INTERNATIONAL STANDARD

ISO 18400-301

First edition
2023-09

Soil quality — Sampling —

Part 301: Sampling and on site semi-quantitative determinations of volatile organic compounds in field investigations

Qualité du sol — Échantillonnage —

Partie 301: Échantillonnage et mesures semi-quantitatives sur site des composés organiques volatils dans le cadre d'investigations sur le terrain

Reference number
ISO 18400-301:2023(E)

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Published in Switzerland

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

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

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.

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Introduction

Soil samples, especially those containing volatile organic compounds (VOCs), are subject to change as a result of physical, chemical or biological reactions that can take place between the time of sampling and the start of the analysis. The nature and intensity of these reactions is often such that, if the necessary precautions are not taken during sampling, transport, storage and laboratory preparation, the determined concentrations will be different from what they were at the time of sampling.

VOCs are flammable and typically toxic, carcinogenic, narcotic, or otherwise harmful to humans and other biota and terrestrial and aquatic ecosystems, and can cause degradation of certain artificial materials, including plastics. Human exposure can be by inhalation, ingestion (direct and indirect) and dermal contact.

Volatile organic compounds (VOCs) are organic compounds that are volatile under normal environmental/atmospheric conditions, although they can be found in the ground in the solid, liquid and dissolved phase form as well as in the gaseous phase (ISO 11074:2015/Amd.1:2020[1], 6.1.25 modified).

A knowledge of how VOCs can be present in the ground (organic phase, adsorbed phase, dissolved phase and vapour phase), their distribution between soil matrix (i.e. solid, liquid and gaseous), and how they can behave in soil is important. This is necessary in order to reduce uncertainties and to understand how reliable determinations of concentrations in soil are likely to provide a realistic picture of potential risks in any particular situation but also to better design remediation strategies.

Research and field experience have shown that:

a) depending on the management context, some sampling techniques are giving reliable results while others can lead to underestimating results;

b) if soil samples for VOC analysis are incorrectly collected and handled during field sampling, storage and laboratory preparation, a significant proportion of the volatiles compounds can be lost.

Therefore, it is important that the applied sampling techniques, and procedures for conservation, packaging, transport, delivery to the laboratory and laboratory preparation are well chosen, in relation to the degree of accuracy expected.

The decision maker and project leader in charge of investigations are responsible for choice of a soil sampling method that will provide representative soil samples and reduce uncertainties for subsequent interpretation. The selection of appropriate techniques and procedures depends on the objectives of the investigations, the soil characteristics, the nature of the volatiles compounds being targeted and possible organizational constraints in the field. Such attention and care assists in the collection of representative samples so that the analytical results later provide a reliable basis for estimating potential risks. In general, investigations performed on a sample in the laboratory can provide evidence for the sample only. Whether this can be transferred to the soil or site of interest and how far it can be valid should be considered carefully; however this is not within the scope of this document.

The main objective of this document is to help all stakeholders (technicians, project leaders, owner, authorities and laboratories) carry out adequate determination of VOCs when VOCs are known to be present or suspected in the soil. It provides requirements and guidance on the selection of relevant methods that can be used for taking soil samples, minimizing in the process the possible loss of VOCs before, during and after collection of soil samples. This document distinguishes two main approaches to the collection of soil samples (in-situ sampling methods and ex-situ sub-sampling methods) and clarifies their use, their applicability and limits. The description of each method takes into account the physical, chemical or biological reactions that can occur in soil and how it influences VOCs determination. For example, this document can provide field operators, project leaders and laboratories, an overview of relevant methods for measuring VOCs concentrations in soil, that minimize the possible loss of VOCs before, during and after sample collection.

This document also lists the main measurement instruments for semi-quantitative determination of VOCs during soil sampling (e.g. photoionization detector).

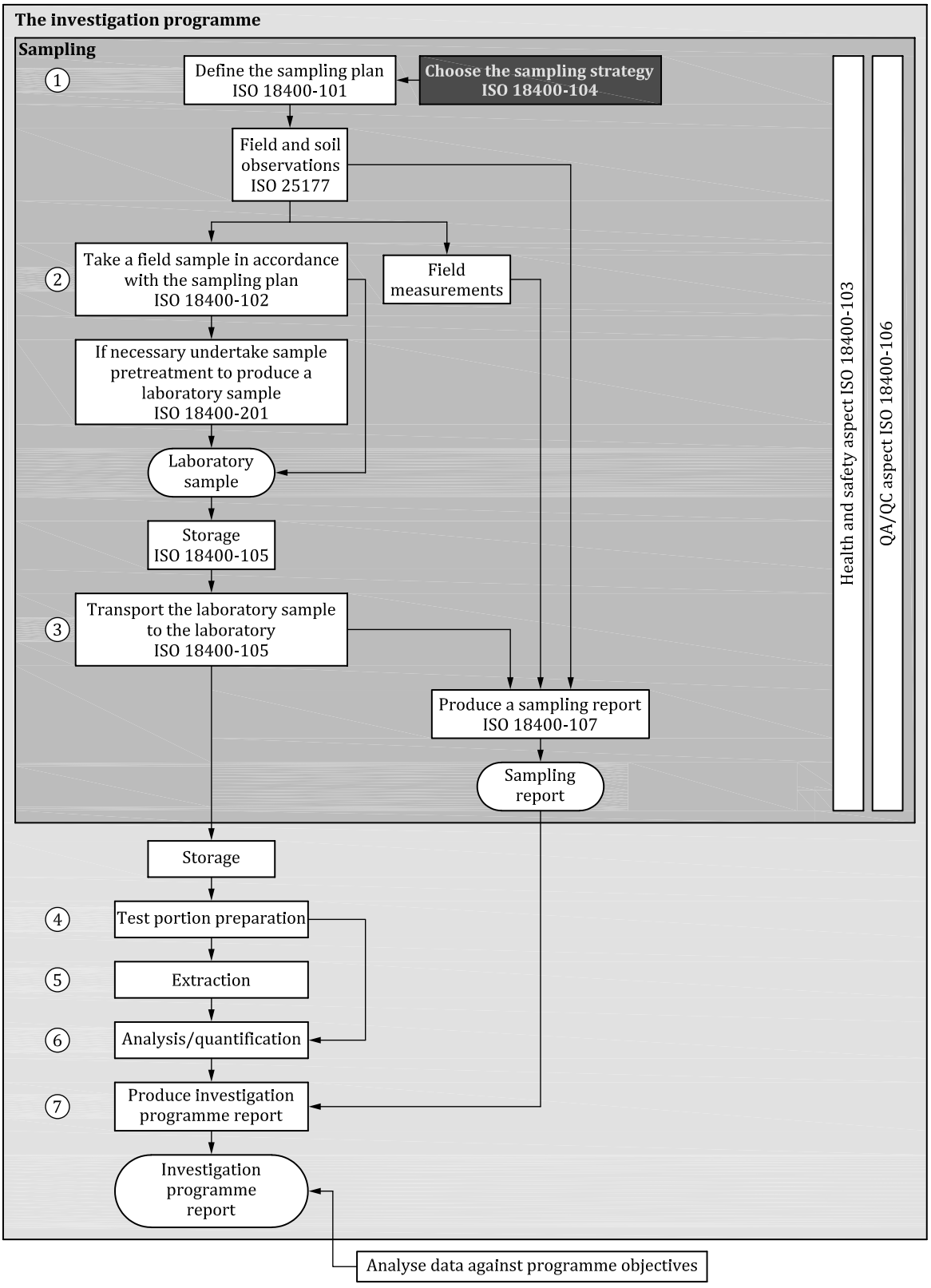
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This document can be used when preparing field investigations or to analyse the results of such investigations. In particular, planning the sampling and measurement procedures can require considerable time, resources, competent staff and quality control during their implementation.

This investigation can be part of a broader environmental investigation or can be limited to only VOCs. Laboratories adopt procedures that will yield accurate results for the sample as presented to the laboratory. The sampling methods described are suitable for use in connection with, amongst others, the analytical methods described in ISO 15009,[2] ISO 16558-1[3] and ISO 22155[4].

International Standards within the total investigation program are shown in Figure 1.

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NOTE 1 The numbers in circles define the key elements (1 to 7) of the investigation program.

NOTE 2 This figure displays a generic process which can be amended when necessary.

NOTE 3 The step requiring undertaking a sample pretreatment to produce a laboratory sample (see ISO 18400-201 “Physical pretreatment in the field”) is not applicable in the context of VOC sampling.

NOTE 4 When a vial with methanol is used, preservation of sample is done on site, not in the laboratory.

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NOTE 5 Step 5 “extraction” consists of agitating the soil sample with the methanol. It is done once the sample is at the laboratory.

NOTE 6 The role of this document is illustrated in Figure 2.

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

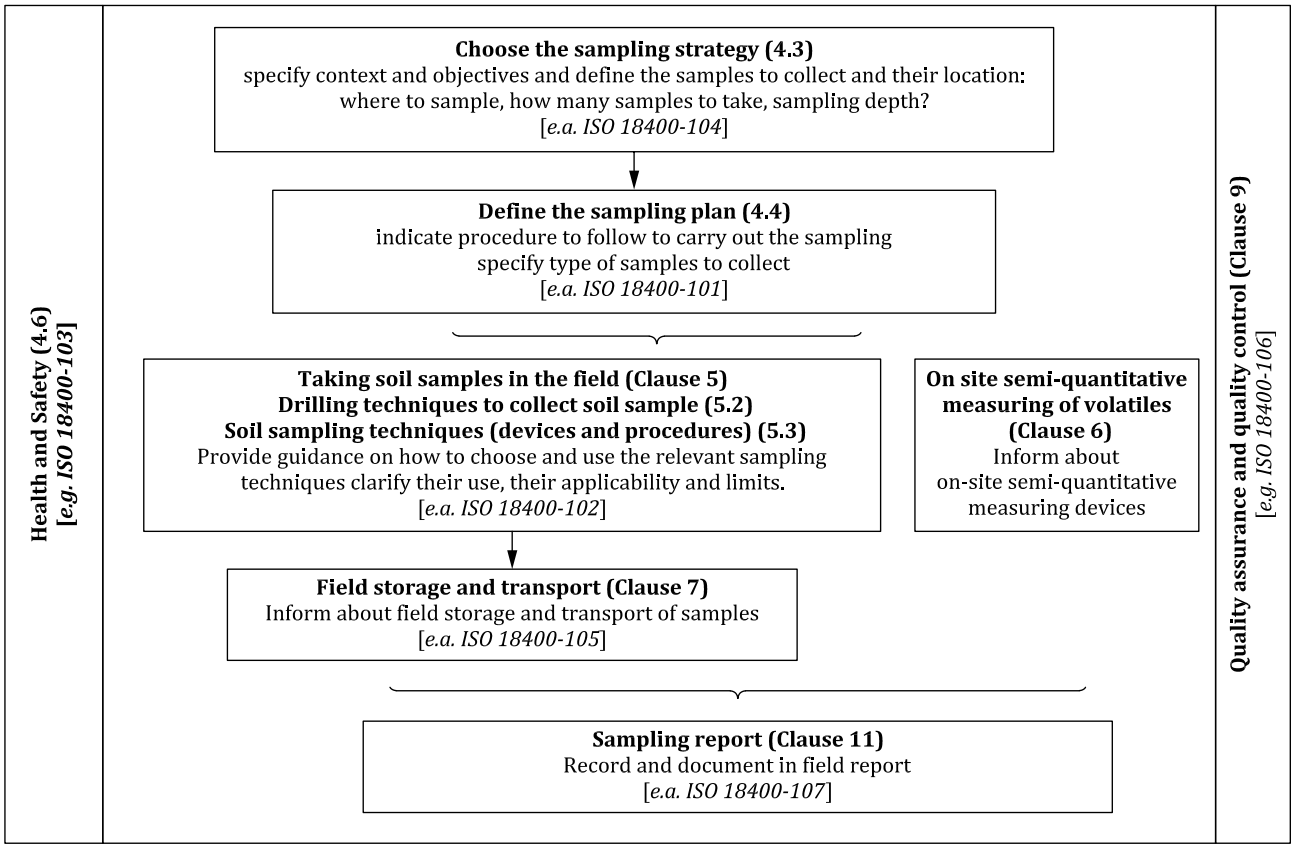


Figure 2 — Soil sampling process described in this standard in the context of VOCs

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Soil quality — Sampling —

Part 301:
Sampling and on site semi-quantitative determinations of volatile organic compounds in field investigations

1 Scope

This document provides specific requirements and recommendations on soil sampling and semi-quantitative measurements in field investigations for volatile organic compounds (VOCs) that are not explicitly covered in the existing ISO 18400 series. In addition, it provides information on the preparation steps (choosing a sampling strategy, defining a sampling plan); describes sampling techniques (drilling techniques, sampling devices and procedures) and field measurements; and gives advice on conservation, packaging, transport and delivery to the laboratory in the context of VOCs (see soil sampling process described in Figure 2).

VOCs to which this document can be applied include:

— volatile aromatic hydrocarbons such as benzene, toluene, ethylbenzene, naphthalene;

— aliphatic ethers such as methyl tert.-butyl ether(MTBE), ethyl tert.-butyl ether (ETBE) and tert.-amyl methyl ether (TAME);

— volatile halogenated hydrocarbons such as tetrachloroethene and, trichloroethene.

The document does not cover the volatile non-organic compounds. However, some information about these is provided in Annex D.

This document provides requirements and guidance on the selection of drilling and sampling techniques for determining VOCs and how to use them. It clarifies the applicability and limits of the drilling and sampling techniques, taking into account the physical, chemical or biological reactions that can occur in soil.

This document gives requirements and recommendations on the use of instrumental measurement techniques for determination of VOC concentrations in air, firstly in relation to worker safety, and subsequently for semi-quantitative measurements of volatiles during soil sampling.

The following subjects are outside the scope of this document:

— direct quantitative measurement of volatile compounds by field analysis laboratories;

— investigations and evaluation of soil gas quality (these are dealt with ISO 18400 204);

— safety risk assessment; and

— analytical procedures.

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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