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## INSPECTIONS & CONSULTING S.r.l.

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# INSPECTIONS & CONSULTING S.r.l.

*- Research & Development Department -*

*- Chemical Laboratory –*



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*We develop services tailored to our client's need*

Company Register n.112526/1998 – CF/P.IVA 00941640328 - Certified ISO 9001:2008, ICIM cert. n. 2149 – Accreditation ISO/IEC

17025:2005, ACCREDIA cert. n. 0503

## INDEX

	Page
1. The Company	3
2. Research & Development Department	4
2.1 Dustiness Determination	5
2.2 Cohesion Determination	6
2.3 Coal washing & sieving support	7
3. Chemical Laboratory	8
4. References of Main Clients	10
5. IN.CO. network	12

## 1. THE COMPANY

IN.CO. offers professional and qualified services in the mineral, oil and industrial fields including Quality Assurance, Quality and Quantity control and operative support through agent/representative personnel.

IN.CO. Head Office is based in Trieste, in the North-East of Italy: thanks to its strategic location, our company operates throughout Italy, Austria, Slovenia and Croatia and in the emerging East European Market.

Furthermore, IN.CO. is associated to a broad network of international companies worldwide, including 10 chemical laboratories, operating in 50 countries all over the world, in particular in North America.



## 2. RESEARCH & DEVELOPMENT DEPARTMENT

IN.CO. has established its own Research & Development Department operating in the environmental field, which focuses its activities on the development of the application of innovative technologies in the traditional manufacturing sectors, with the purpose of reducing pollution load.

IN.CO. Research & Development chemical Laboratory is one of the few Italian organization certified UNI EN ISO 9001:2008 and accredited UNI CEI EN ISO/IEC 17025:2005 (standard for testing and calibration laboratories required for coal discharges in Italy).

Over the years, IN.CO. has constantly developed new analysis methods to analyze and predict coal behaviour in different situations, to assess the environmental impact of coal treatment and to evaluate and solve functional and economic problems related to coal handling operations.

In particular, IN.CO. offers two innovative services in the field of coal quality control:

- Dustiness determination (according to the method EN 15051:2006);
- Cohesion determination;
- Coal Washing & Sieving Support.

These test methods are employed to successfully estimate if a specific type of material will cause problems during handling, transportation and storage operations.

IN.CO. Laboratory offers also a complete consulting service, which has been created to help the customers to better understand all test results and to provide a technical evaluation of materials properties.

## 2.1 DUSTINESS DETERMINATION

Dustiness is determined according to UNI EN 15051:2006 (Method B: Continuous drop down) *“Workplace atmospheres – Measurement of the dustiness of bulk materials – Requirements and reference test methods”*, identifying the potential of a given bulk material to produce airborne dusts when moved.

INSPECTIONS & CONSULTING S.r.l. conducted the first studies on dustiness in 2001, initially operating according to ASTM D 547-41 regulation – Standard Method of Test for Index of Dustiness for Coal and Coke – which, though, appeared obsolete and no longer suitable for the contemporary scientific environment. Several attempts were made to verify the possibility to complete innovative and accurate dustiness measurement tests. Prototypes were therefore produced for this purpose together with the University of Edinburgh and several other research centres, such as the University of Bochum, Germany.

This cooperation promoted the development of a method to determine and measure dustiness of bulk materials in compliance with EN 15051:2004 (D) regulation recently approved as **UNI EN 15051:2006**.

### Description of Dustiness Determination Method

The method used for Dustiness Determination is called C2D (Continuous Drop Down).

The test apparatus simulates the dust generation process during coal handling operations (involving conveying, discharging, filling, refilling, weighing, sacking, metering, loading and unloading and so on) in which dust is liberated through the rotational air stream produced by material impact.



Fig. 1 C2D test apparatus.

## Applications

The determination of inhalable and respirable dustiness mass fractions of coal can be used for several purposes:

- prevent the risk of high dustiness during discharging operations;
- classification of coals according to the tendency to produce dust;
- optimization of technical procedures, such as dosing of suppressants, to reduce or eliminate the dustiness problems.

## Database of obtained results

Thanks to the Dustiness determination method, IN.CO. Research & Development department has developed a database reporting all data collected during the analysis activity, created to provide a standard way to record and communicate the test results.

The database includes the index of breathable and inhalable fractions as obtained through several tests carried out on different materials such as coal, ashes, flour, different types of sand, aluminium-hydroxide, soot, pharmaceutical products, etc.

## 2.2 COAL COHESION DETERMINATION

Coal can contain fine particles of clay or other materials: in this case, the moisture present in the coal tends to migrate to the small interstitial spaces between the fine particles. Once this coal is compressed (stressed), these fine particles are compressed together and the surface tension forces in the moisture increase considerably. As the stress rises, this effect becomes progressively stronger. After the compression, the surface tension forces cause the coal to be held together in a solid mass even when the stress is not applied anymore.

The force holding together this unstressed coal is referred to as *cohesion* or *cohesional strength* and is measured as the effect of consolidation stress level on unconfined yield strength.

## Market opportunities

The method of cohesion determination applied by IN.CO. laboratory offers the following advantages to assess and solve functional problems related to coal handling operations:

- Monitoring of coal handleability on arrival at power stations as part of contractual agreement;
- Rapidity of tests, allowing real-time decision making;
- Characterization of handleability of different source coals available at mine (run of mine, stock, singles, filter cake etc.)
- Evaluation of coal potential to cause flow stoppages;
- Evaluation of coal potential to cause problems on arrival at stockpile;
- Monitoring of handleability properties of coal produced from preparation plants and blended for shipment to power stations.



Fig. 2 Cohesion test apparatus.

## 2.3 COAL WASHING & SIEVING SUPPORT

IN.CO. has carried out several research studies on behalf of international clients, with the intent of verifying the behaviour of different types of coal subjected to washing and sieving treatments.

Thanks to these studies, it has been possible to identify the variations in the chemical and chemo-physical composition of the different granulometric coal fractions, and also to evaluate the relevance of the “small” fractions in the quality of coal.

During the investigation, particular attention was given to the variation of the ash content in each granulometric fraction. For this purpose, IN.CO. has created a specific department for the study and the analysis of ash: the result of these researches have been used for the creation of industrial plants near mines and ports for coal washing and sieving operations.

### 3. CHEMICAL LABORATORY

IN.CO. Chemical Laboratory is one of the few Italian organizations certified **UNI EN ISO 9001:2008** and accredited **UNI CEI EN ISO/IEC 17025:2005** (standard for testing and calibration laboratories required for coal discharges in Italy): IN.CO. provides analyses and physical testing of solid and liquid fuels, and is particularly specialized in coal characterization. On a regular basis, the Laboratory takes part to Proficiency Testing Schemes (SABS) on coal chemical analysis in order to verify the performances of its instruments and its laboratory team, achieving consistently the most successful results.

Thanks to its strategic location and its consistent structural organization, IN.CO. is able to offer to its customers a wide range of dedicated and *competitive services just in time*.



## LIST OF THE TESTS ACCREDITATED

The tests marked by [A] are accredited by ACCREDIA, the Italian Laboratory Accreditation Body.

<b>COAL ANALYSIS</b>	
<b>Test</b>	<b>Method</b>
Carbon [A]	ASTM D 5373
Hydrogen [A]	ASTM D 5373
Nitrogen [A]	ASTM D 5373
Total moisture [A]	ISO 589 (Method B2)
<b>COAL, COKE AND PETROLEUM COKE ANALYSIS</b>	
<b>Test</b>	<b>Method</b>
Carbon [A]	ISO 29541
Hydrogen [A]	ISO 29541
Nitrogen [A]	ISO 29541
Ash	ASTM D 3174
Ash [A]	ISO 1171
Volatile matter	ASTM D 3175
Inherent moisture [A]	ASTM D 3173
Gross calorific value [A]	ASTM D 5865
Net calorific value [A]	ASTM D 5865
Gross calorific value [A]	ISO 1928
Net calorific value [A]	ISO 1928
Sulfur [A]	ASTM D 4239 (Method B)
Sulfur [A]	ISO 19579
Fixed carbon	ASTM D 3172
CO2 Factor (by calculation) [A]	Dec CE 18/07/2007 GU CE L229 31/08/2007 All I p.to 5.5
Chlorine	ASTM D 4208
Fluorine	ASTM D 3761
Boron	ICP/OES
Elemental analysis of ash	ASTM D 3682
Proximate Analysis by Instrumental Procedures (inherent moisture, ash, volatile matter and fixed carbon)	ASTM D7582
Proximate analysis (inherent moisture, ash, volatile matter and fixed carbon)	ASTM D 3172
Ultimate analysis (inherent moisture, ash, carbon, hydrogen, nitrogen and sulfur)	ASTM D 3176
Total Mercury	ASTM D 3684
Trace Elements	ASTM D 3683
Arsenic and Selenium	ASTM D 4606
<b>PETROLEUM COKE ANALYSIS</b>	
<b>Test</b>	<b>Method</b>
Total moisture [A]	ASTM D 4931
<b>COAL AND COKE PHYSICAL TESTING</b>	
<b>Test</b>	<b>Method</b>
Hardgrove grindability index	ASTM D 409
Ash fusion temperatures	ASTM D 1857

## 4. REFERENCES OF MAIN CLIENTS

- Coal quality and quantity control, chemical analysis, dustiness and cohesion determination for **ALPIO** Italy, Slovenia (Koper) and Croatia (Ploce);
- Coal quality and quantity control, chemical analysis for **AEM Trading in Italy**;
- Coal quality and quantity control, chemical analysis for **CARBOTRADE** in Italy;
- Coal quality and quantity control, chemical analysis for **Colacem** Italy;
- Coal quality and quantity control, chemical analysis for **Duferco** in Italy;
- Coal quality and quantity control, chemical analysis for **ENDESA** in Italy;
- Ferro alloy sampling and analysis for **BERTOLI SAFAU** Udine;
- Coal quality and quantity control, chemical analysis, dustiness and cohesion determination for **ENEL TRADE** since 1998 in Italy, Croatia, Indonesia, Slovenia and Spain;
- Coal quality and quantity control, chemical analysis for **ENERGY Coal** in Italy;
- Coal quality and quantity control, chemical analysis for **Glencore** in Italy;
- Coal quality and quantity control, chemical analysis for **ITALIANA COKE** in Italy;
- Ferro alloy sampling and analysis for **METALLCOM** - Napoli
- Coal quality and quantity control, chemical analysis for **SAIF Combustibili** in Italy;
- Coal quality and quantity control, chemical analysis for **Tirreno Power** in Italy;
- Coal quality and quantity control, chemical analysis for **UNICOAL** in Italy;

Laboratories involved in R & D projects:

- Research projects on radon together with the ARPA FVG – Regional Agency for Environmental Protection, Friuli-Venezia Giulia, Italy;
- Coal research projects together with the University of Trieste, Italy;
- Dustiness tests connected to coal together with the University of Bochum, Germany;
- Researches and tests on coal cohesion together with the University of Edinburgh, UK;
- Creation of new primary standard for the calibration of laboratory test devices together with the laboratory of SGS, North America.



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## 5. IN.CO. NETWORK

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### **AFFILIATED OFFICES IN ITALY:**

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Milan; Naples; Padua; Syracuse; Taranto; Turin; Udine.*

### **AFFILIATED OFFICES WORLDWIDE:**

*Austria; Brazil; China; Croatia; Czech Republic; France; Germany; Japan; Macedonia;  
Montenegro; Poland; Portugal; Romania; Russia; Slovakia; Slovenia; South Korea;  
Switzerland; Thailand; The Netherlands; Ukraine; United Kingdom; USA.*