SLOVENSKI STANDARD
oSIST prEN ISO 13196:2025

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[Not translated]

Soil quality - Screening soils for selected elements by energy-dispersive X-ray fluorescence spectrometry using a handheld or portable instrument (ISO/DIS 13196:2025)

Bodenbeschaffenheit - Screening ausgewählter Elemente in Böden mit handhaltbaren oder tragbaren Röntgenfluoreszenzspektrometern (ISO/DIS 13196:2025)

Qualité du sol - Diagnostic rapide d'une sélection d'éléments dans les sols à l'aide d'un spectromètre de fluorescence X à dispersion d'énergie de type mobile ou pistolet (ISO/DIS 13196:2025)

Ta slovenski standard je istoveten z: **prEN ISO 13196**

ICS:

13.080.10	Kemijske značilnosti tal	Chemical characteristics of soils

oSIST prEN ISO 13196:2025 **en,fr,de**

DRAFT International Standard

ISO/DIS 13196

Soil quality — Screening soils for selected elements by energy-dispersive X-ray fluorescence spectrometry using a handheld or portable instrument

Qualité du sol — Analyse rapide d'une sélection d'éléments dans les sols à l'aide d'un spectromètre de fluorescence X à dispersion d'énergie portable ou portatif

ICS: 13.080.10

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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).

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).

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.

This document was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 3, *Chemical and physical characterization*.

This second edition cancels and replaces the first edition (ISO 13196:2013), which has been technically revised, not touching the principle and procedure designated in the first version.

The main changes are as follows:

— the details of measurement options have been made clearer;

— suitable materials for the equipment for sampling and sample preparation are indicated;

— more information is provided for users of the International standard on requirements for:

  — sieve;

  — sample cup;

  — basic operation of XRF spectrometers;

  — safety instructions;

  — sample preparation.

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.

Introduction

X-ray fluorescence spectrometry (XRF) using battery or active source-powered handheld or portable equipment is a quick method for determination of total elemental compositions of soil samples. Unlike laboratory analyses by inductively coupled plasma atomic emission spectroscopy (ICP-OES) and atomic absorption spectroscopy (AAS), handheld/portable XRF needs no digestion step to prepare a test solution to be analysed. Consequently, handheld/portable equipment of energy-dispersive XRF (ED-XRF) is suitable for the rapid on-site determination of selected elements, mainly heavy metals, in screening processes. When performing analyses at a site, it might be important to have information on the presence of an element (qualitative analysis) and also to obtain semiquantitative results. Typical elements that can be detected and measured are Cr, As, Se, Cd, Hg and Pb, depending on the instrument. It is often impracticable to carry out calibration using reference materials at a site to be investigated. In these situations, factory pre-set calibrations should be used. For quantitative results, complementary analysis by alternative means is required.

An ED-XRF exercise can comprise a single determination at one location, in accordance with the guidance in this document, several determinations, or a large number of determinations. How the results of multiple determinations are to be synthesized to address the objectives of the exercise, is outside of the scope of this document. See Annex B for examples of when screening with a handheld/portable ED-XRF spectrometer can be useful.

Where XRF analysers are being used to assess concentrations of soil contaminants which are harmful to humans and/or the environment, there may be applicable national regulations with frameworks of standards, guidance and codes of practice for such investigations.

This document does not aim to provide a strategy, tactics or methodology for environmental investigations, or human health assessments of potentially contaminated land or soil, nor does it provide any such strategies etc. for the assessment of mineral resources.

Adherence to this document does not demonstrate compliance with any national contaminated land investigation regulations.

Soil quality — Screening soils for selected elements by energy-dispersive X-ray fluorescence spectrometry using a handheld or portable instrument

WARNING — Soil samples can contain toxic contaminants. Avoid direct contact of soil samples with exposed parts of the body. Appropriate measures shall be taken to avoid ingestion and inhalation.

Exposure to X-rays can give rise to radiation burns throughout the body as well an increased risk of cancer among many other detrimental effects. XRF spectrometers are usually required to comply with national regulations. Those managing or supervising the use of such equipment are usually required to be qualified to do so in accordance with national regulations.

The XRF spectrometer to be used by following this document shall employ a fail-safe function to prevent the operator and the public from an inadvertent exposure to the X-ray beams. A security system for the spectrometer shall be installed as designated in IEC 62495 where only the permitted operators and supervisors of the spectrometer can activate it with a password given by the supervisors. Automatic X-ray irradiation block mechanisms shall also work when no samples are found by the spectrometer or human bodies are detected by an IR sensor equipped thereon. XRF users should engage a radiation protection officer to look at their proposed activity with the XRF spectrometer and provide informed advice on the safety implications of those proposals.

For *in-situ* analysis, a safe working area or controlled area should be established by signs and barriers, if necessary, in accordance with national health and safety guidelines in order to ensure bystanders are kept at a safe distance.

1 Scope

This document specifies the procedure for screening (3.5) soils for selected elements using handheld or portable equipment of ED-XRF. It addresses primary the application of this method or screening method (3.6) on-site, to obtain qualitative or semiquantitative data to assist decisions on a sampling strategy for detailed assessment of soil quality using laboratory methods of chemical analysis.

Note 1 Screening methods generally give qualitative or semiquantitative concentration values that mean concentration levels while the methods occasionally give quantitative results under specific or limited conditions. See 3.5 and 3.6 for the definitions and characteristics of screening methods.

Note 2 The higher the efforts for pretreatment used on soil samples, the better the analytical results can be expected (see e.g. Reference [11]).

This document does not explicitly specify elements for which it is applicable, since the applicability depends on the performance of the apparatus and the objective of the screening. The elements which can be determined are limited by the performance of the instrument used, the concentrations of particular elements present in the soil, and the requirements of the investigation in terms of the minimum concentrations of concern (e.g. guideline value).

Note 3 The XRF measurements of As, Cd, Co, Cr, Cu, Hg, Mo, Ni, Pb, Sb, Sn, V and Zn were validated as described in Annex A.

Note 4 Examples of when screening with a handheld/portable ED-XRF spectrometer can be useful are provided in Annex B.

This document does not provide guidance on how to use the equipment to provide quantitative data for use in detailed site assessments.

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/EN 12404, *Soil quality — Guidance on the selection and application of screening methods*

ISO 18227, *Soil quality — Determination of elemental composition by X-ray fluorescence*

IEC 62495, *Nuclear instrumentation — Portable X-ray fluorescence analysis equipment utilizing a miniature X-ray tube*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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/

3.1
XRF spectrometer
X-ray fluorescence spectrometer

3.2
handheld XRF spectrometer
XRF spectrometer which can be used for *in-situ* analysis by handheld operation

Note 1 to entry: Handheld XRF spectrometers are applicable to both *in-situ* measurements and measurements with sampling or post-sampling measurements where post-sampling measurement means application of determination methods including XRF to samples which are collected and pre-treated, if needed, at a site or in a laboratory.

3.3
portable XRF spectrometer
XRF spectrometer for samples taken out of a site, which can be carried to the site by hand

Note 1 to entry: Portable XRF spectrometers are applicable to post-sampling measurements.

3.4
fundamental parameter approach
method to obtain element composition through successive approximation of the theoretical X-ray fluorescence intensities to the measured X-ray fluorescence intensities

Note 1 to entry: The calculation of the theoretical X-ray fluorescence intensities is carried out based on assumed element composition, theoretical parameters and pre-determined sensitivity coefficients of the XRF spectrometer.

3.5
screening
application of any analytical semi quantitative method for exploratory analysis

[SOURCE: ISO/EN 12404:2021, 3.1]

3.6
screening method
method which is used (often on site) to quickly explore a given area including target parameter distribution or to test a set of samples and obtain data on sample characteristics

Note 1 to entry: It is not necessarily directly comparable with *reference methods* (3.7).

[SOURCE: ISO/EN 12404:2021, 3.2]