

# Coal Quality and Combustion Workshop

## Class Outline

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Boiler Basics

Major components of PC - fired boiler

Coal Formation

What is Coal -

Coal Rank

Coal Mining

Surface

Deep

Out of seam dilution

Coal Washing

Drying coal

Transportation Impacts

Time and Climate

Barge Coal tends to gain moisture

Sampling coal and coal analyses

Sampling methods

The Good, The Bad and the Ugly

Good sampling is hard work

ISO, ASTM Sampling

Guidelines

Hand samples

Feeder and belt

Car top

Mechanical Sampling

Sampling systems

Augers

Core holes

## Terms

Proximate . Moisture, ash, volatile, fixed carbon (by difference)

Short Prox . Moisture, ash, sulfur, Btu/lb

Ultimate . Moisture, ash, sulfur, + carbon, hydrogen, nitrogen, oxygen (by difference)

## Coal Cost

Sold by the ton - \$/ton

Boilers want Calorific Value not tons

Evaluated by the Kcal or millions of Kcal (MMcal.)

## Coal Handling

Moisture plays a dominant role

Fines

What sizes are important?

Clays and mineral matter

Chemical additives

## Spontaneous Combustion

## Combustion

The three Ts in practice

Size the coal and add air!

Coal Reactivity

The Story of NOX

To minimize the formation of NOx

Post Combustion Control

Pulverizers

Coal properties

Coal fineness

Measurement Surface moisture HGI Coal size Heating value

Combustion Process

Coal Rank

Air to fuel ratios

Balancing furnaces

Balancing burners

NOx formation

CO analysis

Boiler Efficiency

Boiler efficiency vs. excess oxygen

Moisture and hydrogen impacts

Higher vs. Lower heating value

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

Analytical Procedures

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 fusion temperatures  
Advanced ash fusion techniques.

Ash Chemistry

Base to acid ratio

Slagging index

Dry sulfur x B/A

Iron squared term

Computer Controlled Scanning Electron Microscopy provide some of the best mineralogical information but has not come into common use.

Fouling Deposits

Chemical Fractionation

Active alkali

Water soluble

Ammonium Acetate soluble

Weak acid soluble  
Micro crystals

Cyclone and Wet Bottom Furnaces  
Deposit Analyses

Electrostatic Precipitator  
ESP Operation  
Equipment  
Airheaters pluggage and leakage  
Resistivity

Opacity

Trace Elements

Coal Specifications

Computerized Evaluations

Test Burns

Online Coal Analyzers

Conclusion