Sand Propped Hydraulic Fracture Stimulation at Illawarra Coal Operations

Update – February 2006

Ken Mills & Rob Jeffrey

Introduction

Sand propped hydraulic fracturing has been shown to increase gas drainage rates over a full longwall panel by 5-6 times in normal coal and 22-180 times in low permeability coal.

First stage is to overcome the borehole completion challenges on South Coast.

Second stage is to introduce sand propped hydraulic fracturing to Illawarra Coal underground mining operations.
Overview of Presentation

• Project Outline

• Concept of implementation based on experience

• Challenges to be overcome

• Implementation strategy

Project Outline

• Completion of overstressed holes
  – Douglas pit bottom – high stresses
  – Slotting trials
• Manufacture of production fraccing system
• Trial in Bulli Seam
• Production in Bulli Seam
• Cross Measure trial (requires drilling development)
• Production in Cross Measure
Hydraulic Fracture

- Fluid injected into sealed section of hole
- Pressure in fracture opens it
- Fracture growth at leading edge

Injection string

packer

packer

borehole

Hydraulic fracture
Challenges for Implementation of Sand Propped Hydraulic Fracturing in Southern Coalfield

- Maintaining borehole stability and / or installing casing
- Perforating / notching casing
- Optimising sand placement
- Drilling and casing long holes in Bulli Seam
Project Update

Staged Implementation Strategy

- Confirm borehole integrity
- Confirm borehole completion and slotting
  - Off site work – Melbourne
  - Trial at Douglas Pit Bottom
- Trial sand-propped hydraulic fracturing
  - Douglas pit bottom – trial of gear
  - Bulli Seam working area – 100 to 400m holes
- Optimise equipment
- Routine implementation

Strategies to Overcome Borehole Instability

- Case and cement holes, slot casing, conduct treatments using packer system
- Drill out of seam and frac through roof into coal
- Drill out of seam with branches into seam
- For cross measure holes case and cement holes and then extend for treatment
Staged Work Program

1. Evaluate potential completion methodologies in laboratory setting in steel pipes (off site in Melbourne) – well advanced
2. Trial and evaluate completion methodologies at a field site where borehole breakout is expected
   - Measure development of breakout
   - Trial different casing systems
   - Test slotting system
   - Test packer setting and fracking system
3. Trial and evaluate completion methodologies at production site in 100m and 400m holes where normal gas production is expected
4. Design and construct purpose built system that BHPB IC personnel can use
5. Provide training, design and ongoing support
**Measured Borehole Diameters – Douglas**

**Hole 1 (Southern)**

- Nominal Diameter (mm)
- Distance into Hole (m)
- Graph showing measured diameters at various angles (Vetical, 45°, Horizontal, 135°)
Measured Borehole Diameters – Douglas

Hole 2 (Northern)

Vertical 45° Horizontal 135°

Measured Borehole Diameters – West Cliff

Hole 5

Distance from Rib (m)

Distance into Hole (m)
Conclusion

Holes are not suitable for packers without some form of completion

Workshop Trials of Casing

Steel Tube

Casing Options
  Steel
  Fibreglass
  PVC

Slotting Trials

Equipment Prep
Equipment System Used to Place Sand Propped Fractures

1. Sand auger
2. Blender
3. Centrifugal pump
4. Triplex pump
5. Packer inflation hose drum
6. Packer inflation pump

Hose to BQ rods for fracturing fluid

Progress

Caliper Measurement – Ongoing
Workshop Testing - Melbourne
  Slotting – completed
  Cementing – completed
  Equipment Prep – February

Douglas
  Drill Rig U/G – 18 Jan
  Gear On Site – Now
  Trial – Next fortnight