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Soil quality — Sampling —

Part 103: Safety

Qualité du sol — Échantillonnage —

Partie 103: Sécurité

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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 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 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 18400-103 cancels and replaces ISO 10381-3:2001, which has been technically and structurally revised. The ISO 18400 series is based on a modular structure and cannot be compared to ISO 10381-3 clause by clause.

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

Introduction

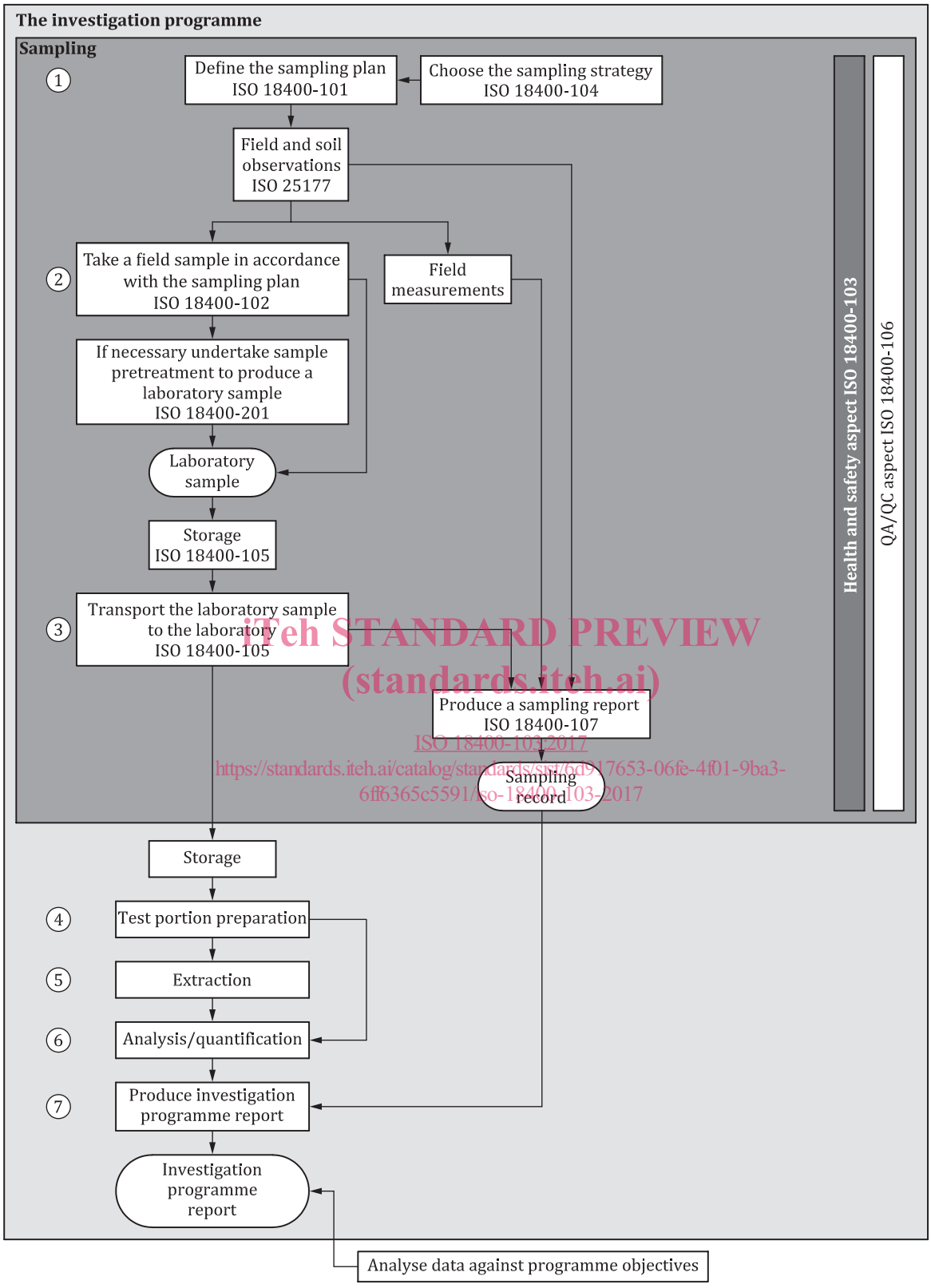
This document is one of a group of International Standards intended to be used in conjunction with each other where necessary (the role/position of the International Standards within the total Investigation programme is shown in Figure 1).

It deals with safety during sampling and other soil investigation activities. International and national regulations regarding health and safety at work and associated guidance produced by statutory bodies and trade associations could exist and may need to be taken into account.

It does not seek to address everyday hazards that could arise from the use of such items as sharp instruments, digging/drilling equipment, nor the hazards of driving to a site location. It is assumed that such hazards are satisfactorily dealt with by the personnel carrying out the investigation and the sampling.

Former production sites for munitions and other warfare agents present special problems to investigators and others involved in handling samples collected at such locations. The guidance given in this document will be of assistance in these situations, but additional guidance about the precautions to be taken should be obtained from specialists, such as those responsible for the former operation of these sites.

Geological and geotechnical investigations are outside of the scope of this document and for detailed guidance, reference is to be made to other relevant International Standards. However, soil quality investigations may sometimes be combined with geotechnical investigations for practical reasons and for economy and thus specific hazards and risks associated with geotechnical investigations might need to be addressed in the overall risk assessment.



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.

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

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Part 103: Safety

1 Scope

This document gives guidelines for:

— identification of hazards that could be encountered during a site investigation and when collecting samples of soil and other ground material, including hazards that are intrinsic in the sampling operation (e.g. physical hazards) in addition to the hazards that might arise, e.g. from contamination with chemicals or biological agents;

— measures to be adopted to control risks once an appropriate risk assessment has been carried out.

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 apply.

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 Preliminary considerations

The main objectives of this guidance on safety are to:

a) identify the hazards that could exist when carrying out site investigations and soil sampling programmes,

b) indicate management procedures to provide a framework for safe working,

c) indicate what working procedures can be adopted to minimize risks from contaminants, physical and other hazards associated with the collection of samples and the use of machinery, and

d) indicate what precautions can be taken in terms of personal protection and cleaning facilities to minimize any risks.

It is not possible, in a guidance document such as this, to identify all the hazards that could be encountered during site work, or to provide guidance on how the associated risks can be dealt with in all situations. Safety depends ultimately on the adoption of an attitude and approach to any particular

situation that will ensure that the hazards are identified and properly evaluated and appropriate precautions taken.

Those authorizing, purchasing, designing and supervising works, the employers, and those carrying out the work have a joint responsibility for safety. This responsibility extends beyond protection of the workforce to include the general public who are living or working close to the site to be investigated, or who might enter the site, with or without permission, while the works are in progress.

In all daily activities, there is an element of risk and this risk is increased when the environment is unfamiliar. Even sampling an agricultural area involves an increased risk to the sampler because the nature of the ground and possible hazards are not necessarily known to the sampler.

When examining a site for contamination, the risks are increased due to the presence of chemicals, compounds and agents which present a hazard to human health. When examining a former industrial site, the risk of physical injury can be increased because of the possibility of voids and cavities (physical hazards) beneath ground level which might not have been properly filled in. Cavities can also be present where there has been underground combustion (for example, in refuse sites and colliery waste disposal sites).

Physical injury is also possible in any sampling situation where machinery is being used. Even minor injuries can provide a pathway for toxic substances and pathogens to enter the body.

Care should be taken to ensure the safety of the investigator when a preliminary site visit (site reconnaissance) is carried out prior to commencing the full site investigation, particularly as all potential hazards might not have been identified at that time.

At most active construction and industrial sites, special safety instructions are in effect. In addition, regulations could exist and may need to be taken into account on site. When relevant, the sampler should be informed before entering the site.

If during the site reconnaissance carried out as part of a preliminary investigation anything is seen that is considered likely to pose an immediate threat to human health and safety or the environment, this should be reported immediately to whoever is in control of the site so that any essential urgent action can be taken.

NOTE 1 There might be a duty under health and safety legislation and/or a professional code of conduct to do this.

When the site surface prior to the investigation is obviously contaminated, or presents a general environmental problem due to exposure of 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 authorities as appropriate, so that preventative measures can be implemented.

In addition to the guidance provided in this document, guidance can be found in:

— international and national legislation and associated guidance;

— industry codes of practice;

— safety documentation produced by employing companies and other organisations;

— site-specific safety instructions.

Some guidance document that might be relevant are listed in the Bibliography.

BS OHSAS 18001[7] specifies requirements for an occupational health and safety management system to enable an organization to control its occupational health and safety risks and improve its occupational health and safety performance. Guidelines for its implementation are provided in BS OHSAS 18002[8]. BS OHSAS 18001[7] is designed to be compatible with ISO 9001[2] (Quality) and ISO 14001[3]

(Environmental) management systems standards to facilitate the integration of quality, environmental and safety management systems by organizations, should they wish to do so.

NOTE 2 BS OHSAS 18001[7] is the internationally recognized assessment specification for occupational health and safety management systems. It was developed with the assistance of a range of national standardization bodies, regulatory and certification bodies, and trade bodies to address a gap where no third-party certifiable International Standard currently exists. It is planned that the future ISO 45001 will replace BS OHSAS 18001.

5 Concepts and processes

5.1 General

In order to properly address health and safety at work, it is necessary to

— identify hazards, i.e. anything with the potential to cause harm, (this can include substances or machines, methods of work and other aspects of the work organization),

— identify and quantify risks, i.e. the likelihood that a particular hazard might cause harm to those exposed to it and the consequences for them (risk therefore reflects both the likelihood that harm will occur and its severity),

— carry out a risk assessment (a careful examination of what could cause harm to people), to determine whether sufficient has been done (precautions taken) to manage the risks or what further needs to be done to prevent harm, and

— manage the risks by assessing them, putting sensible health and safety measures in place to control them and then making sure they work in practice (a process usually termed “risk management”).

5.2 Risk assessment

A risk assessment should be carried out by an appropriately qualified person before any sampling or other investigation activities, including a site reconnaissance, are carried out as part of a preliminary investigation. This is particularly important on former industrial sites and waste disposal sites. If site reconnaissance forms part of the preliminary investigation, the risk assessment should be based on the results of the desk study. It might be possible to refine the assessment once the preliminary investigation is completed, and it should be kept under review as the investigation proceeds.

Risk assessment typically involves:

— identification of the hazards;

— deciding who or what might be harmed and how;

— evaluating the risks and deciding on precautions;

— recording findings and implementing them;

— reviewing the risk assessment frequently (e.g. daily) and amending it as necessary.

The risk assessment should take into account that site investigation workers are typically:

— exposed to weather extremes;

— exposed to physical hazards;

— sometimes exposed to other potential hazardous substances such as cement and adhesives;

— are often peripatetic (move between sites and possibly employers).

The risk assessment record should show:

— a proper check of the hazards was made;

— that those who might be affected have been identified;

— all the obvious significant hazards have been dealt with, taking into account the number of people who could be involved;

— the control measures are acceptable, and the remaining risk is minimised;

— staff or their representatives were involved in the process;

— who carried out the risk assessment and their qualifications for this task.

NOTE 1 A common method for evaluating risks involves working out a risk level by categorizing the likelihood of the harm and the potential severity of harm and then plotting these two risk-determining factors against each other in a risk matrix (see Table 1). The risk level determines which risks should be tackled first.

Using a matrix can be very helpful for prioritizing actions. It is suitable for very many assessments but particularly lends itself to more complex situations. However, it does require a fair degree of expertise and experience to judge the likelihood of harm accurately. Getting this wrong could result in applying unnecessary controls or failing to take important ones. People working full time in health and safety often use a version of this method. It provides a good alternative to the "good practice" approach, i.e. adopting practices that are widely recognized and set out in authoritative guidance.

Table 1 — Risk matrix

		Potential severity of harm		
		Slightly harmful 1	Harmful 2	Extremely harmful 3
Likelihood of harm occurring	Highly unlikely 1	Trivial 1	Tolerable 2	Moderate 3
	Unlikely 2	Tolerable 2	Moderate 4	Substantial 6
	Likely 3	Moderate 3	Substantial 6	Intolerable 9

NOTE 2 An example of a risk assessment for driven probe boring (window/windowless drilling) is provided in Annex C.

5.3 Risk management

In order to achieve safe working conditions (i.e. to reduce risks to an acceptable minimum), the employing organizations should adopt formal "policies" and operating frameworks requiring (see also 6.1 and 6.2):

— identification of hazards and evaluation of risks;

— avoidance of risks wherever possible;

— failing this, control of the risks through adoption of appropriate operating procedures;

— failing this, or in addition, the protection of individuals against unavoidable risks.

Employers should provide training and keep records of procedures adopted and of any incidents. It might be necessary to establish health screening and surveillance programmes.

In order that appropriate risk reduction and management procedures can be identified on a site-specific basis, those managing site investigations should:

— identify hazards;

— identify under what circumstances the hazards might present a risk;

— quantify the actual risks.

In relation to contaminated sites, the importance of a preliminary investigation (see ISO 18400-202[1)]) for identification of hazards from contamination and physically hazardous conditions is emphasized.

5.4 Identifying hazards

As indicated in 5.2, potential and actual hazards should be identified taking into account:

— the history of the site as established in the preliminary investigation (see ISO 18400-202[1)]);

— the activities to be carried out on the site (e.g. exploratory and sampling techniques);

— the nature of the site (e.g. agricultural land, industrial land, forest);

— topography and other physical aspects such as waterlogging;

— weather/climate.

NOTE Clause 6 and Annex B provide information on the hazards that could be encountered in a variety of situations including on agricultural and contaminated sites.

6 Safety precautions — General aspects

6.1 Safety policy

Any organization involved in site investigations and sampling should have a safety policy which sets out the requirements for safe working. Adherence to the policy should be part of the conditions of employment of all personnel. The policy should:

— emphasize the need for alertness and vigilance on the part of site personnel to protect themselves from hazards during investigation and sampling;

— emphasize the requirement to follow standard operating procedures where these exist;

— describe the responsibilities of each member of the investigation team, including the responsibilities to any subcontracted personnel and to the general public;

— require competency to be demonstrated and the evidence for this to be recorded;

— include a mandatory ban on smoking, eating or drinking while carrying out a sampling exercise or other investigation on-site.

The policy should be supported by standard procedures setting out the requirements for safe working in general, and in specific locations such as confined spaces. These standard procedures should include the provision and use of protective clothing and equipment and the minimum number of personnel that should be involved in site work. The standard procedures should also specify the requirements for contacting local emergency services, methods of communication and methods of washing and decontamination.

NOTE Employing organisations (i.e. clients) sometimes enforce their own safety policies through contractual requirements on the organization(s) carrying out the investigation.

1) Under preparation.

6.2 Planning and managing for safety

To ensure the safety of personnel in site investigations or sampling exercises, it is necessary to plan and manage for safety. This requires a combination of measures which should include as appropriate (see also Table 2):

— compliance with company safety policy (see 6.1);

— preparation of a safety plan;

— appointment of an individual to take responsibility for implementation of the safety plan and measures;

— clear assignment of responsibilities;

— provision of information to all concerned;

— provision of training;

— identification and assessment of the hazards arising from the site (see 5.3 and 5.4);

— avoidance of hazards where possible;

— selection of sampling methods with safety in mind;

— provision and use of personal protection equipment (see 6.4 and Table 2);

— provision of equipment for the detection of hazardous environments (see Table 2);

— adoption of appropriate working procedures and provision of supporting facilities as listed in Table 2;

— health surveillance;

— consultation with managers of the site where works are to be undertaken regarding site conditions, site works within the area for sampling and other issues which could be relevant to the general safety of those undertaking the works (e.g. activities beyond the site boundary which could compromise the site works, ground conditions, unreported incidents within the area of study).

Requirements and systems for controlling the exposure of workers to substances hazardous to health shall be complied with. Precise requirements might differ, but often include a framework requiring:

— avoidance of exposure to potential physical, chemical and biological hazards;

— if this is not possible, use of control measures to prevent exposure or limit exposure to “permitted levels” (these might be defined in national regulations);

— if this is not possible, the use of personal protective equipment.

They could also require:

— the provision of information and training;

— health surveillance programmes;

— the preservation of personnel exposure records for an extended period of time.

NOTE 1 The above provides a useful framework for a policy to protect personnel from hazardous substances.

When establishing suitable safety procedures, not only should the hazard be considered, but also the way the hazard is likely to be encountered by the investigator or sampler and the consequences of the exposure to the hazard which might vary from skin irritation and simple physical injury to death.

NOTE 2 In most cases, chemicals are likely to be considered hazardous because they can cause acute toxic effects, but chronic effects could also be of concern in respect of regular investigators and samplers.

NOTE 3 Annex A describes how investigators could be exposed to the hazards that might occur in different situations and some of the consequences of such exposures.

6.3 Personnel

There are various roles that need to be performed by one or a number of persons during an investigation, including project leader, field manager, field investigator and skilled operatives (e.g. drillers). Tasks to be carried out include direction, planning and execution; supervision in the field; sampling and measurement, formation of exploratory holes and logging of excavations and boreholes, etc. Whoever performs these roles and tasks has responsibility to ensure safe working and that health is protected. They should therefore be appropriately knowledgeable, qualified, trained, experienced and able to communicate with other members of the team. The prescription of the qualifications, etc. required by those performing these roles is outside the scope of this standard. However, the provisions in national, international and European geotechnical standards might be useful by analogy regarding the roles to be performed and appropriate levels of qualification, etc.

NOTE 1 Those performing the various roles and tasks mentioned above could work for the client, a consultant or a contractor.

The lead driller in charge of an individual drilling rig should be skilled in the practice of exploration of the ground by means of boreholes, simple sampling and testing, making groundwater observations in boreholes, and properly recording the information obtained. In some jurisdictions, all boring and drilling operatives are required to hold specific qualifications.

Operators of excavating plant should be skilled and experienced in the safe use for digging trial pits and trenches and have any relevant specific qualifications required in the jurisdiction in which they are operating.

Physical support to ensure safety on site should be installed by skilled operatives who should have any relevant specific qualifications required in the jurisdiction in which they are operating.

NOTE 2 ISO/TS 22475-2[4] provides guidance on qualification criteria for enterprises and personnel including for “qualified operators” and ISO/TS 22475-3[5] provides guidance on conformity assessment of enterprises and personnel by a third party.

6.4 Safety equipment

Appropriate safety equipment including personal protective clothing and equipment and monitoring equipment should be provided and operatives trained in their proper use by their employer.

The selection of appropriate safety equipment can be a complex process, because of the range of conditions that might be encountered and the range of equipment available. The project manager and/or safety manager should always obtain specialist advice if there is any doubt about the type of equipment required.

The aim should always be to take precautions aimed at preventing hazards or reducing risks at source. However, such measures, will seldom completely remove a risk and thus use of personal protective equipment (PPE) will usually be necessary. Even in situations where chemical or similar hazards are negligible, there will remain a need to provide protection against physical hazards and adverse weather conditions. The selection of PPE can be made more difficult because of the availability in some markets of counterfeit PPE.

For those forms of personal protective equipment (PPE) where several classes of protection are available, it is important to select the right level of protection for the risk involved. For example,