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Soil quality — Sampling —

Part 101: Framework for the preparation and application of a sampling plan

Qualité du sol — Échantillonnage —

Partie 101: Cadre pour la préparation et l'application d'un plan d'échantillonnage

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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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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 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 2, *Sampling*.

This first edition of ISO 18400-101, together with ISO 18400-104 and ISO 18400-107, cancels and replaces ISO 10381-1:2002, which has been technically and structurally revised. The ISO 18400 series is based on a modular structure and cannot be compared to ISO 10381-1 clause by clause.

A list of all parts in the ISO 18400 series can be found on the ISO website.

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Introduction

The characterization of soils and soil materials within the scope of this document, in terms of their potential environmental impact, or suitability for a particular use, requires a variety of tests to be performed. These tests may relate to the chemical, physical and biological properties of the soil or soil material. Validity of these tests requires performance on a representative sample or a number of representative samples.

The potential scope of an investigation programme can be complex; the process flowchart in Figure 1 defines seven key elements that make up the essential elements of the investigation programme. The principles outlined in this document provide a framework that can be used to design and develop a sampling plan, which is the first of the seven key elements. Other International Standards provide detailed instructions on how to complete the remaining key elements.

Before any investigation programme is devised, it is important that the objectives be first established since they are the major determining factors for the actual sampling, e.g. the position, density and depth of sampling points, time of sampling, sampling procedures, the acceptable levels of sampling uncertainty and the subsequent treatment of samples and analytical requirements. The details of an investigation programme depend on whether the information needed is the average value, the distribution, or the variability of given soil parameters.

The degree of detail and measurement uncertainty required and also to the manner in which the results are to be expressed and presented, for example, concentration of constituents, maximum and minimum values, arithmetic means, median values, etc. needs some considerations. Additionally, it is advisable to compile a list of constituents of interest and the relevant analytical procedures consulted, since these will usually give guidance on precautions to be observed during sampling and subsequent handling of soil samples. The investigation programme design often involves iterative discussion between the involved parties.

Given that complexity, a sampling plan is defined by the specific objectives of the investigation programme and how those objectives can be practically achieved with reference specifically to the sampling activities for the situation under investigation. The sampling plan provides simple and unambiguous instructions for the sampler, and as a consequence sampling is to be performed only when an approved sampling plan is available.

A large variety of sampling objectives exist, including the following:

— sampling of ex-situ soil (e.g. soil stockpiles) in order to estimate the (average) concentration of constituents in a specified quantity of soil material;

— sampling of agricultural, natural and near natural soils in the landscape in order to estimate the (average) concentration of constituents over a specified soil area and depth;

— sampling to determine chemical, physical or biological characteristics of the soil material;

— sampling of (potentially) contaminated sites in order to characterize and delineate the contamination and to estimate the risks for human health and the environment.

ISO 18400-104[1)] requires that a preliminary (phase 1) investigation comprising a desk study and a site reconnaissance is carried out before any sampling or other intrusive activities are carried out. The extent of the preliminary investigation will depend on the objectives of the overall investigation and the on-site activities expected will be required (see ISO 18400-202[1)].

It will often be necessary to carry out an exploratory (phase 2) investigation as described in ISO 18400-104[1)] before the final objectives for the detailed (phase 3) investigation can be defined.

It is important to take into account all relevant data from previous investigation programmes at the same or similar locations and other information on local conditions. Previous personal experience can

1) Under preparation.

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also be very valuable. Time and money allocated to the design of a proper investigation programme is usually well justified because it ensures that the required information is obtained efficiently and economically.

In addition to the design and development of a sampling plan, this document deals with the actual sampling in accordance with that sampling plan and it deals with the development of the sampling report. A sampling plan shows details of all the information pertinent to a particular sampling exercise.

The procedural elements that will be considered to complete key element 1 'The preparation and application of a sampling plan' are detailed in Figure 2. It is this process map that provides the basic framework for the practitioner developing a sampling plan to meet the requirements of any investigation programme. This document can be used to

— produce standardized sampling plans for use in more routine circumstances,

— incorporate the specific requirements of national legislation, and

— design and develop a sampling plan for use on a case-by-case basis.

This document is part of a series on sampling standards for soil. The role/position of the International Standards within the total investigation programme is shown in Figure 1.

Essential information for the application of this document and reference to all International Standards belonging to the ISO 18400 series is provided in ISO 18400-100. ISO 18400-100 will be updated on a regular basis as long as the International Standards of this series are under development.

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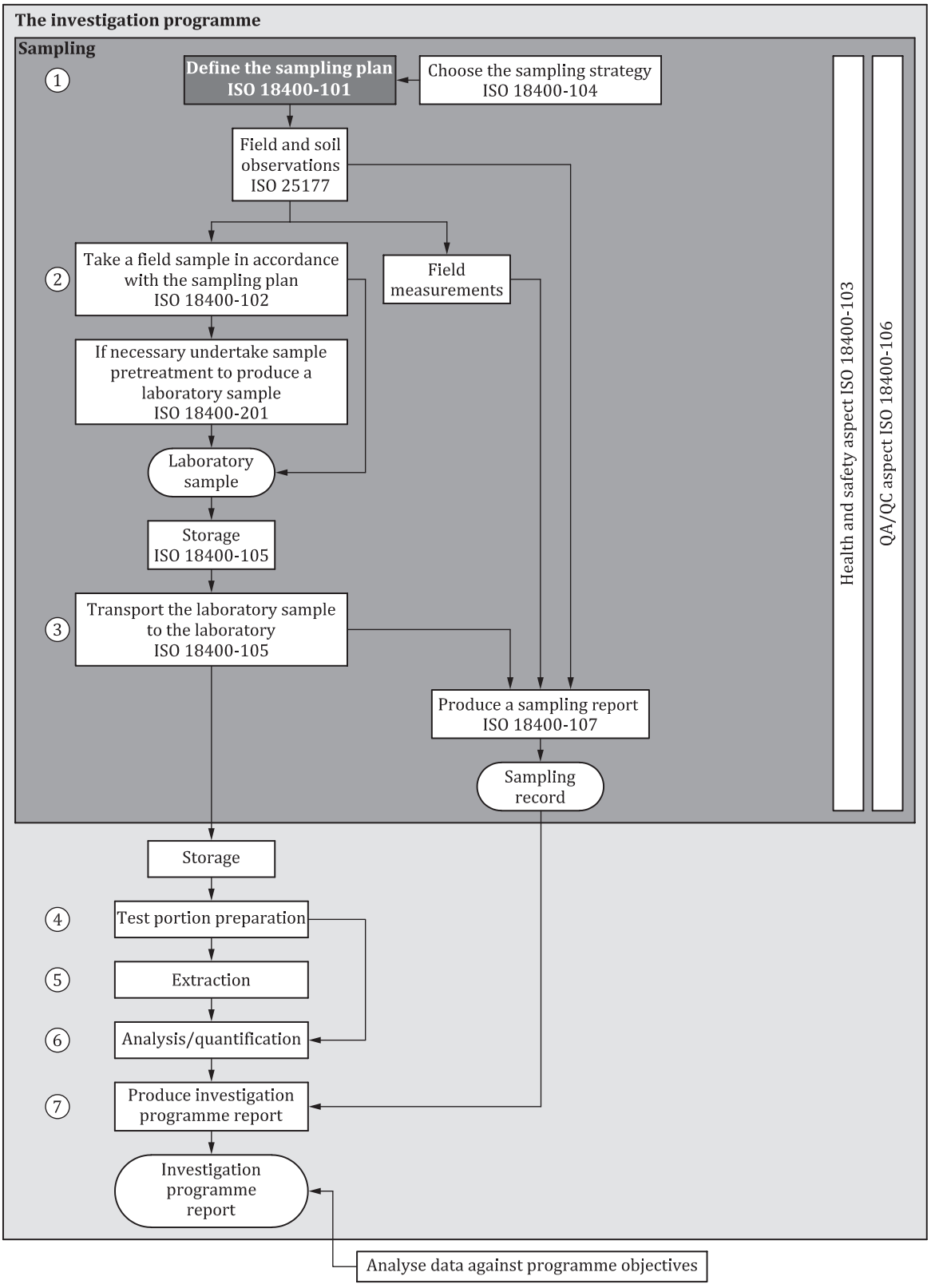


Figure 1 — Links between the essential elements of an investigation programme

NOTE 1 Numbers in circles define the key elements (1 to 7) of the investigation programme.

NOTE 2 Figure 1 displays a generic process which can be amended when necessary.

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Soil quality — Sampling —

Part 101: Framework for the preparation and application of a sampling plan

1 Scope

This document specifies the procedural elements to be taken in the preparation and application of a sampling plan. The sampling plan describes among other things what laboratory samples are to be taken, how they are to be taken and from where they are to be taken, in order that the objectives of the investigation programme can be achieved. The principles or basic rules outlined in this document provide a framework that can be used to

— produce standardized sampling plans for use in more regular or routine circumstances,

— incorporate the specific requirements of national legislation, and

— design and develop a sampling plan for use on a case-by-case basis.

This document is applicable to sampling of soil and soil material, more specifically, e.g.

— soil in the landscape,

— soil stockpiles,

— potentially contaminated sites,

— agricultural soils,

— landfills, and

— forest soils.

Ultimately, the sampling plan provides the sampler with detailed instructions on how sampling should be carried out.

NOTE 1 There might be a need for more than one sampling plan to meet all the requirements of the investigation programme.

NOTE 2 It might sometimes be appropriate to divide a site or above-ground deposit (e.g. stockpile) into two or more zones and to develop separate sampling plans for each zone. For example, a (potentially) contaminated site might be zoned on the basis of past use, future use, topography or geology and an agricultural site on the basis of known or suspected soil types or use (pasture, type of crops, etc.).

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*

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3 Terms and definitions

No terms and definitions are listed in this document.

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

4 Preparation of a sampling plan

4.1 Principle

A sampling plan should be completed prior to undertaking any sampling.

The principles laid out in this document can be used to produce a sampling plan for any investigation programme. A checklist for the sampling plan is provided in Annex A.

The essential elements of the investigation programme (see Figure 1) should be addressed when defining a sampling plan (see Figure 2). This standardized process can be used in the three situations as described in Clause 1.

By providing specific and practical instructions to the sampler, the sampling plan defines the boundaries and logistics of the sampling element of the investigation programme in an unambiguous way.

The sampling plan shall

a) meet the requirements arising from other key elements in the investigation programme,

b) set out the sampling design arrived at following consultation with involved parties (see 4.2.2),

c) provide specific instruction for when, where and how samples or increments are to be taken, the number of samples or increments to be taken and by whom they are to be taken,

d) provide specific instructions as to whether and how coarse grained and heterogeneous soil materials are to be sampled, and

e) provide all necessary health and safety precautions to be taken by the sampler (see ISO 18400-103).

NOTE 1 The specific details contained within any sampling plan will differ according to the objectives of the investigation programme.

In the process of defining a sampling plan, the specific objectives of the investigation programme are translated into practical instructions to the sampler. The sampling plan therefore details all the information pertinent to a particular sampling exercise and instructs the sampler how the sampling is to be carried out. Basically, the sampling plan specifies how the objectives of the investigation programme can be achieved for the situation under investigation. In order to facilitate the understanding of the sampling plan and allow the sampler to judge whether changes to the sampling plan can influence the quality of sampling, the sampling plan should normally specify the objective of the investigation programme, as well as the technical objectives derived from it.

NOTE 2 Biological sampling is very specific (see also ISO 18400-206[2)]).

NOTE 3 Figure 2 is mainly based on the assumption that samples will be used for chemical analysis. When other forms of testing are required, the key elements can be different.

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