SLOVENSKI STANDARD
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Kakovost tal - Modeli za domnevno onesnažena območja (ISO 21365:2019)

Soil quality - Conceptual site models for potentially contaminated sites (ISO 21365:2019)

Qualité du sol - Schémas conceptuels de sites pour les sites potentiellement pollués (ISO 21365:2019)

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Soil quality — Conceptual site models for potentially contaminated sites

Qualité du sol — Schémas conceptuels de sites pour les sites potentiellement pollués

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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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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*.

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

This document provides a definition of the conceptual site model (CSM) for contaminated sites consistent with other ISO standards related to contaminated land. It refers to ISO accepted terminology and generally accepted understanding of a CSM. Links with the ISO 18400 series of standards (*Soil quality — Sampling*) are made. It is applicable to the management of potentially contaminated sites, sites that are known to be contaminated, and also to land with naturally elevated concentrations of potentially harmful substances.

It provides general guidance on the application of CSMs, how they are developed and how they can evolve, with respect to all media, for example, air, surface water, sediments, soil, groundwater, soil gas, biota, subsoil, including buildings and other artefacts.

The CSM is a synthesis of all relevant information about a potentially contaminated site with interpretation as necessary and recognition of uncertainties. The description relies on the concept, of "source-migration pathway-receptor linkages" (sometimes termed « contaminant linkages ») that are, or might be, present.

The investigation of land potentially affected by contamination is usually performed using observations and measurements made on-site as well as by taking samples for laboratory analysis and testing. Soil and groundwater characteristics include a wide span of features, such as chemical and mineralogical composition, soil texture, the concentrations, amounts and distribution of contaminants and soil components. For practical and economic reasons, these investigations cannot cover the total volume of interest, and the on-site measurements and especially the sampling have to be limited to certain points or small areas/volumes.

Spatially limited investigations will give the best possible information if they are be planned thoroughly. The questions: "what are we looking for, and what can we expect?" are essential for developing an investigation programme that is efficient and fit for purpose. The best way to start the planning of the investigation is to formulate a CSM, based on a thorough preliminary investigation (desk study and site reconnaissance in accordance with ISO 18400-202) prior to any intrusive investigation.

Therefore, a CSM is a synthesis of information about the site together with some interpretation, assumptions, and hypotheses. By testing the assumptions and hypotheses, intrusive investigations can concentrate on the essential questions and data gaps, and can be planned and carried out more efficiently. Depending on the results of the intrusive investigation, the CSM can be developed further. It can become more detailed, more reliable, and often also modified or corrected, and step by step can lose its conceptual character, although remaining a model.

In the context of potentially contaminated land, a CSM is a tool that can be developed for the planning of an investigation, for undertaking a risk assessment, and for planning remediation and aftercare of a site. It can also be used for construction or other engineering works that are planned for after remediation. A CSM can be used when conducting environmental audits and "due diligence" exercises. The degree of detail needed for the CSM can depend on the objectives of any of these tasks, and the nature, current use and possible development of the site.

When preparing a CSM the terms that are being used should be carefully defined because terms might not be understood to have the same meaning by people with different backgrounds and experience. In addition, CSMs are intended to be of use to those without a technical background.

NOTE This document follows the established convention for documents published by ISO Technical Committee 190 (TC 190) in distinguishing between "contaminant" ("substance or agent present in an environmental medium as a result of human activity – see 3.2 in this document) and pollutant ("substance or agent present in the soil (or groundwater) which, due to its properties, amount or concentration, causes adverse impacts on soil functions" - see ISO 11074:2015, 3.4.18). Hence, "contamination" and "pollution" are not considered to be the same thing. However, it is recognised that this distinction is not always made at "official" level in all jurisdictions. Even in those jurisdictions where it is recognised, it might be for some purposes but not others and the definitions of "contamination" and "pollution" used in legislation and regulations for different purposes can differ. In addition, the use of the terms is not necessarily consistent between and even within guidance documents produced by government and professional bodies.

Soil quality — Conceptual site models for potentially contaminated sites

1 Scope

This document provides guidance on developing and using conceptual site models (CSMs) through the various phases of investigation, remediation (if required), and any subsequent construction or engineering works.

It describes what CSMs are, what they are used for and what their constituents are. It stresses the need for an iterative and dynamic approach to CSM development.

This document is intended to be used by all those involved in developing CSMs and by those who rely on using them such as regulators, landowners, developers, and the public (and other relevant parties). Ideally, this includes representatives from all phases of the investigative and remedial processes, for example, preliminary assessment, detailed investigation, baseline human health and environmental risk assessments, and feasibility study, and, any subsequent construction or engineering work.

NOTE 1 This document is applicable whenever the presence of "potentially harmful" or "hazardous" substances are present irrespective of whether they are naturally occurring or present due to human activity (i.e. are "contaminants").

NOTE 2 Although most of the principles described for developing CSMs in this document can apply to other domains, such as groundwater resources management, the present document is specifically written for the management of potentially contaminated sites or known contaminated sites.

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
anthropogenic ground
deposits which have accumulated through human activity

[SOURCE: ISO 11074:2015/DAmd 1:2019[1)]]

1) Under preparation. Stage at the time of publication: ISO 11074:2015/DAmd 1:2019.

3.2
conceptual site model
synthesis of all information about a potentially contaminated site relevant to the task in hand with interpretation as necessary and recognition of uncertainties

3.3
contaminant
substance or agent present in an *environmental medium* (3.4) as a result of human activity

Note 1 to entry: There is no assumption in this definition that harm results from the presence of the contaminant.

Note 2 to entry: ISO 11074:2015, 3.4.6 defines "contaminant" as "substance or agent present in soil as a result of human activity".

3.4
environmental medium
soil, underlying material, sediments, surface water, groundwater, soil gas, and air that can contain *contaminants* (3.2)

3.5
exposure pathway
path, route or other means, a *contaminant* (3.3) or hazardous substances from a particular source takes to a *receptor* (3.7)

Note 1 to entry: Each exposure pathway links a source to a receptor.

[SOURCE: ISO 11074:2015, 5.2.12 modified]

3.6
fill
anthropogenic ground in which the material has been selected, placed and compacted in accordance with an engineering specification

[SOURCE: ISO 11074:2015/DAmd 1:2019]

3.7
made ground
anthropogenic ground comprising material placed without engineering control and/or manufactured by man in some way, such as through crushing or washing, or arising from an industrial process

[SOURCE: ISO 11074:2015/DAmd 1:2019]

3.8
migration pathway
means by which *contaminants* (3.3) or hazardous substances from a particular source of contamination can spread or distribute

Note 1 to entry: A migration pathway does not necessarily link to a receptor.

3.9
pollutant
substance or agent present in an *environmental medium* (3.3), which, due to its properties, amount or concentration, causes adverse impacts on an environmental medium

Note 1 to entry: ISO 11074:2015, 3.4.18 defines "pollutant" as "substance or agent present in the soil (or groundwater) which, due to its properties, amount or concentration, causes adverse impacts on soil functions"

3.10
receptor
defined entity that is vulnerable to the adverse effect(s) of a hazardous substance or agent

Note 1 to entry: Receptors might include persons (e.g. trespassers, current and intended users, construction workers), other organisms or complete ecosystems, environmental media or artificial construction.

[SOURCE: ISO 11074:2015, 3.3.29, modified, note added]

3.11
source
place from which a *contaminant* (3.2) or hazardous agent is released

Note 1 to entry: ISO 11074:2015, 3.3.35 defines "source" as "place from which a substance or agent is released giving rise to potential exposure to one or more *receptor*" (3.7).

4 Basics

4.1 Structure of this document

The structure of this document is shown in Figure 1.

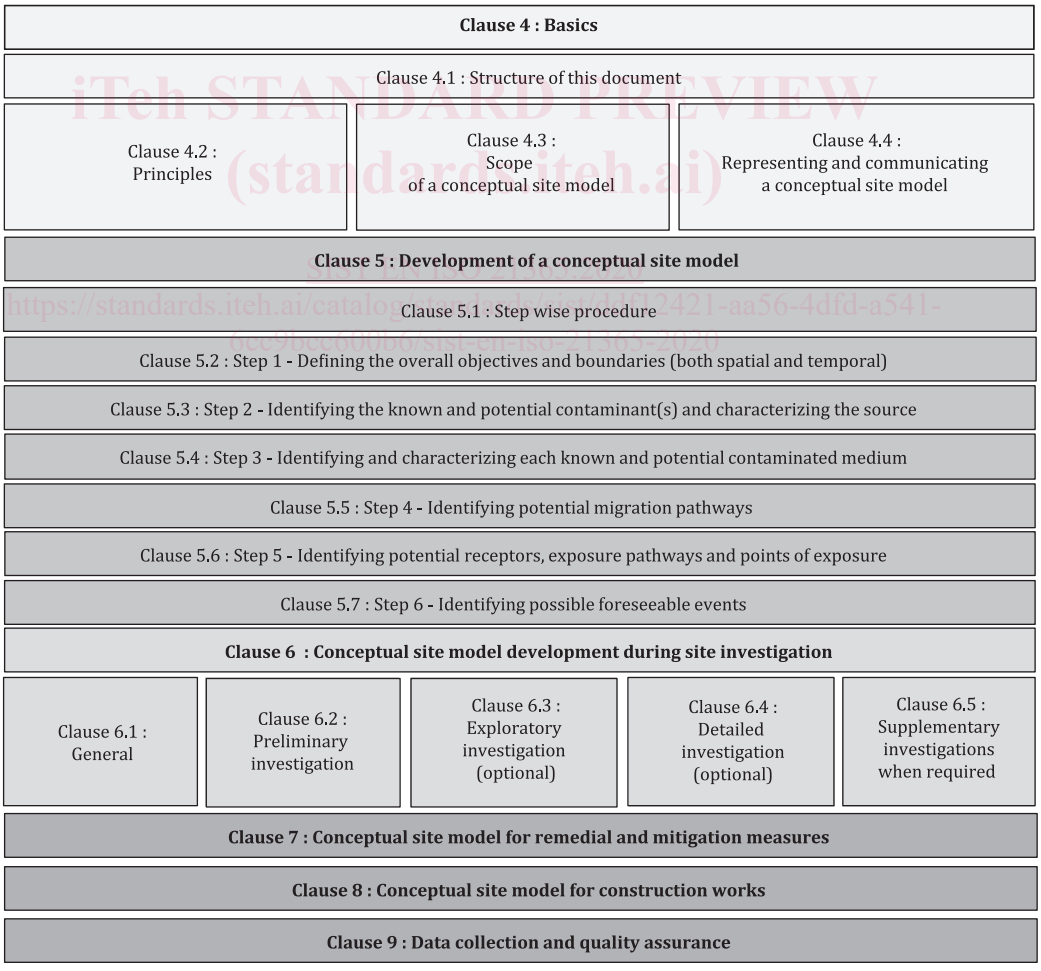

Figure 1 — Content of present document and interactions between the descriptive clauses

4.2 Principles

The conceptual site model (CSM) is a synthesis of all information about a potentially contaminated site or a site known to be contaminated, relevant to the task in hand with interpretation as necessary and recognition of uncertainties.

CSMs are important aids for the development of site-specific investigation programmes, the undertaking of site risk assessments, remediation design, follow up post remediation, and if necessary for subsequent construction on those sites that have been managed to deal with contamination. It is developed following a step-by-step approach (see Clause 5). Its preparation requires judgement by the person(s) preparing and developing the model.

Once, developed, a CSM should comprise all relevant information, including:

— past and present uses (see ISO 18400-202);

— intended future uses, included where known existing configuration and or future buildings/ infrastructure (e.g. basements, crawlspace under the floor of a building);

— the geological, geomorphological, hydrogeological and hydrological settings, soil, sediments, and air (indoor air and the atmosphere) of the site and surrounding area;

— the properties of the potential contaminants (e.g. volatility solubility, toxicity) and their sources, including distribution of contamination [e.g. plume of contaminant(s)], potential migration pathways (natural and anthropogenic features such as sewer lines) and transport mechanisms;

— potential receptors of the contamination;

— possibilities of new exposure pathways and new receptors associated with the construction and completion of a new development;

— foreseeable events [e.g. potentials for flooding (rivers, sea, groundwater), rising groundwater or seawater levels, extreme weather conditions, change of use, etc.].

The aim of a CSM can be, as appropriate, to:

— present the characteristics of the site;

— identify uncertainties and data gaps and act as a basis for designing further investigations and assessments;

— provides a basis for planning remediation and mitigation measures;

— provide a systematic review of where risks might potentially occur by summarizing possible direct and indirect exposure pathways;

— facilitate as a communication tool, the overall management of potentially contaminated site, e.g. to help in the decision-making process of experts in designing and planning all required actions;

— enable experts from all disciplines, clients, members of the public and regulators to communicate effectively with one another about issues concerning a site and facilitate the decision-making process.

CSM development should start as early in the site investigation process as possible. It should be an iterative process of refinement in which the uncertainties are recognized and reduced as more information becomes available (see Clause 6). The CSM can evolve as the results of investigations become available and remediation strategies are formed. Refinement of the CSM should continue through any remediation works and protective mitigation measures (see Clause 7). The planned use of a site following any remediation cannot always be known when the CSM is first developed. The CSM is likely to require review and possible extension following construction works and additional protective mitigation measures as these confirm expected site conditions or reveal new information (see Clause 8).

Eventually, the CSM should take into account all measures whose implementation can determine the final acceptability of the project, i.e. the total compatibility of site conditions and current or planned uses.

4.3 Scope of a conceptual site model

The complexity of a CSM should be consistent with the complexity of the site and available data and the purpose for which it is developed.

The formulation of CSM should make it possible to determine the linkages between:

— the potential sources of hazardous substances (see 5.3);

— the potential migration pathways, including the various transport mechanisms in each medium and their characteristics (see 5.4 and 5.5);

— the existing and/or future receptors that must be protected (see 5.6).

A CSM should:

— be developed for a defined purpose;

— be no more complex and detailed than required by the task in hand;

— identify uncertainties in the available information and in the conclusions.

A CSM should be prepared taking into account:

— the objectives of the investigation, or the purpose of the remediation (if required) and the purpose of any subsequent construction or engineering works;

— the reason(s) for preparing the CSM, e.g. to aid risk assessment, help communicate with interested parties, to plan remedial measures, or any subsequent construction or engineering works;

— uncertainties in the available data and other information.

The concerns of environmental risk assessment are different from those of human-health risk assessment. These differences are usually sufficient to warrant separate descriptions and representations of the CSM in the human health and environmental risk assessment reports. There can be elements of the CSM that are common to both representations. However, the risk assessors should develop these together to ensure consistency.

4.4 Representing and communicating a conceptual site model

The development of a CSM helps integrate technical information from various sources so it can be used to communicate effectively.

A fully developed CSM can be seen as a mental construct of all the gathered information (see the six steps in Clause 6). The CSM or one or several aspects of the CSM can be expressed or presented using one or more of the following approaches/representations:

— a text description of the site and all relevant features and processes;

— one or more maps of the site;

— one or more tabular or matrix description;

— one or more drawings or other diagrammatic illustration;

— a series of hypotheses to which qualitative probabilities can be attached.

For example, a diagram can be used to illustrate important examined questions on a potentially contaminated site. It can also help to identify and formulate what the risks are, i.e. understanding what