An Overview of Belt Air Issues and NIOSH Belt Entry-related Research

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Today’s Presentation

• Why use belt air?
• What are the risks of using belt air?
• How are these risks managed?
• How does the research inform the decision?
• What are some focus areas for deliberation?
Cited Advantages

- Dust & gas coursed to return
- Smoke from a fire doesn’t flood the face (not entirely true)

Cited Disadvantages

- unable to move sufficient air to the face, in some mines, without the use of belt air on intake
- Lack of protection associated with 75 CFR 350
Cited Advantages
- Improved ventilation under difficult conditions
- Early detection of fire
- Water line/airflow in same direction
- 30CFR 75.350 safeguards

Cited Disadvantages
- Potential for increased dust & gas at the working face
- Flood the face with smoke if there is a fire in the belt entry
Why Use “Belt Air”? 

- Need for additional air quantity
  - Methane control
- Inability to deliver additional air through existing aircourses
  - Pressure limitations relative to adjacent entries
  - Practical limitations on power
- Inability to deliver additional air by adding another entry or by increasing entry width
  - Ground control limitations
Entry Restrictions Relative to Ground Control

• Stress level (Pressure Arch Theory)
  – Direct function of panel width and number of entries
  – Extreme conditions require minimizing stress
    • Deep cover
    • Bump-prone strata
    • Weak roof or floor
Entry Restrictions
Relative to Ground Control

- Intersections
  - Roof failures eight-times more likely than straight entries
  - Two-entry developments contain 33% fewer intersections than 3-entry, 50% fewer than 4-entry
Concerns arising from coursing intake air over the belt

- Conveyor-belt system subject to problems that can ignite fires, e.g. idler bearing failures, belt tracking, belt slippage, etc.
- Coal spillage and accumulation problems
- Conveyor belt flammability
- Dust entrainment
- Methane
## Belt-use Risk Surveys

<table>
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<tr>
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<tbody>
<tr>
<td>Fires</td>
<td>56</td>
<td>62</td>
</tr>
<tr>
<td>Percent of Total Fires</td>
<td>28</td>
<td>15-20</td>
</tr>
<tr>
<td>Fatalities</td>
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<td>1</td>
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What are the risks?

- Increased respirable dust concentration at the face
- Increased methane at the face
- Increased density of smoke at the face if there is a fire in the belt (hindering escape)
- Increased density of smoke in the intake escapeway due to pressure imbalance (hindering escape)
- Increased smoke load based on belt flammability
How are these risks addressed?

- Keep average respirable dust concentration at or below 1.0 mg/m³ (30CFR 75.350)

- Provide early detection and warning of fire
  - AMS (30CFR 75.350)
    - Sensors in Intake (primary escapeway), Belt, and at Point-feed

- Reduce likelihood of smoke flooding the intake escapeway (30CFR 75.350)
  - No more than 50% of total intake air can be supplied from belt
  - Point-feed
    - Remote closing
    - 300 ft/min min velocity thru regulator
    - Upstream air in belt and intake monitored for CO and smoke

- Require minimum of three entries (30CFR 75.350)

- Use directional lifelines (30CFR 75.380)
Effect of Fires on Ventilation

- Ventilated entry permits byproducts to flow more rapidly throughout mine.
- Reduces air movement within entry.
- Potential secondary problems of reduced airflow:
  - Methane accumulation
  - Inadequate oxygen
  - Flow into adjoining entries
  - Escape difficulties
Effect of Fires on Ventilation (continued)

- Smoke will migrate to face regardless of the air flow direction
- Belts on return air
  - Fires can be larger and more deadly
    - Additional level of protection afforded by 30CFR 75.350 not required
Atmospheric Monitoring System

- Mature technology
- 157 Mines presently using AMS
- Tested and calibrated every 31 days
- Automatic visual and audible alert signals
  - Surface
- Automatic visual and audible alarm signals
  - Surface
  - Working sections
  - Affected areas
  - Other locations specified in Mine Emergency Evacuation and Firefighting Program of Instruction
- Automatic visual and audible signal when two consecutive sensors alert
  - Surface
  - Working sections
  - Affected areas
USBM/NIOSH Related Research

- Ground Control
- Belt Flammability
  - Conveyor Belt Flammability Studies
  - Testing of Fire-resistant Conveyor Belting
- Toxicity
  - Primary Gas Toxicities and Smoke Particle Characteristics During a Two-stage Combustion of Mine Conveyor Belts
- Ventilation
  - Calculating Fire-throttling of Mine Ventilation Airflow
- Dust Control
  - Dust Concentrations When Using Belt Entry Air to Ventilate Work Areas
Presentation Topics

- Belt Flammability - Charles P. Lazzara, Ph.D.
- Belt Toxicity - C. David Litton
- Ventilation - Robert B. Krog
- Escape - Fred N. Kissell, Ph.D.
- Ground Control
- Dust
- Sensors
Possible Focus Issues

• Flammability of belts
  – Changes over the years in belt makeup
  – Tradeoffs in belt materials
  – Adequacy of other measures

• Air velocity cap
  – Efficacy of fire suppression systems at higher velocities
  – Adequacy of pressure balance and sensor placement guidance, if no limit on velocity