

# SVENSK STANDARD

## SS-EN ISO 13196:2015

Fastställt/Approved: 2015-10-21  
Publicerad/Published: 2015-11-03  
Utgåva/Edition: 1  
Språk/Language: engelska/English  
ICS: 13.080.10

---

**Markundersökningar – Screening av utvalda grundämnen i jord genom energidispersiv röntgenfluorescensspektrometri (XRF) med handhållet eller portabelt instrument (ISO 13196:2013)**

**Soil quality – Screening soils for selected elements by energy-dispersive X-ray fluorescence spectrometry using a handheld or portable instrument (ISO 13196:2013)**



# Standarder får världen att fungera

*SIS (Swedish Standards Institute) är en fristående ideell förening med medlemmar från både privat och offentlig sektor. Vi är en del av det europeiska och globala nätverk som utarbetar internationella standarder. Standarder är dokumenterad kunskap utvecklad av framstående aktörer inom industri, näringsliv och samhälle och befrämjar handel över gränser, bidrar till att processer och produkter blir säkrare samt effektiviserar din verksamhet.*

## Delta och påverka

Som medlem i SIS har du möjlighet att påverka framtida standarder inom ditt område på nationell, europeisk och global nivå. Du får samtidigt tillgång till tidig information om utvecklingen inom din bransch.

## Ta del av det färdiga arbetet

Vi erbjuder våra kunder allt som rör standarder och deras tillämpning. Hos oss kan du köpa alla publikationer du behöver – allt från enskilda standarder, tekniska rapporter och standardpaket till handböcker och onlinetjänster. Genom vår webbtjänst e-nav får du tillgång till ett lättnavigerat bibliotek där alla standarder som är aktuella för ditt företag finns tillgängliga. Standarder och handböcker är källor till kunskap. Vi säljer dem.

## Utveckla din kompetens och lyckas bättre i ditt arbete

Hos SIS kan du gå öppna eller företagsinterna utbildningar kring innehåll och tillämpning av standarder. Genom vår närhet till den internationella utvecklingen och ISO får du rätt kunskap i rätt tid, direkt från källan. Med vår kunskap om standarders möjligheter hjälper vi våra kunder att skapa verklig nytta och lönsamhet i sina verksamheter.

**Vill du veta mer om SIS eller hur standarder kan effektivisera din verksamhet är du välkommen in på [www.sis.se](http://www.sis.se) eller ta kontakt med oss på tel 08-555 523 00.**



# Standards make the world go round

*SIS (Swedish Standards Institute) is an independent non-profit organisation with members from both the private and public sectors. We are part of the European and global network that draws up international standards. Standards consist of documented knowledge developed by prominent actors within the industry, business world and society. They promote cross-border trade, they help to make processes and products safer and they streamline your organisation.*

## Take part and have influence

As a member of SIS you will have the possibility to participate in standardization activities on national, European and global level. The membership in SIS will give you the opportunity to influence future standards and gain access to early stage information about developments within your field.

## Get to know the finished work

We offer our customers everything in connection with standards and their application. You can purchase all the publications you need from us - everything from individual standards, technical reports and standard packages through to manuals and online services. Our web service e-nav gives you access to an easy-to-navigate library where all standards that are relevant to your company are available. Standards and manuals are sources of knowledge. We sell them.

## Increase understanding and improve perception

With SIS you can undergo either shared or in-house training in the content and application of standards. Thanks to our proximity to international development and ISO you receive the right knowledge at the right time, direct from the source. With our knowledge about the potential of standards, we assist our customers in creating tangible benefit and profitability in their organisations.

**If you want to know more about SIS, or how standards can streamline your organisation, please visit [www.sis.se](http://www.sis.se) or contact us on phone +46 (0)8-555 523 00**



Europastandarden EN ISO 13196:2015 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN ISO 13196:2015.

Denna standard ersätter SS-ISO 13196:2013, utgåva 1.

The European Standard EN ISO 13196:2015 has the status of a Swedish Standard. This document contains the official English version of EN ISO 13196:2015.

This standard supersedes the Swedish Standard SS-ISO 13196:2013, edition 1.

© Copyright/Upphovsrätten till denna produkt tillhör SIS, Swedish Standards Institute, Stockholm, Sverige. Användningen av denna produkt regleras av slutanvändarlicensen som återfinns i denna produkt, se standardens sista sidor.

© Copyright SIS, Swedish Standards Institute, Stockholm, Sweden. All rights reserved. The use of this product is governed by the end-user licence for this product. You will find the licence in the end of this document.

*Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00. Standarder kan beställas hos SIS Förlag AB som även lämnar allmänna upplysningar om svensk och utländsk standard.*

*Information about the content of the standard is available from the Swedish Standards Institute (SIS), telephone +46 8 555 520 00. Standards may be ordered from SIS Förlag AB, who can also provide general information about Swedish and foreign standards.*

Denna standard är framtagen av kommittén för Karaktärisering av avfall, mark och slam, SIS/TK 535.

Har du synpunkter på innehållet i den här standarden, vill du delta i ett kommande revideringsarbete eller vara med och ta fram andra standarder inom området? Gå in på [www.sis.se](http://www.sis.se) - där hittar du mer information.



EUROPEAN STANDARD

**EN ISO 13196**

NORME EUROPÉENNE

EUROPÄISCHE NORM

July 2015

ICS 13.080.10

English Version

**Soil quality - Screening soils for selected elements by energy-dispersive X-ray fluorescence spectrometry using a handheld or portable instrument (ISO 13196:2013)**

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 (ISO 13196:2013)

Bodenbeschaffenheit - Screening ausgewählter Elemente in Böden mit handhabbaren oder tragbaren Röntgenfluoreszenzspektrometern (ISO 13196:2013)

This European Standard was approved by CEN on 16 July 2015.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

# Contents

Page

<b>European foreword</b> .....	<b>jj</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 Principle</b> .....	<b>2</b>
<b>5 Apparatus</b> .....	<b>2</b>
5.1 X-ray fluorescence spectrometer (XRF) .....	2
5.2 Container for sampling and preparation .....	2
5.3 Spoon .....	2
5.4 Sieve (optional) .....	2
5.5 Sample cup for portable XRF .....	2
5.6 Sample container for handheld XRF .....	2
5.7 Drying device (optional) .....	2
<b>6 Procedure</b> .....	<b>3</b>
6.1 General .....	3
6.2 Performance check of instrument .....	3
6.3 Calibration .....	3
6.4 <i>In situ</i> measurement .....	3
6.5 Analysis of soil with sampling .....	4
<b>7 Quality control</b> .....	<b>4</b>
7.1 Performance test by standard reference material .....	4
7.2 Energy calibration .....	5
<b>8 Test report</b> .....	<b>5</b>
<b>Annex A (informative) Precision data</b> .....	<b>6</b>
<b>Bibliography</b> .....	<b>12</b>

## European foreword

The text of ISO 13196:2013 has been prepared by Technical Committee ISO/TC 190 "Soil quality" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 13196:2015 by Technical Committee CEN/TC 345 "Characterization of soils" the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2016, and conflicting national standards shall be withdrawn at the latest by January 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

### Endorsement notice

The text of ISO 13196:2013 has been approved by CEN as EN ISO 13196:2015 without any modification.

## Introduction

X-ray fluorescence spectrometry (XRF) is a quick method for determination of total elemental compositions of soil samples. Unlike analyses by atomic absorption spectroscopy and inductively coupled plasma spectroscopy, XRF needs no digestion step to prepare a test solution to be analysed. Factory pre-set calibrations can be used. Consequently XRF is suitable for the rapid on-site determination of selected elements, mainly heavy metals in screening processes. Typical elements that can be analysed are Cr, As, Se, Cd, Hg and Pb, depending on the instrument. For *in situ* or abbreviated preparation analyses at a site, a battery-powered handheld or portable XRF equipment is required.

When performing analyses at a site, it might be important to have information on the presence of an element and also obtain semiquantitative results. It is often impracticable to carry out calibration using reference materials at the site to be investigated. In these situations, factory pre-set calibrations should be used.

This International Standard describes rapid methods for the on-site analysis of selected elements, including heavy metals, using battery-powered handheld or portable energy-dispersive XRF (ED-XRF).



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

**WARNING — Soil samples may 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 may give rise to dermal and haematological diseases. X-ray fluorescence spectrometers shall comply with national regulations relevant to radiation protection. At least one person involved in X-ray fluorescence analysis shall qualify for managing or supervising the operation of X-ray apparatus according to national regulations.**

## 1 Scope

This International Standard specifies the procedure for screening soils and soil-like materials for selected elements when handheld or portable energy-dispersive XRF spectrometers are used. This quick method is assumed to be applied on-site to obtain qualitative or semiquantitative data that assists decisions on further sampling strategy for assessing soil quality. The higher the efforts for pretreatment used on soil samples, the better the analytical results can be expected (see e.g. Reference<sup>[4]</sup>).

This International Standard 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 instruments used, the concentration of the element present in the soil, and the requirements of the investigation (e.g. guideline value).

For Hg, Cd, Co, Mo, V and Sb, a majority of instruments are not sensitive enough to reach sufficiently low limits of quantification (LOQ) to meet the requirements (limit or threshold values) set in the ordinances of different countries. In this case, other methods need to be employed to measure these low concentrations. Usually, wet chemical methods are used, based on *aqua regia* extracts, in combination with optical or mass spectrometric (MS) methods like atomic absorption spectrometry (AAS), inductively coupled plasma–optical emission spectrometry (ICP–OES) or ICP–MS.

## 2 Normative references

The following referenced documents are indispensable for the application 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 12404, *Soil quality — Guidance on the selection and application of screening methods*

EN 15309, *Characterization of waste and soil — Determination of elemental composition by X-ray fluorescence*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1

#### **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 X-ray fluorescence spectrometer.

### 3.2

#### **handheld XRF spectrometer**

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

### 3.3

#### **portable XRF spectrometer**

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

## 4 Principle

The concentration of selected elements in soil is determined using a handheld or portable XRF in the field. Element concentrations are measured after sampling and limited pretreatment or directly *in situ*.

## 5 Apparatus

### 5.1 X-ray fluorescence spectrometer (XRF)

Appropriate battery-powered handheld or portable energy-dispersive X-ray fluorescence spectrometer (ED-XRF).

### 5.2 Container for sampling and preparation

A plastic cup or tray that can accommodate a sufficient amount of soil sample. The plastic material shall be strong enough to hold aggregates while crushing them by pressing.

### 5.3 Spoon

A non-metal spoon (e.g. plastic, ceramic) to take soil samples from sites and to disaggregate the sample.

### 5.4 Sieve (optional)

A sieve of size 2 mm.

### 5.5 Sample cup for portable XRF

A plastic cup, which is suitable for the XRF-equipment to be used, having a window at its bottom made of polypropylene or polyethylene terephthalate. Alternatively, for heavy metals a plastic bag may be used. The concentration of target elements in the cup or plastic bag material shall be negligible.

### 5.6 Sample container for handheld XRF

Plastic container suitable for simple sample pretreatment and direct XRF measurement. The concentration of target elements in the container shall be negligible.

### 5.7 Drying device (optional)

A portable electric drying oven, hot plate etc. that are powered by batteries, a portable generator or a heater driven by exothermic chemical reactions, e.g. hydration of calcium oxide.

## 6 Procedure

### 6.1 General

Handheld XRF instruments can be used for direct *in situ* soil measurement to receive qualitative results. Handheld and portable XRF instruments in combination with limited sample pretreatment will give semiquantitative results.

If quantitative results are needed, a complete set of sample pretreatment with homogenization and particle size reduction is necessary (see EN 15309).

Before starting calibration and measurements, define the parameters to be analysed. Check if the level of concentration to be measured is within the working range of your instrument. Use the manufacturer's instructions and perform tests with samples of known composition.

For further details of sampling and measurement concepts, see ISO 12404.

### 6.2 Performance check of instrument

Before analysis, follow the instrument manufacturer's instructions for setup, conditioning, preparation and maintenance. Additionally, the performance control of the instrument has to be carried out at least once a day to ensure the stability of the instrument.

X-ray fluorescence spectrometry would have spectral overlap interferences. In order to confirm the performance of the instrument and interference-correction software, it is recommended that the instrument be tested by using multi-element reference samples having elemental compositions similar to those of actual soils.

### 6.3 Calibration

Usually, calibration is not necessary and the pre-installed manufacturer's calibration is sufficient. If specific calibration is needed, follow the manufacturer's instructions.

If site-specific calibration graphs are to be used, measurement shall be done under the same operation and sample conditions that were employed in the calibration. For samples having large or unknown matrix effects, a fundamental parameter approach is recommended.

### 6.4 *In situ* measurement

#### 6.4.1 Preparation of the measuring spot

Remove extraneous materials from the targeted spot and smooth the surface with a non-metal scoop or spoon.

#### 6.4.2 Spot or surface measurement

Start up the handheld XRF spectrometer following the manufacturer's instructions.

Hold and apply the XRF spectrometer to the levelled ground surface.

Carry out measurement, and read elemental composition of the target elements. Besides the qualitative information estimated, concentration levels can be obtained.

NOTE Be aware that basically elements on the surface and the outermost soil layer can be measured.