Improving Mine Safety Technology and Training: Establishing U.S. Global Leadership

Report of the Mine Safety Technology & Training Commission
# Commissioners

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Process

✓ Created March 2006
✓ Process, charter and outline done at March meeting
✓ Additional meetings in April, May, July
✓ Preliminary draft report in July
✓ Final draft report in August
✓ Expert review: August-September
✓ Final report due in October 2006
Charter

- Mine tragedies in 2006 revealed vulnerabilities at some underground coal mines
- Miners must be protected by addressing them
- Significant development of new technology and practices in:
  - Communications
  - Risk management
  - Information analysis
  - Emergency response
  - Training
Charter

- Study existing and new technologies, including in other industries
- Determine which can improve protection of underground coal miners
- Consider dynamic aspects of mining, and need for new perspectives and approaches
- Particularly look at new technologies and procedures potential impact in significantly increasing odds of survival for miners in emergency situations
Improvements in Mine Safety
Underground Mining

- Dramatic since 1977 Act

- Underground Coal - 2004
  - Fatal IR down 47.8% to 0.036
  - Fatalities dropped from 112 to 14*

- Underground Metal/Nonmetal - 2004
  - Fatal IR down 83.7%
  - Fatalities dropped from 35 to 1* (2003)

* Record low
Improvements in Mine Safety
Underground Mining

- Underground Coal - 2004
  - NFDL IR: 10.87 to 6.24
  - Down 42.6%

- Underground Metal/Nonmetal - 2004
  - NFDL IR: 10.54 to 3.50
  - Down 66.8%
Fire & Explosion Fatalities
24 Years

1984-1992 (9 years)
- 5 explosions – 28 fatalities
- 1 fire – 27 fatalities

1993-1999 (7 years)
- No fatalities

Remarkable!!!

2000-2006 (6 years, to early 2006)
- 5 explosions – 35 fatalities
- 1 fire – 2 fatalities

6.11/yr
40% of fatalities

Why the recent problems?
Fire & Explosion Fatalities
Weaknesses & Gaps

- 1984-1992 (9 years)
  - Inadequate ventilation of bleeders and active workings – 5 of 6 incidents
  - Air flows to bleeders disrupted by roof falls, rising water, construction or removal of controls, missing controls, liberation of methane from rider seam
  - Repercussions of air changes not understood
Fire & Explosion Fatalities
Weaknesses & Gaps

- 1984-1992 (9 years)
  - Monitoring of methane inadequate in 2 cases
  - Low barometric pressure enhanced migration of methane
  - Serious/blatant violations of regulations in four cases
Fire & Explosion Fatalities
Weaknesses & Gaps

- 1984-1992 (9 years)
  - Inattention to good mining practices (fire protection, delayed response to escape, trying to help other miners)
  - Lack of familiarity with alternate escape route
  - SCSR/FSR not used properly
Fire & Explosion Fatalities
Weaknesses & Gaps

- 2000-2006 (6 years)
  - Inadequate ventilation in 2 of 6 cases
  - Only one bleeder system inadequately ventilated
  - Sealed gob areas involved in 2 cases (Sago and Darby mines)
  - Delayed response to escape (2 cases)
Fire & Explosion Fatalities
Weaknesses & Gaps

- 2000-2006 (6 years)
  - Communication systems destroyed
  - Knowing location of miners problematic
  - SCSR s not fully used; difficulty in using them reported
Persistent Issues and New Complexities

- Worked-out areas of mines a critical issue, including detecting methane levels in and near sealed areas
- Not delaying escape is a paramount issue
- Maintaining communications with escaping and trapped mines is critical
- Reliability and meeting intended purpose of SCSRs is critical
Persistent Issues and New Complexities

- Improving state of preparedness for escape and emergency response is imperative
- Slow response in reporting emergency needs addressed (done now)
- Need better means for protecting trapped miners
- Complex and dynamic change occurring; more hazards likely in future
Recommendations by Content Area

- Risk-Based Design and Management
- Communications Technology
- Emergency Response and Mine Rescue Procedures
- Training for Preparedness
- Escape and Protection Strategies
Conclusions

- Mine safety in the U.S. has dramatically improved since the Mine Safety and Health Act of 1977, and fatalities have dropped dramatically over the past two decades.

- Recent tragedies have challenged that record, however, causing concern among all constituencies of the underground coal industry and reminding us that such an excellent record of improvement can be compromised quickly.
Conclusions

- The commission believes that strong measures need to be adopted by all constituencies of the industry now to move the safety performance level forward to a leadership position globally, matching the industry’s leadership in productivity.

- The commission has outlined the details of a comprehensive, risk assessment-based approach toward prevention, which should significantly increase the odds of survival for miners in emergency situations, but also provides a guideline for pursuing zero accidents.
Conclusions

- Details are included in the areas of communications technology, emergency response and mine rescue procedures, training for preparedness, escape and protection strategies, along with 71 recommendations for systematically achieving the overarching goals of zero fatalities and zero lost-time accidents.
Conclusions

- In particular in order to move forward safely and productively, the commission believes that a number of broad issues framed by our recommendations deserve serious attention, and should be used to fundamentally change the management approaches and work practices taken to fulfill basic safety requirements.
Conclusions

- First and foremost, risk-based decision-making must be emphasized, employed, and improved in relevant aspects of design, assessment, and management.

- It is imperative that a systematic and comprehensive approach be used to manage risks, founded on the establishment of a value-based culture of prevention that focuses all employees on the prevention of all accidents and injuries.
Conclusions

- Importantly, every mine should employ a sound risk-analysis process, should conduct a risk analysis, and should develop a management plan to address the hazards and related contingencies identified by the analysis; simple regulatory compliance alone is not sufficient to mitigate significant risks.
Conclusions

- In partnership, the commission exhorts industry to pursue further research, development, and deployment of promising new technologies to protect miners at much higher levels.
Conclusions

- Technology gaps for protecting miners and emergency responders exist in communications, mine rescue equipment, realistic training, SCSR technology, and means for maintaining trapped miners.

- Recommendations were made in the report regarding the salient research and development needs that must be pursued.
Conclusions

- At the same time, while solutions to many mine safety problems are enabled by technology, they are not technology problems, rather, they are management and organizational problems.

- The commission made numerous recommendations to address such areas, involving miners, mine rescuers, mine managers, and incident command teams.
Conclusions

- The recommendations span needs for facilities, high-fidelity training, familiarity with mines and escape routes, mine rescue teams’ capabilities and needs, and processes and protocols for responding to emergencies.
Conclusions

- Broader and deeper professionalization of the mine rescue function is also much needed.

- Certification and training of teams are critical aspects as well as the skill-composition of teams and standardization of procedures.

- Facilities, organizations, and structure to facilitate the development of professionalization are needed as well.
Conclusions

- More sophisticated miner training on critical skills and key performance-oriented competencies for successful self-escape and aided-rescue is needed, and it must be well grounded in the principles of effective-learning evaluation.
Conclusions

➢ Further, much more realism must be embedded in the training, even to the point that miners and emergency responders interact in mock emergencies with practice anchored in deployment based on existing comprehensive emergency plans.

➢ In these areas, significant research and development needs exist; our recommendations address these in detail.
Conclusions

- Although the initial goal of this study was to significantly increase the odds of miners’ survival in emergency situations, the overriding issues mentioned above came to the forefront as the commission realized that much needs to be done systematically across a broad range of areas to achieve the goal.
Conclusions

- In the end, the commission is hopeful that its comprehensive recommendations, once adopted, will make a significant difference in preventing fatalities and serious injuries from occurring in the future.