

---

---

**Soil quality — Sampling —**  
**Part 204:**  
**Guidance on sampling of soil gas**

*Qualité du sol — Échantillonnage —*

*Partie 204: Lignes directrices pour l'échantillonnage des gaz de sol*





**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Ch. de Blandonnet 8 • CP 401  
CH-1214 Vernier, Geneva, Switzerland  
Tel. +41 22 749 01 11  
Fax +41 22 749 09 47  
copyright@iso.org  
www.iso.org

# Contents

	Page
<b>Foreword</b> .....	<b>v</b>
<b>Introduction</b> .....	<b>vi</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>2</b>
<b>3 Terms and definitions</b> .....	<b>2</b>
<b>4 Preliminary items to be considered</b> .....	<b>5</b>
<b>5 Basic principles</b> .....	<b>6</b>
5.1 Physical and chemical principles.....	6
5.1.1 Permanent gases.....	6
5.1.2 Volatile organic compounds.....	7
5.2 Environmental conditions.....	7
5.3 Soil gas dynamics.....	9
5.4 Identifying the source of soil gas.....	9
<b>6 Requirements for sampling plan</b> .....	<b>10</b>
6.1 General considerations for sampling plan.....	10
6.1.1 Objectives and general recommendations.....	10
6.1.2 Initial explorations (field screening).....	12
6.1.3 Known contamination centre.....	12
6.1.4 Determination of the contamination hot spots (areas showing highest concentrations) and gas monitoring wells location.....	12
6.1.5 Determination of horizontal and vertical distribution of VOCs.....	13
6.1.6 Observation of spatial distribution of VOCs in the course of time.....	13
6.1.7 Evaluation of soil gases contribution to ambient, indoor and/or outdoor air.....	13
6.2 Working ranges of measurement methods.....	13
6.3 Monitoring well options.....	14
6.4 Sampling plan.....	17
6.4.1 Horizontal location of sampling devices.....	17
6.4.2 Monitoring depths.....	18
6.4.3 Timing and frequency of monitoring.....	19
6.4.4 Sample volumes and sampling rates.....	20
<b>7 Construction of monitoring installations</b> .....	<b>21</b>
7.1 General.....	21
7.1.1 Environmental conditions.....	21
7.1.2 Instruments.....	21
7.2 Soil gas sampling devices.....	21
7.2.1 Passive soil gas sampling.....	21
7.2.2 Sub-slab.....	22
7.2.3 Driven probes.....	22
7.2.4 Gas-monitoring standpipe in a borehole.....	23
<b>8 Sampling</b> .....	<b>26</b>
8.1 Generic consideration.....	26
8.2 Preparation of the monitoring installations.....	29
8.2.1 Preparation of the sampling point.....	29
8.2.2 Leakage test.....	29
8.2.3 Purge.....	29
8.3 Active sampling.....	30
8.3.1 General.....	30
8.3.2 Sorbent tubes or filters.....	31
8.3.3 Sample containers — Sampling bags.....	34
8.3.4 Sparging.....	35
8.3.5 Sample containers — Pressurized containers.....	35

8.4	Passive sampling .....	35
8.5	Sampling for on-site measurements .....	36
<b>9</b>	<b>Identification, packaging and transport of samples for laboratory analysis .....</b>	<b>37</b>
9.1	Identification .....	37
9.2	Packaging and transport .....	37
<b>10</b>	<b>Sampling report .....</b>	<b>37</b>
<b>11</b>	<b>Quality assurance .....</b>	<b>38</b>
11.1	General .....	38
11.2	Quality control samples .....	39
11.2.1	General .....	39
11.2.2	Blind replicate samples .....	40
11.2.3	Split samples .....	40
11.2.4	Trip blanks .....	40
11.2.5	Field blanks .....	40
11.2.6	Other quality control samples .....	40
11.2.7	Evaluation of quality control sample results .....	40
11.2.8	Chain of custody .....	41
11.2.9	Equipment .....	41
11.3	Interferences .....	42
11.3.1	General .....	42
11.3.2	Large sample volume .....	42
11.3.3	Cohesive soils .....	42
11.3.4	Soil moisture .....	42
11.3.5	Low ambient temperatures .....	42
11.3.6	Heterogeneous stratigraphy .....	42
11.3.7	Seepage front .....	42
11.3.8	Perched water table horizon .....	43
11.3.9	Contamination .....	43
11.3.10	Breakthrough .....	43
11.4	Interpretation of soil gas analyses for VOCs .....	43
<b>Annex A (informative) Standard equipment and instruments used for soil gas sampling for VOCs .....</b>		<b>44</b>
<b>Annex B (informative) Portable equipment to measure gases .....</b>		<b>46</b>
<b>Annex C (informative) Equipment to measure flow rates and borehole pressure .....</b>		<b>48</b>
<b>Annex D (informative) Example of sampling sheet .....</b>		<b>50</b>
<b>Bibliography .....</b>		<b>52</b>

## 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](http://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](http://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](http://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 18400-204 cancels and replaces ISO 10381-7:2005, which has been technically and structurally revised. The ISO 18400 series is based on a modular structure and cannot be compared to ISO 10381-7 clause by clause.

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

## Introduction

This document is one of a group of International Standards to be used in conjunction with each other where necessary. The ISO 18400 series deals with sampling procedures for the various purposes of soil investigation. The roles/positions of the individual standards within the total investigation programme are shown in [Figure 1](#). The stated soil gas and landfill-gas measurements do not give any quantitative statement of the total quantity of material detected in soil gas or soil. The measurement results can be influenced by, e.g. temperature, humidity, air pressure, minimum extraction depth, etc.

The general terminology used is in accordance with that established in ISO/TC 190 and, more particularly, with the vocabulary given in ISO 11074.

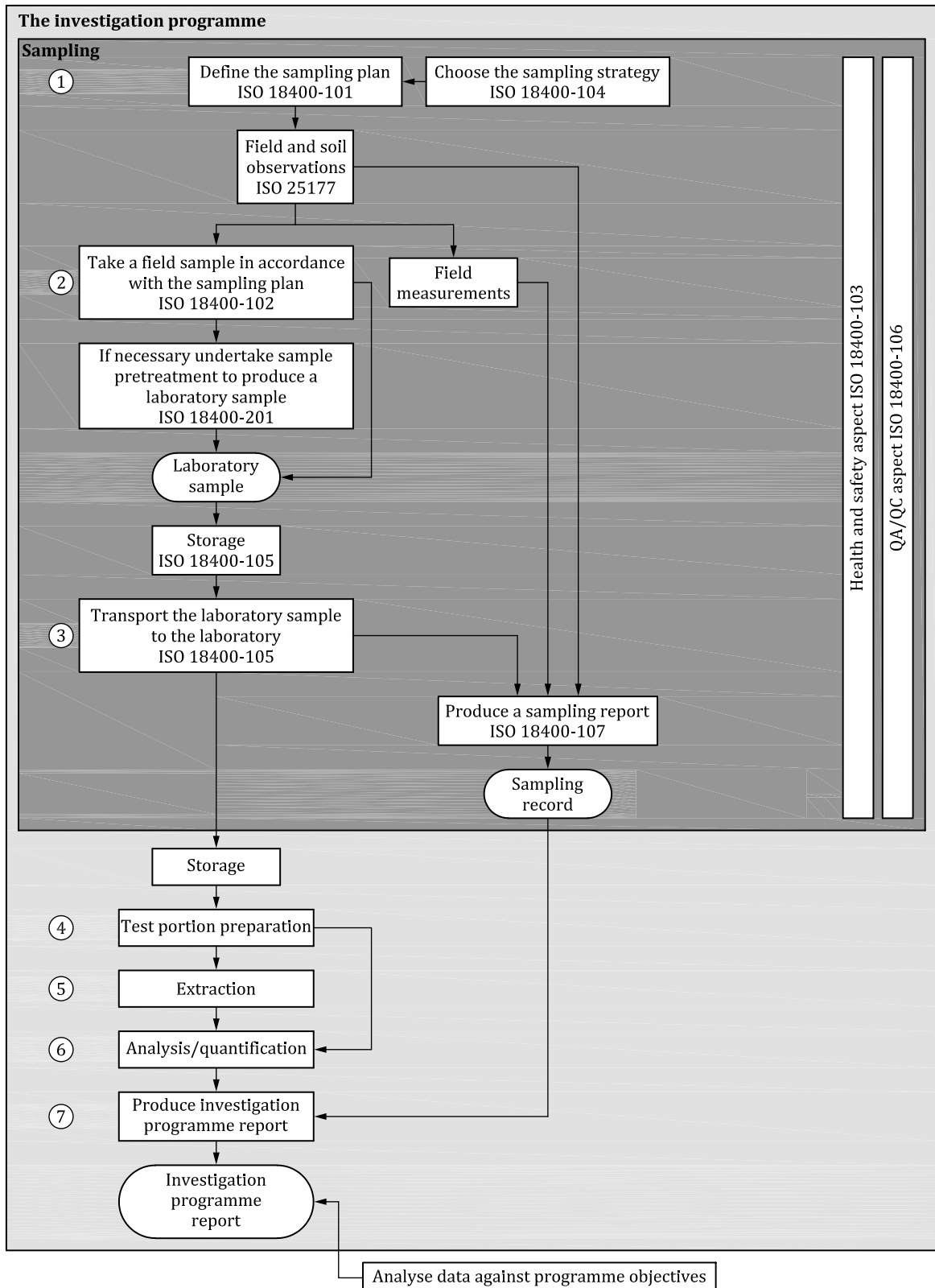
Toxic, asphyxiating and explosive soil gases can enter buildings and other built development on and below ground and variously pose potential risks to occupants and users and to the structures themselves.

Such gases might be present in the ground naturally, or be present as a result of contamination of the ground, or arise from buried wastes. In addition to the main components found in air (nitrogen and oxygen), soil gas can contain volatile organic compounds (VOCs), inorganic vapours (e.g. mercury) and a wide range of other gases (e.g. methane, carbon dioxide, carbon monoxide, hydrogen sulfide, ammonia, helium, neon, argon, xenon, radon, etc.).

These gases can have several origins such as: landfilled wastes; contaminated soils on a brownfield site; plume of contaminated groundwater; spill or leakage of chemicals products, leaks of mains gas (natural gas); sewer gas, etc.

In order to complete an assessment of the risks posed by the presence of permanent and other soil gases like VOCs, it is necessary to understand and characterize the potential sources of gas in and around a site.

Guidance on installations for soil gas sampling (equipment and instruments, methods of sampling, requirements of controls, etc.) and other relevant information (e.g. on environmental conditions) are provided in this document.



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

NOTE 1 The numbers in circles in [Figure 1](#) 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.





# Soil quality — Sampling —

## Part 204: Guidance on sampling of soil gas

### 1 Scope

This document contains guidance on soil gas sampling using

- active sampling (adsorbents, filters, air containers), and
- passive sampling

applied at permanent or temporary monitoring wells or other installations in soils or underneath buildings (sub-slab).

It provides guidance on:

- development of a sampling plan;
- construction of monitoring installations;
- transport, packaging and storage soil gas samples;
- quality assurance.

This document also gives basic information about

- soil gas dynamics, and
- identification of soil gas sources

relevant to permanent or temporary boreholes in soils or underneath buildings (sub-slab).

The compounds covered by this document are:

- volatile organic compounds (VOCs);
- inorganic volatile compounds (e.g. mercury, HCN);
- permanent gases (i.e. CO<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub>, CH<sub>4</sub>).

This document does not give guidance on:

- risk evaluation and characterization;
- selection and design of protective measures;
- the verification of protective measures, although the site investigation methodologies described can be used when appropriate;
- the sampling of atmospheric or indoor gases;
- the measurement of gases from the soil entering into the atmosphere;
- monitoring and sampling for radon.