
Soil quality — Sampling —
Part 2:
Guidance on sampling techniques

Qualité du sol — Échantillonnage —

Partie 2: Lignes directrices pour les techniques d'échantillonnage

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 10381-2:2002

<https://standards.iteh.ai/catalog/standards/sist/851c9fce-797e-4ccd-95d4-f1f4dc647656/iso-10381-2-2002>



PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 10381-2:2002

<https://standards.iteh.ai/catalog/standards/sist/851c9fce-797e-4ccd-95d4-f1f4dc647656/iso-10381-2-2002>

© ISO 2002

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

Contents

	Page
Foreword	iv
Introduction.....	v
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions	2
4 Principle	2
4.1 Sampling of soil.....	2
4.2 Sampling of water	3
4.3 Sampling of soil gas	3
5 Choice of sampling technique	3
5.1 Preliminary information	3
5.2 Type of sample	4
5.3 Selection of sampling technique	5
5.4 Cross-contamination	6
6 Safety and environmental protection in the investigation.....	6
6.1 Personal protection.....	7
6.2 Protection of buildings and installations.....	7
6.3 Environmental protection.....	7
6.4 Backfilling	8
7 Techniques	8
7.1 General	8
7.2 Cross-contamination	10
7.3 Undisturbed samples.....	11
8 Storage of samples	11
8.1 General	11
8.2 Sample containers	11
8.3 Labelling.....	13
8.4 Sample storage.....	13
9 Sampling report.....	14
Annex A (informative) Manually and power-operated sampling tools	15
Bibliography.....	23

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 10381 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10381-2 was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 2, *Sampling*.

ISO 10381 consists of the following parts, under the general title *Soil quality — Sampling*:

- *Part 1: Guidance on the design of sampling programmes*
- *Part 2: Guidance on sampling techniques*
- *Part 3: Guidance on safety*
- *Part 4: Guidance on the procedure for the investigation of natural, near-natural and cultivated sites*
- *Part 5: Guidance on investigation of soil contamination of urban and industrial sites*
- *Part 6: Guidance on the collection, handling and storage of soil for the assessment of aerobic microbial processes in the laboratory*

The following parts are under preparation:

- *Part 7: Guidance on the investigation and sampling of soil gas*
- *Part 8: Guidance on the sampling of stockpiles*

Annex A of this part of ISO 10381 is for information only.

Introduction

This part of ISO 10381 is one of a group of International Standards intended to be used in conjunction with each other where necessary. It deals with various aspects of sampling for the purposes of soil investigation, including agricultural and contamination investigations, but is not applicable to investigations for geotechnical purposes.

General principles to be applied in the design of sampling programmes for the purpose of characterization of soil and identification of sources and effects of pollution of soil and related material are given in ISO 10381-1. ISO 10381-1, ISO 10381-4 and ISO 10381-5 should be consulted regarding the appropriate equipment, information about where to sample, the tests to be conducted, the type of sample, the depth of sampling, soil type and the required representativeness of the sampling system.

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 10381-2:2002

<https://standards.iteh.ai/catalog/standards/sist/851c9fce-797e-4ccd-95d4-f1f4dc647656/iso-10381-2-2002>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 10381-2:2002

<https://standards.iteh.ai/catalog/standards/sist/851c9fce-797e-4ccd-95d4-f1f4dc647656/iso-10381-2-2002>

Soil quality — Sampling —

Part 2: Guidance on sampling techniques

1 Scope

This part of ISO 10381 gives guidance on techniques for taking and storing soil samples so that these can subsequently be examined for the purpose of providing information on soil quality.

This part of ISO 10381 gives information on typical equipment that is applicable in particular sampling situations to enable correct sampling procedures to be carried out and representative samples to be collected. Guidance is given on the selection of the equipment and the techniques to use to enable both disturbed and undisturbed samples to be correctly taken at different depths.

The guidance provided is intended to assist in the collection of samples for soil quality for agricultural purposes and also provide guidance for the collection of samples for contamination investigations which will require different techniques and skills.

This part of ISO 10381 makes reference to some aspects of the collection of samples of groundwater and soil gas as part of a soil sampling programme.

This part of ISO 10381 specifically does not cover investigations for geotechnical purposes, though where redevelopment of a site is envisaged the soil quality investigation and the geotechnical investigation may be beneficially combined.

This part of ISO 10381 is not applicable to the sampling of hard strata such as bedrock.

Techniques to collect information on soil quality without taking samples, such as geophysical methods, are not covered by this part of ISO 10381.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 10381. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 10381 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 11074-1, *Soil quality — Vocabulary — Part 1: Terms and definitions relating to the protection and pollution of the soil*

ISO 11074-2, *Soil quality — Vocabulary — Part 2: Terms and definitions relating to sampling*

ISO 11074-4, *Soil quality — Vocabulary — Part 4: Terms and definitions related to rehabilitation of soils and sites*

3 Terms and definitions

For the purposes of this part of ISO 10381, the terms and definitions in ISO 11074-1, ISO 11074-2, ISO 11074-4 and the following apply.

3.1

spot sample

single sample

sample of material collected from a single point

NOTE This may be a disturbed or undisturbed sample.

3.2

slot sample

sample taken as a vertical slot from within a stratum or other subpart which is putatively homogeneous

NOTE This is a disturbed sample.

3.3

stratified sample

sample obtained as a combination of spot samples from strata or subparts, putatively homogeneous

NOTE This is a disturbed sample.

3.4

cluster sample

sample which is a composite of small incremental point samples taken close together

NOTE This is a disturbed sample.

3.5

spatial sample

sample which is a composite of small incremental point samples taken over an area (such as a field)

NOTE This is a disturbed sample.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 10381-2:2002](https://standards.iteh.ai/catalog/standards/sist/851c9fce-797e-4ccd-95d4-f181dc647656/iso-10381-2-2002)

[https://standards.iteh.ai/catalog/standards/sist/851c9fce-797e-4ccd-95d4-](https://standards.iteh.ai/catalog/standards/sist/851c9fce-797e-4ccd-95d4-f181dc647656/iso-10381-2-2002)

[f181dc647656/iso-10381-2-2002](https://standards.iteh.ai/catalog/standards/sist/851c9fce-797e-4ccd-95d4-f181dc647656/iso-10381-2-2002)

4 Principle

4.1 Sampling of soil

Soil samples are collected and examined primarily to determine associated physical, chemical, biological and radiological parameters. This clause outlines the more general factors to be considered when selecting sampling equipment and its use. More detailed information is given in subsequent clauses.

Whenever a volume of soil is to be characterized, it is generally impossible to examine the whole and it is therefore necessary to take samples. The samples collected need to be as fully representative as possible of the whole to be characterized, and all precautions should be taken to ensure that, as far as possible, the samples do not undergo any changes in the interval between sampling and analysis. The samples normally collected are described as disturbed samples, i.e. the soil particles become loosened and separated in the sampling process. If it is necessary to collect undisturbed samples, e.g. for microbiological or geotechnical purposes, the samples need to be collected in such a manner that the soil particles and pore structure remain unaltered in comparison with the original ground structure. The sampling of multiphase systems, such as soils containing water or gases which are not of natural origin (e.g. waste materials), can present special problems.

The sampling technique should be selected to enable the collection of samples of ground material which can be presented to the laboratory for examination or analysis to establish basic information on the pedology and distribution of naturally occurring or manmade soils, their chemical, mineralogical and biological composition, and their physical properties at selected locations.

The choice of sampling technique depends, in addition, on the required precision of the results, which in turn depends on the ranges of concentration of components, the sampling procedures and the type of analysis.

Sampling equipment should be carefully selected in relation to the different materials which may be present in the ground and the analysis to be carried out. Utmost care should be taken to avoid cross-contamination, loss of volatile compounds, change of composition due to exposure to air, and other changes which may occur between sampling and the testing of the sample.

Every soil sampling technique usually consists of two separate steps:

- a) gaining access to the point of sampling (removing the cover or sealing, digging or drilling a hole to reach the desired depth of sampling), and
- b) taking the soil sample.

Both steps depend on each other and both shall meet the requirements of the sampling principles.

4.2 Sampling of water

Soil investigation programmes, particularly those carried out at contaminated sites, may also require water samples to be taken. These should be collected in accordance with appropriate International Standards on ground or surface water sampling with regard to ground investigation. For further information see ISO 10381-1.

4.3 Sampling of soil gas

Ground investigation programmes may involve assessment of soil gas composition for typical landfill gas components such as methane and carbon dioxide. In the case of contaminated sites, the suspected presence of solvents or fuels may require investigation. An International Standard (ISO 10381-7) is in the course of preparation to cover such investigations, and some indicative guidance is incorporated in this part of ISO 10381.

<https://standards.iteh.ai/catalog/standards/sist/851c9fce-797e-4ccd-95d4-f14dc647656/iso-10381-2-2002>

5 Choice of sampling technique

5.1 Preliminary information

The choice of sampling technique, the selection of the sampling equipment and the method of taking soil samples depends upon the objectives of the sampling, the strata to be sampled, the nature of possible contamination, and the examination or analysis to be carried out on the samples.

Thus certain information is needed to make this choice. This information may include

- the size and topography of the area to be sampled,
- the nature of the ground to be sampled,
- some indication of the possible lateral and vertical variations of soil type or strata,
- the geology of the site and surrounding area,
- the depth to groundwater and its direction of flow,
- the depths from which samples are to be taken, taking into consideration the future use of the site, including depth of excavations or foundations,
- previous usage or treatment of the site,

- the presence of buildings and obstructions, such as foundations or hardstandings, buried tanks and underground services (e.g. electricity, sewers, mains, cables),
- indications of the presence of underground tanks and service (for example inspection covers, inspection chambers, vent pipes),
- the presence of concrete or tarmac pathways, roadways or hardstandings,
- the safety of the site personnel and protection of the environment,
- the growth of vegetation leading to extensive root development,
- the presence of unexpected surface-water pools or water-saturated ground,
- the presence of fences, walls or earthworks designed to prevent access to the site,
- the presence of tipped material above the level of the site, or material from the demolition of buildings,
- location of water bodies at risk from contamination, including surface and ground water.

Extreme natural circumstances, such as permafrost, laterization, calcrete or other indurations, may occur which require special techniques in order to obtain samples. This shall be known prior to the design of a sampling programme.

To collect this information, a desk study or preliminary survey of the site is strongly recommended. When investigating soils suspected of contamination, the preliminary survey is an essential part of the investigation programme [see clause 6 of ISO 10381-1:—¹) and clause 6 of ISO 10381-5:—¹]. Its main relevant concerns are

- a) to ensure an investigation which is both technically and cost effective;
- b) to ensure the safety of personnel and to protect the environment.

The preliminary survey may comprise both desktop studies and site reconnaissance (field work). It does not normally include taking samples, but in some circumstances limited sampling may be useful in relation to determining the parameters for the site investigation, investigating some methodical aspects, and identifying possible hazards to the investigating personnel.

5.2 Type of sample

There are two basic types of sample which are collected for the purposes of investigating soil and ground conditions. These are:

- a) disturbed samples: samples obtained from the ground without any attempt to preserve the soil structure; that is the soil particles are collected “loose” and are allowed to move in relation to each other;
- b) undisturbed samples: samples obtained from the ground using a method designed to preserve the soil structure; i.e. special sampling equipment is used so that the soil particles and voids cannot change from the distribution which exists in the ground before sampling.

Disturbed samples are suitable for most purposes, except for some physical measurements, profiles and microbiological examinations for which undisturbed samples may be required. Undisturbed samples should be collected if it is intended to determine the presence and concentration of volatile organic compounds, since disturbance will result in loss of these compounds to the atmosphere.

1) To be published.

If undisturbed samples are required for soil sampling, these can be taken, for example, using a Kubiena Box, a coring tool or coring cylinder. In each case the sampling device is pushed into the soil and subsequently removed with the sample, so that the soil is collected in its original physical form.

There are different methods of taking samples from the ground for the purpose of investigating soil quality (see clause 3).

If a slot sample (single sample) is small it may be taken for a spot sample. All other sampling methods produce composite samples (average samples, aggregate samples). Composite samples are not useful to determine soil characteristics that suffer changes during the composition process, such as concentrations of volatile compounds. They also cannot be used if peak concentrations of any substance or variations of soil characteristics are to be determined.

Spot samples can be readily collected using hand augers and other similar sampling techniques. Where undisturbed samples are required, special equipment (see above) is necessary in order to collect the sample whilst maintaining the original ground structure.

Cluster samples are appropriate when using machines for excavating ground to obtain samples. In these circumstances, the samples should be formed by taking portions from locations within the bucket of excavated material (e.g. nine-point sample).

Spatial samples or other composite samples can be collected using hand or powered augers, but care shall be taken to ensure the auger repetitively collects the same amount of sample.

5.3 Selection of sampling technique

Within this International Standard, it is not possible to fix one sampling technique to every possible sampling objective, because there are so many objectives and many of them are satisfied by more than one technique.

The following examples indicate some of the main rules that shall be followed.

- Soil characteristics that are bound to soil horizons (which are most of them) require horizon-bound (stratified) sampling.
- If the spatial variation of soil characteristics is of interest, spot samples are required. If the required precision of the results is low, other types of sample also may be accepted.
- Samples taken to identify the distribution and concentration of particular elements or compounds are normally spot samples, or perhaps slot or cluster samples within the area being examined.
- Samples taken to assess the overall quality or nature of the ground in an area, e.g. for certain agricultural purposes, are spatial samples.
- Sample size shall be sufficiently large to enable all tests and analyses to be performed.
- Sample size shall be sufficiently large to represent all soil characteristics of interest.
- Samples shall not be too large to obscure variations in soil characteristics of interest.
- Soil characteristics of interest shall not be affected by the sampling process, nor by the transportation and storage of samples.
- Representative sampling usually means that increments with different properties shall be (if applicable at all) combined into a composite sample only according to their volume fraction of the parent population to be sampled.
- Cross-contamination shall be avoided, as well as the spread of contaminants.

5.4 Cross-contamination

Chemical soil properties, in particular, can be changed by the sampling procedure in many ways:

- by transmission of substances fixed to sampling equipment or containers;
- by uncontrolled transport of soil particles to the sampling point from adjacent points of a site or a soil profile, especially by material dropping into the sample from higher up a bore hole, either during augering/drilling or during withdrawal of the sample;
- by transfer of substances from the sampling device or container;
- by loss of volatile compounds, leakage of liquids or mechanical separation;
- by contamination with auxiliary substances used to enable or facilitate the sampling (fuels, exhaust fumes, greases, oils, lubricants, glues and others);
- by contamination with wind-blown particles, spread liquids or precipitation.

Whatever method is used for obtaining the sample, it is important that the sampling system used and the material from which the equipment is made do not contaminate the sample.

The sampling equipment should be kept clean so that parts of a previous sample are not transmitted to a subsequent sample causing cross-contamination. Even for agricultural purposes, with repetitive sampling across a field to form a composite sample, the sampling device should be cleaned between each location.

Where it is necessary to use lubrication, e.g. water, to ease formation of a borehole to enable sample collection, only lubrication should be used which will not conflict with nor confound the analysis to be performed on the samples in the sense of matrix effects or contribution to the contamination.

Only devices of controlled chemical quality and composition shall be used to handle samples. For example, a hand trowel of stainless steel can be useful when investigating organic compounds, while plastics normally do not interfere with heavy metals. Devices that have contact with samples shall never be painted, greased or have otherwise chemically treated surfaces.

Lining the borehole can prevent cross-contamination from material dropping into the sample from higher up the bore.

6 Safety and environmental protection in the investigation

In any soil-sampling investigation there is some disturbance of the ground. In areas of agricultural use, woodland and semi-natural vegetation, this disturbance is usually minimal and unlikely to result in the creation of any hazard.

When carrying out investigations on highly contaminated sites, consideration should be given to using probehole, borehole or similar techniques, rather than excavations, in order to minimize and reduce problems due to exposure, disturbance and potential dispersal of the contamination.

When the site surface prior to the investigation is obviously contaminated, or presents a general environmental problem due to exposure to humans or animals, and there is the possibility of dispersal of contaminated dust or water pollution, in addition to taking precautions to minimize disturbance and dispersal of contamination during the site investigation, the situation should be brought to the attention of the landowner and local authorities, so that preventative measures can be implemented. National or local regulations on information procedures or obligations shall be obeyed.

NOTE See also ISO 10381-3.