



Association of Geotechnical &
Geoenvironmental Specialists

**STANDARDS RELATING TO INVESTIGATION,
ASSESSMENT, REMEDIATION AND DEVELOPMENT OF
POTENTIALLY CONTAMINATED AND CONTAMINATED
SITES^{©2020}**

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Foreword

This document provides a guide to the available British, European and International standards that could be relevant to investigation, assessment, remediation and development of potentially contaminated and contaminated sites. It is a personal view and not necessarily an exhaustive listing.

The principal standard of interest is *BS 10175:2011 + A2:2017 Investigation of potentially contaminated sites -Code of practice*. This British Standard and a number of other of direct relevance were produced by BSI committee *EH/4 Soil quality*. EH/4 “shadows” ISO Technical Committee 190 Soil quality and CEN Technical Committee TC444 *Test methods for environmental characterization of solid matrices* (see [BSI committee page for EH/4 - Soil quality](#) and Section 4 of this document).

EH4 actively seeks to broaden its membership. The wider the membership of EH4, the greater the confidence that the standards produced are technically sound and known about by potential users from a wide variety of backgrounds. It also increases the pool of people from which it might be possible to draw on from time to time to represent the UK in ISO and CEN Working Groups. BSI can nominate one or more experts to each of the numerous Working Groups in ISO TC190 and CEN TC444.

Most of the members of EH4 represent a nominating body but membership is also open to individuals with particular expertise. BSI provides guidance on its web site on how to get involved with standards ([How to get involved with standards](#)). All enquiries will be sent to the relevant committee manager. Alternatively, contact me or the Committee Manager Jessy Matthew (Jessy.Mattheww@bsigroup.com).

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1. INTRODUCTION

Key standards relating to investigation and assessment of potentially contaminated sites are **BS 10175** and **BS 8576**. Proper application of these standards **requires** reference to a number of British Standards cited as “normative” (see **2.3**). In practice, there is a constellation of British, European and/or International standards that could be relevant (see **Section 3** & Figure 1). Many of the relevant British Standards are UK implementations of International and/or European Standards.

Reference to **BS ISO 18400-104** is particularly important for correct application of BS 10175.

Regard should also be paid as appropriate to **BS 5930** which gives guidance on ground investigations for geotechnical purposes and the conduct of combined geotechnical and geoenvironmental investigations.

BS 10175 and **BS 8576** are **Codes of Practice**, i.e. guidance documents, and provide **recommendations** about what **should** be done. They assume that the user has sufficient experience and expertise to be able to use professional judgement when applying or deviating from the recommendations. Deviation from the recommendations is permitted provided they can be technically justified but anyone deviating from them must be prepared to justify the deviations, possibly in Court.

BS 10176 and most analytical and testing standards are **Specifications** containing **requirements** that **shall** be obeyed.

It is important to be aware that British Standards follow set conventions in their use of certain words (see **2.4**). Failure to understand this can lead to a failure to properly understand recommendations or requirements in standards. International and European Standards follow the same conventions.

There is also a convention as to how standards should be referred to – see **2.2**.

Table 1.1: Key British Standards

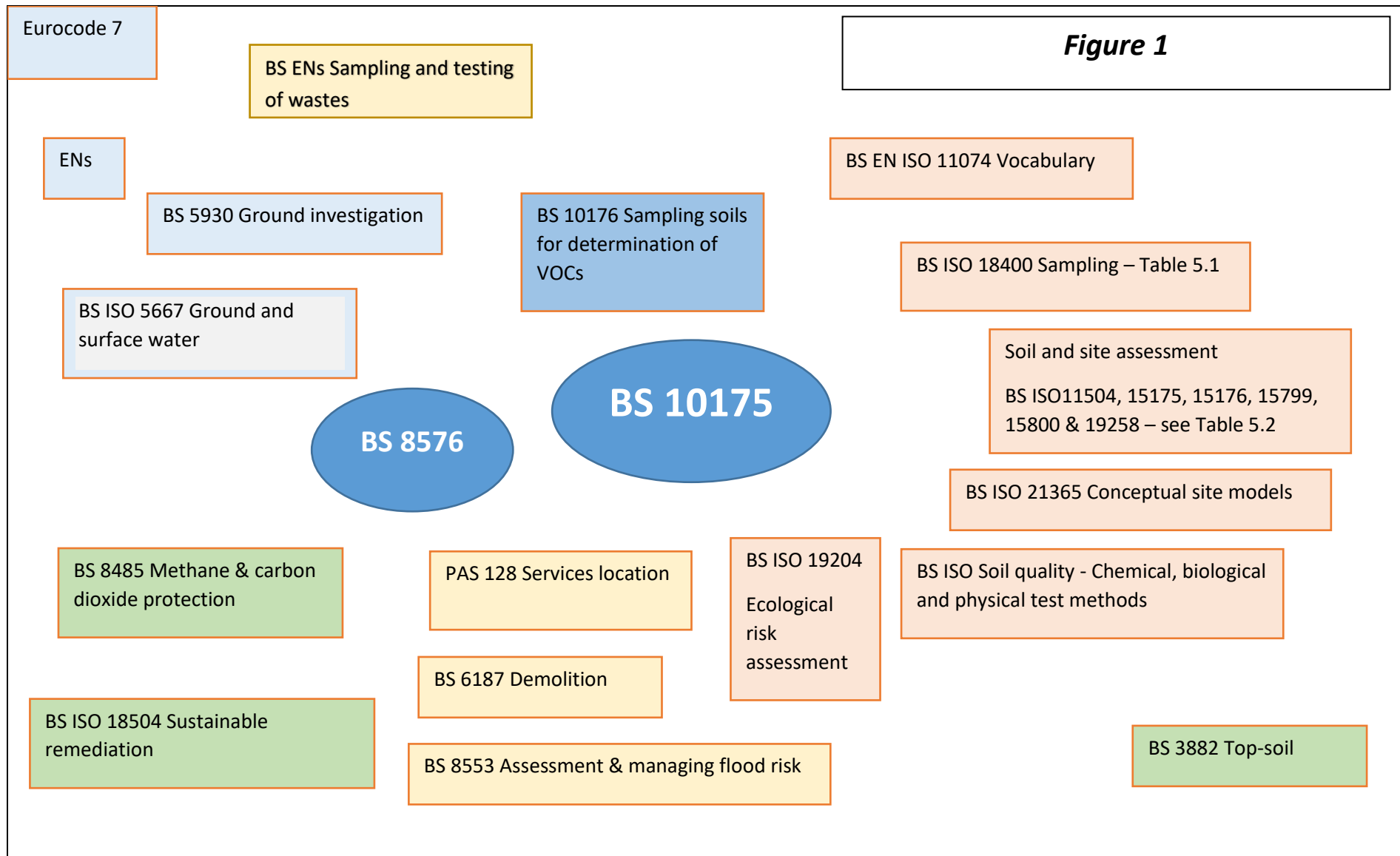
BS 5930:2015 + A1:2020 Code of practice for ground investigations

BS 8576: 2013 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds

BS 10175:2011 + A2:2017 Investigation of potentially contaminated sites. Code of practice

BS 10176:2020 Taking soil samples for determination of volatile organic compounds (VOCs) - Specification

BS ISO 18400-104 Soil quality – Sampling - Strategies



2. BACKGROUND

2.1 Terminology

Standards relating to contaminated land either contain definitions of the terminology used in the standard or by default refer to **BS EN ISO 11074 Soil quality – Vocabulary**. It is particularly important to keep in mind the definition of “contamination” in BS 10175 which refers to the presence of substances etc. as a result of human activity – there is no such thing as “natural contamination”. The correct usage is “naturally elevated concentrations of potentially harmful substances” or similar.

2.2 References to Standards

Undated references to standards in British Standards (e.g. BS10175 rather than BS 10175:2001+A2:2017) are to the current version. References to dated versions are only required when reference is being made to a specific Clause etc. in case numbering changes in subsequent versions. This should not usually be a problem in relation to Amended standards (e.g. BS 8576 +A1) because the Clause numbering in the original version is always retained even if one or more Clauses have been deleted or added.

2.3 Normative Standards

Normative standards are referenced standards that are indispensable for the application of a standard: some or all of their content constitutes requirements of the standard in which they are cited.

In the case of dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

2.4 Presentational Conventions

British Standards follow set conventions in their use of certain words. For example, the Foreword to BS 10175 (a guidance document) states:

“The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

The word “may” is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word “can” is used to express possibility, e.g. a consequence of an action or an event.”

Specifications contain **requirements** expressed in sentences in which the principal auxiliary verb is “shall”. Thus, use of “shall” in any standard expresses a requirement strictly to be followed and from which no deviation is permitted.

As appropriate to the context, “could” and “might” are also used to express possibility.

2.5 Development of Standards

Standards are developed by BSI, ISO (International Organization for Standardization) or CEN (European Committee for Standardisation) Working Groups (WGs) comprising “experts” nominated by national standard bodies (NSBs). Experts serve as individuals not representatives of particular organisations, or in the case of ISO and CEN WGs, national standards bodies. All draft standards are subject to public consultation before approval by BSI, CEN or ISO as appropriate.

Most Standards relating to soil quality have been developed by ISO Working Groups (WGs) Some ISO standards are then, or in parallel, adopted as European Standards (ENs).

More recently, some analytical and other standard specifications have been prepared initially at European level in CEN, in some cases as the lead organisation for International/European standard but also as in the form of stand-alone European standards covering not only soils but also other solid matrices such as sludges and wastes.

BSI EH4 decides whether an ISO standard should be adopted as a British Standard.

BSI is [currently] obliged to adopt all European Standards as British Standards.

There is an opportunity in the case of both International and European Standards to add a national foreword explaining how the standard should be used in the UK.

Information on the most relevant standards organisation is provided in Section 4.

The relationship between the relevant BS, European and International committees is illustrated in Figure 2.

2.6 Revision and Amendment of Standards

All British, European and International Standards are subject to periodic review (usually at five yearly intervals) to decide whether they should be “confirmed” without change, “amended”, or revised.

Standards can be “amended” between periodic reviews for example to deal with particular issues, e.g. Amendment 1 to BS10175 was in response to the publication of BS 8576 and Amendment 2, the publication of the BS ISO 18400 series of standards.

2.7 What is “Soil”

The term “soil” has a different meaning in soil quality standards than that used in geotechnical standards.

BS EN ISO 11074: 2015, **2.1.11** defines “soil” as:

“upper layer of the Earth’s crust transformed by weathering and physical/chemical and biological processes and composed of mineral particles, organic matter, water, air, and living organisms organized in generic soil horizons

Note 1 to entry: In a broader civil engineering sense, soil includes topsoil and sub-soil; deposits such as clays, silts, sands, gravels, cobbles, boulders, and organic matter and deposits such as peat; materials of human origin such as wastes; ground gas and moisture; and living organisms.”

However, BS 10175 employs the definition:

“topsoil and subsoils; deposits such as clays, silt, sand, gravel, cobbles, boulders and organic matter and deposits such as peat; material of human origin such as wastes; ground gas and moisture; and living organisms

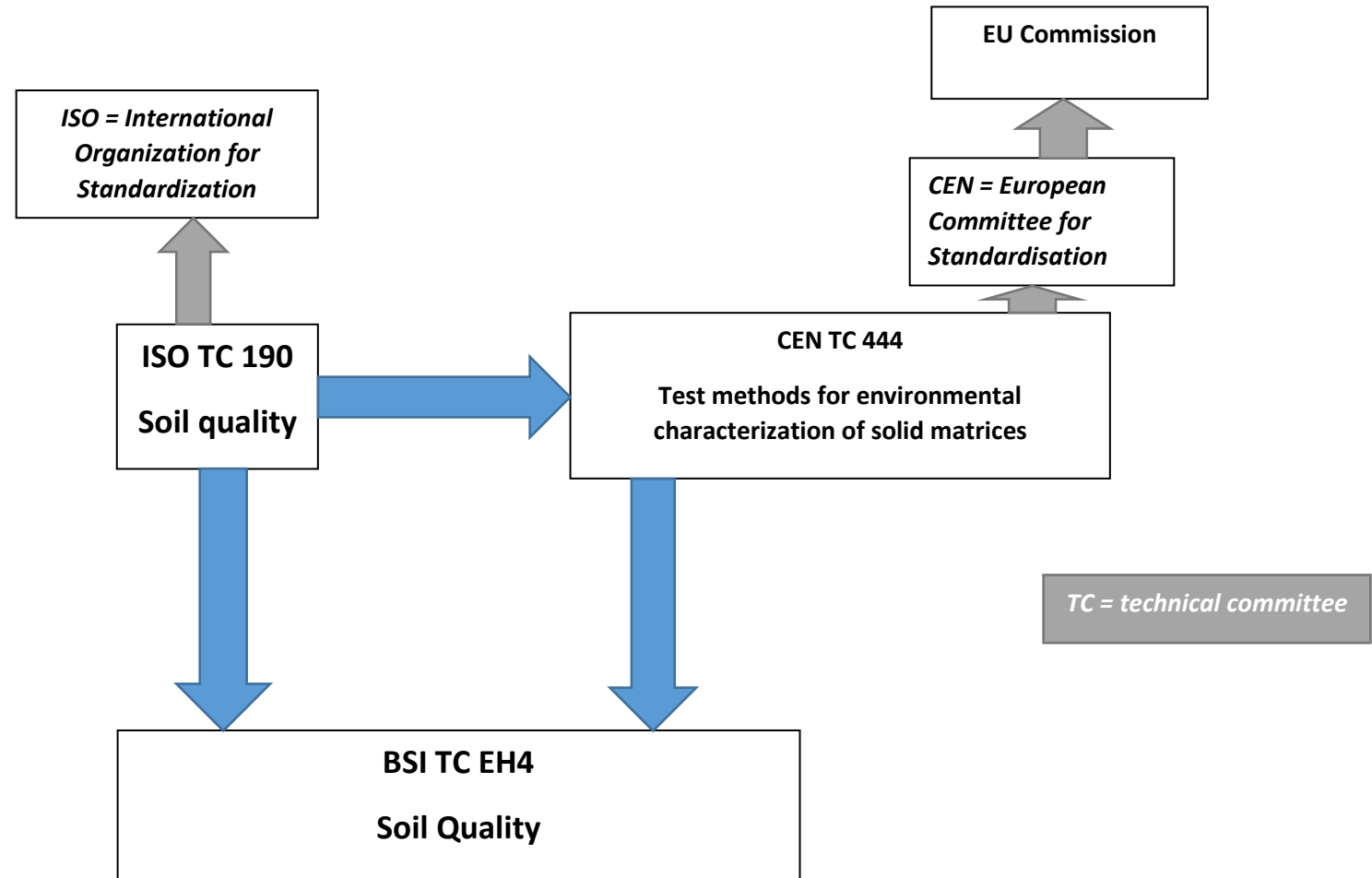
NOTE This is the meaning ascribed through ground engineering and encompasses fills and deposited wastes.”

It should be noted that BS ISO 18400-104:2017, Clause 4.1, Note 2 states:

“Soils (and other soil materials) are composed of a mixture of mineral particles, organic matter, water, air (soil gas) and living organisms. In the case of some contaminated soils, a non-aqueous liquid phase might also be present. The solid matrix (phase), consists of particles of different size, shape and physical and chemical properties. The aim when carrying out soil sampling is usually to obtain sufficiently representative samples that can be used to characterize the properties of the whole soil entity (e.g. *in situ* soil in the form of a volume or horizon, or surface deposit such as a stockpile) or the portion considered relevant to the objectives of the investigation (e.g. <0.1 mm fraction for exposure assessment via hand-to-mouth activity). The properties of discrete entities such as individual soil particles are not addressed.”

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Figure 2: ISO/CEN/BSI RELATIONSHIPS



3. RANGE OF BS SOIL QUALITY STANDARDS

3.1 Available Standards

About two hundred British/European/International standards have been produced by Technical Committees BS EH4, CEN TC 444 (which has absorbed CEN TC 345 & TC 292) and ISO TC 190. These technical committees deal with all aspects of soil quality not only those relating to potentially contaminated and contaminated sites. They are variously applicable to natural, near natural (e.g. agricultural) soils and urban soils.

The scope of BS EH4, for example, includes the protection, remediation, classification, and investigation of soils along with the measurement, definition of terms and reporting of soil characteristics including those related to greenhouse gas production and sequestration, and sustainable use of soil. The work undertaken includes the review and production of a diverse but consistent set of standards. This includes physical, chemical, biological and statistical analysis, and site investigation and monitoring procedures. The committee also considers the storage, disposal, or re-use of soils, and soil-related materials and processes.

In addition, as illustrated in Figure 1, there are numerous other standards that might be relevant during the investigation, assessment, remediation or development of particular sites.

Selected standards relating to particular topics are listed in **Section 5**. The “Scopes” of selected standards are provided in Annex A.

A full listing of published, proposed and withdrawn standards for which BSI committee EH4 is responsible see:

<https://standardsdevelopment.bsigroup.com/committees/50001294>

3.2 Soil Characterisation Guidance.

A number of standards provide guidance about the characterisation of soil in particular contexts, e.g. in relation to human health risk assessment – BS ISO 15800 (see Table 5.1). These standards typically explain the reasons why it could be important to determine certain soil characteristics in a particular context and indicate ISO analytical methods etc. available when the document was prepared that could be used to make the recommended determinations. Examples of the application of the principles set out in the main text are sometimes included as Annexes. These standards can be helpful during the design stage of an investigation.

3.3 Use of BS Soil Quality Analytical and Other Test Methods

A requirement for chemical analysis (for example) according to a particular BS Standard Specification can be included in a Specification for a Site Investigation or a contract for laboratory services. It is important to be aware that a laboratory might be unable (or unwilling) to follow a particular specification. In this case it might suggest an alternative in-house method that is claimed to yield comparable results. In this case, it should be able to demonstrate the likely equivalence of the results achievable using the in-house method and the BS method.

It is important to be aware that some methods are “empirical”, and must be used strictly according to the Standard Specification, if the results are to be “fit for use”.

It is also important to be aware that superficially similar analytical methods can yield different results. Where there are a number of methods for determination of a particular substance the most appropriate to use will depend on the purpose for which the results is required. BS ISO 15176 provides a useful guidance on such issues (see for example text in Box 2.1).

Note that unlike in many jurisdictions, the UK does not specify what analytical methods should be used when using generic assessment criteria, e.g. does a criterion for cadmium refer to the “total concentration” or the “pseudo-total concentration”? The latter is commonly assumed but there is no technical justification for this – it is just simpler and cheaper.

Box 2.1 Extract from BS ISO 15176:2019, Clause 4.4.3.1

In order to estimate the availability of inorganic substances to different environmental compartments and receptors, it can be necessary to distinguish between different fractions of an analyte, e.g. soluble in strong acid, weak extractants, or water (see [Table 2](#)). Although the extractants might differ, it is often possible to use the same methods to analyse the extractant.

Other specialist empirical methods have been developed to estimate the proportions of some substances that are bioaccessible in humans (i.e. that will enter the body if ingested.), e.g. ISO 17924.

Table 2 — Examples of extraction methods for metals and metalloids

Fraction	Examples of extraction method	Measurement method (example)
Total ^[x]	Digestion with hydrofluoric and perchloric acids in accordance with ISO 14869-1	ISO 11047
Pseudo-total	Trace metals soluble in aqua regia in accordance with ISO 11466	
Weak extractants	e.g. NH ₄ NO ₃ NaNO ₃ CaCl ₂	ISO 11047
Water	Batch leaching tests using various water: soil ratios (e.g. ISO 21268-1 ^a or ISO 21268-2 ^b) Column leaching tests (e.g. ISO 21268-3 ^c)	ISO 11047
Tests to simulate human bioaccessibility	Batch testing using a combination of extractants simulating digestion	ISO 17924

NOTE Extraction methods using water and weak extractants are generally empirical methods. The results obtained are often highly dependent on factors such as particle size of the test sample, the time period over which the extraction is carried out, the temperature at which the procedure is carried out and the ratio of extractant to solid. Strict adherence to the conditions stipulated in the standardised procedures is essential if consistent and comparable results are to be obtained.

a Under preparation. Stage at the time of publication: ISO/FDIS 21268-1:2019.

b Under preparation. Stage at the time of publication: ISO/FDIS 21268-2:2019.

c Under preparation. Stage at the time of publication: ISO/FDIS 21268-3:2019.

[X]: Additional note to this document – Can also be determined using XRF.

4. RELEVANT BS, CEN and ISO COMMITTEES

4.1 Introduction

Most Standards relating to soil quality have been developed by ISO Working Groups (WGs) comprising “experts” nominated by national standard bodies (NSBs). Some ISO standards are then, or in parallel, adopted as European Standards (ENs).

More recently, some analytical and other standard specifications have been prepared initially at European level in CEN, in some cases as the lead organisation for International/European standard but also as in the form of stand-alone European standards covering not only soils but also other solid matrices such as sludges and wastes.

BSI EH4 decides whether an ISO standard should be adopted as a British Standard.

BSI is obliged to adopt all European Standards as British Standards.

There is an opportunity in the case of both International and European Standards to add a national foreword explaining how the standard should be used in the UK.

4.2 BSI Committees

EH/4 Soil Quality

EH/4, is responsible for developing British Standards in the fields of soil quality, soil pollution and contaminated soil. The scope includes the protection, remediation, classification, and investigation of soils along with the measurement, definition of terms and reporting of soil characteristics including those related to greenhouse gas production and sequestration, and sustainable use of soil. The committee has a varied work programme that includes developing British Standards to address specific issues highlighted by UK industry. The work undertaken includes the review and production of a diverse but consistent set of standards. This includes physical, chemical, biological and statistical analysis, and site investigation and monitoring procedures. It also considers the storage, disposal, or re- use of soils, and soil-related materials and processes. The committee provides significant input to European and International Standards development from proposal and inception through to standards under systematic review and standards in active drafting. It does this by mirroring the work programmes in relevant CEN and ISO Technical Committees. This is achieved by active participation in CEN/TC 444 (*Test methods for environmental characterization of solid matrices*) and ISO/TC 190 (*Soil quality*). The EH/4 committee comprises UK industry experts who are all representatives of relevant industry and academic bodies, learned and professional organisations and/or individual experts. The members bring their specific skills and experience to develop robust and meaningful standards to advance these key topics. The committee generally meets two to three times a year.

Published, proposed and withdrawn standards are listed on the EH/4 web-site as are the members of the committee.

<https://standardsdevelopment.bsigroup.com/committees/50001294>

B/526/03 Site investigation and ground testing

B/526/03 is responsible for the UK input to national, European and international standards, in particular Eurocode 7 Part 2 and Eurocodes related material including the extensive series of testing standards developed by CEN/TC 341 and ISO/TC 182/SC 1 Geotechnical investigation

Published, proposed and withdrawn standards are listed on the B526/3 web-site as are the members of the committee.

<https://standardsdevelopment.bsigroup.com/committees/50001991>

EH/3/2 Water quality - Physical chemical and biochemical methods

Under the direction of the EH/3 (*Water quality*), is responsible for standardization of physical, chemical and biochemical methods of water analysis, and the provision of UK input to ISO/TC147/SC2 and CEN/TC230/WG1. *EH/3/2* is also Responsible for BS 2690 and BS 1427.

<https://standardsdevelopment.bsigroup.com/committees/50002177>

EH/3/6 Water quality - Sampling

Under the direction of the EH/3 (*Water quality*), EH/3/6 is responsible for the standardisation of sampling practices used in the field of water quality assessment, provision of UK input to ISO/TC147/SC6 and all other matters associated with sampling in connection with water quality management.

<https://standardsdevelopment.bsigroup.com/committees/50002181>

4.3 ISO and CEN Committees

ISO TC190 Soil Quality

Standardization in the field of soil quality

- Soils in situ;
- Soil materials intended for reuse in or on soils, including dredged sub-aquatic soil materials (= excavated sediments).

Excluded:

- Threshold or limit values for the assessment of soil quality;
- Civil engineering aspects (are dealt with by ISO/ TC 182 "Geotechnics");
- In situ sediments (these are dealt with by ISO/TC 147 "Water quality").

Published, proposed and withdrawn standards are listed on the TC190 web-site

<https://www.iso.org/committee/54328.html>

CEN TC444 Test methods for environmental characterization of solid matrices

Standardization of test methods for the environmental characterization of soil, solid and liquid waste, biowaste and sludge. This covers:

- Sampling, assessment methods and vocabulary
- Digestion / extraction, chemical analysis, physical methods, quality assurance and quality control (laboratories);
- Where appropriate and decided by matrix specific environmental Technical Committees: leaching tests, screening methods, sample pretreatment, biological and microbiological analysis, reporting.

Excluded are:

- Sampling, assessment methods and vocabulary related to sludge, which are covered by CEN/TC 308 '*Characterization and management of sludges*'

https://standards.cen.eu/dyn/www/?p=204:7:0:::FSP_LANG_ID,FSP_ORG_ID:25,2046877&cs=1B8134894C997F4F8E9411CF88107C0C7#1.

5. STANDARDS GROUPED BY TOPICS Etc.

For a full listing of “Soil Quality” standards see the EH4 web-site:

<https://standardsdevelopment.bsigroup.com/committees/50001294>

5.1 Introduction

Available standards for some selected subject areas relevant to the investigation, assessment, remediation and development of contaminated land are listed in Table 5.1 to 5.10. The versions current in **June 2020** are listed but it is important to always check that you are using the current version, and for regulators to check that the current version has been used.

Biological, chemical and physical test methods are not listed because of the large numbers of standards for these.

Table 5.1: BS ISO 18400 series of standards

BS ISO DIS 18400-100: 2017
Soil quality – Sampling - Umbrella

BS ISO 18400-101: 2017
Soil quality – Sampling – Framework for the preparation and application of a sampling plan

BS ISO 18400-102: 2017
Soil quality – Sampling – Selection and application of sampling techniques

BS ISO 18400-103: 2017
Soil quality – Sampling – Safety

BS ISO 18400-104:2018
Soil quality – Sampling - Sampling strategies

BS ISO 18400-105: 2017
Soil quality – Sampling - Packing, transport, storage and preservation of samples

BS ISO 18400-106:2017
Soil quality – Sampling - Quality control and quality assurance

BS ISO 18400-107: 2017
Soil quality – Sampling – Recording and reporting

BS ISO 18400-201: 2017
Soil quality – Sampling - Pretreatment in the field

.BS ISO 18400-202:2018
Soil quality – Sampling - Preliminary investigations

BS ISO 18400-203:2018
Soil quality – Sampling – Investigation of potentially contaminated sites

ISO 18400-204: 2017 ()*
Soil quality – Sampling – Soil gas

BS ISO 18400-205: 2018
Soil quality – Sampling – Guidance on the procedure for investigation of natural, near natural and cultivated sites

BS ISO 18400-206:2018
Soil quality – Sampling –Collection, handling and storage of soil for the assessment of biological functional and structural endpoints in the laboratory

(*) *ISO 18400-204 has not been adopted as a British Standard because it deals with the same subject area as BS 8576.*

Table 5.2: Soil characterisation for particular purposes

<p>BS EN ISO 11504: 2017 (ISO 2017) Soil quality – Assessment of impact from soil contamination with petroleum hydrocarbons</p> <p>BS EN ISO 15175:2018 Soil quality -- Characterization of contaminated soil related to groundwater protection</p> <p>BS ISO 15176: 2019 Soil quality – Guidance on characterization of excavated soil and other materials intended for re-use</p> <p>BS ISO 15799: 2019 Soil quality -- Guidance on the ecotoxicological characterization of soils and soil materials</p> <p>BS ISO 15800: 2019 Soil quality – Characterization of soil with respect to human exposure</p> <p>BS ISO 19204: 2017 Soil quality – Procedure for site-specific ecological risk assessment of soil contamination (soil quality TRIAD approach)</p> <p>BS EN ISO 19258: 2018 Soil quality – Guidance on the determination of background values</p> <p>BS EN ISO 21365:2020 Soil quality – Conceptual site models for potentially contaminated sites</p>
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Table 5.3 : Preliminary Investigations etc.

<p>BS 5930:2015 + A1:2020 Code of practice for ground investigations</p> <p>BS 8576:2013 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds</p> <p>BS 10175:2011 + A2:2017 Investigation of potentially contaminated sites. Code of practice</p> <p>BS EN ISO 21365:2020 Soil quality – Conceptual site models for potentially contaminated sites</p> <p>BS ISO 18400-202:2018 Soil quality – Sampling - Preliminary investigations</p>

Table 5.4: Reporting

BS 8576: 2013

Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds

BS 10175:2011 + A2:2017

Investigation of potentially contaminated sites. Code of practice

BS ISO 18400-107: 2017

Soil quality – Sampling – Recording and reporting

BS EN ISO 28258: 2013 + A1:2019

Soil quality – Digital exchange of soil-related data

Table 5.5: Sample handling, preparation and storage

BS ISO 11464: 2006

Soil quality – Pretreatment of samples for physio-chemical analyses

BS ISO 14507:2003

Soil quality -- Pretreatment of samples for the determination of organic contaminants

BS EN ISO 16720:2007

Soil quality – Pretreatment of soil samples by freeze drying for subsequent analysis

BS ISO 18512: 2007

Soil quality – Guidance on long and short term storage of soil samples

BS ISO 18400-105: 2017

Soil quality – Sampling - Packing, transport, storage and preservation of samples

BS ISO 18400-201: 2017

Soil quality – Sampling - Pretreatment in the field

BS ISO 18400-206:2018

Soil quality – Sampling – Collection, handling and storage of soil for the assessment of biological functional and structural endpoints in the laboratory

BS ISO 23909:2008

Soil quality – Preparation of laboratory samples from large samples.

Table 5.6: Field Activities

BS 10176:2020

Taking soil samples for determination of volatile organic compounds (VOCs) – Specification

BS ISO 11271:2002

Soil quality – Determination of redox potential - Field method

BS EN ISO 12404: 2015

Soil quality – Guidance on the selection and application of screening methods

BS EN ISO 13196:2015

Soil quality – Screening soils for selected elements by energy-dispersive X-ray fluorescence spectrometry using a handheld or portable instrument

BS ISO 15903:2002

Soil quality -- Format for recording soil and site information

BS ISO 18400-102: 2017

Soil quality – Sampling – Selection and application of sampling techniques

BS ISO 18400-201: 2017

Soil quality – Sampling – Pretreatment in the field

BS ISO 18400-206:2018

Soil quality – Sampling –Collection, handling and storage of soil for the assessment of biological functional and structural endpoints in the laboratory

BS EN ISO 25177: 2019

Soil quality – Field soil description

Table 5.7: Remedial and Protective Measures

BS 8485: 2015 + A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings

BS ISO 15176: 2019

Soil quality – Guidance on characterization of excavated soil and other materials intended for re-use

BS ISO 18504: 2017

Soil quality – Sustainable remediation

Table 5.8: Leaching

BS EN ISO 18772: 2014 (ISO 2008)

Soil quality – Guidance on leaching procedures for subsequent chemical and ecotoxicological testing of soils and soil materials.

BS EN ISO 21268-1: 2019

Soil quality -- Leaching procedures for subsequent chemical and ecotoxicological testing of soils and soil materials -- Part 1: Batch test using a liquid to solid ratio of 2 L/kg dry matter

BS EN ISO 21268-2: 2019

Soil quality -- Leaching procedures for subsequent chemical and ecotoxicological testing of soils and soil materials -- Part 2: Batch test using a liquid to solid ratio of 10 L/kg dry matter

BS EN ISO 21268-3: 2019

Soil quality – Leaching procedures for subsequent chemical and ecotoxicological testing of soils and soil materials -- Part 3: Up-flow percolation test

BS EN ISO 21268-4:2019

Soil quality – Leaching procedures for subsequent chemical and ecotoxicological testing of soil and soil-like materials – Part 4: Influence of pH on leaching with initial acid/base addition

Table 5.9: SELECTED OTHER STANDARDS

BS EN ISO 11074: 2015

Soil Quality – Vocabulary

BS EN ISO 17402:2011

Soil quality – Requirements and guidance for the selection and application of methods for the assessment of bioavailability of contaminants in soil and soil materials

BS ISO 17616:2019

Soil quality – Guidance on the choice and evaluation of bioassays for ecotoxicological characterization of soils and soil materials

BS ISO 17924: 2018

Soil quality – Assessment of human exposure from ingestion of soil and soil material – Procedure for the application estimation of human bioaccessibility/bioavailability of metals in soil

BS ISO 21266: 2019 Soil quality – Guideline for the screening of soil polluted with toxic elements using soil magnetometry

Table 5.10: BS ISO 5667 Series

BS EN ISO 5667-1: 202X Water quality -- Sampling. Part 1: Guidance on the design of sampling programmes and sampling techniques^[A]

BS EN ISO 5667-3:2018
Water quality. Sampling. Preservation and handling of water samples

BS ISO 5667-4:2016
Water quality. Sampling. Guidance on sampling from lakes, natural and man-made

BS ISO 5667-11:2009, BS 6068-6.11:2009
Water quality. Sampling. Guidance on sampling of groundwaters

BS ISO 5667-12:2017
Water quality. Sampling. Guidance on sampling of bottom sediments from rivers, lakes and estuarine areas

BS EN ISO 5667-13:2011
Water quality. Sampling. Guidance on sampling of sludges

BS EN ISO 5667-14:2016
Water quality. Sampling. Guidance on quality assurance and quality control of environmental water sampling and handling

BS EN ISO 5667-16:2017
Water quality. Sampling. Guidance on biotesting of samples

BS ISO 5667-17:2008
Water quality. Sampling. Guidance on sampling of bulk suspended solids

BS EN ISO 5667-19:2004, BS 6068-6.19:2004
Water quality. Sampling. Guidance on sampling in marine sediments

BS ISO 5667-20:2008
Water quality. Sampling. Guidance on the use of sampling data for decision making. Compliance with thresholds and classification systems

BS ISO 5667-22:2010
Water quality. Sampling. Guidance on the design and installation of groundwater monitoring points

BS EN ISO 5667-23:2011
Water quality. Sampling. Guidance on passive sampling in surface waters

BS ISO 5667-24:2016
Water quality. Sampling. Guidance on the auditing of water quality sampling

[A] In preparation June 2020. Previous version (BS EN ISO 5667-1:2006, BS 6068-1:2006) has been withdrawn.

ANNEX A: SCOPE OF KEY/SELECTED STANDARDS

BS EN ISO 11074:2015

Soil quality - Vocabulary

Scope

This International Standard defines a list of terms used in the preparation of the standards in the field of soil quality.

The terms are classified under the following main headings:

- general terms (terms relating to soil, soil materials, land, and sites);
- description of soil (soil characteristics, soil water, properties of soils and substances, processes in soil, contamination, pollution, background content);
- sampling (general terms, sample types/sampling type, sampling stages, execution of sampling, quality control samples, sample pretreatment);
- terms relating to the assessment of soils (quality, assessment of soil and sites with respect to risk, hazard and exposure, soil protection);
- remediation (general terms, principal remediation types, engineering-based methods, process- based treatment methods);
- soil ecotoxicology.

NOTE See also the ISO online browsing platform (OBP): www.iso.org/obp/ui/

BS 8576:2013

Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds

Scope

This British Standard provides guidance on the monitoring and sampling of ground gases. It covers volatile organic compounds (VOCs) and permanent gases such as carbon dioxide, methane and oxygen. It is intended to be read in conjunction with BS 10175.

Guidance is not provided on:

- risk evaluation and characterization;

NOTE 1 Guidance can be found in CLR 11 [3], CIRIA C665 [4], CIRIA C682 [5] and the Ground Gas Handbook [6].

- 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 gases;
- monitoring and sampling for radon.

NOTE 2 Radon occurs naturally at varying concentrations in large parts of the United Kingdom. It is commonly present in mine gas and can also be released from groundwater when it is extracted from the ground. It can also arise from deposited wastes such as those from the nuclear industry, phosphorus slags, and coal ash. Its importance lies in the fact that the risks associated with exposure to it are serious and its effects on the human condition are backed by extensive epidemiological information. There are established or draft International Standards for investigation and determination of radon in soils (BS ISO 18589 series) and in air (BS ISO 11665-1). The latter provides guidance on analysis of historic records, site reconnaissance, identification of preferential migration pathways, development of a sampling plan and how to measure radon in air once it has been emitted from the ground (see Annex B for further information). At the time of publication of this standard, the committee are not aware of any international standards or other authoritative guidance on the measurement and sampling of radon in the ground analogous to that provided in this standard for permanent gases and VOCs. The state-of-the-art is not sufficiently developed in the UK to provide such guidance as part of this standard but some preliminary guidance is provided for information in Annex B.

NOTE 3 The term “permanent gas” (3.10) is used rather than “bulk gas” as used in much UK guidance. The two are not synonyms. “Permanent gas” is an accepted international term in use for over 100 years. Its usage does not indicate any relationship between the proportion of a gas present and its properties in the way that the terms “bulk gas” and “trace gas” do. These terms were originally used in connection with “landfill gas”. “Permanent gas” is considered more appropriate for the range of sources covered by this standard.

NOTE 4 “Ground gas” has the same meaning as “soil gas” as defined in BS ISO 11074, i.e. “gas and vapours in the pore spaces of soils”.

BS 10175:2011 + A2:2017

Investigation of potentially contaminated sites. Code of practice

Scope

This British Standard gives recommendations for, and guidance on, the investigation of land potentially affected by contamination and land with naturally elevated concentrations of potentially harmful substances, to determine or manage any risks. It covers:

- a) setting the objectives of an investigation;
- b) developing a strategy for the investigation;
- c) designing the different phases of the investigation;
- d) sampling and field testing;
- e) laboratory analysis;
- f) reporting,

in order to obtain scientifically robust data on soil, groundwater, surface water and ground gas contamination.

It is intended for use by those with an understanding of the risk-based approach to the assessment of sites (as described in the Model Procedures for the Management of Land Contamination (CLR 11)).

The relevant recommendations and guidance within this standard are intended to ensure that the objectives of an investigation are achieved and that appropriate data for the risk assessment are obtained. However, it is not feasible to provide detailed guidance for every possible investigation scenario.

This British Standard does not give:

- 1) guidance on certain constraints or problems that can affect a site, such as geotechnical aspects (which are covered by BS 5930);
- 2) guidance on legal aspects, including the need for licences and permits, etc.;
- 3) detailed guidance for the investigation and assessment of radioactively contaminated sites (see Note 1).
- 4) procedures for the formal assessment of the potential risks posed by land potentially affected by contamination (see Note 2);
- 5) guidance on sampling from stockpiles (see Note 3);
- 6) detailed guidance on investigations for ground gases, i.e. Volatile Organic Compounds (VOCs) and permanent gases such as methane and carbon dioxide.

When relevant, this standard is to be used in conjunction with other standards and codes of practice, for example, BS 8576 for investigations for ground gas and BS 5930 for investigations for civil engineering purposes.

NOTE 1 Guidance on the investigation and assessment of radioactivity in soils is given in the BS ISO 18589 series. The appropriate methodology for such works will be dependent on the nature of the contamination and the site conditions and ought to be discussed with the regulator in advance.

NOTE 2 See the guidance published by Defra and the Environment Agency in CLR 11.

NOTE 3 Guidance on sampling stockpiles is given in BS ISO 18400-102 and BS ISO 18400-104.

NOTE 4 Guidance on the investigation of uncontaminated natural, near-natural and agricultural sites, for example to determine factors relevant to assessment of potential productivity, is provided in BS ISO 18400-205.

NOTE 5 Further guidance on assessment of soil quality in relation to particular purposes can also be found in BS EN ISO 15175, BS ISO 15176, BS ISO 15799, ISO 15800 and BS ISO 19258.

BS 10176:2020

Taking soil samples for determination of volatile organic compounds (VOCs) — Specification

Scope

This British Standard specifies methods for taking soil samples for the determination of volatile organic compounds (VOCs) to minimize the possible loss of VOCs to atmosphere during and after sample collection.

Two principal ways of taking samples for VOC determination are specified:

- an intact core sealed to prevent loss of VOCs is taken and sent to the laboratory; and
- a small portion of material taken with a coring device is immediately placed in water or a preservative (e.g. methanol or sodium hydrogen sulfate) in a subsequently sealed vial to be sent to the laboratory.

The methanol immersion method described amplifies the guidance in BS EN ISO 15009, BS EN ISO 16558-1, BS ISO 18512 and BS EN ISO 22155 about this method and is intended to be followed in preference to the briefer descriptions in these four standards.

NOTE 1 This standard uses the term "soil" to refer to "soil and soil materials" as defined in BS EN ISO 11074:2015, 7.4.16, although the procedures specified might not be applicable to certain coarse soils and rocks (see 4.1.2, Figure 1 and 6.3).

NOTE 2 The methods described can be applied at the sampling location, in an on-site facility or at an off-site facility. In all three cases, the sample is then sent to the analytical laboratory. It is assumed that the overall site investigation is carried out in accordance with BS 10175 and that the sampling strategy is developed in accordance with BS 10175 and BS ISO 18400-104.

NOTE 3 Analytical procedures are outside the scope of this standard. Laboratories should 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:

- *BS EN ISO 15009, Gas chromatographic determination of the content of volatile aromatic hydrocarbons, naphthalene and volatile halogenated hydrocarbons – Purge-and-trap method with thermal desorption;*
- *BS EN ISO 16558-1, Risk-based petroleum hydrocarbons – Determination of aliphatic and aromatic fractions of volatile petroleum hydrocarbons using gas chromatography (static headspace method);*
- *BS EN ISO 22155, Gas chromatographic determination of volatile aromatic and halogenated hydrocarbons and selected ethers – Static headspace method.*

Observations and recommendations regarding analytical procedures in commentaries and notes are provided for information only.

BS ISO18400-102:2017

Soil quality — Sampling —

Selection and application of sampling techniques

This document gives guidelines for techniques for taking samples so that these can subsequently be examined for the purpose of providing information on soil quality. It gives information on equipment that is typically 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.

This document does not cover:

- investigations for geotechnical purposes, though where redevelopment of a site is envisaged, the soil quality investigation and the geotechnical investigation may sometimes be beneficially combined;
- sampling of hard strata such as bedrock;
- methods for the collection of information on soil quality without taking samples such as geophysical methods;
- collection of water samples (these are to be collected in accordance with appropriate International Standards on ground or surface water sampling; for further information, see the ISO 5667 series);
- investigations of soil gas about which guidance is provided in ISO 18400-204;
- investigation of radioactively contaminated sites.

NOTE 1 "Sampling technique" is defined in ISO 11074.

NOTE 2 Guidance on the investigation and assessment of radioactivity in soils is provided in the ISO 18589 series.

BS ISO18400-104:2018

Soil quality — Sampling — Strategies

This document gives general guidance on the development of site investigation strategies and detailed guidance on the development of sampling strategies, when collecting information on

- the average properties of soil,
- the variability of soil properties, and
- the spatial distribution of soil properties.

It is applicable to soil samples intended for chemical testing and determination of a variety of other properties (e.g. physical).

Although the main focus of this document is the collection of material (field samples) for transfer to a laboratory for testing, it is also applicable when measurements are made directly in the field.

NOTE 1 This document also provides information on the statistical principles underlying the development of appropriate sampling strategies and statistical methodologies.

NOTE 2 Guidance on other forms of related sampling activities are given in other International Standards [for soil gas (ISO 18400-204) and for biological testing purposes (ISO 18400-206)]. Guidance on sampling groundwater is provided in ISO 5667-11 and ISO 5667-22 and on sampling methods and groundwater measurements in geotechnical investigations in ISO 22475-1.

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