

Belt Air Advisory Committee Report – November, 1992

Raja V. Ramani, Ph.D., P.E.
Emeritus Professor of Mining
Engineering, Penn State Univ.
March 30, 2007, Pittsburgh, PA

Committee

- ❖ Secretary of Labor: Lynn M. Martin
- ❖ Originally constituted to be a nine member committee [2 labor representatives, 2 industry representatives, 5 representatives with no economic interests, neither affiliated with labor or industry].
- ❖ Met for 14 days over a 6 month period
- ❖ Took testimony from many sources and visited a mine using belt air for face ventilation and AMS

Committee

- ❖ Dr. Mary Jo Jacobs, Chairman
- ❖ Dr. Ragula Bhaskar
- ❖ Ms. Shirley K. Clark
- ❖ Ms. Diane M. Doyle-Coombs
- ❖ Mr. Jack Holt
- ❖ Dr. Raja V. Ramani
- ❖ Dr. Lee W. Saperstein
- ❖ Mr. John W. Stevenson [non-voting, Alt.]

❖ Charge

- ❖ "Review MSHA's belt entry air proposal , including related provisions and other technical data."
1. Conditions under which belt air can be safely used as intake air courses to ventilate working places
 2. Minimum velocities in conveyor belt haulageways
 3. Ventilation of escapeways

Identification of Key Issues by the Committee

- ❖ *Health and safety issues associated with the use of belt air in working places [dust, products of combustion, etc]*
- ❖ *Coal mine fire safety with particular attention to belt entries, belts, fire-fighting plans, etc*
- ❖ *Atmospheric monitoring systems [AMS], sensors, reliability, alert/alarm levels, etc*
- ❖ *Mine ventilation systems and escapeway design, alternate escapeways, escapeway integrity*
- ❖ *Education, training and management*
- ❖ *Worldwide developments, research, etc*

❖ Resources for the Committee

- ❖ Background Materials – BEVR
- ❖ Proposed Regulations, Record of hearings
- ❖ UMWA submissions and presentations
- ❖ U.S. Bureau of Mines and MSHA investigations and personnel on ventilation, fires, dust, belt materials, air velocities, etc. Other experts from industry and government agencies. Health versus Safety – dust, escapeways, 2-entry development
- ❖ Panels of [1] AMS manufacturers and [2] Conveyor belt manufacturers.

Recommendations Summary

- ❖ In total the committee made 12 recommendations. These recommendations can be organized in terms of how they address the three charges to the committee.
- ❖ Charge 1: Belt haulage courses can be safely used as intake air courses. This is more of a finding than a recommendation.
- ❖ Several conditions were specified for such use. Depending on the manner in which the recommendations are interpreted, six or seven of the 12 recommendations are relevant to this finding.

Recommendations Summary

- ❖ Charge 2: Velocities in a belt entry, both minimum and maximum, should contain methane and dust levels in belt entries to below those specified in the standards, and prevent methane layering.
- ❖ Two recommendations specifically addressed the velocity issues.

Recommendations Summary

- ❖ Charge 3: Ventilation system should be designed and maintained to protect the integrity of the mine atmosphere in the primary intake escapeway. A positive pressure differential should be maintained from the primary escapeway to adjacent entries to the extent feasible/practicable.
- ❖ Two recommendations specifically address the escapeway issues

Recommendations Summary

- ❖ Two recommendations of the committee were directed to MSHA to develop standards for testing and approval
- ❖ The committee identified a list of research in several areas such as [1] communications when wearing SCSRs, [2] belts in returns, [3] pressurizing primary intake escapeway, and [4] discriminating sensors.

First Issue/Charge

- ❖ Conditions for the safe use of Belt Entry as an intake aircourse to ventilate working places

 1. Can belt entry be used as an intake aircourse?
 2. If yes, what are the conditions that must be met?

Recommendation No.1 [1/1]

- ❖ ***Belt haulage entries can be safely used as intake aircourses to ventilate working places provided additional safety and health conditions are met [This is a finding].***

 1. Current systems inadequate to meet the goals of regulation [belt air into face].
 2. Combustion products in belt entry enter face.
 3. BEVR report, hearing transcripts, and comments.

Recommendation No. 2 [2/1]

- ❖ ***When belt entries are used to ventilate working places, one of the additional requirements is the presence within the belt haulage entry of an early warning fire detection system.***
- 1. The early warning fire detection system discussed in the report is Atmospheric Monitoring System [AMS].
- 2. Several specific guidelines were developed by the committee, most of them based on existing MSHA petitions for modifications [PFM] and dealt with a number of topics.

Guidelines for AMS

1. Actions before the use of belt air
2. Capabilities of the AMS
3. Minimum velocity and location of sensors
4. Section alarms
5. Responsible person at surface
6. Actions of underground persons upon alert/alarm activation
7. Actions of surface persons upon alert/alarm activation

Guidelines for AMS

8. Avoidance of nuisance alerts
9. Fire fighting and evacuation plan contents and records
10. AMS calibration, testing, examinations and records
11. AMS malfunction
12. Mine ventilation map
13. Smoke sensors; slippage switches
14. Backup communication

Recommendation No. 3[3/1]

- ❖ ***This is a three part recommendation dealing with the training of mine personnel on early warning fire detection system.***
- ❖ The three groups of miners are: [1]miners, [2] personnel responsible for the installation, maintenance, operation and inspection of the system and [3] the atmospheric monitoring system [AMS] operator, responsible for monitoring the system and initiating fire fighting and evacuation plan.
- ❖ MSHA should, by examination assure the competency of the AMS operator.
- ❖ When miners are underground, an AMS operator must be on the surface within sight or sound of the surface control station.

Recommendation NO. 4 [4/1]

- ❖ ***In mines using AMS as a condition for using air in the conveyor entry to ventilate working faces, the minimum velocity of air in the belt entry should be 50 fpm.***
- 1. Considerations of fire eruption and transport of combustion products.
- 2. Expert from U.S. Department of Commerce.
- 3. Multiple neutral entries and their effects

Recommendation No. 5 [1/M]

- ❖ ***MSHA should move forward with the development and promulgation schedules for early warning fire detection systems [including smoke sensors].***
- ❖ ***Approval schedules should include [1] performance standards and [2] safety standards and should be flexible to permit advances in technology***

Recommendation No. 6 [1/2]

- ❖ *Velocities, both minimum and maximum, should provide air that is capable of containing methane and dust levels at or below the levels specified in the standards.*
- 1. Respirable dust < 1 mg/m³ at section tail piece
- 2. Respirable dust < 2 mg/m³ at all other outby locations
- 3. Designated areas [DAs] should be established at appropriate locations for measurement and noted on ventilation system and methane and dust control plans.

Recommendation No. 7 [2/2]

- ❖ *The minimum air velocity in belt haulage entries in all mines, whether belt air is used to ventilate working places or not, should be established based on ability of the air current to reduce the potential for methane layering*
- 1. Scope of the recommendation much broader than for belt aircourse used as an intake air
- 2. Relationship to minimum velocity for transport of combustion products to sensor [sensor spacing]

Recommendation No. 8 [1/3]

- ❖ *Lifelines should be installed and maintained in all primary and alternate escapeways. Tracks and belts can be treated as acceptable lifelines, provided that, where track switches and belt transfers exist, provisions are made for clear designation of the escape route*
- 1. Applicability to all mines
- 2. Replacement of reflectors/redundancy
- 3. Use of directional cones

Recommendation No. 9 [2/3]

- This recommendation on ventilation of escapeways has a number of components:
- ❖ mining system considerations [e.g. haulage system, ventilation system, production system, etc];
 - ❖ primary escapeway and alternate escapeway;
 - ❖ integrity of the atmosphere in the escapeways;
 - ❖ positive pressure differential between the primary escapeway and adjacent entries;
 - ❖ information for mine ventilation plan approval on data relative to the integrity of the atmosphere in the escapeways under normal and pressurized conditions.

Recommendation No. 9 [2/3] [continued]

- ❖ *Ventilation of the primary and alternate escapeways should consider the interfaces and interrelationships among all aspects of the mining system*
- ❖ *Ventilation systems should be designed and maintained to protect the integrity of the atmosphere in the primary intake escapeway. Evaluation of this fact should be on a mine-by-mine basis of the following:*
- 1. Prudent engineering to provide positive pressure differential between the primary escapeways and adjacent entries
- 2. Planned, evaluated and practiced use of devices to pressurize the primary escapeway in the event of an emergency

Recommendation No. 9 [2/3] [continued]

- ❖ *The alternate escapeway should be designed and maintained to maximize the possibilities of escape*
- 1. Prefer the alternate escapeway in intake air; no need for a totally separate and distinct split of intake air; physical separation is required
- 2. Does not preclude the use of a return entry or considerations of other factors for escapeway ventilation

Recommendation No. 9 [2/3] [continued]

- ❖ *Information submitted for ventilation plan approval should include substantiating data relative to the integrity of the mine atmosphere in the escapeways under normal and pressurized conditions.*
- 1. Methods of evaluation of the escapeway integrity include [a] measured data from existing system and experimental data from pressurized system, and [b] analytical methods including computer-oriented simulations

Recommendation No. 10 [2/M]

- ❖ *MSHA proceed rapidly to develop regulations for improved fire resistant belting, including new testing and approval schedules.*
- ❖ *When available, the improved fire resistant belting and material should be used in all underground coal mines*

Recommendation No. 11 [5/1]

- ❖ *The alert and alarm levels for AMS should not exceed 5 ppm and 10 ppm [or equivalent] above ambient, respectively. The MSHA district manager may establish lower alert and alarm levels for AMS based on the sensor type and sensitivity, sensor spacing, air flow, cross-sectional area and local mining conditions.*
- ❖ *Alerts and alarms should be automatically activated on the surface and on the working sections when the CO [or equivalent] levels exceed the established levels.*

Recommendation No. 12 [6/1]

- ❖ *In mines using belt air to ventilate working places, increased emphasis should be placed on belt entry cleanup and conveyor belt maintenance*
- Coal spillage and float dust accumulations were considered problem areas. Case studies of fires being initiated due to these conditions led the committee to make this recommendation. While the recommendation is directed to specific mines, applicability to all mines is obvious.

Committee votes

- ❖ All the recommendations were voted on by the Committee.
- ❖ Unanimous approvals: Use of belt air [#1], Use of AMS [#2], MSHA AMS approval[#5], Minimum and maximum velocities for dust and methane control [#6], Lifelines [#8], Escapeway ventilation [#9], MSHA Fire resistant belt approval [#10], and alert and alarm levels [#11]
- ❖ Split approvals: Training [#3, 6-1], Belt air velocity minimum [#4, 6-1], Minimum air velocity for methane layering [#7, 5-2] and Belt entry cleanup and maintenance [#12, 6-1]

After 15 Years

- ❖ The basic approach to increasing health and safety remains the same:
- ❖ Eliminate the hazards
- ❖ Reduce the hazard occurrence
- ❖ Reduce the potential impact of an occurrence
- ✓ Increase the possibility of early detection
- ✓ Increase the possibility of effective response
- ✓ Increase the possibility of successful evacuation and escape