SLOVENSKI STANDARD
oSIST prEN ISO 19204:2022

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Kakovost tal - Postopek za oceno ekološkega tveganja onesnaženosti tal za posamezno lokacijo (pristop TRIAD za kakovost tal)

Soil quality - Procedure for site-specific ecological risk assessment of soil contamination (soil quality TRIAD approach) (ISO 19204:2017)

Qualité du sol - Procédure d'évaluation des risques écologiques spécifiques au site de la contamination des sols (approche TRIADE de la qualité du sol) (ISO 19204:2017)

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Soil quality — Procedure for site-specific ecological risk assessment of soil contamination (soil quality TRIAD approach)

Qualité du sol — Procédure d'évaluation des risques écologiques spécifiques au site de la contamination des sols (approche TRIADE de la qualité du sol)

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Foreword

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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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The committee responsible for this document is ISO/TC 190, *Soil quality*, Subcommittee SC 7, *Soil and site assessment*.

Introduction

This document is set up to ensure the quality of the site-specific ecological risk assessment of soil contamination. This process was described previously in a report by the Dutch PGBO (Integrated Soil Research Programme Agency), continued in the current SKB (Foundation for Soil Knowledge Development and Transfer)[69]. The present document is based on these Dutch reports but has been shortened in order to increase its general applicability. In addition, parts of the ecological risk assessment framework for contaminants in soil prepared by the British Environment Agency[21][22][23][24][25][26][27] were considered (this tiered framework does use the same three Lines of Evidence (LoE) as the TRIAD but not in parallel but consecutively). Experiences from various other sources[29][30][68], in particular, a summary of a Danish study performed as part of the EU FP6 project Liberation[36], as well as a Danish report[35], were added.

The term TRIAD relates to the following three LoE's: chemistry, toxicology and ecology[10]. Originally, it was described as Sediment Quality TRIAD by Long and Chapman[38]. The TRIAD does not particularly consist of three lines of evidence (up to five have been proposed[11]) but in specific situations, two might be sufficient. Descriptions of the soil quality TRIAD approach in the context of soil contamination are given, for example, in References [36], [40], [55], [59], [60], [63], [69], [71] and [73]. It should be mentioned that the soil quality TRIAD is not only used in Central Europe but also in other regions of the world, for example, in Portugal[1], Italy[67] or Brazil[44]. These publications can be used as case studies for the application of the soil quality TRIAD.

NOTE Recently, the ecological risk assessment procedures in The Netherlands, Norway, Sweden and the United Kingdom were compared[35]. The basic ideas of the TRIAD approach [e.g. a tiered approach and the combination of information from different disciplines (chemistry, ecotoxicology, and ecology)] have been accepted in these countries. However, only in the United Kingdom[21][22][23][24][25][26][27] and The Netherlands[40][43][53][58][60][61][63] have detailed frameworks been developed. The overall structure of this document combines and modifies both national frameworks in order to provide guidance independently from the country or region where the site to be assessed is located. The terminology of this document does follow the approach described in the EU project Liberation[36].

Soil quality — Procedure for site-specific ecological risk assessment of soil contamination (soil quality TRIAD approach)

1 Scope

This document describes in a general way the application of the soil quality TRIAD approach for the site-specific ecological risk assessment of contaminated soils. In detail, it presents in a transparent way three lines of evidence (chemistry, ecotoxicology and ecology) which together allow an efficient, ecologically robust but also practical risk assessment of contaminated soils. This procedure can also be applicable to other stress factors, such as acidification, soil compaction, salinization, loss of soil organic substance, and erosion. However, so far, no experience has been gained with these other applications. Therefore, this document focuses on soils contaminated by chemicals.

NOTE 1 This document focuses on ecological risk assessment. Thus, it does not cover human health end points.

In view of the nature of this document, the investigation procedure is described on a general level. It does not contain details of technical procedures for the actual assessment. However, this document includes references relating to technical standards (e.g. ISO 15799, ISO 17616) which are useful for the actual performance of the three lines of evidence.

In ecological risk assessment, the effects of soil contamination on the ecosystem are related to the intended land use and the requirements that this use sets for properly functioning soil. This document describes the basic steps relating to a coherent tool for a site-specific risk assessment with opportunities to work out site-specific details.

This document can also be used for the evaluation of clean-up operations, remediation processes or management measures (i.e. for the evaluation of the environmental quality after having performed such actions).

NOTE 2 This document starts when it has already been decided that an ecological risk assessment at a given site needs to be performed. In other words, the practical performance of the soil quality TRIAD and the evaluation of the individual test results will be described. Thus, nothing will be said about decisions whether (and if yes, how) the results of the assessment are included in soil management measures or not.

NOTE 3 The TRIAD approach can be used for different parts of the environment, but this document focuses mostly on the soil compartment. Comparable documents for other environmental compartments are intended to be prepared in addition (e.g. the terrestrial aboveground compartment) in order to perform a complete site assessment, based on the same principles and processes.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
stakeholder
person or party with an interest in the *soil quality* (3.21) of a potentially contaminated site

Note 1 to entry: The composition of the stakeholder group depends on the specific local conditions.

3.2
assessment criteria
criteria set up to decide if a site requires further investigation or other action (e.g. remediation)

Note 1 to entry: They can be drawn up by the *competent authority* (3.3), the *stakeholders* (3.1) and the investigators for the interpretation of the results of the soil quality TRIAD study before the investigation is carried out. Two criteria could be distinguished, namely:

a) threshold that marks the boundary between adequate and inadequate removal of uncertainties in the assessment;

b) threshold that marks the boundary between an effect that is considered acceptable and one that is not considered acceptable, based on a reference or a limit value.

Note 2 to entry: Assessment criteria are necessary for every collection of ecological conditions (for example, all species in a generic system, a key species or a protected species).

3.3
competent authority
part of the authorities that is responsible for the implementation of the soil clean-up operation

Note 1 to entry: Depending on the site and the country, the competent authority could be very different. The competent authority assesses investigation results and takes decisions via decrees about the severity and urgency of the soil contamination found. The competent authority also assesses the clean-up plans of the clean-up teams on their own initiative (for example, companies).

3.4
soil management
all the anthropogenic activities that influence the soil system at the site to be assessed

Note 1 to entry: This can include choices in *land use* (3.5) (e.g. groundwater level management, nature management, park management, loading with soil-contaminated substances).

3.5
land use
using the *ecosystem services* (3.8) that the soil provides

3.6
land user
person or group of people who uses the *ecosystem services* (3.8) of the soil, whereby in the role allocation, the larger spatial scales are generally represented by organizations, societal parties and authorities

3.7
ecological effect
change to an aspect of the ecosystem caused by anthropogenic *stress factors* (3.15)

Note 1 to entry: Changes [see also *assessment criteria* (3.2)] to an ecosystem as a result of the presence of contaminants are regarded as negative changes regardless of the direction. In this document, the three lines of evidence (LoE) in accordance with the soil quality TRIAD approach are required for the effect to be determined. In addition, the variation in space, time and parameters is also important. See also *type 1 error* (3.17).

3.8
ecosystem service
service that is (directly or indirectly) provided by an ecosystem

Note 1 to entry: The Ecosystem Service Approach is becoming more and more the theoretical basis for the definition of protection goals in the context of the risks of chemicals in the environment (e.g. EFSA 2012), including the risk assessment of contaminated soils (e.g. [2], [41], and [74]).

Note 2 to entry: Examples of ecosystem services that the soil provides to people are agricultural products, clean surface water, groundwater and drinking water, and a healthy environment in which to live. The provision of many of these services depends in many cases on the activity of diverse organism communities, e.g. degradation of contaminants in soil by microbes, meaning that groundwater is kept clean[75].

Note 3 to entry: Some soil functions (organic substance composition and degradation, natural self-cleaning ability of the soil and soil structure for a good rooting of vegetation and crops) are counted as ecosystem services in this context. In detail, four basic soil services are distinguished, namely, soil fertility, resistance to stress and adaptation, the soil as a buffer and reactor, and biodiversity. The Millennium Ecosystem Assessment[41] distinguishes at ecosystem level regulating services (regulation of ecosystem processes), provisioning services (products), cultural services (non-material benefits) and support services (for the provision of all the other ecosystem services).

3.9
generic assessment
assessment of a site using a general investigation method that is not geared to the properties of the site

3.10
site-specific assessment
assessment of a site using an investigation method that is partially geared to the properties of the site

Note 1 to entry: The assessment consists of a combination of generally applicable and possibly specifically developed (tailor-made) parts. The interpretation of the results of the investigation is site-specific and can be generalized only to a limited extent [see also *generic assessment* (3.9)].

3.11
site-specific model
description of the local ecosystem and of the intended *land use* (3.5) in terms of ecological conditions for this use, and of the nature and spread of the contamination

Note 1 to entry: This model makes it clear which exposure routes are relevant for aspects of the ecosystem that are needed for the *land use* (3.5). Suitable parameters can then be selected for the soil quality TRIAD study with optimum *weight of evidence* (3.20) and support[70].

3.12
uncertainty
degree of doubt about the assumptions or investigation results, to be broken down in the case of the assessment of the ecological risks of soil contamination into: communications uncertainty, model uncertainty (epistemic uncertainty), uncertainty because of variation and uncertainty in decision-making

Note 1 to entry: For the different types of uncertainty, see also Clause 5.

3.13
reference
part of a site, of a sample or of a group of literature data that acts as a benchmark for the effect scale (the baseline, measure or standard)

Note 1 to entry: It is a description of the condition of the soil in quantitative and qualitative terms that can be used as part of the measure for the *soil quality* (3.21) to be assessed. The ideal reference is identical to the site (or the sample) to be assessed, the only difference being that the *stress factor* (3.15) to be assessed is missing. Chemical, physical and biological aspects form partial aspects of the reference. For a site-specific application, site-specific details are needed to obtain an accurate reference. A reference is preferably chosen at the investigation site; measurements are then preferably taken at the same time as the samples/measurements to be assessed. If no comparable clean reference is available, the least contaminated sample can also be chosen (for example, in a gradient), on condition that the sample is regarded as being sufficiently representative to be used as a reference. A reference can also be based on samples of a comparable site elsewhere or on literature data (= virtual reference).

3.14
scaling
process in which measurement or model data are interpreted using a measure intended for this purpose

Note 1 to entry: When applying the *soil quality TRIAD* (3.16), assessment data are generated to ascertain an effect on the level of the ecosystem as quantitatively as possible. A practical, standardized scale runs from 0 to 1 or from 0 % to 100 %. 0 or 0 % represents no effect and 1 or 100 % represent the maximum theoretical effect at a high concentration of the contaminating substances. Sometimes, only a low level of quantitative scaling is possible, such as on an ordinary scale or on a 2 or 3 point scale (yes/no or yes/maybe/no). These low quantitative scaling methods can be used in a *weight-of-evidence (WOE)* (3.20) approach. Examples of scaling are given in, e.g. Reference [40].

3.15
stress factor
outcome of an anthropogenic activity that has a possible negative effect on the ecosystem, such as chemical soil contamination, overfertilization, desiccation or soil compaction

3.16
soil quality TRIAD
procedure for a site-specific ecological risk assessment, whereby the *weight of evidence (WOE)* (3.20) is made up of three independent lines of evidence (LoE):

1) a line of evidence based on environmental chemistry with data about concentrations of toxic substances being converted into the expected effect on the ecosystem,

2) a line of evidence based on measurements of the ecotoxicity in samples of the site with tests, and

3) a line of evidence based on observations of the ecosystem at the site that focus on demonstrating the effects caused by the contamination

Note 1 to entry: The total of these elements is more than the sum of the separate parts because the burden of proof is partly based on consistency between the elements.

Note 2 to entry: Descriptions of the approach of the soil quality TRIAD study applied to soil contamination are given in References [36], [40], [59], [60] and [63], among other places. For the choice of tests, see also ISO 17616.

3.17
type 1 error
judgment that unjustly concludes that there is an unacceptable effect

Note 1 to entry: The term comes from statistics. If there is a type 1 error, the assessment is based not on an actual unacceptable effect but on chance or a model error. The risk of a type 1 error occurring can be reduced by making more observations or by improving the model with the ecological aspects and indicators. This latter option can be achieved by choosing improved conditions and investigation parameters.

