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Coal — Guidance for sampling in coal preparation plants

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Contents

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see ~~www.iso.org/directives~~www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 27, *Coal and coke*, Subcommittee SC 1, *Coal preparation: Terminology and performance*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at ~~www.iso.org/members.html~~www.iso.org/members.html.

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Coal — Guidance for sampling in coal preparation plants

1 Scope

This document specifies recommended practices for sampling in coal preparation plants (CPPs).

The document is applicable to sampling of all coal product(s), reject material(s) and magnetite. The coal and mineral matter size covered by this document ranges from a nominal top size of 63 mm to 0,1 mm.

This document also covers larger sizes in the case of mechanical sampling. Manual sampling is not recommended for particle size larger than 63 mm.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1213-1, *Coal and coke — Vocabulary — Part 1: Terms relating to coal preparation*

~~ISO 8833, *Magnetite for use in coal preparation — Test methods*~~

ISO 1213-2, *Solid mineral fuels — Vocabulary — Part 2: Terms relating to sampling, testing and analysis*

ISO 7936, *Coal — Determination and presentation of float and sink characteristics — General directions for apparatus and procedures*

ISO 8833, *Magnetite for use in coal preparation — Test methods*

ISO 13909 (all parts), *Hard coal and coke — Mechanical sampling*

ISO 18283, *Coal and coke — Manual sampling*

ISO 20904, *Hard coal — Sampling of slurries*

AS 1038.21.1.1, *Coal and coke — Analysis and testing, Part 21.1.1: Higher rank coal and coke — Relative density — Analysis sample/density bottle method*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1213-1, ISO 1213-2, ISO 13909 ~~series,~~(all parts), ISO 18283, ISO 20904 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at ~~https://www.iso.org/obp~~https://www.iso.org/obp

— IEC Electropedia: available at ~~https://www.electropedia.org/~~https://www.electropedia.org/

3.1
boil-box
box or compartment installed in a piped flow stream, designed for very short residence time and vigorous turbulence of the flow-through stream, with a fully accessible weir overflow arrangement that the full stream shall pass over

3.2
by-line
side-stream~~,~~ or branch line ~~which~~that only ~~accommodated~~accommodates a portion of the total stream flow

3.3
diverter type sampler
device ~~which~~that temporarily diverts the full stream to a position accessible to full-stream sampling

3.4
full-stream sampler
sampling device ~~which~~that traverses the full extent of a flowing stream at constant speed

3.5
hindered bed separator
beneficiation device ~~which is~~ based on the principles of hindered bed settling

3.6
hydraulic separator
coal beneficiation device that uses water as the separation medium~~. Examples are spirals, hindered bed separators and water washing cyclones~~

EXAMPLE Spirals, *hindered bed separators* (3.5) and water washing cyclones.

3.7
partition curve
curve indicating the percentage of each density (or size) fraction contained in one of the products of the separation

3.8
point sampler
device that collects a sample from only one point within the flowing stream

3.9
pressure pipe sampler
variation of a *point sampler* (3.8)

3.10
RD_{50}
~~is the~~ cut-point~~,~~ being the exact relative density at which a separation into two fractions is desired or achieved~~.~~

3.11
supervisory control and data acquisition (SCADA)

user software interface for accessing process control setpoints, current and historical on-line parameter data~~ such as that from belt scales, pressure and level transducers, on-line ash analysers, motor amperages, etc~~

Note 1 to entry: Data come from belt scales, pressure and level transducers, on-line ash analysers, motor amperages, etc.

3.12
sampling implement
device used to collect or extract a sample increment

3.13
two-in-one slurry sampler
device ~~which~~that includes both primary and secondary slurry sampling apparatus

4 General principles and considerations

4.1 General

The objective of sampling is to collect a manageable quantity of material and use it to represent the total amount of material from which it was collected. This manageable quantity of material is called a sample. As the sample will be used to estimate the characteristics of the whole material from which it was collected, some important rules should be followed to ensure the sample is statistically representative of the population. This includes consideration of the location and time of sampling; type of sampling implements and volume of sample.

Results are required to be precise (of minimum scatter) and accurate (as close as possible to the true value) to generate information for decision making.

~~Annex A provides a table (~~Table A.1~~) that~~ in Annex A shows all major equipment found in coal preparation plants, the manual sampling technique that should be used for each, and where to find details on the technique in this document.

WARNING This document does not purport to address safety issues that ~~may~~can be associated with its use. It is the responsibility of the user to establish appropriate safety and health practices in line with site safety regulations and work health and safety legislation in the country where it is being used. It is highly recommended that clear safety instructions be provided to all staff involved, and a risk assessment be undertaken prior to conducting any sampling exercise.

4.2 Principles of sampling

Correct sampling in a coal preparation plant (CPP) should ensure that every particle and associated entity (e.g. water and medium) in the stream have an equal chance of reporting to the collected sample during the sampling process.

The full stream should be accessible to the sampling implement. It should be noted that incorrect sampling methodology will adversely affect the accuracy of the measured result. Depending on the stream nature, sampling methods ~~may~~can be categorized as follows:

a) sampling of dry or moist solids stream, e.g. screen discharge;

b) sampling of slurry stream, e.g. correct medium.

In addition, the sampling methods ~~may~~can be categorized depending on the purpose of sampling as:

— sampling for feed quality characterization;

— sampling for quality monitoring and control;

— -sampling for equipment/process performance evaluation, i.e. “special case” sampling.

It is recommended that each CPP maintain a sample point register, listing each sample point, the sampling implement required (photographs are helpful), the volume of sample collected per implement cut, and the usual number of cuts (increments) per sample. If special sampling implements are required, the fabrication drawings should be referenced in the register and filed for re-ordering purposes.

4.3 Objectives of sampling in coal preparation plants

4.3.1 General

Reasons for sampling include:

a) identification of process problems to assist formulation of solutions;

b) process auditing;

c) measuring process efficiency;

d) generating data for process modelling;

e) assessing coal quality;

f) providing reliable results for decision-making;

g) process control;

h) inventory accounting and reconciliation;

i) process evaluation.

The sampling method (location and time, sample mass, procedure etc.) will depend on the reason for sampling. Hence, the sampling objective(s) should first be clearly established. A decision tree will assist with choosing and implementing the best sampling method.

A sample is subject to certain preparation procedures that render it suitable for either physical testing or laboratory analysis. The type of tests or analyses that are performed are dependent on the characteristics required to categorize the material.

4.3.2 Determination of scope of sampling using a sampling decision tree

Before planning and carrying out sampling, it is necessary to determine the scope of the sampling exercise. The methods used, duration of sampling and sample volume will each depend on the sampling goal, i.e. what the user is looking to achieve. The decision tree in Figure 1 will assist with planning.

If sampling is for quality control, smaller sample masses may be used since individual samples may be analysed separately, for example, as a shift production sample, thereby generating many individual results over time. However, in the case of a process audit where only a single sample of each stream is collected, and the result of its analysis considered as final, then the sample taken should be larger, and will correspond to a composite of increments. Therefore, the sample requirement depends on whether the results of analysis are accumulated or singular.

When sampling for process performance investigations, requiring the calculation of size and/or density partition data, larger samples are required so that enough material is present for size analysis and/or float-sink testing.

For partition curve determinations, density tracers offer an alternative to methods based on coal sampling. Density tracers are synthetic particles of precise sizes, shapes, and densities. For separators with feed top size greater than 63 mm, they usually provide the only economically and practically viable technique. Known numbers of tracer particles of known sizes, shapes and densities are added to the feed of a density separator. After partitioning, they are collected from, or detected in, the product and reject streams~~;~~, and the partition number for each density class is calculated for reporting in a partition curve.

Coal sampling offers the following advantages:

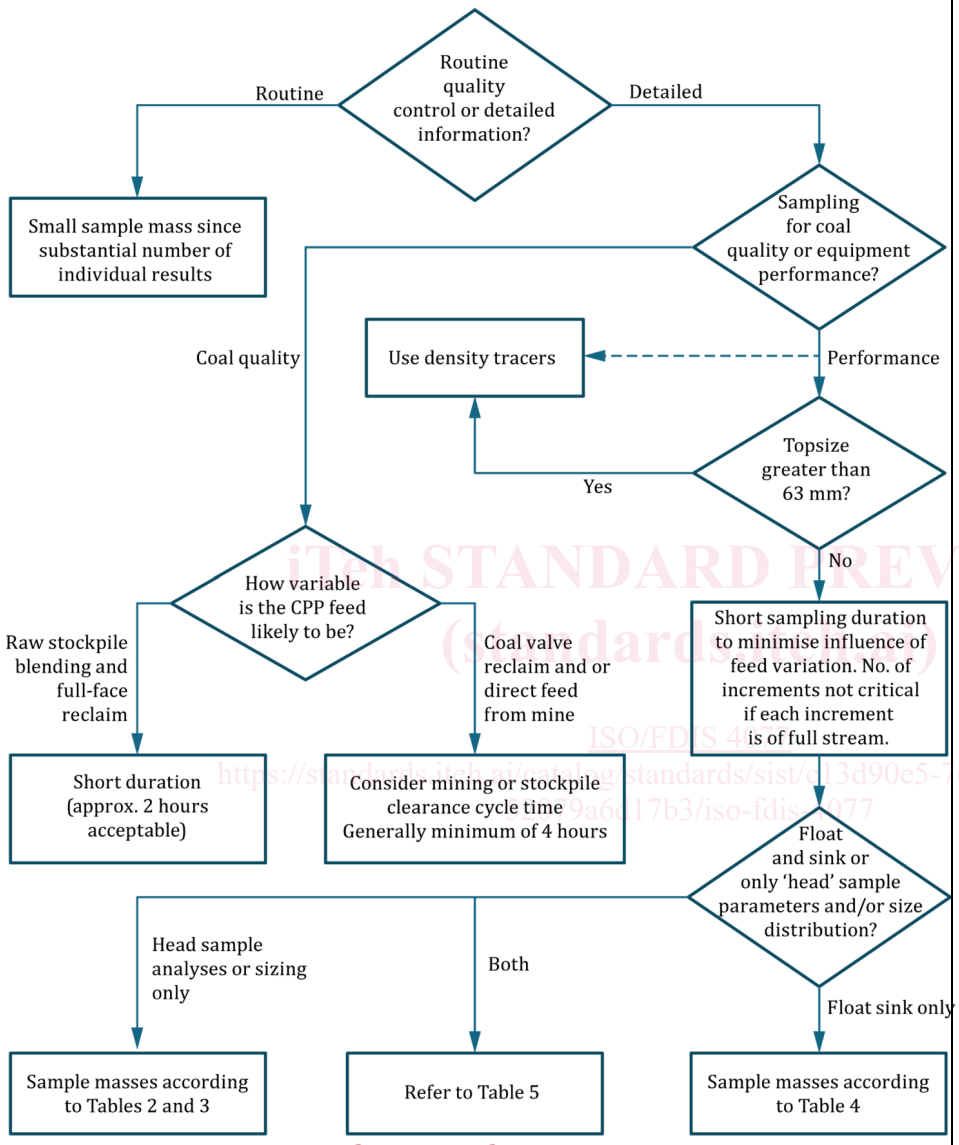
a) sampling facilitates measurement of process impacts for each size class of particles;

b) sampling facilitates fractionation and analyses of the resulting samples for any relevant coal quality parameter.

Density tracer tests typically only comprise a single size of tracer for any given test, but offer the following advantages:

— tracers facilitate a rapid result (no analysis requirements);

— tracers facilitate a rapid assessment of validity and possible error-range of result (based on tracer losses).



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