Mine Ventilation and Air Conditioning

Chapter 1
Introduction

Purpose:
To provide air to sustain and protect miners and make the work environment as comfortable as feasible; sometimes to prevent deterioration of conditions or protect infrastructure.

Importance
- Humans need oxygen
- Disease, injury or death can result from exposures to toxic agents
- Exhaustion, injury or death can result from exposures to specific physical conditions

Historical Perspective
- Underground mining perhaps as early as 40,000 B.C.
- Air coursed through mines by first millennium
- Middle Ages: deflectors, bellows, fans
- Modern fans give great flexibility

Ultimate Challenge
Providing adequate air and comfort (meeting regulatory and organizational requirements) to miners working at great depth at reasonable cost.

Total Air Conditioning
Entails application of the following, alone or in combination:
1) quality control
2) quantity control
3) temperature-humidity control
Quality Control

Purifying air and removing contaminants. Contaminants are:

1) gases – vapors and gaseous matter; radiation as well
2) dusts – particulate matter

Quantity Control

Regulating the magnitude and direction of air flow through:

1) ventilation (primary)
2) auxiliary or face ventilation
3) local exhaust

Temperature-Humidity Control

Controlling latent and sensible heat by the following:

1) cooling
2) heating
3) humidification
4) dehumidification

Hierarchy of Engineering Controls

Ordered principles for coping with environmental contaminants:

1) prevention or avoidance
2) removal or elimination
3) suppression or absorption
4) containment or isolation
5) dilution or reduction

Medical control principles may also be used, as follows:

1) education
2) physical exams
3) lung X-rays
4) personal protective devices
5) prophylaxis/Prevention
6) therapy

Legal control principles are often imposed by societal consensus (rulemaking):

1) statutory or regulatory provisions
2) workers’ compensation laws/provisions
Coordination of Mining and Ventilation Systems

- Consider role vs. production and cost
- Need to integrate considerations as total mine system is optimized under realistic constraints
- Better able to do this today because of computing advances and robust modeling capability that can consider social, political, economic, and environmental consequences

Foundations of Mine Ventilation and Air Conditioning

- Physical chemistry, thermodynamics, fluid mechanics and mechanical design
- Mining methods; awareness of mining technology

Accuracy of Calculations

- Four significant figures for this course
- It depends on the accuracy of measurements

Mathematical Units

- English and System Internationale (SI)
- English given preference; SI in parenthesis
- Conversion factors in Appendix B

Mathematical Symbols

- Scientifically standard ones are used
- Defined on first use in book
- Refer to pp. xiii – xvi in book, necessary

Map Symbols

- Largely standard in literature and practice
- Refer to pp. xvii – xviii, as necessary