Arch Western Resources, LLC
Arch Western Bituminous Group, LLC.
West Elk Mine Overview
MSHA Belt Air Technical Panel Visit
May 15, 2007
West Elk Safety Performance
MSHA REPORTABLE INJURY
INCIDENT RATE COMPARISON
1990 - 2007
Underground Bituminous Coal Mines

[Bar chart showing incident rates for West Elk, Colorado, and National from 1990 to 2007 with specific rates for each year.]

West Elk
Colorado
National

4/30 YTD
West Elk Citation Performance
MSHA Citations Per Inspector Shift Comparison
2001 - 2007
Underground Bituminous Coal Mines

* 4/30 YTD
West Elk Environmental Performance

NOTICES OF VIOLATION

2000 - 2007

0 0 0 0 0 0 0 0

2000 2001 2002 2003 2004 2005 2006 2007

4/30 YTD
West Elk
Safety Is A Value

- A Non Compromising Commitment to Achieve An Injury Free and Environmentally Responsible Workplace.

- West Elk Mine Considers Maintaining Healthy Work Conditions, Ensuring the Safety of Its People, and Protection of the Environment To Be Core Values.

- Core Belief Is That All Injuries Can Be Prevented.

- Focus On Behavior – Currently Implementing Behavioral Injury Prevention Process

- Monthly Standup For Safety Meetings Have Been A Key Element To Safety Success
West Elk History

1969  First Coal Lease Acquired
1976  Reserve Drilling Started
1981  Permits Approved/Initial Construction
1982  Initial F Seam Production
1990  Initial B Seam Production
1992  Longwall Commissioned
1994  Jumbo Mountain Lease Acquired
1994  Longwall Extended to 950 Feet Wide
1995  Box Canyon Lease Acquired
West Elk History

1995  East Mains Development Initiated
1997  Sylvester Gulch Ventilation Facilities Started
1998  **Acquired by Arch Coal, Inc.**
1999  Sly Gulch Facilities Commissioned
2000  Spontaneous Combustion Event
2001  High Methane Encountered
2002  North Reserve Area Developed
2004  **Started E Seam Development**
2005  Spontaneous Combustion Event
West Elk
Geological Challenges

- Roof/Rib Control Impacted By
  - Depth of Cover
    - 600 ft to 2,300 ft
  - High Horizontal Stress
    - Maximum N65E – 3,507 PSI
    - Minimum N25W – 797 PSI
    - Strongly Anisotropic – Floor Heave, Pillar Crushing
  - Faults
    - Displacement 1 ft to 23 ft
    - Numerous fracture zones – no displacement
    - Serve As Conduits For Increased Methane and Water Inflows
    - Concentrates Tectonic and Abutment Stresses
  - Spars
    - Thickness inches to 8 ft
    - Hardness > 15,000 PSI
  - Multi Seam Mining
    - Stress Distribution / Shadow Influence
    - 3 Seam Interaction F, B, and E Seams
West Elk
Cover Map
West Elk Mine Stress Orientation Diagram

Note: Horizontal stress measurements vary across zone depending, in part, upon stratum stiffness. Reported values reflect peak stresses measured in roof at each location (except as noted).
West Elk
Geological Challenges

• Methane Liberation
  ➢ Initial Room and Pillar Mining in F-Seam Resulted in Little to No Methane Liberation.
  ➢ Longwall Mining in B-Seam Commenced in August 1992, Resulting In An Increase In Methane Liberation.
  ➢ Methane Liberation Gradually Increased In B-Seam, Resulting in MSHA 5-Day Spot Inspections in September 2001.
    – Methane Liberation Of 10 million to 20 million Cubic Feet/Day
  ➢ Significant Methane Production From Caving On The LW. Methane Stored In Roof Rock Is Liberated By Mining.
  ➢ Control With A Combination of Vertical Drainage and High Volume Mine Ventilation System.
West Elk
Geological Challenges

• Spontaneous Combustion
  ➢ Combustion Produced In A Substance By The Generation Of Heat Through The Chemical Action Of Its Own Elements, Rather Than Being Initiated By A Flame or External Heating Source.
  ➢ Factors Affecting Spon Com
    - Fragmentation (Fine Coal)
    - Oxygen Availability
    - Heat/Oxidation
    - Moisture
    - High Ventilation Pressure Differentials
  ➢ Coal In Both B and E Seam Are Ranked As Having "Moderate" Susceptibly to Spontaneous Combustion
  ➢ Historic Problem Areas at West Elk
    - Gob Connectors
    - Faults/Fractures in Pillars
West Elk
Geological Challenges

- Spontaneous Combustion
  - Caused Mine Fires In 2000 and 2005 Resulting In Mine Outages Up to 6 Months.
  - Have Experienced Multiple Minor Heating Events In Pillars That Did Not Result In Mine Outages.
  - Use of Belt Air Has Allowed Lower Main Fan Operating Points and Ventilation Pressure, Reducing The Risk Of Pillar and Gob Fires.
West Elk
Belt Air

• Petition for Modification For Use of Belt Air Filed In May 1990.
  ➢ To Provide Higher Volumes of Air at the Working Face
    - Reduce Exposure to Respirable Dust
    - Dilute Methane Anticipated In B Seam
  ➢ To Reduce The Number of Entries Required
    - Reduce Exposure to Injury From Roof & Rib
  ➢ To Align Belt Entry Air Flow and Water Flow Direction
    - Enable Fire Fighting From Fresh Air Side

• Petition Granted in May 1991.
• Implemented Petition in June 1992 in Both the Continuous Miner and Longwall Sections.
• Petition Stipulations Were Fairly Close to the Requirements of the Current Belt Air Regulations.
West Elk
Belt Air

• Petition Superseded By New Belt Air Regulations in June 2004
  ➢ Lowered Alert/Alarm Levels By 5 PPM
  ➢ Required CO Monitors In Intake Escapeway
  ➢ Limited Air Volume In Belt Entry To <50% Of Total Intake Air Quantity
  ➢ Required A Means To Close Point Feed Regulators
  ➢ Required Continued Two-way Communication If AMS System Malfunctioned
  ➢ Required Separation of AMS Line and Other Communication Lines
West Elk Mine
Belt Air Advantages

• Provides Higher Volumes of Air at the Working Face
  ➢ Reduces Exposure to Respirable Dust and Black Lung Disease By Reducing the Level of Dust That Miners Are Exposed To During the Coal Extraction Process

• Lowers Main Fan Operating Point and Mine Ventilation System Pressure
  ➢ Reduces the Risk of Spontaneous Combustion
    - Pillars
    - Gob
  ➢ Reduces Exposure to Strains, Sprains, Falls, and Contacted-By Injuries Associated With High Pressure Ventilation Doors.
West Elk Mine
Belt Air Advantages

• Provides Air Direction in Belt Entry Toward Working Section
  ➢ Facilitates Detection of Fire By Smell in the Event All Other Detection Systems Fail.
  ➢ Enables a Fire in the Belt Entry to be Fought From the Fresh Air Side of the Fire.

• Provides Lower Air Velocity In Main Travel Way
  ➢ Reduces Exposure to Respirable Dust and Black Lung Disease By Reducing the Level of Dust That Miners Are Exposed To in the Travel Way
• Safety Precautions
  - AMS System Continuously Monitored By Designated Person. Their Primary Job Is Monitoring the System.
  - AMS Includes Carbon Monoxide, Methane, Oxygen and Air Velocity Sensors Throughout the Mine.
  - Carbon Monoxide (CO) Sensors At
    - Each Belt Drive
    - Each Tailpiece
    - Each Belt Take-up Unit
    - Each Transfer Point
    - Each Loading Point
    - Each Belt Air Split
    - Each Point Feed
    - Each Primary Escapeway at the Mouth
    - At 1,000' Intervals in the Belt Entry.
  - Equates to Over 140 CO Sensors At West Elk At Present Time
Safety Precautions (Cont’d)

- Carbon Monoxide Sensors Are Much Better In Detecting Fires At The Incipient Stages When Compared To Point-Type Heat Sensors.
- Warning System Automatically Activates At 10 PPM (Alert Level) and 15 PPM (Alarm Level).
- Warning System Provides Audible and Visual Alarms At the AMS Operator Station and At Each Working Section.
- Source Is Identified and Communicated to AMS Operator.
West Elk
AMS
System Map
# AMS Mainline Monitors

## CO

<table>
<thead>
<tr>
<th>C1 Belt (4e)</th>
<th>2-Belt (5e)</th>
<th>3-Belt (5e)</th>
<th>4-Belt (1e)</th>
<th>6-Belt (4e)</th>
<th>6-Belt (4e)</th>
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</thead>
<tbody>
<tr>
<td>Tail 0.98</td>
<td>05 xc 0.98</td>
<td>46 xc 0.98</td>
<td>74 xc 0.98</td>
<td>Head 0.90</td>
<td>19.5 xc 0e</td>
</tr>
<tr>
<td>09.5 xc 0.98</td>
<td>53 xc 0.98</td>
<td>02 xc 0.98</td>
<td>03 xc 3e*</td>
<td>Head 0.90</td>
<td>20.5 xc 1e</td>
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<tr>
<td>10 xc 4-5e*</td>
<td>56.5 xc 0.98</td>
<td>04 xc 0.98</td>
<td>03.5 xc 3e*</td>
<td>0.90</td>
<td>02.5 xc 0e</td>
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<tr>
<td>18 xc 0.98</td>
<td>57.5 xc 4e*</td>
<td>01 xc 4e bx</td>
<td>06 xc 5.10</td>
<td>03.5 xc 0e</td>
<td>08 xc 0.98</td>
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<tr>
<td>28 xc 0.98</td>
<td>62.5 xc 0.98</td>
<td>Tail 0.98</td>
<td>12 xc 3.14</td>
<td>08 xc 0.98</td>
<td>13 xc 0.98</td>
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<td>36 xc 0.98</td>
<td>70 xc 0.98</td>
<td>18 xc 1.96</td>
<td>19 xc 1.96</td>
<td>13 xc 0.98</td>
<td>16 xc 0.98</td>
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<tr>
<td>Tail 0.98</td>
<td>72 xc 0.98</td>
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<td></td>
<td>Tail 0.98</td>
<td>16 xc 0.98</td>
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## CD

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<thead>
<tr>
<th>BCN-9 (6e)</th>
<th>BCN-9 (6e)</th>
<th>ESMB (6e)</th>
<th>ESMB (6e)</th>
<th>ESMRPO (29 xc)</th>
<th>ESMRPO (5e)</th>
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<td>Head 0.98</td>
<td>65 xc 0.98</td>
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<td>Mouth 2.75</td>
<td>Cross Head 2.85</td>
<td>Parallel Head 2.18</td>
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<tr>
<td>25.5 xc 0.98</td>
<td>144 Outb 1.27</td>
<td>144 Outb 1.76</td>
<td>144 Inby 1.57</td>
<td>144 Inby 1.76</td>
<td>144 Inby 1.76</td>
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<td>30 xc 0.98</td>
<td>144 Outb 1.76</td>
<td>144 Inby 1.57</td>
<td>144 Inby 1.76</td>
<td>144 Inby 1.76</td>
<td>144 Inby 1.76</td>
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<tr>
<td>35 xc 0.98</td>
<td>144 Outb 1.76</td>
<td>144 Inby 1.57</td>
<td>144 Inby 1.76</td>
<td>144 Inby 1.76</td>
<td>144 Inby 1.76</td>
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<td>39 xc 0.98</td>
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<td>144 Inby 1.57</td>
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<td>44 xc 0.98</td>
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<td>49 xc 0.98</td>
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<td>54 xc 0.98</td>
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<td>59 xc 0.98</td>
<td>144 Outb 1.76</td>
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<td>144 Inby 1.76</td>
<td>144 Inby 1.76</td>
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## Smoke

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<td>Break ctrl</td>
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<td>1L0 ctrl</td>
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</tr>
<tr>
<td>Conspec</td>
<td>OK</td>
<td>Boiler w</td>
</tr>
<tr>
<td>Trailer a</td>
<td>OK</td>
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</tr>
<tr>
<td>Trailer w</td>
<td>OK</td>
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<tr>
<td>Trailer dt1</td>
<td>OK</td>
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<tr>
<td>Trailer dt2</td>
<td>OK</td>
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## CH4

| 22 TG | Susp 0.10 |

## Legend

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<tr>
<th>Comm</th>
<th>Sensor</th>
<th>OK</th>
<th>Low</th>
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<tr>
<td>4+++</td>
<td>0.00</td>
<td>3.01</td>
<td>11.15</td>
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* Font Feed
## AMS Operator's Screen

### Longwall Monitors / Status

<table>
<thead>
<tr>
<th>Stage Loader</th>
<th>Crusher</th>
<th>Head Conv No.1</th>
<th>Head Conv No.2</th>
<th>Tail Conv</th>
<th>Shear</th>
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<tbody>
<tr>
<td>Amps 40</td>
<td>Amps 50</td>
<td>Amps 75</td>
<td>Amps 72</td>
<td>Amps 58</td>
<td>Amps 155 Vols 2320</td>
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### CO

<table>
<thead>
<tr>
<th>19 HG (1e)</th>
<th>19 HG (1e)</th>
<th>19 HG (2e)</th>
<th>19 TG Mix Pt</th>
<th>19 BMP</th>
</tr>
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<tbody>
<tr>
<td>Head 0.98</td>
<td>End mono 0.98</td>
<td>Sec Alm 0.98</td>
<td>0.5 x 1e 2.35</td>
<td>Hg 1.96</td>
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<tr>
<td>Drive 0.98</td>
<td>Mid mono 0.98</td>
<td>Mouth 0.98</td>
<td>Tg 3.35</td>
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<tr>
<td>00.5 x 1-2e* 0.98</td>
<td>Stage idr 0.98</td>
<td>Intake 0.98</td>
<td>Moving 6.47</td>
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<tr>
<td>HTU 1.75</td>
<td>07 x 0.98</td>
<td>12 x 0.98</td>
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### CH4

<table>
<thead>
<tr>
<th>19 TG Alt Ret</th>
<th>19 BMP</th>
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<tr>
<td>Shield 165 0.20</td>
<td>Hg 0.14</td>
</tr>
<tr>
<td>03.5 x 4e 0.25</td>
<td>Tg 1.12</td>
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<tr>
<td>19 TG Mix Pt 0.5 x 1e 1.43</td>
<td>Moving 0.67</td>
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### Rate / Amps

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<th>C1 rate</th>
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<tr>
<td>2948</td>
<td>2079</td>
<td>18224</td>
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</table>

### Belts

<table>
<thead>
<tr>
<th>Belts</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
</tr>
<tr>
<td>2 Belt</td>
</tr>
<tr>
<td>3 Belt</td>
</tr>
<tr>
<td>4 Belt</td>
</tr>
<tr>
<td>6 Belt</td>
</tr>
<tr>
<td>BCM</td>
</tr>
<tr>
<td>BCE</td>
</tr>
<tr>
<td>BCN</td>
</tr>
<tr>
<td>BCN trip</td>
</tr>
</tbody>
</table>

**Last Updated:** 07/13/06

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**Clear Alarms:** Clear All

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**Clear All**
West Elk
Belt Air Summary

- Belt Air Has Significantly Enhanced Miner Safety at West Elk.
  - Use of Belt Air Has Prevented Methane Concentrations in the Working Faces From Significantly Increasing, Resulting In Improved Safety For the Miners.
  - Use of Belt Air Has Resulted In Reduced Respirable Dust Concentrations in the Working Faces.
    - Over the Past 10 Years, Respirable Dust Standards Have Been Consistently Met At Each MMU and DA (3 Citations Were Issued Over 10 Years)
  - The West Elk AMS System Is Reliable and Alerted Us of Problems In January 2000 By Detecting Increasing CO At the Main Fan.
Current Mining Area
With Belt Air Utilization
Current Mining Area
Without Belt Air Utilization
## West Elk
### Belt Air Summary

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>AIR VOLUME (CFM)**</th>
<th>METHANE CONCENTRATION (%)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W/ BELT AIR</td>
<td>W/O BELT AIR</td>
<td>W/ BELT AIR</td>
</tr>
<tr>
<td>Mix Point*</td>
<td>140,400</td>
<td>117,700</td>
<td>1.7</td>
</tr>
<tr>
<td>18TG LOXC**</td>
<td>143,000</td>
<td>112,000</td>
<td>0.8</td>
</tr>
<tr>
<td>18HG LOXC**</td>
<td>169,000</td>
<td>136,000</td>
<td>0.8</td>
</tr>
</tbody>
</table>

* Methane at the mix point \{75.323(e)\} must be ≤ 2.0%
** Methane in the LOXC must be ≤ 1.0%
*** Fan pressure @ 10.86"

- **Without the Use of Belt Air, the Reduced Air Quantities in Each Location Results in Borderline Compliance.**

- **To Maintain Equivalent Methane Concentrations Would Require Fan Pressure To Be Increased To 15.1".**

- **The Increased Fan Pressure Will Result In Diminished Safety Due to Increased Potential For Spontaneous Combustion.**
West Elk
Belt Air Summary

• Belt Air Has Significantly Enhanced Miner Safety at West Elk.
  ➢ Potential Heatings, Such As Hot Conveyor Rollers, Have Been Detected Through Sense of Smell In The Working Section Prior To Detection By The Sensors. This Early Detection Further Reduces the Potential of Fires in the Belt Entry.
  ➢ Fire Fighting Is Enhanced With The Use of Belt Air, Allowing Fire Fighters to Approach the Fire From Upwind.
  ➢ We Recommend That Belt Air Usage Be Allowed to Continue.