US MINE SAFETY REGULATIONS AND METHANE HAZARD PREVENTION

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HISTORY AND EXAMPLES OF COAL MINE REGULATION
REGULATION HISTORY OF THE U.S. COAL INDUSTRY

• U.S. Bureau of Mines – Congress passed the Organic Act, which established the agency in 1910.

• Federal Coal Mine Health & Safety Act of 1969 – followed the No. 9 Mine explosion that killed 78 miners in West Virginia.
  • Mine Enforcement Safety Administration (MESA)
  • Inspections
  • No smoking or open flame sources
  • Ventilation plans
  • Training of miners
  • Separate splits of air
  • Air changes essential personnel only
  • Permissible equipment
MINE SAFETY & HEALTH ADMINISTRATION (MSHA)

  - Separate split of air to each section, exhaust to return
  - Main fan on surface with explosion proof installation
  - Minimum air quantities
  - Set methane limits and actions
  - Intrinsically safe, incapable of causing ignition of the most easily flammable mixture of methane or natural gas
  - All face equipment built & maintained to be permissible
  - Equipment and personnel charged with atmospheric monitoring must be certified
Mine Safety & Health Administration (MSHA)

  - Fire suppression systems
  - Control of combustible materials
  - Seals, appropriately designed, installed, maintained and monitored
  - Ventilation plan approved by MSHA district manager
  - Escapeways
  - Maps
  - Communications & tracking
  - Oil and Gas wells
Mandatory Safety Standards for Underground Mines (30 CFR Part 75)

- §75.325 prescribes the required minimum air quantity for different coal types and mine locations.
- §75.326 mandates that a mean entry air velocity of at least 60 feet per minute must reach each working face.

<table>
<thead>
<tr>
<th>Location within the Mine</th>
<th>Bituminous/Lignite Mines</th>
<th>Anthracite Mines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working face where coal is being cut</td>
<td>3,000</td>
<td>1,500</td>
</tr>
<tr>
<td>Last open crosscut or end of pillar line</td>
<td>9,000</td>
<td>5,000</td>
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<tr>
<td>Longwall or shortwall mining systems</td>
<td>30,000</td>
<td>30,000</td>
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</tbody>
</table>
CAUSES OF METHANE EXPLOSIONS

- **Human Factors**
  - Ventilation duct at face not close enough
  - Use of scavenger system with inadequate overlap
  - Fan turned off
  - Ductwork leaky or pinched
  - Smoking
  - Methane monitor calibration
  - Equipment permissibility not maintained explosion proof
  - Gas checks not made prior to and during welding
CAUSES OF METHANE EXPLOSIONS

• Combination of Human Factors & Engineering Specifications
  • Methane monitoring off or not present
  • No other warning system for excess gas
  • Engineering specifications
  • Ductwork undersized
  • Equipment not explosion-proof by design

• Neither
  • Cutter pick sparks
PREVENTIONS OF EXPLOSIONS

• Three Basic Elements
  • Main mine system of intake and return and sweep of working face with fresh air by line brattices or ventilation duct with fan
  • Regular monitoring of methane gas concentrations with action levels including equipment shut down
  • Ignition sources eliminated
EXAMPLE: UPPER BIG BRANCH MINE
UPPER BIG BRANCH MINE

- Located in Montcoal West Virginia, USA
- Operated by Performance Coal Company, was a former subsidiary owned by Massey Energy Company
- 5 April 2010 at 15:02 EDT a small methane explosion occurred quickly followed by a massive coal dust explosion
- 29 miners died making it the largest coal mine disaster in 40 years
- The disaster resulted in intensive investigations, prosecution of mine managers and the Chairman and CEO of Massey Energy
FINDINGS OF THE POST MINE DISASTER INVESTIGATIONS

- Investigations were conducted under the authority of the Federal Mines Safety and Health Act 1977 (Mine Act)

- Investigation based on interviews, data and information gathered at the site determined that:
  - Miners died in massive coal dust explosion that started as a methane ignition transitioned into a methane explosion and followed by a massive dust explosion
  - The disaster was the result of:
    - Basic safety violations
    - Unreported and disregarded hazards
    - Unlawful policies and practices
  - The disaster was entirely preventable

DNIPRO, UKRAINE
12 JUNE 2019
WORKSHOP ON BEST PRACTICES IN COAL MINE METHANE CAPTURE AND UTILIZATION
WHAT WERE THE UNDERLYING CAUSES OF THE DISASTER?

• The methane ignition and ensuing explosion would not have occurred if the longwall shearer was maintained in safe condition—the bits on the rotating drum were worn and the water spray was missing or functioning poorly

• Methane concentration was not measured properly, therefore there was no opportunity to prevent or contain the methane ignition

• The MSHA approved ventilation and roof control plans were not followed, so fresh air flow was impeded by a roof fall; volume and velocity of air flow was unreliable and changed direction frequently

• Float coal dust, coal dust, and loose coal was allowed to accumulated—rock dust was not sufficiently applied to suppress fire and explosion

• Regular pre-shift, on shift, and weekly inspections for hazards and follow-up remediation did not take place
BEST PRACTICES FOR THE PREVENTION OF MINE EXPLOSIONS

• Maximum 1% methane
• Single pass ventilation
• Prevention of face ignitions
• Bleeder systems
• Mine atmospheric and ventilation system monitoring including gobs for spontaneous combustion
• Dedicated ventilation officer
• Miners empowered to report unsafe conditions and protected from retribution
• Dust control
REFERENCES


• MSHA.gov

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