Sampling to Support Coal Blending

What is needed for Precise blending?

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Blending:

From Coal Preparation Manual - Leonard

*The primary objective of basic blending is to blend or thoroughly mix to maximize uniformity of a non-homogeneous material.*

This definition assumes that there is a competent way to control the in-feed from two or more sources and know the in-feed quality

Is this a realistic goal?
Coal Quality Managers at Mines

- Keep extensive spreadsheets of coals to be blended
- Update Daily
- On-Site Coal Lab
  - Likely use of accelerated analysis
  - Flexibility to react quickly - verify quality excursions
- Preparation Plant Testing
The reality of blending is:

Over-blending!
What are the major challenges to blending?

- Coal quality variability
- Coal availability
- Dozer operators not feeding consistently
- Batch loadouts with no scale on loadout in-feed belt
- Mass flow feed gates / Eccentric Feeders
- Overlap of coals in the storage piles
- Outdated facilities
What Measurements are needed to support blending?

- **Coal Quality**
  - Sampling to form database
  - Seams, various pits, known variability

- **Scales – Belt, Truck**

- **Feeder Control – What percents to use?**

- **Sampling to verify results**
As an inspector, tester or laboratory person the only thing I know with any relative certainty is:

When all is “perfect”
- Conditions
- Recommendations, manufacturer or inspector

A competent quality assurance plan includes verification of sampling analysis and weighing equipment and methods
7.2.2 **Condition of Preparation** - If there is any doubt as to the condition of preparation of the coal (for example, mechanically cleaned coal or raw coal), the number of increments for raw coal shall apply. For the purpose of application of the minimum number of increments in Table 1, **mechanically cleaned coal is defined as coal, which has been mechanically cleaned by a specific gravity process in all sieve sizes above No. 100 USA Standard.** Similarly, although a coal has been mechanically cleaned it may still show significant variation. For example, the coal may be a blend of two different portions of one seam or a blend of two different seams. In such cases where significant variation is possible, the number of increments should be as specified for raw (uncleaned) coal.
Types of Sampling – Mine Quality Control Sampling:

- **Core Sampling**
  - Pre and During Mining
  - Predicts long term quality i.e. monthly, semi-annually or longer time periods
  - Used to mathematically model the mine reserves
  - How useful is this day to day?

- **In-Pit Sampling**
  - Verify core sampling
  - Investigate unexpected variations

- **Production Accelerated Analysis**
  - From Clean coal sampler
  - Loadout Sampler
There are many techniques for blending and sampling/quality assurance to support blending

Some general concepts are:

- Determination of the quality of coal seams, blends or deliveries
- Segregating individual qualities of coal into bins, silos or stockpiles
- Ensuring that the out-flow from bins, silos or stockpiles can be controlled to blend to specification
BLENDING BENEFITS IN COAL OPERATIONS

• Reduces the Costly Safety Margin in Meeting Contract Specifications
• Maintains More Consistent Quality
• Obtain the Most Benefit From the Highest Quality Coal
• Enables the Competent Use of Low Quality Coal
• Improves the Efficiency of Coal Cleaning
Objective - Controlling Variation

All Coal Has Variability

An Acceptable Limit
Objective - Controlling Variation

STEP 1:
Narrow The Variation
(Standard Deviation)
Objective - Controlling Variation

STEP 2: Move The Mean Closer To The Limit
Objective - Controlling Variation

STEP 3: Maintain Consistency To The Limit
What are the blending targets?

- Never to be exceeded?
- Hourly averages?
- Daily Averages?
- Monthly Averages?
Types of Sampling – Mine Quality Control Sampling:

- Auger Sampling
Types of Sampling – Mine Quality Control Sampling:

- Conveyor sampling to stockpiles
Types of Sampling – Mine Quality Control Sampling:

- On-Line Analysis
Blending Case Studies:
Process Objectives and Economics go together
8,000 ton Flood Load Silo

- Filled 5,000 tons of high sulfur coal approx. 3 lb SO2
- Filled 3,000 tons of low sulfur coal <1% Sulfur
- The train loading began at approximately the time that the low sulfur coal (last 3,000 tons) began to be loaded into the silo.

**Problem:** SO2 Exceedance at the destination Power Plant

- Unloading of 80 car train – 10-12 cars/shift at Power Plant
- Coal not uniformly blended – no contract specification
- Now the plant is more closely monitored by EPA
Blending Using On-Line Analysis

Central Texas Captive Lignite Mine / Utility

- No on-site laboratory
- Analysis usually 48 – 72 hours
- Multiple Seams / Stockpiles / Endloader Blending!
- High Variability
- Forgiving unit
- High Ash is economic problem
- Cross-belt PGNAA unit
- Payback in load curve, gas co-firing, handling
Utility Application

- 3 Million TPY Burn
- Objective - 10% or 300,000 tons blend-in of much lower cost product
- $10/ton cost differential
- $3 million per year savings
- How much automation is needed?
- Manual vs. OLA?
Blending Using On-Line Analysis

**Mining Application**

- Two Qualities
  - Mine product – about 9% Ash
  - Stranded High Ash Product – about 30% ash.
- High ash product sold separately – as a mine product.
- $20/ton cost differential
- 100,000 tons of the High ash product mined annually
- Mine wouldn’t attempt to blend manually
- Using OLA to blend-in the high ash product - ~$2 million/year.
Questions?

www.sgs.com/coal