

Soil quality — Guidance on the determination of background values

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National foreword

This British Standard is the UK implementation of EN ISO 19258:2011. It is identical to ISO 19258:2005. It supersedes BS ISO 19258:2005, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EH/4, Soil quality.

A list of organizations represented on this committee can be obtained on request to its secretary.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

The text of ISO 19258:2005 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 19258:2011 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of an identical text or by endorsement, at the latest by December 2011, and conflicting national standards shall be withdrawn at the latest by December 2011.

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Endorsement notice

The text of ISO 19258:2005 has been approved by CEN as a EN ISO 19258:2011 without any modification.

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 19258 was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 7, *Soil and site assessment*.

Soil quality — Guidance on the determination of background values

1 Scope

This International Standard provides guidance on the principles and main methods for the determination of pedo-geochemical background values and background values for inorganic and organic substances in soils.

This International Standard gives guidance on strategies for sampling and data processing and identifies methods for sampling and analysis.

This International Standard does not give guidance on the determination of background values for groundwater and sediments.

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 10381-1, *Soil quality — Sampling — Part 1: Guidance on the design of sampling programmes*

ISO 10381-5, *Soil quality — Sampling — Part 5: Guidance on the procedure for the investigation of urban and industrial sites with regard to soil contamination*

ISO 11074:2005, *Soil quality — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11074 and the following apply.

3.1

background content

content of a substance in a soil resulting from both natural geological and pedological processes and including diffuse source inputs

3.2

background value

statistical characteristic (3.8) of the background content

3.3

contaminant

substance or agent present in the soil as a result of human activity

NOTE There is no assumption in this definition that harm results from the presence of the contaminant.

3.4

diffuse source input

input of a substance emitted from moving sources, from sources with a large area or from many sources

NOTE 1 The sources can be cars, application of substances through agricultural practices, emissions from town or region, deposition through flooding of a river.

NOTE 2 Diffuse source input usually leads to sites that are relatively uniformly contaminated. At some sites, the input conditions may nevertheless cause a higher local input such as near the source or where atmospheric deposition/rain is increased.

[ISO 11074:2005]

3.5

pedo-geochemical content

content of a substance in a soil resulting from natural geological and pedological processes, excluding any addition of human origin

NOTE It may be hardly possible to determine the precise pedo-geochemical content of certain substances in a soil due to anthropogenic diffuse contamination.

3.6

pedo-geochemical background value

statistical characteristic (3.8) of the pedo-geochemical content

NOTE Any estimate of pedo-geochemical background value will be prone to a certain amount of error given the uncertainty associated with determining the pedo-geochemical content.

3.7

soil

upper layer of the Earth's crust composed of mineral parts, organic substance, water, air and living organisms

[ISO 11074:2005]

3.8

statistical characteristic

numerical value calculated from a variate of a chosen parameter of the population

EXAMPLE Examples of the statistical characteristics are the mean, the median, the standard deviation or the percentiles of the ordered frequency distribution.

3.9

study area

three-dimensional definition of the area where samples are to be obtained from and thus for which the background value(s) are to be estimated

3.10

support

size, shape and orientation of a soil sample

NOTE For the purpose of analysing spatial variation in soils geostatistically (by estimation of the variogram of a soil property), the support should be the same at each sampling site.

3.11

variate

set of observed values of a variable

EXAMPLE A variate could for instance be the series of numbers of the concentration of a substance in soil or numerous, individual soil samples.

4 General

Soils retain the evidence of their past history including impacts due to natural events or human activities. Chemical impacts related to human activities can be detected in soils all over the world, even in regions far from any source of contamination. For this reason, the background contents of inorganic and organic substances in soils consist of a pedo-geochemical fraction and an anthropogenic fraction. The ratio of these fractions varies widely depending on the type of substances, the type of soil and land use, and the kind and extent of external impacts.

For many inorganic substances, the background content of unpolluted soils is dominated by the pedo-geochemical content and consequently by the mineralogical composition of the soils parent material. Pedogenetic processes may lead to a redistribution (enrichment/impoverishment) and consequently to a horizon-specific differentiation of the substances within a soil profile. Persistent organic substances in soils originate more often from non-natural sources and therefore the background content of soils is governed by the kind and extent of diffuse contamination from non-soil sources.

In practice, it is often difficult to distinguish clearly between the pedo-geochemical and the anthropogenic fraction of the background content of soils. Nonetheless, a detailed knowledge of the background content as well as of its natural fraction for the substances of concern is essential both for any evaluation of the current status of soils for environmental or land use related aspects or just for scientific purposes within the scope of pedology or geochemistry. To this end, so-called background values in terms of the statistical characteristics of both, the pedo-geochemical and the anthropogenic fraction have to be determined.

A variety of different objectives can be identified for the determination of background values of inorganic and/or organic substances in soils. The objectives themselves provide insufficient information to define the technical programme that will produce the desired background values. Thus a number of technical approaches have to be defined which together form the basis of the technical programme.

This guidance provides essential aspects of sampling strategies and procedures, minimum requirements regarding the necessary steps and ways of sample pre-treatment, analytical methods and statistical evaluation procedures for determining sound and comparable background values.

Guidance is given for

- a) evaluating existing data from different data sources and
- b) setting up complete investigation programs aiming to compile background values for a clearly defined three-dimensional picture of the soil.

These situations are representing the two extreme starting positions for the process of compiling background values. In practice, a third intermediate situation may be dealt with when additional data need to be collected because the quantity or quality of the existing data is insufficient.

5 Procedures

5.1 General

The procedures to determine background values encompass aspects of sampling (strategy, procedure), soil analysis (pre-treatment, extraction and measurement), data processing and presentation. In general, two starting positions can be distinguished, namely

- a) the evaluation of existing data mostly from different data sources, and
- b) the collection of new data based on an appropriate investigation strategy.

5.2 Objectives and technical approaches

5.2.1 General

Before commencing any survey on background values in soils it is of crucial importance to define the objective of the survey and the related technical approach.

The objective is, in general terms, the definition of 'why' background values are to be determined. The technical approaches describe aspects like the 'where', 'what', 'how' and 'when'. Together the technical approaches determine the technical programme that will provide the required background values.

NOTE It should be noted that a technical approach that is fit for one objective, will often be unfit for other objectives.

The objectives for defining background values might be:

- to identify the current contents of substances in soils, e.g. in the context of soil-related directives;
- to assess the degree of contamination by human activities;
- to derive reference values for soil protection;
- to define soil values for reuse of soil material and waste;
- to calculate critical levels and tolerable additional critical loads;
- to identify areas/sites with atypically enhanced levels of element contents due to geogenic reasons or human impact;
- etc.

In order to meet the objective, the technical approaches might include the following.

- Definition of the substances and parameters
 - For example, the background values to be estimated may be the total heavy metal content or the bioavailable heavy metal content. (See 5.2.2)
- Definition of the study area
 - The (three-dimensional) definition of the area where samples are to be obtained from. This has to be a detailed description of what is to be considered as the study area, and what is not. (See 5.2.3.)
- Definition of the time period of interest:
 - Are the historical or current contents relevant for the objective? (See 5.2.4.)
- Definition of the size and geometry (support) of the area sampled at a sampling location. (See 5.2.5.)

5.2.2 Substances and parameters

Background values can be determined for all kinds of inorganic and organic substances in soils as well as soil characteristics. In practice, the more persistent and immobile compounds are of primary interest because of their potential to adsorb and accumulate in soil, whereas remobilization and intrinsic biodegradation are of less significance.

As well as the substances of concern, basic soil parameters and site characteristics (see 5.4.1.3) need to be provided to assist in interpretation of the contents of substances. A number of so-called basic soil parameters influence soil processes that affect the contents of inorganic and organic substances. Table 1 lists these parameters which should be analysed according to the given International Standards.