

REAL TIME ANALYSIS IN THE COAL INDUSTRY

Real time interrogation and analysis of coal makes it possible to quickly respond to changing conditions and efficiently control coal quality closely to meet operational or contractual specifications. Real time measurement systems generally include an online analyzer, an integrated mechanical sampling system for calibration of the analyzer and for collecting shipment or daily contract samples, and computer software for control of the material handling system on a real time basis. SGS recommends using online measurement systems that are robust to changes in coal seam or type, such as prompt gamma neutron activation analyzers which directly measure sulfur and ash mineral components on an as-received basis.

SGS is a leader in innovative and technologically advanced services related to real time measurement systems used in the coal industry. We provide clients with the knowhow to maximize their return on investment and gain operational efficiency.

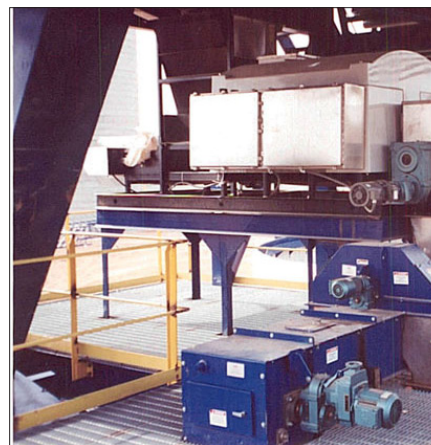
SYSTEM EVALUATION, ENGINEERING AND PROJECT MANAGEMENT

SGS engineers are experienced in designing and supporting on-line analyzer systems for the coal industry and can assure that a real time measurement system is designed to meet site specific requirements and in accordance with international standards and industry best practices. SGS technical experts will also install, commission and calibrate the system in accordance with specified standards. After start-up and acceptance,

the system can then be supported by experienced SGS personnel with a continuous calibration and surveillance program.

SGS assists clients in reaching logical decisions about the use of online analysis by:

- Carefully studying existing laboratory analysis data to develop criteria that must be met for the system to be considered acceptable. How accurate do the measurements need to be for the material passing during what interval of time? Is the main focus on directly measured results or inferred results? If inferred results, does the data indicate a good correlation with those characteristics that are directly measured by the analyzer?
- Developing consensus on reasonable expectations of analyzer performance. SGS has tested many online analyzers and consequently has experience with actual analyzer performance with various coals and conditions, independent of manufacturer claims.
- Clearly stating the expectations of analyzer performance in terms that can be measured and assessed during acceptance tests. This expertise will be used when preparing system and equipment specifications for our customers.



CALIBRATION AND ANALYZER PRECISION TESTING

The methodology developed and used by SGS staff is unique. In determining calibration parameters, measurement errors of both the analyzer and the physical sampling and analysis are taken into account. This avoids the biases inherent in ordinary least squares regression, which is based on the premise of no error in measurements of the independent variable. Unbiased estimates of calibration parameters and measurement precision are calculated using a latent variable statistical model. No assumption about the status of the current analyzer calibration during the initial test period is required.

When a special test is needed for formal recalibration or precision testing of the analyzer, SGS will:

- Prepare detailed test specifications.
- Perform the necessary sampling and inspection work.
- Prepare and analyze the test samples in the laboratory.
- Do the detailed statistical analysis.
- Provide a comprehensive report with results and calibration recommendations.

ON GOING SYSTEM SURVEILLANCE

An experienced SGS inspector will periodically perform on-site inspections of the analyzer and associated coal sampling system on a fixed schedule to collect reference block data and collect special samples used for on-going performance monitoring of the system. Shortly after the visit SGS provides a report detailing the calibration results, any deficiencies noted and drawing on our experience, offers recommendations for enhancements and improvements to the system and procedures.

SGS also does continuous surveillance by monitoring differences between shift, daily or shipment samples against analyzer results, using optimum statistical routines for detection of analyzer drift.



BENEFITS TO THE COAL INDUSTRY

COAL PRODUCERS

OUT-OF-SEAM DILUTION

Rock extracted with the coal (out-of-seam-dilution) lowers the value of mined coal and presents an ongoing challenge for preparation plant operators. By monitoring the as-mined coal with an on-line analyzer, the amount of out-of-seam dilution can be effectively controlled in real time. Better dilution control results in:

- Improve mine efficiency.
- Reduce shipping costs.
- Increase raw coal value.
- Increase prep plant yield.

COAL SORTING AND BLENDING

Traditionally, coal producers have used online coal analyzers to meet tight specifications for sulfur. However, given the power of on-line analyzer systems to sort coal and blend coal consistently and accurately based on multiple quality factors (sulphur, ash, moisture, the ash minerals, etc), there are many opportunities for coal producers to realize additional value.

Sorting raw coal based on quality many allow a portion of the coal that meets product specifications to be bypassed around the preparation plant, increasing plant yield and resulting in a more efficient and profitable operation.

The ability to reliably blend various coal qualities to arrive at a specific product allows the producer to:

- Blend poorer quality coals with high quality coals to more precisely meet contract specifications at minimum cost.
- Avoid quality penalties and rejected shipments.



POWER GENERATORS

Coal is a global commodity and individual power generators often purchase fuels of variable quality from many sources. This quality variability can present serious problems in power generation, including loss of generation and exceedance of air quality emission limits. A coal blending system controlled by a real time measurement system enables cost optimum use of various coals while maintaining the quality of coal fed to the boiler. SGS experts have developed unique conditional simulation methods for studying and engineering such coal blending applications that provide realistic outcomes that are used for economic evaluations.

REDUCING FORCED OUTAGES AND DERATES

Forced outages and derates due to coal quality related slagging and fouling of boilers are costly. Slagging occurs when molten or partly fused ash particles are deposited on convective surfaces in the lower regions of the boiler and fouling occurs when volatilized constituents within the coal deposit on convective surfaces in the upper regions. Excessive deposits are often difficult to remove and result in:

- Increased operation of soot blowing equipment, reducing boiler efficiency and increasing external tube surface erosion.
- Reducing the efficiency of heat transfer, thus reducing boiler efficiency.
- Periodic derating of the generating unit in order to remove the deposits.

By measuring ash constituents in real time and using the data to infer ash fusion temperatures it is often possible to blend coals and/or limit the use of certain coals so as to maintain ash fusion temperatures above the levels where significant slagging occurs. This reduction in slagging not only reduces derates and outages but also increases boiler efficiency. A one percent improvement in thermal efficiency typically results in a two to three percent reduction in CO₂ emissions. SGS experts are prepared to evaluate client data and determine the potential of improving generating unit equivalent forced outage rate (EFOR) and reducing CO₂ emissions by use of real time measurements.

Fuel Cost Savings through Coal Blending

Real time monitoring and control of coal quality characteristics allows precise adjustment of the quality of the coal being fed to the generating unit to match power output and meet emission requirements. Without real time control operators select a coal blend that will never cause the plant trouble. Often, for instance in the case of sulfur emissions control, this will result in the over use of the lower sulfur coal (usually the expensive coal) to insure permit requirements are never exceeded. With real-time quality control the use of higher value blend coals can be reduced hence reducing plant fuel costs.

CONCLUSION

Most sizeable operations that mine, process or use significant amounts of coal can likely benefit from using real time measurement systems. The process involved in providing real time analysis is complex and a full economic evaluation requires experienced engineers who understand the processes. SGS offers the coal industry world class technical expertise and experience in real time measurements and is prepared to assist clients in evaluating the use of real time measurements at the site of their choice.

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