



Coal Combustion Inc.
Understanding the business of coal

Coal Combustion School for Operators

Coal Quality Introduction

- Coal
- Moisture, Ash, Volatiles, Sulfur, Btu/lb
- Sizing, Slagging

Now we follow coal through the plant and examine how coal quality interacts with equipment performance, maintenance, and cost.

Wet Coal

- Causes
- Measurements
- Solutions

Dusty and Spontaneous Combustion

- Minimizing and controlling dust
- Clean up procedures
- Spon Comb potential
- Fire fighting and precautions

Combustion Process

- Coal Rank
- Air to fuel ratios
- Balancing furnaces
- Balancing burners
- NOx formation
- CO analysis

Pulverizers

- Basic operation
- Adjustments
- Coal Quality Impacts
 - Low Btu
 - High Ash
 - Reject material
 - High Moisture
 - Concern for fires
 - Impact of high air flow
 - Impacts on flame, NOx and SLAG

Boiler Efficiency and Heat Rate Variables

- Boiler Efficiency vs. Excess Oxygen
- Moisture and Hydrogen Impacts
- Higher vs. Lower Heating Value
- Exit Gas Temperatures
- Steam Temperature Impacts on Heat Rate
- Carbon and CO Losses

Ash Deposits - Introduction

Types of Ash Deposits

- Wall Slag
- Superheater Slag
- Convection Pass Fouling
- Low Temperature Deposits

Causes of Ash Deposits

- Fuel Related
- Equipment Related
- Design Related

Coal Testing

- The ASTM Fusion Temperature Test.
- Ash Levels
- Slagging and Fouling Indices.
 - Elemental loading
 - Pounds of iron per million Btu
 - Pounds calcium, sodium, and other elements
- Slagging with Bituminous Type Ash - High Iron
- Ash Chemistry
- Base to acid ratio, Slagging Index = $\text{Dry sulfur} \times \text{B/A}$
- Iron squared term

TABLE I - Major Causes of Ash Deposits

Fuel Related

Large pyrite particles that impact the furnace wall before they completely combust

Clay minerals that contain significant amounts of iron, calcium, sodium or potassium causing them to have low melting temperatures

Interaction of pyrite, clays and alkalis with alumino silicates to form low viscosity melts

Extremely fine or organically bound alkalis

Equipment Related

Soot blowers not in operation or used improperly

Poor pulverization of fuel

Improper air to fuel ratio

Burners damaged or improperly adjusted

Changes in operation of boiler or other equipment

Design Related

Furnace size too small for fuel

Tube material and/or spacing inadequate

Soot blowing coverage inadequate

No means provided to observe slag buildup

Soot Blowing

- Minimizing slags with combustion.
- Controlling slag with soot blowers
- Preventative blowers - IR
- Reactive blowers IK
- other soot blowing, air heater, SCR

How Slags and other Ash Deposits Cause Tube Leaks

- Furnace Corrosion
- High Temperature Corrosion
- Erosion
- Erosion and particle size and velocity

Pollution Control

- Ammonia Slip and NOX SCR
- Air Heater Pluggage and Leakage
- Pollution control equipment basics
- Particulate
- SO₂
- Mercury
- SO₃

Summary and Exam