Aerosol Control Technology

Chapter 4 (continued)

Cardinal rule of dust control is to prevent dust from occurring.

Prevention Strategies

- Water/steam infusion: high expense, moderate efficiency
- Foam infusion: high expense, moderate efficiency
- Wet drilling: low expense, high efficiency

Water Infusion – 50% Efficient in U.S.; up to 95% in Europe

Removal Strategies

- Dust collectors – wet: moderate expense, high efficiency
- Dust collectors – dry: moderate expense, high efficiency
- See Table 4.5 for characteristics

Dust Collector Example
Dust Collector Mounting

Two Side Inlets and a Center Inlet Capture the Dust

The Telescoping Joint Compensates for Movement in the Head Frame

The Scrubber Screen is Change before Every Shift

Camp #11 Flooded Bed Scrubber System

Suppression Strategies ($, Eff.)
- Water sprays (low, mod)
- Wet cutting (low, mod)
- Foam (mod, mod)
- Cutting variable optimization (low, mod)
- Deliquescent chemicals (mod, mod)
- Rock dusting (mod, mod)
- Water-jet assisted cutting (high, mod)
**Type Water Sprays**

- **Solid Stream**
  - (aim at pick)

- **Flat Spray**
  - (wet coal)

- **Full Cone**
  - (clean, wet)

- **Hollow Cone**
  - (2nd best at faces)

- **Atomizing Spray**
  - (best)

- **Venturi Spray**
  - (moves air)

**Isolation Strategies**
- Enclosed cabs (mod, mod-high)
- Enclosed dust generation (mod, mod)
- Exhaust ventilation (low, mod)
- Blasting off-shift (low, mod)
- Control of airflow: separate split, spray fans, air curtains (low, mod)
- Control of personnel location: remote control, unidirectional cutting (low, mod; high, mod)

**Dilution Strategies**
- Main ventilation stream (mod, mod)
- Local ventilation (low, mod)
Discussion of Strategies

- Underground coal: longwall, continuous mining
- Surface mines: haulroads, trucks, dozers, crushers, etc.
- Plants: crushers, sizing operations, bag-loading areas, etc.

Dilution by Ventilation

- Different ways of changing quantity
- Minimum velocity 13-40 fpm for turbulent flow
- Coal regs require at least 60 fpm
- Effective velocity on longwall ~ 400-600 fpm

Dilution by Ventilation

Modified Chapter 3 (gas) formula:

\[
\frac{(G + BQ) \cdot xQ}{(G + BQ) \cdot x_0Q} = e^{(Q/Y)T}
\]

- \( G \) – dust generation rate, mg/s
- \( Q \) – air quantity, m³/s
- \( Y \) – volume of space, m³
- \( T \) – time, s
- \( B, x, x_0 \) – dust concentrations, mg/m³; \( B \) in intake air, \( x \) at \( T \), \( x_0 \) at time = 0

Simplified form of dilution equation, as time approaches infinity:

\[
Q = \frac{G}{T \text{LV} - B}
\]

This is the steady-state equation for dust dilution; used when dust generation rate is constant or where an average value is known.

Personal Protection Devices

- Standard respirators
- Powered positive-pressure respirators
- Air helmets
Personal Protection Devices

Medical and Legal Means of Dust Control

- Coal Mine Health and Safety Act, 1969
- X-ray Surveillance Program – NIOSH