

---

---

**Coal — Selection of methods for the  
determination of trace elements —  
Guidance and requirements**

*Charbon — Sélection des méthodes de détermination des éléments  
traces — Recommandations et exigences*



This document is a preview generated by EUS



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2022

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

Page

<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Abbreviated terms</b> .....	<b>1</b>
<b>5 Discussion of methods</b> .....	<b>2</b>
5.1 General.....	2
5.2 Arsenic and selenium.....	2
5.3 Boron.....	2
5.4 Antimony, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, thallium, vanadium, zinc, thorium and uranium.....	2
5.4.1 General.....	2
5.4.2 Radionuclides.....	3
5.5 Chlorine.....	3
5.6 Fluorine.....	3
5.7 Mercury.....	3
<b>6 Use of certified reference materials</b> .....	<b>4</b>
<b>7 Calculation of results</b> .....	<b>4</b>
<b>8 Sensitivity</b> .....	<b>4</b>
<b>Annex A (informative) Scheme of analysis for trace elements</b> .....	<b>6</b>
<b>Annex B (informative) Alternative dissolution procedures for coal</b> .....	<b>7</b>
<b>Bibliography</b> .....	<b>8</b>

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 27, *Coal and coke*, Subcommittee SC 5, *Methods of analysis*.

This third edition cancels and replaces the second edition (ISO 23380:2013) which has been technically revised.

The main changes are as follows:

- The title has been changed to add "Guidance and requirements";
- Clause 9, Reporting of results including Table 2, Clause 10, Precision and Clause 11, Test Report, have been removed.

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](http://www.iso.org/members.html).

## Introduction

The determination of trace elements in coal and coke is becoming more important due to the considerable emphasis being placed on the effect of these elements on the environment. In order to have accurate and precise results for the analysis of trace elements, it is imperative that standard methods be available and that these methods be based on reliable procedures.

The objective of this document is to assist in the selection of the appropriate methods available to determine the common trace elements in coal.



# Coal — Selection of methods for the determination of trace elements — Guidance and requirements

## 1 Scope

This document provides guidance and requirements on the selection of methods used for the determination of trace elements in coal. The trace elements of environmental interest include antimony, arsenic, beryllium, boron, cadmium, chlorine, chromium, cobalt, copper, fluorine, lead, manganese, mercury, molybdenum, nickel, selenium, thallium, vanadium and zinc. The radioactive trace elements thorium and uranium can be added to this list.

This document does not prescribe the methods used for the determination of individual trace elements. The analysis of appropriate certified reference materials (CRMs) is essential to confirm the accuracy of any method used (see ISO Guide 33).

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

ISO 5725 (all parts), *Accuracy (trueness and precision) of measurement methods and results*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1213-2 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>
- IEC Electropedia: available at <https://www.electropedia.org/>

## 4 Abbreviated terms

AAS	atomic absorption spectrometry
AFS	atomic fluorescence spectrometry
CRM	certified reference material
GFAAS	graphite-furnace atomic absorption spectrometry
IC	ion chromatography
ICP-AES	inductively coupled plasma atomic emission spectrometry — often referred to as ICP-OES, i.e. inductively coupled plasma optical emission spectrometry
ICP-MS	inductively coupled plasma mass spectrometry
ISE	ion-selective electrode
XRF	X-ray fluorescence spectrometry