology and Reservoir Characteristics of the Sabinas Basin
• CMM Drainage Techniques
• Case Study and Results
• Considerations
REI DRILLING, INC.

• Operate 7 long hole directional drills and 2 core drills on a contract basis across North America.
• Provide methane drainage consulting and directional drilling training.
• Developed first US in-mine CMM recovery and sale project.
• Managed and participated in numerous international directional drilling projects.
• Expanded uses for directional drilling. e.g. exploration and dewatering
• 25 years experience.
19 Years Experience in Sabinas Basin

- **1990:** Conceptualized & implemented Surface CBM test project at Pasta de Conchos Mine (IMMSA)
- **1990-91:** In Mine Methane drainage (CMM) project at Pasta de Conchos Mine
- **1992-2000:** In Mine Methane drainage (CMM) project at MIMOSA’s Mine II, IV and VI
- **1993:** In Mine Methane drainage (CMM) project at Pasta de Conchos Mine
- **1995:** Discussion for CBM development with GAN
- **2004:** Sale of drill & CMM training of MIMOSA personnel
- **2008:** Fletcher Training for Mimosa personnel
Geologic Reservoir Characteristics
Ventilation vs. Methane Drainage
Olmos Reservoir Conditions

Results of Field Tests (CNR):

- Depth: 170 m
- Coal Thickness: 3.9 m
- Coal Rank: High Volatile A (Ro = 0.99%)
- In-Situ Gas Content: 8.4 m³/t
- Desorption Time: 56.6 hours
- Permeability: 33.6 md
- Cleat Spacing: 1 mm
- Gas Composition: 89.97% CH₄
- Under Pressured: 7 kPa/m
Observations

- A shallow single thick high gas content coal seam.
- Thick clay parting – “Double Seam”
- Thick clay zone on top of coal
- Minimal gas bearing strata or other coal seams in overlying strata
- High Permeability
- Short Sorption times
Methane Drainage Techniques

- Pre-Mining
- Gob Degasification
Methane Drainage

- Pre-Mining - Long, In-Seam Boreholes:

**HDH-13 Profile**

**Vertical Exaggeration:**
Design of Vertical CBM and CMM Wells

- Pumping Unit
- Blower
- 13-3/8" Casing
- 12-1/4' Open Hole
- No. 4 Coal Seam
- No. 3 Coal Seam
- 5-1/2" Production Casing with Formation Packer Shoe
- Rathole
- Longwall Mining Equipment

REI DRILLING
Methane Drainage

- Gob Gas – Vertical Gob Wells

Diagram:
- 10 5/8" Borehole
- 7" OD. 6" Casing
- Flow Within Casing
- Slotted Casing (Used Sometimes)
- 5 5/8" Open Hole
- Mined Seam

Image: A photo of a methane drainage setup with a gas well and associated equipment.
Case Study
Mimosa #1 and #2
Methane Drainage Approach
Average Daily Gas Production For In-Seam Boreholes
MIMOSA Mina I

Hole 12: 466 m
Hole 13: 385 m
Hole 14: 269 m
Effect on Gate Road Development
MIMOSA #1 Mine

Methane Emissions, Airflow Requirements, and Advance Rate
Before and After Degasification for 2 West Developments, Mine I

- Advance Rate (10's of Meters Per Month)
- Methane Emissions (1000's of Cubic Meters Per Day)
- Airflow Rate (Cubic Meters Per Second)

500 m Borehole on Production

Emisson/Airflow/Advance Rate

Months in 1994

- October
- November
- December
- January
- February
- March
- April
- May
- June
Methane Drainage Results
Mimosa Mine #2

Mine II Methane Vented, Drained, Airflow Requirements, and Production Rate
Before and After Degasification in 1993

- Methane Drained (1000's cubic meters per day)
- Methane Vented (1000's of Cubic Meters Per Day)
- Airflow Rate (Cubic Meters Per Second)
- Coal Production (10,000 tons per year)


Data for each year:
- 1988: Methane Drained = 66 86 86 95 0 0 0 0 0
- 1989: Methane Drained = 0
- 1990: Methane Drained = 0
- 1991: Methane Drained = 0
- 1992: Methane Drained = 60
- 1993: Methane Drained = 78
- 1994: Methane Drained = 78
- 1995: Methane Drained = 69
- 1996: Methane Drained = 69
Cretaceous Age Sub Basins

Six (6) Sub-Basins ("sub-cuencas"):  
1. Sabinas  
2. Esperanzas  
3. Saltillo  
4. San Patricio  
5. Adjuntos  
6. Monclova

Main Basin: **Sabinas**  
Most mine projects have been developed here. The Sabinas sub-basin has been well characterized with almost 80% explored.
Keys to Prospect Generation

- In-place resource
- Geologic and reservoir characteristics
- Land acquisition
- Market considerations
- Drilling and completion costs
- Economic viability
- Favorable surface culture
- Financing
Project Considerations

- Scale
- Business Climate. Pace
- Ownership issues. Clear title?
- Local perception
- Coordination of mining, drilling, and gas recovery operations
- Market? Pipeline? Need to create gas utilization alternatives
- Environmental factors
Ownership Issues

International Background
Unclear CBM ownership has stalled development in many countries
- Different laws governs ownership of CBM in the USA
- Concept of “forced pooling”

Mexican Background
Gas Associated to Mineral Carbon Deposits (gas grisú) – mostly methane
- Ministry of Energy and Ministry of Economy
- Regulatory Law of Article 27 of the Mexican Constitution Regarding Oil and the Mining Law (Ley Minera)
- Amendment 11/08 and regulations published on 12/16/08
- Restricted use to self consumption by holder of mining concession or delivery to PEMEX through purchase Agreement
- sale to third parties by concession holder is prohibited
- Permit application guidelines include demonstrate the evidence of gas, utilization approach, recovery process, and financial analysis.
Coordination of Operations

- Mining
- Drilling
Environmental Considerations

- Global attention on GHG mitigation projects
- Methane unique due to energy value
- High demand
- Monetization of credits
- CO2 Sequestration projects
- Public and private funding