



BSI Standards Publication

Soil quality - Guidance on the determination of background values

National foreword

This British Standard is the UK implementation of EN ISO 19258:2018. It is identical to [ISO 19258:2018](#). It supersedes [BS EN ISO 19258:2011](#), which is withdrawn.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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© The British Standards Institution 2018
Published by BSI Standards Limited 2018

ISBN 978 0 580 89015 4

ICS 13.080.99

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 September 2018.

Amendments/corrigenda issued since publication

Date	Text affected
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EUROPEAN STANDARD

EN ISO 19258

NORME EUROPÉENNE

EUROPÄISCHE NORM

September 2018

ICS 13.080.99

Supersedes EN ISO 19258:2011

English Version

Soil quality - Guidance on the determination of background values (ISO 19258:2018)

Qualité du sol - Lignes directrices
pour la détermination des valeurs de
bruit de fond (ISO 19258:2018)

Bodenbeschaffenheit - Leitfaden zur Bestimmung
von Hintergrundwerte(ISO 19258:2018)

This European Standard was approved by CEN on 3 August 2018.

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Ref. No. EN ISO 19258:2018: E

European foreword

This document (EN ISO 19258:2018) has been prepared by Technical Committee ISO/TC 190 "Soil quality" in collaboration with 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of an identical text or by endorsement, at the latest by March 2019, and conflicting national standards shall be withdrawn at the latest by March 2019.

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

This document supersedes EN ISO 19258:2011.

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The text of [ISO 19258:2018](#) has been approved by CEN as EN ISO 19258:2018 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.

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).

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

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 7, *Impact assessment*.

This second edition cancels and replaces the first edition ([ISO 19258:2005](#)), which has been technically revised. The main changes compared to the previous edition are as follows:

- [Clauses 2](#) and [3](#), and subclauses [5.3](#), [5.4](#), [5.4](#) and [Annex B](#) (formerly Annex C) have been completely technically revised;
- 5.2.2 has been revised and the structure of its subclauses has been changed to [5.2.2.1](#), *Basic parameters*, [5.2.2.2](#), *Persistent compounds* (split up into [5.2.2.2.1](#), *Inorganic substances*, and [5.2.2.2.2](#), *Organic substances*), and [5.2.2.3](#) *Non persistent compounds* (added);
- text has been added to [5.2.5](#);
- “typological” has been replaced by “judgemental” throughout the document;
- “scale of sampling” has been deleted from [Annex A](#);
- the Bibliography has been updated.

Soil quality - Guidance on the determination of background values

1 Scope

This document gives guidelines for the principles and main methods for the determination of background values for inorganic and organic substances in soils at a local/regional scale. The site scale is excluded.

It gives guidelines for sampling and data processing strategies. It identifies methods for sampling and analysis.

This document does not apply to the determination of background values for groundwater and sediments.

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 11074](#), *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.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

background concentration

concentration of an element or a substance characteristic of a soil type in an area or region arising from both natural sources and anthropogenic diffuse sources such as atmospheric deposition

[SOURCE: ISO 11074:2015, 3.5.1, modified — In the definition, “an element or” has been introduced before “a substance” and “anthropogenic” has replaced “non-natural”. Note 1 to entry has been removed.]

3.2

background value

statistical characteristics ([3.8](#)) of the total (natural pedo-geochemical and anthropogenic) content of a substances in soil

Note 1 to entry: Commonly expressed in terms of average, typical, median, mode, a range of values or a background value.

[SOURCE: ISO 11074:2015, 3.5.2, modified — Note 1 to entry has been added from ISO 11075:2014, 3.5.1.]

3.3 diffuse source input

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

Note 1 to entry: In practice, two situations are commonly recognized: rural areas with diffuse source inputs typically from land spreading and aerial deposition; and urban areas where the diffuse source inputs come typically from traffic and industrial activities.

Note 2 to entry: Diffuse source input usually leads to sites that are relatively uniformly contaminated. At some sites, the input conditions can nevertheless cause a higher local input, such as near the source or where atmospheric deposition/rain is increased. Two types of main diffuse source input can be considered: one in rural areas (e.g. atmospheric deposits, spreading); and one in urban areas (e.g. traffic, industries).

[SOURCE: ISO 11074:2015, 3.3.9, modified — Note 1 to entry has been replaced with new text. The last sentence in Note 2 to entry has been added.]

3.4 pedo-geochemical concentration

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

Note 1 to entry: It is difficult to determine the precise pedo-geochemical concentration of certain substances in soil due to the presence of anthropogenic diffuse contamination.

3.5 pedo-geochemical background value *statistical characteristic (3.8) of the pedo-geochemical concentration (3.4)*

Note 1 to entry: Any estimate of pedo-geochemical background value is prone to certain errors given the uncertainty associated with determining the pedo-geochemical concentration.

[SOURCE: ISO 11074:2015, 3.5.9, modified — In the definition, “concentration” has replaced “content”.]

3.6 anthropogenic concentration concentration of a substance in a soil resulting from anthropogenic origin

3.7 anthropogenic background value *statistical characteristic (3.8) of the anthropogenic background concentration (3.1) of a substance in soils*

3.8 statistical characteristic numerical value calculated from a *variate (3.10)* of a selected parameter of the population

EXAMPLE Mean, median, standard deviation, standard error, percentiles of the ordered frequency distribution.

[SOURCE: ISO 11074:2015, 3.5.11, modified — “selected” has replaced “chosen” and “standard error” has been added in the example.]

3.9 study area three-dimensional definition of the area where samples are to be obtained from and, thus, for which the *background values (3.2)* are to be determined

[SOURCE: ISO 11074:2015, 5.2.29]

3.10 variate set of observed values of a variable

EXAMPLE Series of numbers of the concentration of a substance in soil; 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 determination of background values of inorganic and organic substances in soils consists 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 concentration is dominated by the pedo-geochemical concentration and, consequently, by the mineralogical composition of the soils' parent material. Pedogenetic processes can 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. Therefore, the background concentration 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 concentration of soils. Nonetheless, a detailed knowledge of the background concentration and its natural fraction for the substances of concern is essential for any evaluation of the current status of soils for environmental or land use related aspects, as well as 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 should 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 should be defined, which together form the basis of the technical programme.

This guidance identifies:

- essential requirements of sampling strategies and procedures;
- minimum requirements regarding the necessary steps and ways of sample pretreatment;
- analytical methods;
- statistical evaluation procedures for determining sound and comparable background values.

Guidance is given on:

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

These situations represent the two extreme starting positions for the process of compiling background values. In practice, there is also a third intermediate situation in which additional data are collected because the quantity or quality of the existing data are insufficient.

5 Procedures

5.1 General

The procedures to determine background values encompass aspects of sampling (e.g. strategy, procedure), soil analysis (e.g. pretreatment, extraction, 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;

- 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 that are determined. The technical approaches describe aspects such as the “where”, “what”, “how” and “when”. Together, the technical approaches determine the technical programme that will provide the required background values.

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 could be:

- to identify the current concentrations of substances in soils, e.g. in the context of soil-related regulations;
- 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 chemical substance contents due to geogenic reasons or human impact, etc.

In order to meet the objective, the technical approaches could include:

- definition of the substances and parameters, e.g. the background values to be estimated may be the total metal concentration or the bioavailable metal concentration (see [5.2.2](#));
- definition of the study area, e.g. the (three-dimensional) definition of the area where samples are obtained from, including 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, e.g. whether the historical or current concentration is relevant for the objective (see [5.2.4](#));
- definition of the size and geometry of the area to be sampled at a sampling location (see [5.2.5](#));
- definition of the pretreatment of the sample (see [5.4.2.2](#)) and the fraction of soil to be analysed.

5.2.2 Substances and parameters

5.2.2.1 Basic 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 substances are of primary interest because of their potential to adsorb and accumulate in the soil. Substances in which the concentration can be influenced by 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](#)) should be provided to assist in the interpretation of the concentrations of substances. A number of so-called basic soil parameters influence soil processes that affect the concentrations of inorganic and organic

substances. [Table B.1](#) lists these parameters, which should be analysed in accordance with the given International Standards.

5.2.2.2 Persistent compounds

5.2.2.2.1 Inorganic substances

Within the group of inorganic substances, trace elements (e.g. metals, micronutrients) are most often analysed (see [Table B.2](#)). While constituting an urban geochemical background, it is recommended to analyse the whole package listed in [Table B.2](#); most of these elements are found with high values due to human activities, but some minerals can appear with high value naturally.

Concerning the analytical methods, a distinction should be drawn between different extraction/preparation methods (see [Table B.2](#)), as very few methods determine the total concentration that could be needed, e.g. when calculating element stocks. Besides total concentrations, the (eco-) toxicologically more relevant mobile fractions (see [Table B.2](#)) are of increasing interest, e.g. if pathway-related questions are to be examined. An analysis of the parameters in [Table B.2](#) should be carried out in accordance with International Standards given in [Table B.2](#).

5.2.2.2.2 Organic substances

Surveys on organic substances usually refer to persistent compounds. The persistent organic contaminants listed in [Table B.3](#) are some of the more commonly encountered, but the list is not complete. Analysis should be carried out in accordance with the International Standards listed in [Table B.3](#). The list should be adapted according to the objectives of the determination of background values.

It is not recommended to sample and analyse non-persistent substances as they will not be detected by the laboratory because of their behaviour (e.g. volatilization, high degradation). These kinds of substances are normally analysed for detecting sources of contamination.

Various methods are used for the analysis of organic substances. The aim of these methods is usually to extract the greatest possible quantity of organic substances from soils. It is important to recognize that organic compounds can be extracted from naturally occurring organic materials (e.g. organic matter, decaying vegetation, peat, charcoal), and that non-specific analyses, in particular, can, therefore, give misleading results.

When collecting new data for determining background values, it is recommended that the investigation programme be designed with regard to additional questions that could arise in future. In most cases, carrying out new sampling campaigns is much more expensive than analysing additional substances in the first place. To this end, suitable storage of soil samples for subsequent analyses of organic or inorganic substances is of crucial importance. Besides the substances of concern (see [Tables B.2](#) and [B.3](#)) and additional soil parameters (see [Table B.1](#)), it is essential to provide a comprehensive site description (see [5.4.1.3](#)) for interpretation purposes. The documentation of all the actions taken is of utmost importance if the data measured are to be of use for other assessments in future investigations.

NOTE Guidance on the storage of soil samples is provided in [ISO 18512](#).

5.2.2.3 Non-persistent compounds

In some cases, generating background values on non-persistent substances could be of interest. Special care should be taken when volatile, degradable organic substances or transformable, inorganic species are the subject of the study. A detailed description and documentation of sampling and analysis is of particular importance in such cases. Storage or archiving of samples is not recommended because of the behaviour of such organic and inorganic species.