METHANE EXPO 2013

THE RESULT OF GAS DRAINAGE AT KHE CHAM COAL MINE AND FORECAST OF DEVELOPING POTENTIAL GAS DRAINAGE AT UNDERGROUND COAL MINES IN QUANG NINH COAL BASIN, VIETNAM

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1. Introduction
2. Gas drainage technology
3. System installation
4. Results
5. Conclusion
1. INTRODUCTION

- **83 million cubic meters of methane** was flared to the atmosphere during extraction of 32.4 million metric tons of coal in Viet Nam in 2005.
1. Introduction

- Four gassy mines (Mao Khe, Khe Cham, Quang Hanh and Duong Huy) were identified.
- The expected coal production in 2015 is 10 million tons of coal which would liberate 99 Million m³ of methane to the atmosphere.

<table>
<thead>
<tr>
<th>Class</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean Value of Lognormal Distribution Used</th>
<th>Mining Complex Name</th>
<th>Forecast Coal Production 2015</th>
<th>Forecast Coal Production 2012 through 2015</th>
<th>Forecast Gas Liberated 2015</th>
<th>Forecast Gas Liberated 2012 through 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>0</td>
<td>5</td>
<td>2.12</td>
<td>Duong Huy</td>
<td>2,596,250</td>
<td>8,055,347</td>
<td>5,511,318</td>
<td>17,099,885</td>
</tr>
<tr>
<td>II</td>
<td>5</td>
<td>10</td>
<td>7.07</td>
<td>Quang Hanh</td>
<td>1,870,000</td>
<td>6,470,000</td>
<td>13,221,191</td>
<td>45,743,908</td>
</tr>
<tr>
<td>III</td>
<td>10</td>
<td>15</td>
<td>12.1</td>
<td>Khe Cham</td>
<td>3,070,000</td>
<td>8,800,000</td>
<td>37,139,183</td>
<td>106,457,594</td>
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<tr>
<td>Super Class</td>
<td>&gt;15</td>
<td>17.07</td>
<td></td>
<td>Mao Khe</td>
<td>2,550,000</td>
<td>8,900,000</td>
<td>43,528,897</td>
<td>151,924,387</td>
</tr>
</tbody>
</table>

Sources: Raven Ridge Resources Incorporated
1. Introduction

Methane recovery and potential utilization in Khe Cham coal mine and other mines in the future

• The Vietnam National Coal - Mineral Industries Holding Corporation Limited (Vinacomin) considers installation of gas turbine generator or gas combustion engine using the mine's own gas as fuel.

• The methane degasification system was installed at Khe Cham I coal mine.

• The success of methane drainage and utilization in Khe Cham mine will encourage expansion of similar systems in other coal mines.
1. Introduction

V13.1 seam, Khe Cham coal mine (29/1/2012)

V5 seam, Quang Hanh coal mine (16/4/2012)

DESIGN OF GAS DRILLING PASSPORT (3)
Location of gas drainage system

Floor hole, L = 80m

Roof holes, L = 80m

Station 1

Methane gas pipe DN 225
3. Installation deployment

- **Build the surface station**
  - 20/12/2011
  - 20/01/2012

- **Install pipe system**
  - 17/01/2012
  - 03/02/2012

- **Install gas drainage station on surface**
  - 14/02/2012
  - 24/02/2012

- **Drilling holes**
  - 25/02/2012
  - 13/03/2012

- **Test and Calibrate**
  - 16/03/2012
  - 19/03/2012

- **Operation**
  - 20/03/2012
  - 20/06/2012

- **Install system at underground**

**Construction company**: Khe cham coal mine and IMSAT, Khe cham coal mine, IMSAT, Poland, Khe cham coal mine, IMSAT, Poland, Khe cham coal mine, IMSAT, Poland, Khe cham coal mine, IMSAT, Poland, Khe cham coal mine, IMSAT, Poland
Methane drainage system at Khe Cham coal mine

- Methane gas pipe from underground
- Compressed air
- Measurement part
- Methane gas mixing chamber
- Office on surface
- Fire isolator
- Fan for methane dilution
- Methane gas
- CH4
- T
- P
<table>
<thead>
<tr>
<th>No</th>
<th>Main specifications</th>
<th>Unit</th>
<th>Value</th>
<th>Value</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Design</td>
<td>Practice</td>
</tr>
<tr>
<td>1</td>
<td>Airlow of gas mixture</td>
<td>m³/min</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Airflow of methane</td>
<td>m³/min</td>
<td>5</td>
<td>2.5</td>
</tr>
<tr>
<td>3</td>
<td>Maximum suction pressure</td>
<td>kPa</td>
<td>-16</td>
<td>-7</td>
</tr>
<tr>
<td>4</td>
<td>Number of bore holes</td>
<td>hole</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Depth of bore hole</td>
<td>m</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>6</td>
<td>Drilling speed</td>
<td>m/min</td>
<td>0 - 2.3</td>
<td>0.2</td>
</tr>
<tr>
<td>7</td>
<td>Compressed air consumption for Injector</td>
<td>m³/min</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>Methane concentration</td>
<td>%</td>
<td>50</td>
<td>40</td>
</tr>
</tbody>
</table>
4. Results

Methane gas concentration at long wall area before gas drainage

Change of gas sensor

Power cut-off threshold (1.3%)

Alarm margin
Evaluation of variation of CH$_4$ concentration

Methane gas concentration at long wall area after gas drainage
Gas concentration before and after drainage

**Before**

**After**
Efficiency on methane drainage

Distance from gas drainage station to longwall face $L(m)$

Efficiency $\eta(\%)$
Before

- Electricity cut – off by gas concentration increases the limitation (1.3%).
- From Jan 20th 2012 to March 20th 2012: electricity cut – off had been occurred for 20 times
- It needs $30 \div 60$ minutse for reproduction again

After

- Working time increase 20h/month
### Efficiency on ventilation issue

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Air flow, m³/min</th>
<th>Gas conc, %</th>
<th>Absolute gas emission, m³/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>524</td>
<td>0.8</td>
<td>4.19</td>
</tr>
<tr>
<td>After</td>
<td>524</td>
<td>0.6</td>
<td>3.14</td>
</tr>
<tr>
<td>Different</td>
<td></td>
<td>-0.2</td>
<td>-1.05</td>
</tr>
</tbody>
</table>

$\Delta Q = 131 \text{ m}^3/\text{min}$

$\approx 25\% \text{ Air flow at longwall}$
### Efficiency on coal production increase

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Before</th>
<th>After</th>
<th>Different</th>
<th>∆A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal production, ton</td>
<td>400</td>
<td>400</td>
<td>-1.05</td>
<td>133.7 tons ≅ 33.4 % production</td>
</tr>
<tr>
<td>Absolute gas emission, m³/min</td>
<td>4.19</td>
<td>3.14</td>
<td>-1.05</td>
<td></td>
</tr>
<tr>
<td>Relative gas emission, m³/T.day.night</td>
<td>15.08</td>
<td>11.3</td>
<td>-3.78</td>
<td></td>
</tr>
</tbody>
</table>

** ∆A = 133.7 tons ≅ 33.4 % production **
5. CONCLUSION

The effectiveness of the methane drainage system at Khe Cham Coal Mine

1. Gas concentration reduces 0.2÷0.6%, increases time for working, increases coal production about 33.4%

2. Reducing the time of electricity cut-off by gas concentration increase (1.3%).

3. Average gas concentration from gas drainage system is 30%, gas flow is 2.5 m³/min (equivalent to pure methane concentration).
Thank you very much for your attention.

For more information, please contact us!

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