

## ANALYTICAL SERVICES FOR COAL

SGS laboratories offers accurate, cost effective chemical analysis in accordance with international standards analytical services to the coal industry. We provide the testing you need whether you are a producer, transporter or consumer of coal. Many of our laboratories conform to recognized global standards such as American Society for Testing and Materials (ASTM), International Standards Organization (ISO) and Japanese Institute of Standards (JIS) for specific registered tests. Our qualified technicians operate in laboratories with state-of-the-art instrumentation, providing you with the utmost attention to accuracy, reputable methodology, and reliable operating procedures.

### QUALITY ASSURANCE

SGS' quality assurance program ensures our data meets international quality standards. We monitor quality through participation in industry and organizational programs, and our own, unique round robin program administered through the Institute for Inter-laboratory Studies. Our labs use concepts of Total Quality Management (TQM), which continuously refines laboratory processes based on continuous quality feedback. This ensures consistent operations on a daily basis.

SGS laboratories continually monitor analytical processes through the application of statistical process control (SPC). SPC involves plotting the results of chemical processes and using statistical methods to monitor, evaluate, and predict process behaviors. SPC is an effective tool that determines if process results are outside either the acceptable range for the chemical process or outside the quality standards our labs adhere to. Problems are detected and remedied promptly to ensure analytical accuracy.

### COAL ANALYSIS CAPABILITIES

SGS provides the following analytical services for our customers:

- Proximate (moisture, ash, sulfur, volatile matter, calorific content)
- Ultimate (moisture, ash, sulfur, carbon, hydrogen, nitrogen, oxygen (by difference))
- Fusion temperature of ash
- Free Swelling Index
- Mineral analysis of ash
- Trade element analysis
- Forms of sulfur
- Equilibrium moisture
- Hardgrove Grindability Index
- Specific Gravity
- Oxidation Index
- Micron Particle Size Distribution
- Sieve analysis
- Metallurgical coke physical and chemical analysis
- Metallurgical coke heological and Petrographic Testing

### PROXIMATE ANALYSIS

#### MOISTURE (STANDARD METHOD: ASTM D3173, ISO 11722, AS1038.3 )

- Moisture is defined as the water that exists in the coal at the site, time, and under the conditions it is sampled. The amount of moisture in a sample is determined by measuring the loss in mass between an as-mined sample and one that has been heated under controlled conditions to drive off water not contained within the chemical structure of the coal.

#### ASH (STANDARD METHOD: ASTM D3174, ISO 1171, AS1038.3)

- The ash content of coal is the non-combustible residue left after carbon, oxygen, sulfur and water has been driven off during combustion. The remaining residue or ash is expressed as a percent of the original coal sample weight. The composition of this final ash differs from the inorganic constituents of the coal prior to



incineration due to chemical changes during combustion. The total mass of ash produced can differ somewhat from those obtained in power plant furnaces because of dissimilar incineration conditions.

#### ASH ELEMENTAL ANALYSIS

- Our technicians provide complete ash elemental analysis, identifying the following compounds in accordance with global industry standards: SiO<sub>2</sub>, CaO, Fe<sub>2</sub>O<sub>3</sub>, Al<sub>2</sub>O<sub>3</sub>, TiO<sub>2</sub>, K<sub>2</sub>O, Mn<sub>3</sub>O<sub>4</sub>, BaO, SrO, P<sub>2</sub>O<sub>5</sub>, and SO<sub>3</sub>. Ash elemental analysis performed by qualified SGS technicians will provide a quantitative evaluation of oxides that adversely affect the ash fusion temperature within your boiler, which leads to increased slagging and fouling problems.

#### ASH FUSION

- The ash fusion temperatures are determined in oxidizing and reducing atmospheres. Ash fusion data combined with the ash's elemental analysis can be used to develop empirical relationships between the ash chemistry and the ash softening temperatures.

#### SULFUR (STANDARD METHOD: ASTM D4239, ISO 351, AS1038.6)

- Sulfur content determinations help to evaluate the potential sulfur emissions from coal combustion, or for contract specifications purposes.

### **CALORIFIC VALUE (STANDARD METHOD: ASTM D5865, ISO 1928, AS1038.9.3)**

- The calorific value (or heat of combustion) of coal or coke is the heat liberated when the solid fuel undergoes complete combustion in oxygen. The fuel sample is burned in a bomb calorimeter and the total heat energy (in BTU/lb) is measured. This is a fundamental test in determining the quality of coal and coke.

### **VOLATILE MATTER (STANDARD METHOD: ASTM D4239, ISO 351, AS1038.3)**

- Volatile matter in coal refers to the components of coal, except for water, which are liberated at high temperature in the absence of oxygen under rigidly controlled conditions. The mass of volatiles liberated is determined through a before and after weight comparison. Generally volatile matter is highest in low grades of bituminous coals and lowest in hard coals such as anthracite. Volatile matter is a key component in the classification of coal and represents a real health and safety concern as coals high in volatiles have an increased risk of spontaneous combustion.

### **FIXED CARBON (STANDARD METHOD: ASTM D5142, ISO 17246)**

- The fixed carbon content of coal is determined by subtracting the percentages of moisture, volatile matter and ash from the original mass of the coal sample. In practical terms it is the solid combustible residue that remains after a coal has had the volatiles driven off. This differs from the ultimate carbon content of the coal because some carbon is lost in the combustion process as hydrocarbons within the volatile components. Fixed carbon is used as an estimate of the amount of coke that will be yielded from a sample of coal.

## **ULTIMATE ANALYSIS**

The ultimate analysis produces more comprehensive results than the proximate analysis and is used in the determination of the elemental composition of the coal

including moisture, ash, carbon, hydrogen, nitrogen, sulfur, and oxygen (by difference). Each element is determined through chemical analysis and expressed as a percentage of the total mass of the original coal or coke sample.

## **ADDITIONAL ELEMENTAL ANALYSIS**

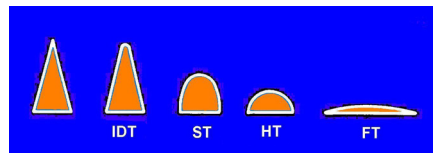
Elemental analysis is utilized to determine the exact percentage of specific elements by analytical chemical means in accordance with accepted industry standards. SGS will perform complete chemical analysis on the following additional elements at your request: arsenic, beryllium, boron, bromine, carbon dioxide, total chlorine, water soluble chlorine, fluorine, hexavalent chrome, inerts (silica), lead, mercury, phosphorus (on a coal or ash basis), selenium, sodium, potassium, sulfur forms, and tellurium.

## **TOXICITY TESTING**

SGS has the capabilities to provide you with complete toxicity analysis for your coal or coke. Quantitative measurements for the following elements can be determined in accordance with recognized national standards: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. In addition, we can perform toxic characteristic leaching procedure (TCLP) extraction analysis, which is used to determine the amount of metal in your coal or coke sample that is likely to be available for leaching into the environment.

## **METALLURGICAL COAL TESTING**

SGS provides a full suite of coal and coke tests, including the capability to coke coal samples in three different coking batch ovens. These capabilities are detailed in our Metallurgical Coal and Coke brochure.



## **WATER TESTING**

SGS has the capability of performing all the water testing required by the operators of coal facilities. Please contact your local coal laboratory for detailed information.

SGS is a global leader in laboratory analysis. SGS strives to maintain international benchmarks for quality and integrity throughout our analytical procedures. Our experienced technicians will provide you with the following chemical analytical services:

- Proximate analysis
- Ultimate analysis
- Calorific value
- Elemental analysis
- Toxicity testing

As your technical partner, SGS can help you maximize your capabilities and reduce the risks associated with coal and coke analysis.

### **CONTACT INFORMATION**

Email us at [minerals@sgs.com](mailto:minerals@sgs.com)  
[www.sgs.com/coal](http://www.sgs.com/coal)

**WHEN YOU NEED TO BE SURE**

**SGS**