APPLICATION PROFILE

PULVERIZED COAL SYSTEMS

TYPICAL INDUSTRIES SERVED

- Power
- Steel/Iron
- Cement

INTRODUCTION

The pulverization of coal to improve burning efficiency and maximize energy output is a method that has been used for more than 75 years. Pulverized coal processing and storage systems are typically found in power generation, steel and iron manufacturing, cogeneration, cement drying, and other industries that employ injection furnaces.

Compliance with the Clean Air Act Amendments (CAAA) of 1990 has moved many facility operators to switch fuels from high-sulfur (bituminous) coal to low-sulfur (sub-bituminous) coal to reduce emissions of sulfur dioxide and nitrogen oxides. Compliance with Phase II of the CAAA is required January 1, 2000.

For all its advantages, the pulverizing process, as well as the conveying and storing of pulverized coal, poses substantial explosion hazards. Many installations include some prevention strategies, such as inerting systems, but these systems only minimize the occurrence of explosions.

The purpose of this application guide is to provide an understanding of the possible explosion hazards and protection solutions for pulverized coal systems. This document is intended to be a guideline and is not applicable to all situations.

If you have any questions, please contact the Fike Explosion Protection group or our sales representative in your area.

Figure 1: Schematic of a typical coal processing and storage system.
THE PROBLEM: DEFLAGRATION (EXPLOSION)

Coal has been pulverized (crushed) since 1924 to produce a more efficient fuel. The potential for explosions in pulverized coal processes is well known. Equipment such as crushers, pulverizers, and conveyors all contribute to the creation of dust. When this coal dust is suspended in air (in the pulverizer, conveying lines, bag filters, cyclones, and storage bins) and an ignition occurs, there is the potential for explosion.

The trend to switch to sub-bituminous coal (lower sulfur) addresses the environmental concerns, however the degree of explosion hazard is greatly increased compared to bituminous coal (see table 1). In steel making, the conversion of using coal in lieu of coke also increases the potential for explosion due to the higher explosibility ratings for coal (see table 1).

This application bulletin outlines responsive protection strategies for the primary areas of explosion potential: pulverizing, conveying, and dust collection/storage.

<table>
<thead>
<tr>
<th>Physical Characteristics</th>
<th>Bituminous Coal</th>
<th>Sub-Bituminous Coal</th>
<th>Coke</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto-Ignition Time</td>
<td>90 to 120 days</td>
<td>15 to 30 days</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td>Auto-Ignition Temperature</td>
<td>870°F (466°C)</td>
<td>765°F (407°C)</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td>Kst (Explosibility Constant)</td>
<td>129 bar-m/sec</td>
<td>209 bar-m/sec</td>
<td>74 bar-m/sec</td>
<td>2, 3</td>
</tr>
<tr>
<td>Pmax (Maximum Explosion Press)</td>
<td>133 psig (0.2 barg)</td>
<td>104 psig (7.2 barg)</td>
<td>110 psig (7.6 barg)</td>
<td>2, 3</td>
</tr>
</tbody>
</table>

References:
2. Determined by ASTM E1226 (ISO 6184/1) test methods at Fike corporation;
3. NFPA 68

THE SOLUTION: PROTECTING THE PULVERIZER

Explosion venting of the pulverizer is not allowed per NFPA 8503, so this equipment is best protected by either containment (tested to 200 psig), or an Explosion Suppression System. System operation follows these steps:

1) When a deflagration begins, it is preceded by a pressure wave. Patented Fike pressure detectors sense these waves in one millisecond (.001 sec.), and instantly send a signal to the control panel.

2) The control Panel receives the signal and issues a command to the suppressant container in less than one millisecond.

3) The suppressant container releases suppressant agent via a dispersion nozzle to suppress the explosion in a matter of milliseconds.

Note: Most systems require multiple detectors and suppressant containers.

Figure 2: Pulverizer Protected by Explosion Suppression
PROTECTING THE CONVEYING LINES

Connected duct work is best protected by a Chemical Explosion Isolation System. System operation follows these steps:

**CONTROL**
2) Control panel receives signal and issues command to suppressant container.

**DETECTION**
1) Detector senses pressure wave & sends signals to control panel.

**ISOLATION**
3) Chemical isolation container releases chemical isolation agent via dispersion nozzle. Explosion is isolated and prevented from traveling to other areas and causing further damage.
4) Mechanical isolation is an option for 24" diameter pipes and smaller.

Figure 3: Chemical Isolation Applied to Conveying Lines

PROTECTING THE DUST COLLECTOR/COAL STORAGE BIN

Dust collection and storage bins are best protected by either:
- Explosion Vents and/or an
- Explosion Suppression System

1) Explosion Vents are designed to open at a predetermined pressure setpoint. This relieves overpressure before destructive levels are reached.

2) Explosion Suppression System. (Operation described in Figure 2.)

Figure 4: Dust Collector Protected by Explosion Vents