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Towards Harmonized Soil Monitoring in the EU: An Inventory of Existing International and European Standards

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Contents

Abstract

The directive on soil monitoring and resilience (Soil Monitoring Law) was included in the Official Journal of the European Union (EU 2025/2360) on November 26th, 20225. After water and air, this Directive puts forward the first EU legislation on the soil environmental compartment. The directive establishes a harmonised soil monitoring framework for assessing the health of soils throughout the EU. A harmonised approach implies that standards become important to ensure intercomparability among, and within, Member States. The directive prescribes reference methodologies and requires transfer functions for other methods. The Directive also includes some standards for the monitoring and measuring of soil descriptors based on those being used through the LUCAS topsoil surveys from 2009 to 2022. The present technical report provides an inventory of 574 soil-related standards from international and European standard bodies including the International Organization for Standardisation (ISO) and the European Committee for Standardisation (CEN), as well as standards from other well-recognised international institutions including the United States Environmental Protection Agency (EPA) and the Food and Agriculture Organization of the United Nations (FAO-GLOSOLAN). There is a need for harmonisation of soil-related standards to ensure consistency and comparability of soil data and to support effective soil management and protection efforts.

Authors

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1. Introduction

Soil is a vital component of the environment, providing essential ecosystem services and supporting human well-being. However, soil pollution and degradation pose significant threats to soil health, biodiversity, and ecosystem functioning. Effective soil monitoring and remediation are crucial to prevent and mitigate these impacts. The Soil Monitoring Law (SML) provides a framework for soil monitoring as the first step in protecting soil health, preventing soil pollution and the remediation of contaminate sites (EU 2025/2360). A key component of the SML is a set of soil indicators (referred to as descriptors) and associated analytical methods using European and/or international standards. The use of standards for definitions and methods are essential for ensuring that soil monitoring and remediation efforts are effective, efficient, and consistent with international best practices. The standards relating to soil descriptors, such as soil texture, salinisation, soil compaction, and soil organic carbon, are particularly important because they provide a common language and framework for describing and assessing healthy soils in a harmonized way. Furthermore, standards describing sampling methods and analytical techniques, are crucial for ensuring that soil data are accurate, reliable, and comparable. These standards help to minimise errors and uncertainties in soil monitoring, providing more effective identification of degradation sources and prioritisation of remediation efforts. By using standardised methods and protocols, soil monitoring data can be integrated into larger databases and models, supporting the development of more effective soil management and protection policies.

In addition, the standards relating to soil remediation techniques and technologies, are essential for guiding efforts for ensuring that contaminated soils are restored to a safe and healthy state using up-to-date methodology. These standards provide guidance on the selection and application of remediation methods, helping to minimise risks to human health and the environment. By using standardised approaches and technologies, soil remediation efforts can be optimised, reducing costs and improving outcomes. A comprehensive approach to harmonisation and standardisation of soil pollution data was done by Yunta et al (2025) for effective policymaking, decision-support, and sustainable land management.

This report aims to provide an inventory of current soil-related standards from international standard bodies. The report provides insights for the development of a harmonised and comprehensive framework for soil monitoring, analysis, and remediation, ultimately supporting effective soil management and protection efforts.

The specific objectives of this report are:

- To provide an inventory of the available soil-related standards from the European standardisation bodies, such as the European Committee for Standardisation (CEN), and the international standard bodies such as the International Organization for Standardisation (ISO). Standards from other well-recognised international institutions including the United States Environmental Protection Agency (EPA) and the Food and Agriculture Organization of the United Nations (FAO-GLOSOLAN) were included in the inventory.
- To analyse the relationships between the standards included in the SML and those available from the international and European standard bodies to explore potential areas of complementarity.

2. Methodology

2.1. Inventory

2.1.1. The Soil Monitoring Law (SML)

The Soil Monitoring Law (EU 2025/2360) was reviewed for the further assessment of standards. The key areas within the SML where new standards could be introduced were pinpointed, specifically highlighting the following topics and sections as opportunities for standard development.

- Article 3: Definitions.
- Article 6: Monitoring framework for soil health and for soil sealing and soil removal
- Article 7: Soil descriptors, criteria for healthy soil condition and soil sealing and soil removal indicators.
- Article 9: Measurements and methodologies
- Annex I: Soil descriptors, criteria for healthy soil condition, and soil sealing and soil removal indicators.
- Annex II: Methodologies for soil descriptors
- Annex IV: Indicative list of risk reduction measures
- Annex V: Phases and principles for site-specific risk assessment
- Annex VI: Content of register of potentially contaminated sites and contaminated sites

2.1.2. Literature review and Data collection

We identified and collected relevant information on soil-related standards from the following:

- CEN: European Committee for Standardisation (https://www.cencenelec.eu/european-standardization/european-standards/). We retrieved 781 standards from the CENELEC webpage by searching for the keyword 'soil'. We then narrowed the selection to standards from the CEN/TC 444 Working Group, as they are responsible for standardizing methods for environmental characterization of soil, waste, and related materials. Ultimately, we included 145 standards from CEN/TC 444 in this work, after excluding 56 withdrawn standards from the initial 201 relevant standards.

- ISO: International Organization for Standardisation (https://www.iso.org/standards.html). 266 standards were selected to be included in this work

- EPA: United States Environmental Protection Agency (https://www.epa.gov/measurements-modeling/index-epa-test-methods). We retrieved 3,222 EPA standards from the EPA webpage. Then, they were selected by using keyword ‘soil’.

- FAO-GLOSOLAN: Food and Agriculture Organization of the United Nations - Global Soil Laboratory Network (https://www.fao.org/global-soil-partnership/glosolan/en/). Twenty standards were identified and included in this work.

- Soil Monitoring Law (EU 2025/2360). Seventeen standards were identified and included in this work (http://data.europa.eu/eli/dir/2025/2360/oj)

In total, 574 standards were identified as relevant for the scope of this report.

2.2. Categorization standards

To categorize and classify the 574 soil-related standards from CEN, ISO, EPA, and FAO-GLOSOLAN into the specified topics, the following methodology was employed:

Standard Review: A thorough review of the 574 standards was conducted to identify the primary topic of each standard, which was categorized into one of the following themes: Soil definitions, Risk Assessment, Soil Analysis, Soil Biodiversity, Soil Monitoring, Soil Pollution, Soil Quality, Soil Remediation, and Soil Sampling. This was achieved by examining the title, abstract, or introductory section of each standard.

Standard Classification: Each standard was then assigned to a specific section of the SML (Article 3, Article 6, Article 7, Article 9, Annex II, Annex IV, Annex V, or Annex VI) based on its main topic.

Data Organization: The classified standards were compiled into a database or spreadsheet, with topics and issuing organizations used as categorization criteria. This facilitated efficient counting and analysis of standards within each topic and organization, enabling a comprehensive overview of the data.

2.3. Development of a Standardised Framework for soil monitoring

A standardised framework for soil monitoring was developed by comparing the 17 standards that are currently included in the SML with the larger set of standards from CEN, ISO, EPA and FAO-GLOSOLAN that were categorized by topic (Section 2.2).

The goal was to establish a comprehensive repository of standards that could be readily utilised for soil monitoring. This collection of standards will serve as a valuable resource, enabling swift implementation and ensuring consistency in the measurement and assessment of soil indicators. By having this set of standards in place, it will be possible to efficiently integrate new soil indicators into existing frameworks, facilitating a more streamlined and effective approach to soil management and monitoring.

The current analysis is based on a thorough examination of the titles and short descriptions of the standards, the lack of access to the full content of most standards may limit the accuracy and comprehensiveness of the classification. However, the expertise of the authors and the available information have enabled a preliminary overview of the standards related to soil monitoring and remediation. Notably, the information provided in the titles and short descriptions has been sufficient for the initial classification purposes of this inventory. The additional details contained within the standards could potentially be utilized for further refinement and deeper categorization in future analyses. This preliminary analysis provides a foundation for future work, highlighting the potential for existing standards to reinforce the SML.

3. Results and discussion

3.1. Inventory

The distribution of the 574 selected standards across the four standardisation bodies, is shown in **Table 1**. In the proposed database, ISO has 266 standards, EPA has 126 standards, CEN has 145 standards, and GLOSOLAN has 20 standards.

Table 1. Summary of standards under the Soil Monitoring Law (SML) and international bodies of Standardisation

	Article 3	Article 6	Article 7	Article 9	Annex II	Annex IV	Annex V	Annex VI	Total
SML			**1**		**16**				**17**
Soil analysis			1		14				15
Soil pollution					2				2
ISO	**2**	**4**	**4**	**30**	**162**	**2**	**38**	**5**	**266**
Risk assessment	1						38		39
Soil analysis			3		73				76
Soil biodiversity					27				27
Soil monitoring		4	1						5
Soil pollution					62			5	67
Soil quality	1								1
Soil remediation						2			2
Soil sampling				28					28
Soil temperature				2					2
NA									19
CEN/TC 444	**1**	**2**	**1**	**1**	**102**	**1**	**35**	**2**	**145**
Risk assessment							35		35
Soil analysis					42				42
Soil biodiversity					23				23
Soil monitoring		2	1						3
Soil pollution					37			2	39
Soil quality	1								1
Soil remediation						1			1
Soil sampling				1					1
Glosolan				**1**	**19**				**20**
Soil analysis					16				16
Soil biodiversity					1				1
Soil pollution					2				2
Soil sampling				1					1
EPA				**30**	**93**		**3**		**126**
Risk assessment							2		2
Soil analysis					17				17
Soil Gas					2				2
Soil monitoring				1			1		2
Soil pollution					74				74
Soil sampling				29					29
Total	**3**	**6**	**6**	**62**	**392**	**3**	**76**	**7**	**574**

Source: This report

Nineteen ISO standards were classified as Not Applicable (NA) because they primarily focus on geotechnical investigation and testing, with eighteen of these standards specifically related to laboratory testing and field instrumentation for soil and geotechnical monitoring. The remaining

standard was found to be unrelated to soil, as it deals with the determination of water quality, specifically the acute toxicity of marine or estuarine sediment to amphipods.

3.2. Inventory of standards of use for SML

The next section presents a complementary inventory of soil-related standards from EPA, ISO, CEN, and FAO-GLOSOLAN, which supplements the standards outlined in the Soil Monitoring Law (SML)

3.2.1. Article 3 – Definitions

Article 3 of SML provide definitions related to soil, ecosystem, and environmental protection that will be used throughout the document. Additionally, the article 3 defines terms related to soil contamination, such as soil contamination, contaminant, potentially contaminated site, and contaminated site. The article also defines land-related terms, such as land, land cover, soil sealing, and sealed soil. Furthermore, the article defines remediation-related terms, such as soil remediation and risk reduction measures. Other definitions include soil district, soil unit, soil descriptor, and soil health assessment. Overall, the article provides a comprehensive set of definitions that can be used to understand and address various aspects of soil and environmental protection.

Three standards covering definitions, conceptual frameworks, and vocabulary related to ecosystem services and soil quality are shown in the **Table 2**. The standards are primarily from ISO, with two standards, and CEN, with one standard. The topics covered include soil functions, ecosystem services, and soil quality vocabulary, providing a foundation for understanding and assessing soil health and ecosystem services.

Table 2. Standards for Ecosystem Services and Soil Quality: Definitions, Conceptual Frameworks, and Vocabulary

Topic	ISO	CEN	Total
Ecosystem services			
Soil functions and related-ecosystem services: definitions and conceptual framework	1		1
Glossary			
Soil quality — Vocabulary	1	1	1
Total	**2**	**1**	**3**

Source: This report

3.2.2. Article 6 – Monitoring framework for soil health and for soil sealing and soil removal

Article 6 of the SML outlines the requirements for a monitoring framework for soil health and soil sealing and removal. Member States are required to establish a monitoring framework that builds on existing frameworks at the national and Union level, and that takes into account the specific characteristics of outermost regions. The framework must be based on soil descriptors and criteria for healthy soil condition, sampling points, soil measurements, and remote-sensing data.

The Commission and the European Environment Agency (EEA) are required to leverage existing space-based data and products to develop soil remote-sensing products and provide Member States with the necessary data on soil sealing and removal indicators. They must also establish a

digital soil health data portal to provide access to soil health data, aggregated at the soil unit level or at a more detailed level.

The digital soil health data portal must provide access to data in a georeferenced spatial format, and the processing and accessing of soil health data must be performed in accordance with relevant Union law. The Commission and the EEA must ensure that Member States could review soil health data and request the correction of any errors before the data is made public.

Article 6 also outlines the requirements for the digital soil health data portal, including the types of data that can be shared or collected, and the formats or methods for integrating data into the portal. The Commission is required to adopt implementing acts to establish these formats or methods, which must be adopted in accordance with the examination procedure referred to in Article 22(2).

Both CEN and ISO standard bodies provide some standards related to the definition of a monitoring framework and the digital exchange (**Table 3**). The table lists standards related to soil monitoring framework, categorized by topic. A total of six standards are identified, covering changes in soil properties, data exchange, and monitoring programs. The breakdown is as follows: four standards are from ISO, and two standards are from CEN. The topics covered include frameworks for monitoring changes in soil properties, digital exchange of soil-related data, and guidance on establishing and maintaining monitoring programs. These standards provide a foundation for effective soil monitoring, data management, and program development.

Table 3. Standards related to monitoring framework for soil health and for soil sealing and soil removal.

Topic	ISO	CEN	Total
Soil monitoring			
Changes on soil properties			
Soil quality — Framework for detailed recording and monitoring of changes in dynamic soil properties	1		1
Data			
Soil quality — Digital exchange of soil-related data — Amendment 1	1		1
Soil quality - Digital exchange of soil-related data (ISO 28258:2013)	1	1	2
Programmes			
Soil quality — Guidance on the establishment and maintenance of monitoring programmes	1	1	1
Total	**4**	**2**	**6**

Source: This report.

3.2.3. Article 7 – Soil descriptors, criteria for healthy soil condition and soil sealing and soil removal indicators

Article 7 of the SML outlines the requirements for soil descriptors, criteria for healthy soil condition, and soil sealing and soil removal indicators. Member States are required to apply the soil descriptors listed in Annex I, Parts A, B, and C when monitoring and assessing soil health. When monitoring soil sealing and soil removal, Member States must apply the soil sealing and soil removal indicators listed in Annex I, Part D.

Article 7 also requires Member States to use criteria for healthy soil condition, which consist of non-binding Sustainable Target Values (STVs) and Operational Trigger Values (OTVs). The soil indicators for which these values need to be defined, are listed in Annex I Parts A and B, and Member States must set these values in accordance with the provisions set out in Annex I, Part B, third column. The OTVs must be set for each soil descriptor, reflecting soil degradation levels on the basis of which support for soil health and soil resilience is needed.

Member States are also required to set a list of organic contaminants for the soil descriptor related to soil contamination, and a list of contaminants for the soil descriptors related to soil contamination, including pesticides, their metabolites, and per- and polyfluoroalkyl substances (PFAS). These lists must be set taking into account the indicative list of soil contaminants referred to in Article 8, as well as relevant information on the toxicity, persistence, and mobility of the soil contaminant, and other factors.

Article 7 allows Member States to set soil descriptors and soil sealing and soil removal indicators in addition to those listed in Annex I and requires them to inform the Commission when they set or adapt these indicators or criteria. Overall, the article aims to establish a framework for monitoring and assessing soil health, and for setting criteria for healthy soil condition, to support the sustainable management of soil resources and protect human health and the environment.

List of standards related to soil descriptors, criteria for healthy soil condition, and soil sealing and soil removal indicators is shown in the **Table 4**. It is categorized into three main topics: Soil analysis, Reference material, and Soil monitoring.

Under the topic of Soil analysis, there is one standard, included in the SML, related to quality control, which is "General requirements for the competence of testing and calibration laboratories" (EN ISO/IEC-17025). This standard provides the general requirements for the competence of testing and calibration laboratories, which is essential for ensuring the accuracy and reliability of soil analysis results. This standard was not included in the CEN/TC 444 database as it was found into the CEN-CLC/JTC technical committee (CEN-CLC/JTC 1-Criteria for conformity assessment bodies)

Under the topic of Reference material, there are two standards. The first one is "General requirements for the competence of reference material producers" (ISO 17034), which deals with reference material meant for the producers. The second one is "Good practice in reference material preparation" (ISO Guide 35), which provides guidance on good practices for preparing reference materials. Under the topic of Soil monitoring, there is one standard related to ring tests, which is "Soil and water quality — Guidance and requirements for designing an interlaboratory trial for validation of biotests" (ISO 5594:2022). This standard provides guidance and requirements for designing an interlaboratory trial for validating biotests, which is essential for ensuring the accuracy and reliability of soil monitoring results. The rest of the standards related to article 7 will be introduced and discussed in the context of Annex II of the SML as the technical standards are introduced there.

Table 4. Standards related to soil descriptors, criteria for healthy soil condition, and soil sealing and soil removal indicators

Topic	SML	CEN	ISO	Total
Soil analysis	**1**		**3**	**4**
Quality control				
General requirements for the competence of testing and calibration laboratories	1	1	1	3

Reference material				
General requirements for the competence of reference material producers			1	1
Good practice in reference material preparation			1	1
Quality control				
Soil monitoring			**1**	**1**
Ring tests				
Soil and water quality — Guidance and requirements for designing an interlaboratory trial for validation of biotests			1	1
Total	**1**	**1**	**4**	**6**

Source: This report.

3.2.4. Article 9 – Measurements and methodologies

Article 9 of the directive outlines the requirements for measurements and methodologies related to soil monitoring. Member States must determine sampling points, collect and analyse data, and apply specific methodologies to determine soil descriptor values. They must also ensure quality management, perform soil measurements every six years, and update soil sealing and soil removal indicators every three years. The Commission may provide support and adopt delegated acts to adapt to scientific and technical progress. No standards related to measurements and methodologies were provided in the SML under Article 9. A list of standards related to measurements and methodologies for soil monitoring are shown in the **Table 5**. The standards are categorized by topic, including soil sampling, biodiversity, description, explosives, field pretreatment, and others. There are a total of 62 standards listed, with 30 being ISO standards, one being GLOSOLAN, one CEN standard, and 30 being EPA standards. The standards cover a wide range of topics, including soil sampling, soil gas sampling, microbiology and biodiversity, and soil temperature measurement. In addition, standards exist to provide guidance on the selection of sampling standards, the preparation of laboratory samples, and the recording and reporting of soil and site information.

Table 5. Standards related to measurements and methodologies

Topic	ISO	CEN	GLOSOLAN	EPA	Total
Soil monitoring					
Vadose Zone Soil					
Vadose Zone Soil-Solute/Gas				1	1
Soil sampling					
Soil Samplers - Auger, Sampling Trier				1	1
Biodiversity					
Soil quality — Sampling of soil invertebrates — Part 1: Hand-sorting and extraction of earthworms	2				2
Soil quality — Sampling of soil invertebrates — Part 2: Sampling and extraction of micro-arthropods (Collembola and Acarina)	1				1
Soil quality — Sampling of soil invertebrates — Part 3: Sampling and extraction of enchytraeids	1				1
Soil quality — Sampling of soil invertebrates — Part 4: Sampling, extraction and identification of soil-inhabiting nematodes	1				1
Soil quality — Sampling of soil invertebrates — Part 5: Sampling and extraction of soil macro-invertebrates	1				1
Soil quality — Sampling of soil invertebrates — Part 6: Guidance for the design of sampling programmes with soil invertebrates	1				1
Description					
Soils - Description & Sampling Field Guide				1	1
Explosives					
Explosives in Soil - Field Sampling- RDX/TNT/HMX				1	1
Field pretreatment					
Soil quality — Sampling — Part 201: Physical pretreatment in the field	1				1
Field soil description					
Soil quality — Field soil description	1	1			2
Gas					
Soil Gas Sampling, Passive - Industrial Hygiene				1	1
Soil Gas Sampling - Mini-Barrel Sampler				1	1
Soil Gas Sampling - One-Liter Syringe				1	1

Soil Gas Sampling - Direct Injection Stopper			1	1
Soil Gas Sampling - Perforated Tube			1	1
Soil Gas Sampling - Tenax Tubes			1	1
Soil Gas Sampling - Downhole Profiling			1	1
Soil Gas Sampling - Direct Injection Auger			1	1
GasSoil Gas Sampling			1	1
GasSoil Gas Sampling - Direct Injection Auger			1	1
GasSoil Gas Sampling - Direct Injection Stopper			1	1
GasSoil Gas Sampling - Downhole Profiling			1	1
GasSoil Gas Sampling - Mini-Barrel Sampler			1	1
GasSoil Gas Sampling - One-Liter Syringe			1	1
GasSoil Gas Sampling - Perforated Tube			1	1
GasSoil Gas Sampling - Tenax Tubes			1	1
GasSoil Gas Sampling, Grab of VOCs - LGAS			1	1
GasSoil Gas Sampling, Passive - Industrial Hygiene			1	1
Soil quality — Sampling — Part 204: Guidance on sampling of soil gas	1			1
Guidance				
Soil sampling guidance -Superfund			1	1
Lead				
Sampling - Collect Soil & Dust Wipe/Vacuum			1	1
Microbiology and biodiversity				
Soil quality — Sampling — Part 206: Collection, handling and storage of soil under aerobic conditions for the assessment of microbiological processes, biomass and diversity in the laboratory	2			2
Natural soils				
Soil quality — Sampling — Part 205: Guidance on the procedure for investigation of natural, near-natural and cultivated sites	1			1
Organic pollutants				
Soil quality — Pretreatment of samples for determination of organic contaminants	1			1
Preliminary investigations				
Soil quality — Sampling — Part 202: Preliminary investigations	1			1

Pretreatment				
Soil quality — Preparation of laboratory samples from large samples	1			1
Soil quality — Pretreatment of samples by freeze-drying for subsequent analysis	1			1
Pre-treatment				
Soil sample pre-treatment		1		1
Protocols				
Soil Sampling Protocols			1	1
Quality control				
SOIL Soil Sampling Quality Assurance User's Guide			1	1
Soil quality — Sampling — Part 106: Quality control and quality assurance	1			1
Reporting				
Soil quality — Sampling — Part 107: Recording and reporting	1			1
Safety				
Soil quality — Sampling — Part 103: Safety	1			1
Soil Sampling			1	1
Soil quality — Sampling — Part 101: Framework for the preparation and application of a sampling plan	1			1
Site information				
Soil quality — Format for recording soil and site information	1			1
Soil analysis VOCs				
SOIL VOC Soil Sampling & Analysis			1	1
SOP Field screening for VOC in aqueous, soil & drum			1	1
Soil standards				
Soil quality — Sampling — Part 100: Guidance on the selection of sampling standards	1			1
Storage				
Soil quality — Guidance on long- and short-term storage of soil samples	1			1
Strategies				
Soil quality — Sampling — Part 104: Strategies	1			1
Techniques				
Soil quality — Sampling — Part 102: Selection and application of sampling techniques	1			1
Soil Sampler. Veihmeyer			1	1

Transport					
Soil quality — Sampling — Part 105: Packaging, transport, storage and preservation of samples	2				2
Soil temperature					
Guidance					
Soil quality — Guidance on soil temperature measurement	1				1
Soil temperature_IR					
Soil quality — Screening method for soil temperature — Measurement by infrared (IR) thermometer	1				1
Total	**30**	**1**	**1**	**30**	**62**

Source: This report

3.2.5. Annex II – Methodologies for soil descriptors

Soil descriptors are introduced in the Annex I of the SML. They are organized in different parts (A-D) as follows:

- Part A: soil descriptors with criteria for healthy soil condition established at EU level; salinisation, loss of SOC, and subsoil compaction
- Part B: soil descriptors with criteria for healthy soil condition established at Member State level; phosphorus, soil erosion, soil contamination, water retention and infiltration, loss of SOC
- Part C: soil descriptors without criteria; (excess nutrient in soil, acidification, topsoil compaction, loss of biodiversity, and soil contamination like PFAS and pesticides and their metabolites
- Part D: soil sealing and soil removal indicators (aspects of soil degradation an soil sealing and soil removal

In Annex II the specific methodologies are introduced for each of the soil indicators described in Annex I, and it is organized as follows:

- Part A: Methodology for determining the number and location of sampling points and for the sampling survey.
- Part B: Methodology for determining or estimating the values of soil descriptors

Where a reference methodology is specifically set out, the following methodologies are to be used in accordance with Article 9: the reference methodology; a methodology equivalent to the reference methodology; or **another methodology**, **if it is available in the scientific literature or publicly available and a validated transfer function is available.** Moreover, **if a CEN methodology is available, it shall be preferred over the reference methodology. In that case, the initial reference methodology shall be an equivalent methodology.**

- Part C: Minimum methodological criteria for determining the values of the soil sealing and soil removal indicators.

The methodologies chosen shall either be available in the scientific literature or publicly available.

The SML includes a total of 16 standards in Annex II, with 14 related to soil analysis and 2 focused on soil pollution.

Standards from ISO, CEN, EPA and GLOSOLAN for soil analyses, on soil indicators included in the SML and beyond, are shown in the **Table 6**. We specifically mention the standards on measuring soil biodiversity, soil gas and soil pollution (**Table 6**), as they will be discussed separately in further sections.

Table 6. Standards available that could be used as methodologies for current and future soil descriptors

Topic	SML	ISO	CEN	GLOSOLAN	EPA	Total
Soil analysis	14	73	42	16	17	162
Soil biodiversity		27	23	1		51

Soil Gas					2	2
Soil pollution	2	62	37	2	74	177
Total	**16**	**162**	**102**	**19**	**93**	**392**

Source: This report

As shown in **Table 6**, total of 392 standards are available on soil analysis, and to measure specifically soil biodiversity, soil gas and soil pollution. The topics with the most standards are soil analysis, with 162 standards, and soil pollution, with 177 standards. The organizations with the most standards are ISO, with 162 standards, followed by CEN, with 102 standards, and EPA, with 93 standards. The inclusion of standards on soil gas, as outlined in ISO 18400-204:2017, could be essential for ensuring a comprehensive understanding of soil dynamics and the identification of soil gas sources. This standard provides basic information on soil gas dynamics and the identification of sources, covering compounds such as volatile organic compounds (VOCs), inorganic volatile compounds (mercury, cyanide, etc), and greenhouse gases emissions (GHG), which can have significant impacts on human health and the environment. Although the standard does not provide guidance on risk evaluation, protective measures, or radon monitoring, its inclusion can prompt the development of complementary regulations or guidelines to address these gaps.

3.2.5.1. Descriptors included in the SML

The SML has introduced 17 standards, with 16 of them being ISO and/or EN-ISO standards and one from GLOSOLAN (**Table 7**). These standards cover a range of soil analysis methods, including quality control (as above already mentioned), soil texture analysis, electrical conductivity, water retention capacity, hydraulic conductivity, soil organic carbon, carbonates, bulk density, available phosphorus, nitrogen, soil pH, and cation exchange capacity. Furthermore, two additional standards have been proposed for the determination of metal(loid)s in soils.

Table 7. ISO standards as included in the Annex II of the SML.

Section	Topic	Code
Soil analysis	Quality control	EN ISO/IEC-17025
Soil analysis	Bulk Density	ISO 11272
Soil analysis	Carbonates	EN ISO 10693:2014
Soil analysis	CEC_$BaCl_2$	ISO 11260
Soil analysis	Nitrogen_Kjeldahl	ISO 11261
Soil analysis	Nitrogen_combustion	ISO 13878
Soil analysis	pH	ISO 10390
Soil analysis	SOC_combustion	ISO 10694:1995
Soil analysis	Water retention	ISO 11274
Soil analysis	Hydraulic conductivity	ISO 17313
Soil analysis	$EC_{saturated}$	GLOSOLAN-SOP-08
Soil analysis	$EC_{1:5}$	EN ISO 11265
Soil analysis	Phosphorus_Olsen	ISO 11263:1994
Soil analysis	Texture_Laser	ISO 13320:2020
Soil analysis	Texture_sieving	ISO 11277:2020
Soil pollution	Aqua_regia	ISO 54321
Soil pollution	Diluted HNO_3	ISO 17586

Source: This report

3.2.5.2. Standards for the analysis of other soil descriptors

The total of 162 standards for soil analysis included in **Table 6**, are further summarized in **Table 8**.

Specific sections within the table focus on acid sulphate soils, detailing procedures for acid-base accounting and the determination of chromium reducible sulphur and suspension peroxide oxidation combined acidity and sulphur methodologies.

Other key areas include acidity and basicity, with standards for determining exchangeable acidity and the use of barium chloride solution as an extractant. Adsorption and aluminium oxides are also addressed, with methods for geochemical modelling of leaching and speciation of constituents in soils. The table further delves into Amorphous Iron and Aluminium, providing extraction methods using ascorbic acid, dithionite, and ammonium oxalate/oxalic acid.

Additionally, Table 8 covers biodegradation of organic chemicals, boron, bulk density, and carbon and nitrogen stocks, among others. Standards for Cation Exchange Capacity (CEC) using different methods and extractants, such as hexamminecobalt trichloride solution and barium chloride solution, are also listed.

The sections on denitrification, hydraulic conductivity, ICP-MS and ICP-OES, iron and aluminium oxides, moisture, nitrogen, and pH provide comprehensive coverage of these critical soil parameters. Furthermore, the table includes standards for phosphorus, pore water pressure, pretreatment of samples, redox potential, screening methods, soil organic carbon (SOC), and soil respiration.

The diversity of topics continues with soil screening, soil water, sulphate and sulphur, texture, thermal conductivity, water content, and water retention, each with its respective standards and methodologies. The inclusion of x-ray fluorescence (XRF) for screening soils for selected elements and various methods for determining soil aggregates, soil microbial mass, and texture using laser and sieving techniques rounds out the extensive list of standards provided in the table. Overall, the table presents a broad and detailed overview of the standards related to soil analysis, emphasizing the complexity and multifaceted nature of soil science.

ISO has the largest number of standards (73) related to soil analysis, covering a wide range of topics, including soil properties, contaminants, and methodologies. CEN has 42 standards related to soil analysis, with a focus on topics such as soil pH, texture, and organic carbon. EPA has 17 standards related to soil analysis, with a focus on topics such as soil contaminants, pollution, and environmental monitoring. GLOSOLAN has 16 standards related to soil analysis, with a focus on topics such as soil fertility, carbon sequestration, and soil conservation. SML standards: SML has 14 standards related to soil analysis, with a focus on topics such as soil properties, contaminants, and methodologies. SML standards are more focused on the regulatory aspects of soil analysis, providing guidelines for soil monitoring and remediation.

Table 8. Standards related to SML soil descriptors on soil analysis.

Topic	SML	ISO	GLOSOLAN	EPA	CEN	Total
Soil analysis	**14**	**73**	**16**	**17**	**42**	**162**
Acid sulphate soils						
Soil quality — Acid-base accounting procedure for acid sulfate soils — Part 1: Introduction and definitions, symbols and acronyms, sampling and sample preparation		1				1
Soil quality — Acid-base accounting procedure for acid sulfate soils — Part 2: Chromium reducible sulfur (CRS) methodology		1				1
Soil quality — Acid-base accounting procedure for acid sulfate soils — Part 3: Suspension peroxide oxidation combined acidity and sulfur (SPOCAS) methodology		1				1
Acidity_$BaCl_2$ available fraction						
Soil quality — Determination of exchangeable acidity using barium chloride solution as extractant		1			1	2
Adsorption						
Adsorption, Batch-Type - Soil Attenuation				1		1
Amorphous Iron and Al						
Soil quality - Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials - Part 1: Extraction of amorphous iron oxides and hydroxides with ascorbic acid (ISO 12782-1:2012)		1			1	2
Soil quality - Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials - Part 2: Extraction of crystalline iron oxides and hydroxides with dithionite (ISO 12782-2:2012)		1			1	2
Soil quality - Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials - Part 3: Extraction of aluminium oxides and hydroxides with ammonium oxalate/oxalic acid (ISO 12782-3:2012)		1			1	2
Biodegradation organic chemicals						
Soil quality — Guidance on laboratory testing for biodegradation of organic chemicals in soil under aerobic conditions		1				1
Soil quality — Guidance on laboratory testing for biodegradation of organic chemicals in soil under anaerobic conditions		1			1	2
Boron						
Soil analysis. Boron			1			1
Bulk Density						

Geotechnical investigation and testing — Laboratory testing of soil — Part 2: Determination of bulk density		1				1
Soil quality — Determination of dry bulk density	1	1			1	3
Standard operating procedure for soil bulk density Cylinder method			1			1
Carbon and nitrogen stocks						
Guidelines for the determination of organic carbon and nitrogen stocks and their variations in mineral soils at field scale		1				1
Carbonates						
Soil quality — Determination of carbonate content — Volumetric method		1			1	2
Soil quality - Determination of carbonate content - Volumetric method (ISO 10693:1995)	1				1	2
CEC_$[Co(NH_3)_6]^{3+}$						
Soil quality - Determination of effective cation exchange capacity (CEC) and exchangeable cations using a hexamminecobalt trichloride solution (ISO 23470:2018)		1			1	2
CEC_AcNa						
CEC_AcNa				1		1
CEC_AcNa Cation-Exchange Capacity of Soils (Sodium)				1		1
CEC_$AcNH_4$_pH7						
CEC_AcNH4_pH7.				1		1
CEC_AcNH4_pH7_Cation-Exchange Capacity of Soils (Ammonium)				1		1
Soil quality — Determination of potential cation exchange capacity (CEC) and exchangeable cations buffered at pH 7, using a molar ammonium acetate solution		1				1
Standard operating procedure for cation exchange capacity and exchangeable bases 1N ammonium acetate, pH 7.0 method			1			1
CEC_$BaCl_2$						
Soil quality — Determination of effective cation exchange capacity and base saturation level using barium chloride solution	1	1			1	3
CEC_$BaCl_2$ (8.1)						
Soil quality — Determination of the potential cation exchange capacity and exchangeable cations using barium chloride solution buffered at pH = 8,1		1				1
Denitrification						
Soil quality — Easy laboratory assessments of soil denitrification, a process source of N_2O emissions — Part 1: Soil denitrifying enzymes activities		1				1

Soil quality — Easy laboratory assessments of soil denitrification, a process source of N_2O emissions — Part 2: Assessment of the capacity of soils to reduce N_2O		1				1
DM_Water content						
Sludge and solid environmental matrices — Determination of dry residue or water content and calculation of the dry matter fraction on a mass basis		1				1
Soil quality — Determination of dry matter and water content on a mass basis — Gravimetric method		1				1
Soil quality — Determination of dry matter and water content on a mass basis — Gravimetric method — Technical Corrigendum 1		1				1
EC_saturated						
Soil analysis. Saturated EC	1		1			2
EC1:5						
Environmental solid matrices - Determination of the specific electrical conductivity (ISO 11265:2025)	1	1			1	3
Sludge, treated biowaste and soil - Determination of specific electrical conductivity					1	1
Soil analysis. Diluted EC			1			1
Soil quality — Determination of the specific electrical conductivity		1				1
Soil quality — Determination of the specific electrical conductivity — Technical Corrigendum 1		1				1
Excavated soils						
Guidance on characterization of excavated soil and other materials intended for re-use		1				1
Gas						
GasSOIL-GAS Off-Site / Portable Gas Chromatograph				1		1
GasSOIL-GAS Portable THC Analyzer				1		1
GasSOIL-GAS Soil Gas Sampling, Grab of VOCs - LGAS				1		1
GasSOIL-GAS VOC Analyzer - Adsorbent				1		1
GasSOIL-GAS VOC Analyzer - Flame Inization Detector (FID)				1		1
GasSOIL-GAS VOC Analyzer - Photoionization Detector (PID)				1		1
GasSOIL-GAS VOC Analyzer - Whole Air				1		1
GasSOIL-GAS VOC Portable Analyzer - Non-dispersive Infrared				1		1
GasSOIL-GAS VOCs, Subsurface - Soil-Gas Passive Sampling				1		1
GasSOP #2149Soil Gas Sampling				1		1
Humus substances						

Soil quality — Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials — Part 4: Extraction of humic substances from solid samples		1			1
Soil quality — Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials — Part 5: Extraction of humic substances from aqueous samples		1			1
Hydraulic conductivity					
Soil quality — Determination of hydraulic conductivity of saturated porous materials using a flexible wall permeameter	1	1			2
Soil quality — Determination of hydraulic conductivity of saturated porous materials using a rigid-wall permeameter		1			1
Inductively Coupled Plasma Mass Spectrometry ICP-MS					
Environmental solid matrices — Determination of elements using inductively coupled plasma mass spectrometry (ICP-MS)		1			1
Soil quality — Determination of trace elements using inductively coupled plasma mass spectrometry (ICP-MS)		1			1
Inductively Coupled Plasma Optical Emission Spectrometry ICP-OES					
Environmental solid matrices - Determination of elements using inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 22036:2024)		1		1	2
Moisture					
Standard operating procedure for soil moisture content by gravimetric method			1		1
N_NO_3-N_NH_4 with $CaCl_2$					
Soil quality — Determination of nitrate nitrogen, ammonium nitrogen and total soluble nitrogen in air-dry soils using calcium chloride solution as extractant		1			1
N_NO_3-N_NH_4 with KCl					
Soil quality — Determination of nitrate, nitrite and ammonium in field-moist soils by extraction with potassium chloride solution — Part 1: Manual method		1			1
Soil quality — Determination of nitrate, nitrite and ammonium in field-moist soils by extraction with potassium chloride solution — Part 2: Automated method with segmented flow analysis		1			1
NH4, NO_3^-, NO_2^-					
Sludge, treated biowaste and soil - Extraction for the determination of extractable ammonia, nitrate and nitrite				1	1
Nitrogen mineralization and nitrification					

Soil quality - Biological methods - Determination of nitrogen mineralization and nitrification in soils and the influence of chemicals on these processes (ISO 14238:2012)		1			1	2
Nitrogen nitrification						
Soil quality - Determination of potential nitrification and inhibition of nitrification - Rapid test by ammonium oxidation (ISO 15685:2012)		1			1	2
Nitrogen_combustion						
Soil quality — Determination of total nitrogen content by dry combustion ("elemental analysis")	1	1				2
Standard operating procedure for soil total nitrogen Dumas dry combustion method			1			1
Sludge, treated biowaste and soil - Determination of total nitrogen using dry combustion method					1	1
Nitrogen_Kjeldahl						
Sludge, treated biowaste and soil - Determination of Kjeldahl nitrogen					1	1
Soil quality — Determination of total nitrogen — Modified Kjeldahl method	1	1				2
Standard operating procedure for soil nitrogen Kjeldahl method			1			1
Nitrogen_NIRS						
Soil quality - Determination of carbon and nitrogen by near-infrared spectrometry (NIRS) (ISO 17184:2014)					1	1
Organic chemicals mineralization						
Soil quality - Laboratory incubation systems for measuring the mineralization of organic chemicals in soil under aerobic conditions (ISO 14239:2017)		1			1	2
Particle density						
Geotechnical investigation and testing — Laboratory testing of soil — Part 3: Determination of particle density		1				1
Soil quality — Determination of particle density		1				1
pH						
pH_9045D				1		1
Soil and Waste pH				1		1
Soil pH			1			1
Soil, treated biowaste and sludge - Determination of pH (ISO 10390:2021)	1	1			1	3
Phosphorus_Bray						
Standard operating procedure for soil available phosphorus Bray I and Bray II method			1			1
Phosphorus_Mehlich						

Standard operating procedure for soil available phosphorus Mehlich I Method			1		1
Phosphorus_Olsen					
Soil quality — Determination of phosphorus — Spectrometric determination of phosphorus soluble in sodium hydrogen carbonate solution	1	1	1		3
Pore water pressure					
Soil quality — Determination of pore water pressure — Tensiometer method		1			1
Pretreatment					
Environmental solid matrices – Guidance for sample pretreatment				1	1
Sludge, treated biowaste and soil - Guidance for sample pretreatment				1	1
Soil quality — Pretreatment of samples for physico-chemical analysis		1			1
Redox on field					
Soil quality — Determination of redox potential — Field method		1			1
Screening methods					
Soil and waste — Guidance on the selection and application of screening methods		1			1
SOC and N_NIRS					
Soil quality — Determination of carbon and nitrogen by near-infrared spectrometry (NIRS)		1		1	2
SOC_combustion					
Soil quality — Determination of organic and total carbon after dry combustion (elementary analysis)	1	2		1	4
Soil, waste, treated biowaste and sludge - Determination of total organic carbon (TOC) by dry combustion (ISO/DIS 15936:2025)				1	1
SOC_LoI					
Soil and waste characterization — Temperature dependent differentiation of total carbon (TOC400, ROC, TIC900)		1		1	2
Soil, waste, treated biowaste and sludge - Determination of loss on ignition				1	1
SOC_stocks					
Guidance for estimating organic carbon stocks in soils according to their biogeochemical stability or or residence time				1	1
SOC_Tyurin					
Standard operating procedure for soil organic carbon Tyurin spectrophotometric method			1		1
SOC_Walkey					
Standard operating procedure for soil organic carbon Walkley-Black method			1		1

Soil respiration				
Standard operating procedure for soil respiration rate		1		1
Soil screening				
Soil and waste - Guidance on the selection and application of screening methods (ISO 12404:2021)			1	1
Soil water				
Soil quality — Soil water and the unsaturated zone — Definitions, symbols and theory	1			1
Sulfate				
Soil quality — Determination of water-soluble and acid-soluble sulfate	1			1
Sulfur				
Soil quality — Determination of total sulfur by dry combustion	1			1
Texture				
Geotechnical investigation and testing — Laboratory testing of soil — Part 4: Determination of particle size distribution	1			1
Soil quality — Determination of particle size distribution in mineral soil material — Method by sieving and sedimentation	1			1
Thermal conductivity				
Geotechnical investigation and testing — Geothermal testing — Determination of thermal conductivity of soil and rock using a borehole heat exchanger	1			1
Water content				
Geotechnical investigation and testing — Laboratory testing of soil — Part 1: Determination of water content	1			1
Geotechnical investigation and testing — Laboratory testing of soil — Part 1: Determination of water content — Amendment 1	1			1
Soil quality — Determination of soil water content as a volume fraction on the basis of known dry bulk density — Gravimetric method	1			1
Soil quality — Determination of soil water content as a volume fraction on the basis of known dry bulk density — Gravimetric method — Technical Corrigendum 1	1			1
Soil quality — Determination of soil water content as a volume fraction using coring sleeves — Gravimetric method	1		1	2
Soil quality — Determination of water content in the unsaturated zone — Neutron depth probe method	1			1
Soil quality — Screening method for water content — Determination by refractometry	1			1
Water retention				

Sludge and solid environmental matrices - Determination of dry residue or water content and calculation of the dry matter fraction on a mass basis (ISO 11465:2025)				1	1
Soil quality - Determination of pore water pressure - Tensiometer method (ISO 11276:1995)				1	1
Soil quality - Determination of soil water content as a volume fraction using coring sleeves - Gravimetric method (ISO 11461:2001)				1	1
Soil quality — Determination of the water-retention characteristic — Laboratory methods	1	1		1	3
Soil quality - Determination of unsaturated hydraulic conductivity and water-retention characteristic - Wind's evaporation method (ISO 11275:2004)		1		1	2
X-ray fluorescence spectrometry (XRF)					
Soil quality — Screening soils for selected elements by energy-dispersive X-ray fluorescence spectrometry using a handheld or portable instrument		2			2
Dry matter					
Sludge, treated biowaste, soil and waste - Calculation of dry matter fraction after determination of dry residue or water content				1	1
Humic substances					
Soil quality - Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials - Part 4: Extraction of humic substances from solid samples (ISO 12782-4:2012)				1	1
Soil quality - Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials - Part 5: Extraction of humic substances from aqueous samples (ISO 12782-5:2012)				1	1
particle density					
Soil quality - Determination of particle density (ISO 11508:2017)				1	1
Soil aggregates					
Soil quality - Measurement of the stability of soil aggregates subjected to the action of water (ISO 10930:2012)		1		1	2
Soil microbial mass					
Standard operating procedure for soil microbial biomass (carbon)			1		1
Texture_Laser					
Texture_Laser	1				1
Texture_sieving					
Soil quality — Determination of particle size distribution in mineral soil material — Method by sieving and sedimentation	1	1			2

Soil quality — Determination of particle size distribution in mineral soil material — Method by sieving and sedimentation — Amendment 1		1				1
Validation physo-chemical methods						
Guideline for the validation of physico-chemical analytical methods					1	1
Total	**14**	**73**	**16**	**17**	**42**	**162**

Source: This report.

3.2.5.3. Biodiversity

A descriptor on biodiversity is included in the SML. Member States shall carry out measurements on at least 5 % of the total number of sampling points. The SML asks Member States to measure biodiversity by DNA metabarcoding for fungi and bacteria, as well as one other soil descriptor for biodiversity out of a list with nine options[1]. For the measurement of the descriptors on biodiversity, the SML prescribes that European or international standards shall be used if available, otherwise a methodology from scientific literature or publicly available shall be used.

Table 9 outlines various standards related to soil biodiversity descriptors. The total number of standards listed is 51, with the majority coming from ISO, totalling 27 standards, followed by CEN with 23 standards, GLOSOLAN with one standard, and no EPA standards. The topics covered under soil biodiversity include guidance for the burial of animal carcasses to prevent epidemics, as well as the measurement of enzyme activity patterns in soil samples using colorimetric substrates. Additionally, ISO and CEN provide nine standards for the determination of dehydrogenases activity in soils, including amendments, and 6 standards for DNA-related analysis, including direct extraction of soil DNA and estimation of abundance of selected microbial gene sequences by quantitative PCR. ISO and CEN also cover the identification of ecotoxicological test species by DNA barcoding with a single standard, and the measurement of enzyme activity patterns in soil samples. The sampling of soil invertebrates is another area covered by ISO and CEN, with 16 standards that include hand-sorting, extraction, and identification of various species. Furthermore, ISO and CEN provide standards for the determination of soil microbial diversity using phospholipid fatty acid analysis and phospholipid ether lipids analysis. Other areas covered by ISO and CEN standards include the determination of abundance and activity of soil microflora using respiration curves, the substrate-induced respiration method for determining soil microbial biomass, laboratory methods for determining microbial soil respiration, and the fumigation-extraction method for determining soil microbial biomass.

A comparison among standards from different sources reveals that CEN adopts some of these ISO standards, indicating a level of international cooperation and harmonisation in the development of standards for soil analysis. The absence of EPA standards in this table suggests that the EPA may not have developed specific standards for soil biodiversity or may rely on standards developed by other organizations. GLOSOLAN contribute minimally, with one standard, focusing on enzyme activities. The comprehensive coverage of topics by ISO and CEN standards underscores the complexity and multifaceted nature of soil biodiversity, emphasizing the need for a unified approach to its analysis and assessment.

[1] (1)metabarcoding of archaea, protists and animals (2) phospholipid fatty acid analysis (PLFA) (3) abundance and diversity of nematodes (4) abundance and diversity of earthworms (5) abundance and diversity of springtails (6) abundance and diversity of native ants (7) soil biological quality based on arthropods (QBS-ar) (8) presence of invasive alien species and plant pests (9) soil basal respiration

Table 9. Standards related to soil descriptors on soil biodiversity.

Topic	ISO	GLOSOLAN	CEN	Total
Burial carcasses				
Soil quality — Guidance for burial of animal carcasses to prevent epidemics	2			2
Colorimetric				
Soil quality - Measurement of enzyme activity patterns in soil samples using colorimetric substrates in micro-well plates (ISO 20130:2018)	1		1	2
Dehydrogenases activity				
Soil quality - Contact test for solid samples using the dehydrogenase activity of Arthrobacter globiformis (ISO 18187:2024)			1	1
Soil quality — Determination of dehydrogenases activity in soils — Part 1: Method using triphenyltetrazolium chloride (TTC)	1		1	2
Soil quality — Determination of dehydrogenases activity in soils — Part 1: Method using triphenyltetrazolium chloride (TTC) — Amendment 1	1		1	2
Soil quality — Determination of dehydrogenases activity in soils — Part 2: Method using iodotetrazolium chloride (INT)	1		1	2
Soil quality — Determination of dehydrogenases activity in soils — Part 2: Method using iodotetrazolium chloride (INT) — Amendment 1	1		1	2
DNA				
Soil quality - Direct extraction of soil DNA (ISO 11063:2020)	1		1	2
Soil quality — Estimation of abundance of selected microbial gene sequences by quantitative PCR from DNA directly extracted from soil	1			1
Soil quality - Estimation of abundance of selected microbial gene sequences by quantitative polymerase chain reaction (qPCR) from DNA directly extracted from soil (ISO 17601:2025)	1		1	2
DNA barcoding				
Soil quality - Identification of ecotoxicological test species by DNA barcoding (ISO 21286:2019)	1		1	2
Enzimatic activity				
Soil quality — Contact test for solid samples using the dehydrogenase activity of Arthrobacter globiformis	1			1
Soil quality — Measurement of enzyme activity patterns in soil samples using fluorogenic substrates in micro-well plates	1			1
Standard operating procedure for soil enzyme activities		1		1
Invertebrates				
Soil quality — Sampling of soil invertebrates — Part 1: Hand-sorting and extraction of earthworms	2			2

Soil quality - Sampling of soil invertebrates - Part 1: Hand-sorting and extraction of earthworms (ISO 23611-1:2018)			1	1
Soil quality - Sampling of soil invertebrates - Part 1: Hand-sorting and extraction of earthworms (ISO/DIS 23611-1:2025)			1	1
Soil quality - Sampling of soil invertebrates - Part 2: Sampling and extraction of micro-arthropods (Collembola and Acarina) (ISO 23611-2:2024)	1		1	2
Soil quality - Sampling of soil invertebrates - Part 3: Sampling and extraction of enchytraeids (ISO 23611-3:2019)	1		1	2
Soil quality - Sampling of soil invertebrates - Part 4: Sampling, extraction and identification of soil-inhabiting nematodes (ISO 23611-4:2022)	1		1	2
Soil quality - Sampling of soil invertebrates - Part 5: Sampling and extraction of soil macro-invertebrates (ISO 23611-5:2024)	1		1	2
Soil quality - Sampling of soil invertebrates - Part 6: Guidance for the design of sampling programmes with soil invertebrates (ISO 23611-6:2012)	2		1	3
Soil quality - Sampling of soil invertebrates - Part 6: Guidance for the design of sampling programmes with soil invertebrates (ISO/DIS 23611-6:2025)			1	1
Microbial diversity				
Soil quality - Determination of soil microbial diversity - Part 1: Method by phospholipid fatty acid analysis (PLFA) and phospholipid ether lipids (PLEL) analysis (ISO/TS 29843-1:2010)	1		1	2
Soil quality - Determination of soil microbial diversity - Part 2: Method by phospholipid fatty acid analysis (PLFA) using the simple PLFA extraction method (ISO/TS 29843-2:2021)	1		1	2
Microflora				
Soil quality - Determination of abundance and activity of soil microflora using respiration curves (ISO 17155:2012)	1		1	2
Respiration method				
Soil quality - Determination of soil microbial biomass - Part 1: Substrate-induced respiration method (ISO 14240-1:1997)	1		1	2
Soil respiration				
Soil quality - Laboratory methods for determination of microbial soil respiration (ISO 16072:2002)	1		1	2
Soil microbial mass				
Soil quality - Determination of soil microbial biomass - Part 2: Fumigation-extraction method (ISO 14240-2:1997)	1		1	1
Total	**27**	**1**	**23**	**51**

Source: This report

3.2.5.4. Soil pollution

On soil pollution, the SML includes two standards focused on measuring metals and metalloids, either by using aqua regia or by diluted nitric acid (this standard was included as optional). Similarly, as for biodiversity, the SML asks Member States to use European or international standards for other contaminants, if available, or publicly available methods or from scientific literature.

Some standards related to soil descriptors on soil contamination are shown in the **Table 10**, with a total of 177 standards listed under the topic of soil pollution. These standards come from ISO (62), EPA (74), CEN (37), and GLOSOLAN with two standards, while SML contributes two standards. The topics covered under soil contamination include a broader spectrum than that set up in the current SML; inorganic, organic, radionuclides, explosives, asbestos, pesticides, etc as well as many different extractants to cover several soil fractions; acid digestion, alkaline extraction, bioavailable fraction, etc. Four standards for determination of hexavalent chromium (Cr VI) were also listed to be in line with the Directive of EU fertilising products (EU 2009/1009) where a maximum Cr(VI) concentration of 2 mg/kg was laid down for the most of the fertilising products (EU 2009/1009).

A comparison among standards from different sources reveals that ISO and EPA are the primary sources for standards related to soil contamination, covering a wide range of topics from acid digestion to the determination of specific contaminants like dioxins and PCBs. CEN adopts some of these ISO standards, indicating a level of international cooperation, coordination, and harmonisation in the development of standards for soil analysis. GLOSOLAN and SML contribute minimally, with a few standards each, focusing on specific aspects of soil contamination such as inorganic contaminants.

The inclusion of standards for the determination of background levels and the guidance on the determination of soil pollution emphasizes the importance of understanding the natural variability of soil properties and the need for a comprehensive approach to soil contamination assessment as set up in the SML.

CEN/TC 444 WG is currently working on developing a standard on determination of PFAS in soils by using target analysis (ISO 25652_under development: analysis of PFAS in soil, sediment, sludge and waste by HPLC and mass spectrometry) additionally preliminary works are carrying out to develop another PFAS standard based on EOF non-target analysis. Further efforts should be conducted to provide some standards for some emerging pollutants or contaminants of emerging concern (CEC). Both CEN and GLOSOLAN working groups are working in developing standards for plastic determination in soils, but further research evidence should be provided in order to choose the right methodology among those available (μFTIR, Pyrolysis-GC-MS, microscopy, etc).

Overall, the table presents a broad and detailed overview of the standards related to soil contamination, highlighting the complexity and multifaceted nature of this topic. The comparison among standards from different sources underscores the importance of harmonisation in the development of standards for soil analysis, ensuring consistency and reliability across different methodologies and applications.

Table 10. Standards related to soil descriptors on soil contamination

Topic	SML	ISO	GLOSOLAN	EPA	CEN	Total
Soil pollution						
Acid digestion						
Acid digestion_3050B				1		1
Acid Digestion of Sediments, Sludges and Soils				1		1
Microwave Assisted Acid Digestion/Sludges, Soils				1		1
Microwave Asst Acid Digestion Sediments/Soil/Oil				1		1
Microwave digestion 3051				1		1
Microwave digestion 3051A				1		1
Alkaline extraction						
Soil quality — Dissolution for the determination of total element content — Part 2: Dissolution by alkaline fusion		1				1
Alkylsufonate						
Soil quality — Determination of linear alkylbenzene sulfonate (LAS) — Method by HPLC with fluorescence detection (LC-FLD) and mass selective detection (LC-MSD)		1				1
Sludge, treated biowaste and soil - Determination of linear alkylbenzene sulfonates (LAS) by high-performance liquid chromatography (HPLC) with fluorescence detection (FLD) or mass selective detection (MS)					1	1
Total element						
Soil, treated biowaste, sludge and waste - Digestion with a hydrochloric (HCl), nitric (HNO_3) and tetrafluoroboric (HBF_4) or hydrofluoric (HF) acid mixture for subsequent determination of elements					1	1
Aqua regia HGAAS						
Soil quality — Determination of arsenic, antimony and selenium in aqua regia soil extracts with electrothermal or hydride-generation atomic absorption spectrometry		1				1
Aqua_regia						
Aqua regia	1					1
Soil, treated biowaste, sludge and waste - Digestion of aqua regia soluble fractions of elements (ISO 54321:2020)		1			1	2

Asbestos					
Standard operating procedure for quasi total elements in soil by acid digestion, including heavy metals		1			1
Asbestos Screening for Soil & Sediment			1		1
Asbestos Screening for Soil & Sediment			1		1
Background levels					
Soil quality - Guidance on the determination of background values (ISO 19258:2018)	1			1	2
Chlordane					
Chlordane_4041			1		1
Chlorophenols					
Soil quality — Determination of some selected chlorophenols — Gas-chromatographic method with electron-capture detection	1				1
Collembolans					
Soil quality - Inhibition of reproduction of Collembola (Folsomia candida) by soil contaminants (ISO 11267:2023)	1			1	2
Cr (VI)					
Soil and waste - Determination of chromium (VI) in solid material by alkaline digestion and ion chromatography with spectrophotometric detection (ISO 15192:2025)	2			1	3
Soil quality — Detection of water soluble chromium (VI) using a ready-to-use test-kit method	1				1
Cyanide					
Cyanide_0335.2 CL			1		1
Total Cyanide in water, soil/sediment			1		1
Background information and guidance on environmental cyanide analysis	1				1
Soil quality — Determination of total cyanide	1				1
Soil quality - Determination of total cyanide and easily liberatable cyanide - Continuous-flow analysis method (ISO 17380:2013)	1			1	2
DDT					
DDT_4042			1		1
DDT Soil Screening by Immunoassy			1		1
Dioxins					

Dioxin - 2,3,7,8-TCDD in Soil & Sediment			1		1
Dioxins & Furans, Chlorinated (CDD & CDF) - Soil			1		1
TCDD Dioxin - 2,3,7,8-TCDD in Soil & Sediment			1		1
Soil, treated biowaste and sludge — Determination of dioxins and furans and dioxin-like polychlorinated biphenyls by gas chromatography with high resolution mass selective detection (HR GC-MS)	1				1
Soil, treated biowaste and sludge — Determination of dioxins and furans and dioxin-like polychlorinated biphenyls by gas chromatography with mass selective detection (HRMS or MS/MS)	1			1	2
Dioxins, etc					
Dioxins, etc.			1		1
DTPA_extractant					
Soil quality — Extraction of trace elements by buffered DTPA solution	1				1
Standard operating procedure for soil available micronutrients (Cu, Fe, Mn, Zn) and heavy metals (Ni, Pb, Cd), DTPA extraction method		1			1
Explosives					
Explosives in Soil - Field Sampling- RDX/TNT/HMX			1		1
Soil quality — Determination of selected explosives and related compounds — Part 1: Method using high-performance liquid chromatography (HPLC) with ultraviolet detection	1				1
Soil quality — Determination of selected explosives and related compounds — Part 2: Method using gas chromatography (GC) with electron capture detection (ECD) or mass spectrometric detection (MS)	1				1
Soil quality - Determination of selected explosives and related compounds - Part 3: Method using liquid chromatography-tandem mass spectrometry (LC-MS/MS) (ISO 11916-3:2021)	1			1	2
TNT					
TNT 4050			1		1
TNT 8515			1		1
TNT Explosives in Water and Soils by Immunoassy			1		1
TNT in Soil by Coloimetric Screening			1		1
GHG emissions					
Soil Quality — Guidance on methods for measuring greenhouse gases (CO_2, N_2O, CH_4) and ammonia (NH_3) fluxes between soils and the atmosphere	1				1

GC-MS					
Soil quality - Guidelines for the identification of target compounds by gas chromatography and mass spectrometry (ISO 22892:2006)		1		1	2
Herbicides_HPLC-UV					
Soil quality — Determination of herbicides — Method using HPLC with UV-detection		1			1
Hexahydro-1,3,5-trinitro-1,3,5-triazine					
Hexahydro-1,3,5-trinitro-1,3,5-triazine 4051			1		1
Hexahydro-1,3,5-trinitro-1,3,5-triazine Field Method for RDX in Soil			1		1
Hexahydro-1,3,5-trinitro-1,3,5-triazine RDX in Soil and Water by Immunoassay			1		1
HF					
Soil quality — Dissolution for the determination of total element content — Part 1: Dissolution with hydrofluoric and perchloric acids		1			1
HF_microwave					
Soil quality — Dissolution for the determination of total element content — Part 3: Dissolution with hydrofluoric, hydrochloric and nitric acids using pressurised microwave technique		1			1
HNO_3					
Sludge, treated biowaste and soil - Digestion of nitric acid soluble fractions of elements				1	1
Soil quality — Digestion of nitric acid soluble fractions of elements		1			1
Soil quality — Extraction of trace elements using dilute nitric acid	1	1			2
Hydrocarbons					
Environmental Solid Matrices — Determination of hydrocarbon content in the range of C10 to C40 by gas chromatography		1			1
Environmental Solid Matrices - Determination of hydrocarbon content in the range of C10 to C40 by gas chromatography (ISO/DIS 16703:2024)		1		1	2
ICP-MS					
Environmental solid matrices - Determination of elements using inductively coupled plasma mass spectrometry (ICP-MS) (ISO 16965:2025)				1	1
Isopropanol					
Soil quality — Screening soils for isopropanol-extractable organic compounds by determining emulsification index by light attenuation		1			1

Lead				
Lead 4510		1		1
Lead in water & soil by immunoassay		1		1
Mercury				
Mercury 0245.5 CL		1		1
Mercury 4500		1		1
Mercury in Soil by Immunoassay		1		1
Mercury in soil/sediment - manual cold vapor		1		1
Soil quality — Determination of mercury — Cold vapour atomic fluorescence spectrometry (CVAFS)	1		1	2
Soil quality — Determination of mercury in aqua regia soil extracts with cold-vapour atomic spectrometry or cold-vapour atomic fluorescence spectrometry	1			1
Sludge, treated biowaste and soil - Determination of mercury - Part 1: Cold-vapour atomic absorption spectrometry (CV-AAS)			1	1
Metals_FAAS				
Soil quality — Determination of cadmium, chromium, cobalt, copper, lead, manganese, nickel and zinc — Flame and electrothermal atomic absorption spectrometric methods	1			1
NH_4NO_3				
Soil quality — Extraction of trace elements from soil using ammonium nitrate solution	1			1
Non-polar OC				
Soil quality — Environmental availability of non-polar organic compounds — Determination of the potentially bioavailable fraction and the non-bioavailable fraction using a strong adsorbent or complexing agent	1			1
Nonylphenols				
Soil quality — Determination of nonylphenols (NP) and nonylphenol-mono- and diethoxylates — Method by gas chromatography with mass selective detection (GC-MS)	1			1
Organic compounds				
Soil quality - Gas chromatographic determination of volatile aromatic and halogenated hydrocarbons and selected ethers - Static headspace method (ISO 22155:2016)	1		1	2
Organohalides				

Organohalides 1656A		1		1
Organohalides-ww, soil, sludge, sediment, tissue		1		1
Organophosphorus				
Organophosphorus_1657A		1		1
Organo-Phosphorus in ww, soil, sediments, tissue		1		1
Organotin				
Soil quality — Determination of selected organotin compounds — Gas-chromatographic method	1		1	2
Soil quality - Determination of selected organotin compounds - Gas-chromatographic method (ISO 23161:2018)			1	1
Polyaromatic Hydrocarbons (PAHs)				
PAHs 4035		1		1
PAHs Soil Screening by Immunoassay		1		1
Soil, sludge, treated biowaste and waste - Determination of polycyclic aromatic hydrocarbons (PAH) by gas chromatography (GC) and high performance liquid chromatography (HPLC)			1	1
PAHs and Polychlorinated biphenyls (PCBs)				
PAHs and PCBs in Soils/Sludges by TE/GC/MS		1		1
PAHs_GC_HPLC				
Soil quality — Determination of polycyclic aromatic hydrocarbons (PAH) by gas chromatography (GC) and high performance liquid chromatography (HPLC)	1			1
PAHs_GC_MS				
Soil quality — Determination of polycyclic aromatic hydrocarbons (PAH) — Gas chromatographic method with mass spectrometric detection (GC-MS)	1			1
PCBs				
PCBs 1668		1		1
PCBs 680		1		1
PCBs 9078		1		1
PCBs in Soil Screening Test		1		1
PCBs in Water, Soil - Isotope Dilution HRGC/HRMS		1		1
Environmental solid matrices - Determination of polychlorinated biphenyls (PCB) by gas chromatography - mass selective detection (GC-MS) or electron-capture detection (GC-ECD) (ISO 18475:2023)	1		1	2

PCBs and pesticides			
PCBs and pesticidesPCBs & pesticides in water & soil/sediment -GCMS		1	1
PCBS, dioxins, PAH			
PCBS, dioxins, PAH4425		1	1
Perchlorate			
Soil quality — Determination of perchlorate in soil using ion chromatography	1		1
Soil quality — Determination of perchlorate in soil using liquid chromatography-tandem mass spectrometry (LC-MS/MS)	1		1
Pesticides			
Pesticides 1556A		1	1
Pesticides ECM		1	1
Organohalide pesticides -ww, soil, tissue-GC/HSD		1	1
Pesticides in soil & water		1	1
Soil quality — Determination of organochlorine pesticides by gas chromatography with mass selective detection (GC-MS) and gas chromatography with electron-capture detection (GC-ECD)	1		1
Soil quality — Simultaneous determination of multi-class pesticide residues in soil using GC-MS/MS and LC-MS/MS analysis	1		1
Phatalates			
Soil quality — Determination of selected phthalates using capillary gas chromatography with mass spectrometric detection (GC/MS)	1		1
Phenols and chlorophenols			
Soil quality — Determination of some selected phenols and chlorophenols — Gas chromatographic method with mass spectrometric detection	1		1
Radionuclides			
Radionuclides Plutonium, uranium & thorium / soil, air, tissue		1	1
Radionuclides Radium-226 & Radium-228 / soil, air, tissue		1	1
Radionuclides RA-LV-Pl Plutonium, uranium & thorium / soil, air, tissue		1	1
Radionuclides RA-LV-Ra Radium-226 & Radium-228 / soil, air, tissue		1	1
Radionuclides RA-LV-Str Strontium-89 & -90 / vegetation, soil, tissue		1	1
Radionuclides Strontium-89 & -90 / vegetation, soil, tissue		1	1

Measurement of radioactivity in the environment — Soil — Part 3: Test method of gamma-emitting radionuclides using gamma-ray spectrometry	1			1
Measurement of radioactivity in the environment — Soil — Part 4: Plutonium 238 and plutonium 239 + 240 — Test method using alpha spectrometry	1			1
Measurement of radioactivity in the environment — Soil — Part 5: Strontium 90 — Test method using proportional counting or liquid scintillation counting	1			1
Measurement of radioactivity in the environment — Soil — Part 6: Gross alpha and gross beta activities — Test method using gas-flow proportional counting	1			1
Measurement of radioactivity in the environment — Soil — Part 7: In situ measurement of gamma-emitting radionuclides	2			2
Radionuclides definition				
Measurement of radioactivity in the environment — Soil — Part 1: General guidelines and definitions	1			1
Radionuclides sampling				
Measurement of radioactivity in the environment — Soil — Part 2: Guidance for the selection of the sampling strategy, sampling and pre-treatment of samples	1			1
Semi Volatile Organic Compound (SMVOC)				
Soil quality - Risk-based petroleum hydrocarbons - Part 2: Determination of aliphatic and aromatic fractions of semi-volatile petroleum hydrocarbons using gas chromatography with flame ionization detection (GC/FID) (ISO/TS 16558-2:2015)			1	1
Total pollutants				
Total pollutants 3200		1		1
Total pollutants Organic, inorganic & total mercury in soils		1		1
Toxaphene				
Toxaphene 4040		1		1
Toxaphene Soil Screening by Immunoassy		1		1
Total Petroleum Hydrocarbons (TPH)				
TPH 4030		1		1
TPH 9074		1		1

Soil quality — Risk-based petroleum hydrocarbons — Part 1: Determination of aliphatic and aromatic fractions of volatile petroleum hydrocarbons using gas chromatography (static headspace method)	1		1
Soil quality — Risk-based petroleum hydrocarbons — Part 1: Determination of aliphatic and aromatic fractions of volatile petroleum hydrocarbons using gas chromatography (static headspace method) — Amendment 1	1		1
Soil quality — Risk-based petroleum hydrocarbons — Part 2: Determination of aliphatic and aromatic fractions of semi-volatile petroleum hydrocarbons using gas chromatography with flame ionization detection (GC/FID)	1		1
TPH immunoassay			
Petroleum Hydrocarbons Soil Screen by Immunoassy		1	1
TPH turbidimetry			
Petroleum Hydrocarbons in Soil by Turbidimetric		1	1
Tyres			
Rubber — Determination of the mass concentration of tyre and road wear particles (TRWP) in soil and sediment — Pyrolysis-gas chromatography/mass spectrometry (GC/MS) method	1		1
VOCs			
VOCs 8265		1	1
VOCs Field screening for VOC in aqueous, soil & drum		1	1
VOC Analyzer - Adsorbent		1	1
VOC Analyzer - Flame Ionization Detector (FID)		1	1
VOC Analyzer - Photoionization Detector (PID)		1	1
VOC Analyzer - Whole Air		1	1
VOC Soil Sampling & Analysis		1	1
VOCs in Soils/Solid Matrices by Equilibrium Head		1	1
VOCs in water, soil, soil gas, air by DSITMS		1	1
VOCs, Subsurface - Soil-Gas Passive Sampling		1	1
Volatiles in low level soils		1	1

Soil quality - Risk-based petroleum hydrocarbons - Part 1: Determination of aliphatic and aromatic fractions of volatile petroleum hydrocarbons using gas chromatography (static headspace method) - Amendment 1 (ISO 16558-1:2015/Amd 1:2020)		1	1
Soil quality - Risk-based petroleum hydrocarbons - Part 1: Determination of aliphatic and aromatic fractions of volatile petroleum hydrocarbons using gas chromatography (static headspace method) (ISO 16558-1:2015)		1	1
Soil quality — Sampling — Part 301: Sampling and on site semi-quantitative determinations of volatile organic compounds in field investigations	1		1
Volatile compounds			
Soil quality - Gas chromatographic determination of the content of volatile aromatic hydrocarbons, naphthalene and volatile halogenated hydrocarbons - Purge-and-trap method with thermal desorption (ISO 15009:2016)	1	1	2
X-ray fluorescence (XRF)			
Characterization of waste and soil - Determination of elemental composition by X-ray fluorescence		1	1
Environmental solid matrices – Determination of elemental composition by X-ray fluorescence spectrometry	1	1	2
Environmental solid matrices - Determination of elemental composition by X-ray fluorescence spectrometry (ISO/FDIS 18227:2025)		1	1
Soil quality — Determination of elemental composition by X-ray fluorescence	1		1
Soil quality - Screening soils for selected elements by energy-dispersive X-ray fluorescence spectrometry using a handheld or portable instrument (ISO 13196:2013)		1	1
Soil quality - Screening soils for selected elements by energy-dispersive X-ray fluorescence spectrometry using a handheld or portable instrument (ISO/DIS 13196:2025)		1	1
Biodegradation organic chemicals			
Soil quality - Guidance on laboratory testing for biodegradation of organic chemicals in soil under aerobic conditions (ISO 11266:1994)		1	1
Characterization of waste			
Characterization of waste - Screening methods for elemental composition by X-ray fluorescence spectrometry for on-site verification		1	1

Halogens						
Soil, treated biowaste and sludge - Determination of adsorbed organically bound halogens (AOX)					1	1
microplastics						
Soil, sediment and sludge — Sampling, pre-treatment and analysis of microplastics					1	1
Nonyphenols and diethosylates						
Sludge treated biowaste and soil - Determination of nonylphenols (NP) and nonylphenol-mono- and diethoxylates using gas chromatography with mass selective detection (GC-MS)					1	1
PFAS						
Sediment, Soil, sludge and waste - Analysis of PFAS by HPLC and mass spectrometry (ISO/DIS 25652:2025)					1	1
Phatalates						
Sludge, treated biowaste and soil - Determination of selected phthalates using capillary gas chromatography with mass spectrometric detection (GC-MS)					1	1
TPH						
Soil quality - Determination of content of hydrocarbon in the range C10 to C40 by gas chromatography (ISO 16703:2004)					1	1
Total	**2**	**62**	**2**	**74**	**37**	**177**

Source: This report.

3.2.6. Annex IV - Indicative list of risk reduction measures

Annex IV of the SML outlines an indicative list of risk reduction measures for soil remediation and exposure reduction. The measures are categorized into three main groups: soil remediation techniques, risk reduction measures other than soil remediation, and additional measures. Soil remediation techniques include physical, biological, and chemical methods for in-situ or ex-situ soil remediation, such as vapor extraction, heat treatment, soil washing, and liquid layer removal, as well as bioremediation, phytoextraction, composting, and bioreactor systems.

Risk reduction measures other than soil remediation aim to reduce exposure to contaminated soil and include restrictions on crop cultivation and consumption, egg consumption, and pet or livestock access, as well as restrictions on groundwater use, demolition, construction, and land use.

Additionally, precautions can be taken to protect human health, such as wearing respirators, gloves, and using wet cleaning methods. The list also includes best available techniques referred to in Directive 2010/75/EU and measures taken by competent authorities and industrial operators following a major accident, in accordance with Directive 2012/18/EU. These risk reduction measures are designed to mitigate the risks associated with contaminated soil and protect human health and the environment.

Two ISO standards related to risk reduction measures, specifically in soil remediation, are shown in the **Table 11**. One standard deal with remediation techniques applied at contaminated sites (also one similar CEN standard is available), and the other standard focuses on sustainable remediation of soil quality. This suggests that ISO and CEN have developed guidelines and best practices for remediating contaminated soil and promoting sustainable approaches to soil remediation, which can help reduce the risks associated with soil pollution and protect the environment.

Table 11. Standards related to risk reduction measures.

Topic	ISO	CEN	Total
Soil remediation	**2**	**1**	**3**
Remediation techniques applied at contaminated sites (ISO 24212:2024)	1	1	2
Sustainable			
Soil quality — Sustainable remediation	1		1
Total	**2**	**1**	**3**

Source: This report

No EPA methods were found specifically tackling soil remediation, but US Congress established the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (EPA 540/F-93/009) in 1980 in response of the thousands of contaminated sites that exist at national level. CERCLA is informally called Superfund (https://www.epa.gov/superfund/learn-about-superfund) and it established prohibitions and requirements concerning closed and abandoned hazardous waste sites; provided for liability of persons responsible for releases of hazardous waste at these sites; and established a trust fund to provide for cleanup when no responsible party could be identified. It allows EPA to clean up contaminated sites by following a key principles (documents) of Superfund Remedy Selection (https://www.epa.gov/superfund/key-principles-superfund-remedy-selection). It also forces the parties responsible for the contamination to either perform cleanups or reimburse the government for EPA-led cleanup work. EPA has collected information about many types of remediation technologies used to clean up contaminated sites. The technology guides collect information about many types of remediation technologies used to clean up contaminated sites.

Federal Remediation technologies roundtable (FRTR) provides information about software tools that can be used as part of a structured decision-making process for environmental site clean-up (**Figure 1**). The matrix allows you to screen 49 in situ and ex situ technologies for either soil or groundwater remediation. Variables used in screening include contaminants, development status, overall cost, and cleanup time.

Figure 1. Decision support tools (https://frtr.gov/decisionsupport/default.cfm)

Source: FRTR (https://frtr.gov/decisionsupport/default.cfm)

3.2.7. Annex V - Phases and principles for site-specific risk assessment

The Annex V of the SML outlines the phases and principles for site-specific risk assessment, which involves a four-step process: characterisation of the contamination, exposure assessment, toxicity or hazard assessment, and risk characterisation. The first step requires identifying the nature and extent of the contaminants present at the site, including their source, concentration, and distribution in the soil, parent material, and groundwater. The second step involves identifying the pathways by which soil contaminants may reach receptors, such as inhalation, ingestion, or dermal contact, and estimating the daily exposure dose. The third step, toxicity or hazard assessment, evaluates the potential adverse effects of the contaminants on human health and the environment, based on the dose and duration of exposure. The final step, risk characterisation, integrates the information from the previous steps to estimate the magnitude and probability of adverse effects of the contaminated site on human health and the environment, and helps to assess and prioritise the need for risk reduction measures and remediation measures. The risk assessment process is inherently complex and subject to a significant degree of uncertainty, which can impact the reliability of the results. However, by utilizing established standards for risk assessment, these uncertainties can be substantially mitigated, and a more harmonized evaluation can be achieved. The application of standards helps to reduce the variability and ambiguity associated with risk assessment, enabling more accurate and informed decision-making. By leveraging standardised

approaches and methodologies, the confidence in the results of the risk assessment is enhanced, ultimately supporting more effective and targeted risk management strategies.

Table 12 provides a comprehensive list of standard methods for site-specific risk assessment, with a total of 76 standards from ISO, EPA, and CEN. The standards cover a wide range of topics, including bioavailability, ecotoxicology, ecological risk assessment, and human health. Most of the standards, 38 and 35, are from ISO and CEN, respectively while EPA have 3 standards. The standards provide guidance on the selection and application of methods for assessing the bioavailability of contaminants in soil, as well as the effects of pollutants on various organisms, including earthworms, collembolans, and higher plants. Especially relevant are the standards focusing on determining the bioavailability of contaminants in soil and the environmental bioavailability of trace elements to plants to quantify the mobility of the pollutant into the soil, from the solid phase to the soil solution as well as the transport from the soil to the plant by assessing the impact on germination, flora, and higher plants. Standards also cover the assessment of human exposure to soil contaminants and the evaluation of the toxicity of petroleum hydrocarbons in soil. The use of these standards can help reduce uncertainties in risk assessment and provide a harmonized approach to evaluating the risks associated with contaminated soil. By utilizing these standards, the results obtained for risk assessment will be comparable as their evaluations are based on reliable and consistent methods, which can lead to more effective and targeted risk management strategies. Therefore, the proposed standards demonstrate the importance of Standardisation in risk assessment and the need for a comprehensive and harmonized approach to evaluating the risks associated with contaminated soil.

Table 12. Standard methods for site-specific risk assessment.

Topic	ISO	EPA	CEN	Total
Risk assessment				
Bioavailability				
Soil quality — Requirements and guidance for the selection and application of methods for the assessment of bioavailability of contaminants in soil and soil materials	1		1	2
Bioavailaty metals with plants				
Soil quality - Plant-based test to assess the environmental bioavailability of trace elements to plants (ISO 16198:2015)	1		1	2
Collembolans				
Soil quality - Avoidance test for determining the quality of soils and effects of chemicals on behaviour - Part 2: Test with collembolans (Folsomia candida) (ISO 17512-2:2011)	1		1	2
Earthworms				
Soil quality - Effects of pollutants on earthworms - Part 1: Determination of acute toxicity to Eisenia fetida/Eisenia andrei (ISO 11268-1:2012)	1		2	3
Soil quality - Effects of pollutants on earthworms - Part 2: Determination of effects on reproduction of Eisenia fetida/Eisenia andrei and other earthworm species (ISO 11268-2:2023)	1		1	2
Soil quality - Effects of pollutants on earthworms - Part 3: Guidance on the determination of effects in field situations (ISO 11268-3:2014)	1		1	2
Ecological risk assessment				
Ecological soil functions: indicators and methods	1			1
Soil quality - Guidance on the choice and evaluation of bioassays for ecotoxicological characterization of soils and soil materials (ISO 17616:2019)	1		1	2
Soil quality — Guidance on the ecotoxicological characterization of soils and soil materials	1		2	3
Soil quality - Procedure for site-specific ecological risk assessment of soil contamination (soil quality TRIAD approach)	1		1	2
Ecotoxicology				
Soil quality - Guidance on leaching procedures for subsequent chemical and ecotoxicological testing of soils and soil materials (ISO 18772:2008)	1		1	2
Enchytraeidae				

Soil quality - Effects of contaminants on Enchytraeidae (Enchytraeus sp.) - Determination of effects on reproduction (ISO 16387:2023)	1	1	2
Flora			
Soil quality - Determination of the effects of pollutants on soil flora - Leaf fatty acid composition of plants to assess soil quality (ISO 21479:2019)	1	1	2
Soil quality — Determination of the effects of pollutants on soil flora — Part 1: Method for the measurement of inhibition of root growth	1	1	2
Soil quality — Determination of the effects of pollutants on soil flora — Part 2: Effects of contaminated soil on the emergence and early growth of higher plants	1	1	2
Soil quality — Determination of the effects of pollutants on soil flora — Screening test for emergence of lettuce seedlings (Lactuca sativa L.)	1		1
Germination			
Soil quality - Determination of the toxic effects of pollutants on germination and early growth of higher plants (ISO 18763:2016)	1	1	2
Higher plants			
Soil quality - Assessment of genotoxic effects on higher plants - Vicia faba micronucleus test (ISO 29200:2013)	1	1	2
Human Health			
Soil quality — Assessment of human exposure from ingestion of soil and soil material — Procedure for the estimation of the human bioaccessibility/bioavailability of metals in soil	1		1
Soil quality — Characterization of soil with respect to human exposure	1		1
larvae			
Soil quality - Effects of pollutants on insect larvae (Oxythyrea funesta) - Determination of acute toxicity (ISO 20963:2005)	1	1	2
Leaching tests			
Soil quality - Leaching procedures for subsequent chemical and ecotoxicological testing of soil and soil-like material - Part 2: Batch test using a liquid to solid ratio of 10 l/kg dry matter (ISO 21268-2:2019)	2	1	2
Soil quality - Leaching procedures for subsequent chemical and ecotoxicological testing of soil and soil-like materials - Part 1: Batch test using a liquid to solid ratio of 2 l/kg dry matter (ISO 21268-1:2019)	1	1	2
Soil quality - Leaching procedures for subsequent chemical and ecotoxicological testing of soil and soil-like materials - Part 3: Up-flow percolation test (ISO 21268-3:2019)	1	1	2
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 (ISO 21268-4:2019)	1	1	2

Soil quality — Leaching procedures for subsequent chemical and ecotoxicological testing of soil and soil-like materials — Part 5: Batch test with forced aerobic or anaerobic conditions	1			1
Marine amphipod				
Marine amphipod Sediment 28-d chronic toxicity - marine amphipod		1		1
Marine amphipod SOIL Tox Sediment 28-d chronic toxicity - marine amphipod		1		1
Metals bioavailability				
Soil quality — Use of extracts for the assessment of bioavailability of trace elements in soils	1			1
Microorganism				
Soil quality - Method for testing effects of soil contaminants on the feeding activity of soil dwelling organisms - Bait-lamina test (ISO 18311:2016)	1		1	2
Mycorrhizal				
Soil quality — Effects of pollutants on mycorrhizal fungi — Spore germination test	1			1
Oral bioaccessibility metals				
Simplified method for prediction of the oral bioaccessibility of metals and metalloids in soils	1			1
Oral bioaccessibility organic				
Soil quality — Bioaccessibility of organic and inorganic pollutants from contaminated soil and soil-like materials	1			1
Oribatid mites				
Soil quality - Test for measuring the inhibition of reproduction in oribatid mites (Oppia nitens) exposed to contaminants in soil (ISO 23266:2020)	1		1	2
Snails				
Soil quality - Effects of pollutants on juvenile land snails (Helicidae) - Determination of the effects on growth by soil contamination (ISO 15952:2018)	1		1	2
Soil quality - In situ caging of snails to assess bioaccumulation of contaminants (ISO 24032:2021)	1		1	2
Soil mite				
Soil quality - Inhibition of reproduction of the soil mite (Hypoaspis aculeifer) by soil contaminants (ISO 21285:2019)	1		2	3
Toxicity high plants				
Soil quality - Biological methods - Chronic toxicity in higher plants (ISO 22030:2005)	1		1	2
TPH				
Soil quality - Assessment of impact from soil contaminated with petroleum hydrocarbons (ISO 11504:2017)	1		1	2

Earthworms				
Soil quality - Avoidance test for determining the quality of soils and effects of chemicals on behaviour - Part 1: Test with earthworms (Eisenia fetida and Eisenia andrei) (ISO 17512-1:2008)	1		1	2
Elutates				
Environmental characterization of eluates from leaching of waste and soil using reproductive and toxicological gene expression in Daphnia magna			1	1
Escherichia coli				
Sludge, treated biowaste and soil - Detection and enumeration of Escherichia coli			1	1
Soil monitoring		**1**		**1**
Soil and foliar				
Soil & Foliar in Long-Term Environ Monitoring		1		1
Total	**38**	**3**	**35**	**76**

Source: This report

3.2.8. Annex VI – Content of register of potentially contaminated sites and contaminated sites

The Annex VI outlines the content of a register for potentially contaminated sites and contaminated sites, which aims to provide transparency and track progress in the identification, investigation, and management of these sites. The register must contain specific information at the site level, including the site's coordinates, location, or cadastral parcel, the year of inclusion in the register, contaminating or potentially contaminating activities, management status, and conclusions regarding the presence or absence of contamination. Additionally, the register must include information on required subsequent actions and management steps. The register may also contain optional information, such as environmental permits, current and planned land use, soil investigation and remediation reports, and timelines for subsequent actions. This information will enable the public to monitor progress and ensure that contaminated sites are properly managed and remediated. The register is a key tool for transparency and accountability in the management of contaminated sites, and its design and presentation should facilitate easy access to information and tracking of progress over time.

Some standards on contaminated sites are shown in **Table 13**. Seven standards related to potentially contaminated and contaminated sites, with 5 standards from ISO and 2 standards from CEN. The standards cover various aspects of contaminated sites, including conceptual site models, sampling, characterization, screening, and soil organic matter decomposition as indicator. The ISO standards provide guidelines for investigating potentially contaminated sites, characterizing contaminated soil, and estimating organic matter decomposition. The CEN standards are adoptions of ISO standards, ISO 21365:2019, which provides a conceptual site model for potentially contaminated sites and ISO 15175:2018 on characterization of contaminated soil related to groundwater protection. These standards can be used to support the identification, assessment, and management of contaminated sites, and to ensure that they are properly remediated and protected.

Table 13. Standards related to potentially- and contaminated sites.

Topic	ISO	CEN	Total
Soil pollution			
Contaminated sites			
Soil quality - Conceptual site models for potentially contaminated sites (ISO 21365:2019)	1	1	2
Soil quality — Sampling — Part 203: Investigation of potentially contaminated sites	1		1
Contaminated soils and groundwater protection			
Soil quality — Characterization of contaminated soil related to groundwater protection (ISO 15175:2018)	1	1	2
Screening			
Soil quality — Guideline for the screening of soil polluted with toxic elements using soil magnetometry	1		1
SOM decomposition			
Soil quality — Test for estimating organic matter decomposition in contaminated soil	1		1
Total	**5**	**2**	**7**

Source: This report

3.3. Other standards

As extensively discussed throughout the document, the primary objective of this study was to provide an inventory of current soil-related standards from international standard bodies. Other standards that address different topics, although potentially useful, were not considered in this work, specifically:

- Standards providing frameworks for improving data quality for specific kinds of data (i.e. the ISO 8000 series).
- Standards related to geographic information and earth observation (ISO 19165 series on Geographic information — Preservation of digital data and metadata; EN-ISO 19115:2014 Geographic information — Metadata, etc). The use of the EN-ISO 19115 was already profusely discussed by Yunta et al (2025) as part of the harmonisation process on soil pollution.
- Standards that are awaiting approval or have been recently published, such as ISO 17298:2025, which focuses on considering biodiversity in an organization's strategy and operations. The content of this standard, which provides requirements and guidelines, is not yet clear and requires further classification.
- As mentioned before only the CEN standards managed into the CEN/TC 444 working group were analysed in this work (except the EN ISO/IEC 17025 as above discussed)

3.4. National Bodies of Standardization

A National Standard Body (NSB) is a National Standards Organization (NSO) from the European Economic Area (EEA) listed by the European Commission in the Official Journal of the European Union (EU 1025/2012, updated list of NSB). The NSBs play a pivotal role in the support of the European Single market, by taking the exclusive responsibility for accepting EC Standardisation Requests (SReq), adopting, changing or stopping related ETSI work items, and adopting or withdrawing the related European Standards and European standardisation deliverables. The updated list of the NSBs is provided in the **Table 14** for further consultation.

Table 14. National standard bodies as listed by the European Commission in the Official Journal of the European Union (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023XC0704(01)

Country	NSB	Acronym	Year	Webpage
Austria	Austrian Standards Institute	ASI	1996	https://www.austrian-standards.at/en
Belgium	Bureau de Normalisation	NBN	1997	https://www.nbn.be/
Bulgaria	Bulgarian Institute for Standardization	BDS	2000	https://bds-bg.org/bg/
Cyprus	Cyprus Organization for Standardization	CYS	2009	https://www.cys.org.cy/
Czech Republic	Czech Office for Standards, Metrology and Testing	UNMZ	1995	https://unmz.gov.cz

Denmark	Dansk Standard (Danish Standards Foundation)	DS	1996	https://webshop.ds.dk
Estonia	Estonian Centre for Standardisation and Accreditation	EVS	1997	https://www.evs.ee/
Finland	Finnish Standards Association	SFS	1995	https://sfs.fi/en/
France	Association française de normalisation	AFNOR	1995	https://norminfo.afnor.org/
Germany	Deutsches Institut für Normung e.V.	DIN	1995	http://www.din.de/
Greece	Hellenic Organization for Standardization	ELOT	1997	https://elot.gr/en/
Hungary	Magyar Szabványügyi Testület	MSZT	1995	https://www.mszt.hu/hu-hu/
Ireland	National Standards Authority of Ireland	NSAI	1998	https://www.nsai.ie/
Italy	Ente Nazionale Italiano di Unificazione	UNI	1995	http://www.uni.com/
Latvia	Standardization, Accreditation and Metrology Centre, Latvian Standard	LVS	1997	http://www.lvs.lv/
Lithuania	Lithuanian Standards Board	LST	1999	http://www.lsd.lt/
Luxembourg	Institut luxembourgeois de la normalisation, de l'accréditation, de la sécurité et qualité des produits et services	ILNAS	1998	http://www.portail-qualite.public.lu/
Malta	Malta Competition and Consumer Affairs Authority	MCCAA	2001	http://www.msa.org.mt/
Netherlands	Nederlands Normalisatie-instituut	NEN	1996	http://www.nen.nl/
Poland	Polski Komitet Normalizacyjny (Polish Committee for Standardization)	PKN	1996	http://www.pkn.pl/
Portugal	Instituto Português da Qualidade	IPQ	1998	http://www.ipq.pt/
Romania	Asociația de Standardizare din	ASRO	1996	http://www.asro.ro/

	România (Romanian Standards Association)			
Slovak Republic	Slovak Office of Standards, Metrology and Testing	SOSMT	2001	http://www.unms.sk/
Slovenia	Slovenian Institute for Standardization	SIST	2006	http://www.sist.si/
Spain	Asociación Española de Normalización	UNE	1996	http://www.une.org/
Sweden	Swedish Institute for Standards	SIS	2002	http://www.sis.se/
European Union	European Committee for Electrotechnical Standardization	CENELEC	1996	http://www.cenelec.eu/
European Union	European Committee for Standardization	CEN	1996	http://www.cen.eu/

source: https://tbtcode.iso.org/list-of-standardizing-bodies.html, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023XC0704(01)

Within the Union, national standards are adopted by national standardisation bodies and they participate in the development of European standards (EU 1025/2012; Article 2, Article 3) as well as they are also responsible for ensuring that national standards are compatible with European standards (EU 1025/2012, Article 4). The national Standardisation bodies are required to establish their work programme and make it available on their website (EU 1025/2012, Article 3). They must also send draft national standards to other European Standardisation organizations, national Standardisation bodies, or the Commission upon request (EU 1025/2012, Article 4).

The level of coordination between national Standardisation bodies and European Standardisation bodies is high to ensure that national standards are aligned with European standards (EU 1025/2012, Article 10) by notifying the Commission of their work programme (EU 1025/2012, Article 3), and to participate in the development of European standards (EU 1025/2012, Article 10). This close coordination ensures that national standards are aligned with European standards, and that the Standardisation process is transparent and effective (EU 1025/2012, Article 3).

Therefore, the role of national Standardisation bodies is essential in ensuring that standards are developed and implemented in a way that supports the internal market and promotes competitiveness (EU 1025/2012, Article 10). By working together with European Standardisation organizations and other national Standardisation bodies, national Standardisation bodies can help to create a cohesive and effective Standardisation system (EU 1025/2012, Article 3).

This study did not examine national standards, as the Soil Monitoring Law advises using internationally and European-adopted standards, specifically those developed by the International Organization for Standardisation (ISO) and the European Committee for Standardisation (CEN).

According to the Regulation (EU) No 1025/2012, national Standardisation bodies are required to work closely with European Standardisation organizations to ensure that national standards are aligned with European standards. Given this close coordination, it can be assumed that national level standards are already taken into account at the European Union level. Therefore, focusing on

European Union or International level standards is sufficient for the analysis, and excluding national level standards does not omit any crucial information. By using European Union or International level standards, the analysis can ensure that the standards used are harmonized and consistent across the European Union, which is in line with the goals of the Soil Monitoring Law.

4 Conclusions

In accordance with the main objective of this work, an inventory of the current available soil-related standards was provided from international (International Organization for Standardisation - ISO) and European (European Committee for Standardisation - CEN) standard bodies, as well as other well-recognised international institutions such as the United States Environmental Protection Agency (EPA), and the Food and Agriculture Organization of the United Nations (FAO-GLOSOLAN).

The inventory includes 574 soil-related standards from the four international Standardisation entities (CEN, ISO, EPA, FAO-GLOSOLAN) by categorizing them into relevant topics, such as soil analysis, soil pollution, risk assessment, soil biodiversity, and soil sampling.

Soil monitoring law (SML) provides a list of 17 international standards covering all the soil descriptors defined for monitoring and assessing soil health.

There is a need for harmonisation of soil-related standards to ensure consistency and comparability of soil data and to support effective soil management and protection efforts.

Standardised methods and protocols for soil monitoring, analysis, and remediation are essential for ensuring accuracy, reliability, and comparability of soil data and for supporting effective soil management and protection efforts.

European and International standards, such as those developed by CEN, ISO, EPA, and FAO-GLOSOLAN, can play a critical role in supporting the development of harmonized and effective soil-related standards and in promoting best practices in soil management and protection.

This report highlights the importance of standardised methods and protocols for supporting effective soil management and protection efforts and the need for harmonisation of standards across different countries and organizations.

5 References

CEN: European Committee for Standardisation (https://www.cencenelec.eu/european-standardization/european-standards/) (last visit on November 4th, 2025)

Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) http://data.europa.eu/eli/dir/2010/75/oj. (last visit on November 4th, 2025)

Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC Text with EEA relevance. http://data.europa.eu/eli/dir/2012/18/oj (last visit on November 4th, 2025)

EPA 540/F-93/009, OSWER 9355.7-03, NTIS: PB93-963325INZ, February 1992 . http://semspub.epa.gov/src/document/HQ/175644

EPA: United States Environmental Protection Agency (https://www.epa.gov/measurements-modeling/index-epa-test-methods) (last visit on November 4th, 2025)

EU 1025/2012 of the European Parliament and of the Council of 25 October 2012 on European standardisation, amending Council Directives 89/686/EEC and 93/15/EEC and Directives 94/9/EC, 94/25/EC, 95/16/EC, 97/23/EC, 98/34/EC, 2004/22/EC, 2007/23/EC, 2009/23/EC and 2009/105/EC of the European Parliament and of the Council and repealing Council Decision 87/95/EEC and Decision No 1673/2006/EC of the European Parliament and of the Council Text with EEA relevance. (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02012R1025-20241213)

EU 1025/2012, updated list of NSB .Publication of an update to the list of national standardisation bodies pursuant to Article 27 of Regulation (EU) No 1025/2012 of the European Parliament and of the Council on European standardisation (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023XC0704(01)

(EU) 2019/1009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 laying down rules on the making available on the market of EU fertilising products and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009 and repealing Regulation (EC) No 2003/2003 (http://data.europa.eu/eli/reg/2019/1009/oj)

FAO-GLOSOLAN: Food and Agriculture Organization of the United Nations - Global Soil Laboratory Network (https://www.fao.org/global-soil-partnership/glosolan/en/) (last visit on November 4th, 2025)

Superfund Remedy Selection (https://www.epa.gov/superfund/key-principles-superfund-remedy-selection (last visit on November 4th, 2025)

Federal Remediation technologies roundtable (FRTR). https://frtr.gov/decisionsupport/default.cfm (last visit on November 4th, 2025)

ISO: International Organization for Standardisation (https://www.iso.org/standards.html) (last visit on November 4th, 2025)

EU 2025/2360 of the European Parliament and of the Council of 12 November 2025 on soil monitoring and resilience (Soil Monitoring Law)

Yunta, F., Vieira, D., van Eynde, E., Jones, A., Bopp, S., Arpd, H.P., Carisi, M., Chalot, M., Guyonnet, D., Glüge, J., Hina, N., Lamé, F., Lebrun, M., Luts, D., Manier, N., Pucheux, N., Řezník, T., Snopková, D., Tarvainen, T., Trier, X., Urier-Cattoire, P., Valkama, M., Zabeo, A., Wojda, P. (2025). Harmonizing soil pollution data and knowledge in Europe: a collaborative effort towards achieving healthy soils by 2050, Publications Office of the European Union, Luxembourg, 2025. https://data.europa.eu/doi/10.2760/4402833, JRC142244

List of abbreviations and definitions

Abbreviations	Definitions
SML	Soil Monitoring Law
CEN	European Committee for Standardization
ISO	International Organization for Standardization
EPA	United States Environmental Protection Agency
FAO	Food and Agriculture Organization of the United Nations
VOCs	Volatile Organic Compounds
GHG	Treenhouse gases emissions
SOC	Soil Organic Carbon
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
STV	Sustainable target values
OTV	Operational trigger values

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Annexes

Annex I. List of ISO standards included in the study

Standard Number	Section	Topic	Title
ISO 11074:2025	Soil quality	Glossary	Soil quality — Vocabulary
ISO 11504:2017	Soil pollution	TPH	Soil quality — Assessment of impact from soil contaminated with petroleum hydrocarbons
ISO 14507:2003	Soil sampling	Organic pollutants	Soil quality — Pretreatment of samples for determination of organic contaminants
ISO 15903:2002	Soil sampling	Site information	Soil quality — Format for recording soil and site information
ISO 16133:2018	Soil monitoring	Programmes	Soil quality — Guidance on the establishment and maintenance of monitoring programmes
ISO 17402:2008	Soil pollution	Bioavailability	Soil quality — Requirements and guidance for the selection and application of methods for the assessment of bioavailability of contaminants in soil and soil materials
ISO 18504:2017	Soil remediation	Sustainable	Soil quality — Sustainable remediation
ISO 18589-1:2019	Soil pollution	Radionuclides definition	Measurement of radioactivity in the environment — Soil — Part 1: General guidelines and definitions
ISO 18589-2:2022	Soil pollution	Radionuclides sampling	Measurement of radioactivity in the environment — Soil — Part 2: Guidance for the selection of the sampling strategy, sampling and pre-treatment of samples
ISO 18589-3:2023	Soil pollution	Radionuclides	Measurement of radioactivity in the environment — Soil — Part 3: Test method of gamma-emitting radionuclides using gamma-ray spectrometry
ISO 18589-4:2019	Soil pollution	Radionuclides	Measurement of radioactivity in the environment — Soil — Part 4: Plutonium 238 and plutonium 239 + 240 — Test method using alpha spectrometry
ISO 18589-5:2019	Soil pollution	Radionuclides	Measurement of radioactivity in the environment — Soil — Part 5: Strontium 90 — Test method using proportional counting or liquid scintillation counting
ISO 18589-6:2019	Soil pollution	Radionuclides	Measurement of radioactivity in the environment — Soil — Part 6: Gross alpha and gross beta activities — Test method using gas-flow proportional counting
ISO 18589-7:2013	Soil pollution	Radionuclides	Measurement of radioactivity in the environment — Soil — Part 7: In situ measurement of gamma-emitting radionuclides
ISO/CD TS 18718	Risk assessment	Ecosystem services	Soil functions and related-ecosystem services: definitions and conceptual framework
ISO/CD TS 18721	Risk assessment	Ecological risk assessment	Ecological soil functions: indicators and methods
ISO 19204:2017	Risk assessment	Ecological risk assessment	Soil quality — Procedure for site-specific ecological risk assessment of soil contamination (soil quality TRIAD approach)
ISO 20951:2019	Soil pollution	GHG emissions	Soil Quality — Guidance on methods for measuring greenhouse gases (CO2, N2O, CH4) and ammonia (NH3) fluxes between soils and the atmosphere
ISO 21365:2019	Soil pollution	Contaminated sites and Models	Soil quality — Conceptual site models for potentially contaminated sites
ISO/DIS 21396	Soil pollution	Tyres	Rubber — Determination of the mass concentration of tyre and road wear particles (TRWP) in soil and sediment — Pyrolysis-gas chromatography/mass spectrometry (GC/MS) method

ISO 23400:2021	Soil analysis	Carbon and nitrogen stocks	Guidelines for the determination of organic carbon and nitrogen stocks and their variations in mineral soils at field scale
ISO 23992:2022	Soil monitoring	Changes on soil properties	Soil quality — Framework for detailed recording and monitoring of changes in dynamic soil properties
ISO 24212:2024	Soil remediation	Contaminated sites	Remediation techniques applied at contaminated sites
ISO 25177:2019	Soil sampling	Field soil description	Soil quality — Field soil description
ISO 28258:2013	Soil monitoring	Data	Soil quality — Digital exchange of soil-related data
ISO 28258:2013/Amd 1:2019	Soil monitoring	Data	Soil quality — Digital exchange of soil-related data — Amendment 1
ISO 4974:2023	Soil temperature	Guidance	Soil quality — Guidance on soil temperature measurement
ISO 10930:2012	Soil analysis	Soil aggregates	Soil quality — Measurement of the stability of soil aggregates subjected to the action of water
ISO 11464:2006	Soil analysis	Pretreatment	Soil quality — Pretreatment of samples for physico-chemical analysis
ISO 12782-1:2012	Soil analysis	amorphous iron	Soil quality — Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials — Part 1: Extraction of amorphous iron oxides and hydroxides with ascorbic acid
ISO 12782-2:2012	Soil analysis	Iron and aluminium oxides	Soil quality — Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials — Part 2: Extraction of crystalline iron oxides and hydroxides with dithionite
ISO 12782-3:2012	Soil analysis	aluminium oxides	Soil quality — Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials — Part 3: Extraction of aluminium oxides and hydroxides with ammonium oxalate/oxalic acid
ISO 12782-4:2012	Soil analysis	Humus substances	Soil quality — Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials — Part 4: Extraction of humic substances from solid samples
ISO 12782-5:2012	Soil analysis	Humus substances	Soil quality — Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials — Part 5: Extraction of humic substances from aqueous samples
ISO 17616:2019	Soil pollution	Ecotoxicology	Soil quality — Guidance on the choice and evaluation of bioassays for ecotoxicological characterization of soils and soil materials
ISO 18386:2025	Soil temperature	Soil temperature_IR	Soil quality — Screening method for soil temperature — Measurement by infrared (IR) thermometer
ISO 18400-100:2017	Soil sampling	Soil standards	Soil quality — Sampling — Part 100: Guidance on the selection of sampling standards
ISO 18400-101:2017	Soil sampling	Sampling plan	Soil quality — Sampling — Part 101: Framework for the preparation and application of a sampling plan
ISO 18400-102:2017	Soil sampling	Techniques	Soil quality — Sampling — Part 102: Selection and application of sampling techniques
ISO 18400-103:2017	Soil sampling	Safety	Soil quality — Sampling — Part 103: Safety
ISO 18400-104:2018	Soil sampling	Strategies	Soil quality — Sampling — Part 104: Strategies
ISO 18400-105:2017	Soil sampling	Transport	Soil quality — Sampling — Part 105: Packaging, transport, storage and preservation of samples
ISO/FDIS 18400-105	Soil sampling	Transport	Soil quality — Sampling — Part 105: Packaging, transport, storage and preservation of samples
ISO 18400-106:2017	Soil sampling	Quality control	Soil quality — Sampling — Part 106: Quality control and quality assurance

ISO 18400-107:2017	Soil sampling	Reporting	Soil quality — Sampling — Part 107: Recording and reporting
ISO 18400-201:2017	Soil sampling	Field pretreatment	Soil quality — Sampling — Part 201: Physical pretreatment in the field
ISO 18400-202:2018	Soil sampling	Preliminary investigations	Soil quality — Sampling — Part 202: Preliminary investigations
ISO 18400-203:2018	Soil pollution	contaminated sites	Soil quality — Sampling — Part 203: Investigation of potentially contaminated sites
ISO 18400-204:2017	Soil sampling	Gas	Soil quality — Sampling — Part 204: Guidance on sampling of soil gas
ISO 18400-205:2018	Soil sampling	Natural soils	Soil quality — Sampling — Part 205: Guidance on the procedure for investigation of natural, near-natural and cultivated sites
ISO 18400-206:2018	soil sampling	Microbiology and biodiversity	Soil quality — Sampling — Part 206: Collection, handling and storage of soil under aerobic conditions for the assessment of microbiological processes, biomass and diversity in the laboratory
ISO/DIS 18400-206	Soil sampling	Microbiology and biodiversity	Soil quality — Sampling — Part 206: Collection, handling and storage of soil under aerobic conditions for the assessment of microbiological processes, biomass and diversity in the laboratory
ISO 18400-301:2023	Soil pollution	VOCs	Soil quality — Sampling — Part 301: Sampling and on site semi-quantitative determinations of volatile organic compounds in field investigations
ISO 18512:2007	Soil sampling	Storage	Soil quality — Guidance on long and short term storage of soil samples
ISO 18772:2008	Soil pollution	Ecotoxicology	Soil quality — Guidance on leaching procedures for subsequent chemical and ecotoxicological testing of soils and soil materials
ISO 21268-1:2019	Soil pollution	Leaching tests	Soil quality — Leaching procedures for subsequent chemical and ecotoxicological testing of soil and soil-like materials — Part 1: Batch test using a liquid to solid ratio of 2 l/kg dry matter
ISO 21268-2:2019	Soil pollution	Leaching tests	Soil quality — Leaching procedures for subsequent chemical and ecotoxicological testing of soil and soil-like materials — Part 2: Batch test using a liquid to solid ratio of 10 l/kg dry matter
ISO 21268-3:2019	Soil pollution	Leaching tests	Soil quality — Leaching procedures for subsequent chemical and ecotoxicological testing of soil and soil-like materials — Part 3: Up-flow percolation test
ISO 21268-4:2019	Soil pollution	Leaching tests	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
ISO 21268-5:2023	Soil pollution	Leaching tests	Soil quality — Leaching procedures for subsequent chemical and ecotoxicological testing of soil and soil-like materials — Part 5: Batch test with forced aerobic or anaerobic conditions
ISO 22892:2006	Soil pollution	G-MS	Soil quality — Guidelines for the identification of target compounds by gas chromatography and mass spectrometry
ISO 23611-1:2018	Soil sampling	Biodiversity	Soil quality — Sampling of soil invertebrates — Part 1: Hand-sorting and extraction of earthworms
ISO/DIS 23611-1	Soil sampling	Biodiversity	Soil quality — Sampling of soil invertebrates — Part 1: Hand-sorting and extraction of earthworms
ISO 23611-2:2024	Soil sampling	Biodiversity	Soil quality — Sampling of soil invertebrates — Part 2: Sampling and extraction of micro-arthropods (Collembola and Acarina)
ISO 23611-3:2019	Soil sampling	Biodiversity	Soil quality — Sampling of soil invertebrates — Part 3: Sampling and extraction of enchytraeids
ISO 23611-4:2022	Soil sampling	Biodiversity	Soil quality — Sampling of soil invertebrates — Part 4: Sampling, extraction and identification of soil-inhabiting nematodes
ISO 23611-5:2024	Soil sampling	Biodiversity	Soil quality — Sampling of soil invertebrates — Part 5: Sampling and extraction of soil macro-invertebrates

ISO 23611-6:2012	Soil sampling	Biodiversity	Soil quality — Sampling of soil invertebrates — Part 6: Guidance for the design of sampling programmes with soil invertebrates
ISO 23909:2008	Soil sampling	Pretreatment	Soil quality — Preparation of laboratory samples from large samples
ISO 5120:2023	Soil pollution	Perchlorate	Soil quality — Determination of perchlorate in soil using liquid chromatography-tandem mass spectrometry (LC-MS/MS)
ISO 10390:2021	Soil analysis	pH	Soil, treated biowaste and sludge – Determination of pH
ISO 10693:1995	Soil analysis	carbonates	Soil quality — Determination of carbonate content — Volumetric method
ISO 10694:1995	Soil analysis	SOC combustion	Soil quality — Determination of organic and total carbon after dry combustion (elementary analysis)
ISO 11047:1998	Soil pollution	metals_FAAS	Soil quality — Determination of cadmium, chromium, cobalt, copper, lead, manganese, nickel and zinc — Flame and electrothermal atomic absorption spectrometric methods
ISO 11048:1995	Soil analysis	Sulfate	Soil quality — Determination of water-soluble and acid-soluble sulfate
ISO 11260:2018	Soil analysis	CEC_BaCl2	Soil quality — Determination of effective cation exchange capacity and base saturation level using barium chloride solution
ISO 11261:1995	Soil analysis	Nitrogen_Kjeldahl	Soil quality — Determination of total nitrogen — Modified Kjeldahl method
ISO 11262:2011	Soil pollution	Cyanide	Soil quality — Determination of total cyanide
ISO 11263:1994	Soil analysis	Phosphorus_Olsen	Soil quality — Determination of phosphorus — Spectrometric determination of phosphorus soluble in sodium hydrogen carbonate solution
ISO 11264:2005	Soil pollution	Herbicides_HPLC-UV	Soil quality — Determination of herbicides — Method using HPLC with UV-detection
ISO 11916-1:2013	Soil pollution	Explosives	Soil quality — Determination of selected explosives and related compounds — Part 1: Method using high-performance liquid chromatography (HPLC) with ultraviolet detection
ISO 11916-2:2013	Soil pollution	Explosives	Soil quality — Determination of selected explosives and related compounds — Part 2: Method using gas chromatography (GC) with electron capture detection (ECD) or mass spectrometric detection (MS)
ISO 11916-3:2021	Soil pollution	Explosives	Soil quality — Determination of selected explosives and related compounds — Part 3: Method using liquid chromatography-tandem mass spectrometry (LC-MS/MS)
ISO 12404:2021	Soil analysis	Screening methods	Soil and waste — Guidance on the selection and application of screening methods
ISO 13196:2013	Soil analysis	XRF	Soil quality — Screening soils for selected elements by energy-dispersive X-ray fluorescence spectrometry using a handheld or portable instrument
ISO/DIS 13196	Soil analysis	XRF	Soil quality — Screening soils for selected elements by energy-dispersive X-ray fluorescence spectrometry using a handheld or portable instrument
ISO 13536:2024	Soil analysis	CEC_BaCl2 (8.1)	Soil quality — Determination of the potential cation exchange capacity and exchangeable cations using barium chloride solution buffered at pH = 8,1
ISO 13859:2014	Soil pollution	PAHs_GC_HPLC	Soil quality — Determination of polycyclic aromatic hydrocarbons (PAH) by gas chromatography (GC) and high performance liquid chromatography (HPLC)
ISO 13878:1998	Soil analysis	Nitrogen_combustion	Soil quality — Determination of total nitrogen content by dry combustion ("elemental analysis")
ISO/TS 13896:2012	Soil pollution	Alkylsufonate	Soil quality — Determination of linear alkylbenzene sulfonate (LAS) — Method by HPLC with fluorescence detection (LC-FLD) and mass selective detection (LC-MSD)

ISO/TS 13907:2012	Soil pollution	Nonylphenols	Soil quality — Determination of nonylphenols (NP) and nonylphenol-mono- and diethoxylates — Method by gas chromatography with mass selective detection (GC-MS)
ISO 13913:2014	Soil pollution	Phatalates	Soil quality — Determination of selected phthalates using capillary gas chromatography with mass spectrometric detection (GC/MS)
ISO 13914:2023	Soil pollution	Dioxins	Soil, treated biowaste and sludge — Determination of dioxins and furans and dioxin-like polychlorinated biphenyls by gas chromatography with high resolution mass selective detection (HR GC-MS)
ISO/DIS 13914	Soil pollution	Dioxins	Soil, treated biowaste and sludge — Determination of dioxins and furans and dioxin-like polychlorinated biphenyls by gas chromatography with mass selective detection (HRMS or MS/MS)
ISO 14154:2005	Soil pollution	Chlorophenols	Soil quality — Determination of some selected chlorophenols — Gas-chromatographic method with electron-capture detection
ISO 14254:2018	Soil analysis	BaCl2 available fraction	Soil quality — Determination of exchangeable acidity using barium chloride solution as extractant
ISO 14255:1998	Soil analysis	N_NO3-N_NH4 with CaCl2	Soil quality — Determination of nitrate nitrogen, ammonium nitrogen and total soluble nitrogen in air-dry soils using calcium chloride solution as extractant
ISO/TS 14256-1:2003	Soil analysis	N_NO3-N_NH4 with KCl	Soil quality — Determination of nitrate, nitrite and ammonium in field-moist soils by extraction with potassium chloride solution — Part 1: Manual method
ISO 14256-2:2005	Soil analysis	N_NO3-N_NH4 with KCl	Soil quality — Determination of nitrate, nitrite and ammonium in field-moist soils by extraction with potassium chloride solution — Part 2: Automated method with segmented flow analysis
ISO 14388-1:2014	Soil analysis	Acid sulfate soils	Soil quality — Acid-base accounting procedure for acid sulfate soils — Part 1: Introduction and definitions, symbols and acronyms, sampling and sample preparation
ISO 14388-2:2014	Soil analysis	Acid sulfate soils	Soil quality — Acid-base accounting procedure for acid sulfate soils — Part 2: Chromium reducible sulfur (CRS) methodology
ISO 14388-3:2014	Soil analysis	Acid sulfate soils	Soil quality — Acid-base accounting procedure for acid sulfate soils — Part 3: Suspension peroxide oxidation combined acidity and sulfur (SPOCAS) methodology
ISO 14869-1:2001	Soil pollution	HF	Soil quality — Dissolution for the determination of total element content — Part 1: Dissolution with hydrofluoric and perchloric acids
ISO 14869-2:2002	Soil pollution	Alkaline extraction	Soil quality — Dissolution for the determination of total element content — Part 2: Dissolution by alkaline fusion
ISO 14869-3:2017	Soil pollution	HF_microwave	Soil quality — Dissolution for the determination of total element content — Part 3: Dissolution with hydrofluoric, hydrochloric and nitric acids using pressurised microwave technique
ISO 14870:2001	Soil pollution	DTPA_extractant	Soil quality — Extraction of trace elements by buffered DTPA solution
ISO 15009:2016	Soil pollution	Volatile compounds	Soil quality — Gas chromatographic determination of the content of volatile aromatic hydrocarbons, naphthalene and volatile halogenated hydrocarbons — Purge-and-trap method with thermal desorption
ISO 15178:2000	Soil analysis	Sulfur	Soil quality — Determination of total sulfur by dry combustion
ISO 15192:2021	Soil pollution	Cr(VI)	Soil and waste — Determination of Chromium(VI) in solid material by alkaline digestion and ion chromatography with spectrophotometric detection
ISO/FDIS 15192	Soil pollution	Cr(VI)	Soil and waste — Determination of chromium(VI) in solid material by alkaline digestion and ion chromatography with spectrophotometric detection

ISO/CD 15936	Soil analysis	SOC_combustion	Soil quality — Determination of organic and total carbon after dry combustion (elementary analysis)
ISO 16558-1:2015	Soil pollution	TPH	Soil quality — Risk-based petroleum hydrocarbons — Part 1: Determination of aliphatic and aromatic fractions of volatile petroleum hydrocarbons using gas chromatography (static headspace method)
ISO 16558-1:2015/Amd 1:2020	Soil pollution	TPH	Soil quality — Risk-based petroleum hydrocarbons — Part 1: Determination of aliphatic and aromatic fractions of volatile petroleum hydrocarbons using gas chromatography (static headspace method) — Amendment 1
ISO/TS 16558-2:2015	Soil pollution	TPH	Soil quality — Risk-based petroleum hydrocarbons — Part 2: Determination of aliphatic and aromatic fractions of semi-volatile petroleum hydrocarbons using gas chromatography with flame ionization detection (GC/FID)
ISO 16703:2004	Soil pollution	Hydrocarbons	Soil quality — Determination of content of hydrocarbon in the range C10 to C40 by gas chromatography
ISO/DIS 16703	Soil pollution	Hydrocarbons	Environmental Solid Matrices — Determination of hydrocarbon content in the range of C10 to C40 by gas chromatography
ISO/TS 16727:2013	Soil pollution	Mercury	Soil quality — Determination of mercury — Cold vapour atomic fluorescence spectrometry (CVAFS)
ISO 16729:2013	Soil pollution	HNO3 extractable	Soil quality — Digestion of nitric acid soluble fractions of elements
ISO 16772:2004	Soil pollution	Mercury	Soil quality — Determination of mercury in aqua regia soil extracts with cold-vapour atomic spectrometry or cold-vapour atomic fluorescence spectrometry
ISO/FDIS 16965	Soil analysis	ICP-MS	Environmental solid matrices — Determination of elements using inductively coupled plasma mass spectrometry (ICP-MS)
ISO/TS 16965:2013	Soil analysis	ICP-MS	Soil quality — Determination of trace elements using inductively coupled plasma mass spectrometry (ICP-MS)
ISO/TS 17182:2014	Soil pollution	Phenols and chlorophenols	Soil quality — Determination of some selected phenols and chlorophenols — Gas chromatographic method with mass spectrometric detection
ISO 17183:2016	Soil pollution	Isopropanol	Soil quality — Screening soils for isopropanol-extractable organic compounds by determining emulsification index by light attenuation
ISO 17184:2014	Soil analysis	SOC and N_NIRS	Soil quality — Determination of carbon and nitrogen by near-infrared spectrometry (NIRS)
ISO 17380:2013	Soil pollution	Cyanide	Soil quality — Determination of total cyanide and easily liberatable cyanide — Continuous-flow analysis method
ISO 17505:2025	Soil analysis	SOC_LoI	Soil and waste characterization — Temperature dependent differentiation of total carbon (TOC400, ROC, TIC900)
ISO 17586:2016	Soil pollution	Diluted HNO3	Soil quality — Extraction of trace elements using dilute nitric acid
ISO/TR 18105:2014	Soil pollution	Cr(VI)	Soil quality — Detection of water soluble chromium(VI) using a ready-to-use test-kit method
ISO 18227:2014	Soil pollution	XRF	Soil quality — Determination of elemental composition by X-ray fluorescence
ISO/FDIS 18227	Soil pollution	XRF	Environmental solid matrices — Determination of elemental composition by X-ray fluorescence spectrometry
ISO 18287:2006	Soil pollution	PAHs_GC_MS	Soil quality — Determination of polycyclic aromatic hydrocarbons (PAH) — Gas chromatographic method with mass spectrometric detection (GC-MS)

ISO 18475:2023	Soil pollution	PCB	Environmental solid matrices — Determination of polychlorinated biphenyls (PCB) by gas chromatography - mass selective detection (GC-MS) or electron-capture detection (GC-ECD)
ISO/DIS 19254	Soil pollution	Pesticides	Soil quality — Simultaneous determination of multi-class pesticide residues in soil using GC-MS/MS and LC-MS/MS analysis
ISO/TR 19588:2017	Soil pollution	Cyanide	Background information and guidance on environmental cyanide analysis
ISO 19730:2008	Soil pollution	NH4NO3	Soil quality — Extraction of trace elements from soil using ammonium nitrate solution
ISO 20244:2018	Soil analysis	Water content	Soil quality — Screening method for water content — Determination by refractometry
ISO 20280:2007	Soil pollution	Aqua regia HGAAS	Soil quality — Determination of arsenic, antimony and selenium in aqua regia soil extracts with electrothermal or hydride-generation atomic absorption spectrometry
ISO 20295:2018	Soil pollution	Perchlorate	Soil quality — Determination of perchlorate in soil using ion chromatography
ISO 21226:2019	Soil pollution	Screeening	Soil quality — Guideline for the screening of soil polluted with toxic elements using soil magnetometry
ISO 22036:2024	Soil analysis	ICP-OES	Environmental solid matrices — Determination of elements using inductively coupled plasma optical emission spectrometry (ICP-OES)
ISO 22155:2016	Soil pollution	Organic compounds	Soil quality — Gas chromatographic determination of volatile aromatic and halogenated hydrocarbons and selected ethers — Static headspace method
ISO/TS 22171:2023	Soil analysis	CEC_AcNH4_pH7	Soil quality — Determination of potential cation exchange capacity (CEC) and exchangeable cations buffered at pH 7, using a molar ammonium acetate solution
ISO 23161:2018	Soil pollution	Organotin	Soil quality — Determination of selected organotin compounds — Gas-chromatographic method
ISO 23646:2022	Soil pollution	Pesticides	Soil quality — Determination of organochlorine pesticides by gas chromatography with mass selective detection (GC-MS) and gas chromatography with electron-capture detection (GC-ECD)
ISO 54321:2020	Soil pollution	Aqua regia	Soil, treated biowaste, sludge and waste — Digestion of aqua regia soluble fractions of elements
ISO 11265:1994	Soil analysis	Electrical conductivity	Soil quality — Determination of the specific electrical conductivity
ISO 11265:1994/Cor 1:1996	Soil analysis	Electrical conductivity	Soil quality — Determination of the specific electrical conductivity — Technical Corrigendum 1
ISO/FDIS 11265	Soil analysis	Electrical conductivity	Environmental solid matrices — Determination of the specific electrical conductivity
ISO 11271:2022	Soil analysis	Redox on field	Soil quality — Determination of redox potential — Field method
ISO 11272:2017	Soil analysis	Bulk Density	Soil quality — Determination of dry bulk density
ISO 11277:2020	Soil analysis	Texture	Soil quality — Determination of particle size distribution in mineral soil material — Method by sieving and sedimentation
ISO 11277:2020/Amd 1:2024	Soil analysis	Texture	Soil quality — Determination of particle size distribution in mineral soil material — Method by sieving and sedimentation — Amendment 1
ISO/DIS 11277	Soil analysis	Texture	Soil quality — Determination of particle size distribution in mineral soil material — Method by sieving and sedimentation
ISO 11465:1993	Soil analysis	DM_Water content	Soil quality — Determination of dry matter and water content on a mass basis — Gravimetric method

ISO 11465:1993/Cor 1:1994	Soil analysis	DM_Water content	Soil quality — Determination of dry matter and water content on a mass basis — Gravimetric method — Technical Corrigendum 1
ISO/FDIS 11465	Soil analysis	DM_Water content	Sludge and solid environmental matrices — Determination of dry residue or water content and calculation of the dry matter fraction on a mass basis
ISO 11508:2017	Soil analysis	Particle density	Soil quality — Determination of particle density
ISO 16720:2005	Soil sampling	Pretreatment	Soil quality — Pretreatment of samples by freeze-drying for subsequent analysis
ISO 17628:2015	Soil analysis	Thermal conductivity	Geotechnical investigation and testing — Geothermal testing — Determination of thermal conductivity of soil and rock using a borehole heat exchanger
ISO 17892-1:2014	Soil analysis	Water content	Geotechnical investigation and testing — Laboratory testing of soil — Part 1: Determination of water content
ISO 17892-1:2014/Amd 1:2022	Soil analysis	Water content	Geotechnical investigation and testing — Laboratory testing of soil — Part 1: Determination of water content — Amendment 1
ISO 17892-2:2014	Soil analysis	Bulk Density	Geotechnical investigation and testing — Laboratory testing of soil — Part 2: Determination of bulk density
ISO 17892-3:2015	Soil analysis	Particle density	Geotechnical investigation and testing — Laboratory testing of soil — Part 3: Determination of particle density
ISO 17892-4:2016	Soil analysis	Texture	Geotechnical investigation and testing — Laboratory testing of soil — Part 4: Determination of particle size distribution
ISO 17892-5:2017	NA	NA	Geotechnical investigation and testing — Laboratory testing of soil — Part 5: Incremental loading oedometer test
ISO 17892-6:2017	NA	NA	Geotechnical investigation and testing — Laboratory testing of soil — Part 6: Fall cone test
ISO 17892-7:2017	NA	NA	Geotechnical investigation and testing — Laboratory testing of soil — Part 7: Unconfined compression test
ISO 17892-8:2018	NA	NA	Geotechnical investigation and testing — Laboratory testing of soil — Part 8: Unconsolidated undrained triaxial test
ISO 17892-9:2018	NA	NA	Geotechnical investigation and testing — Laboratory testing of soil — Part 9: Consolidated triaxial compression tests on water saturated soils
ISO 17892-10:2018	NA	NA	Geotechnical investigation and testing — Laboratory testing of soil — Part 10: Direct shear tests
ISO 17892-11:2019	NA	NA	Geotechnical investigation and testing — Laboratory testing of soil — Part 11: Permeability tests
ISO 17892-12:2018	NA	NA	Geotechnical investigation and testing — Laboratory testing of soil — Part 12: Determination of liquid and plastic limits
ISO 17892-12:2018/Amd 1:2021	NA	NA	Geotechnical investigation and testing — Laboratory testing of soil — Part 12: Determination of liquid and plastic limits — Amendment 1
ISO 17892-12:2018/Amd 2:2022	NA	NA	Geotechnical investigation and testing — Laboratory testing of soil — Part 12: Determination of liquid and plastic limits — Amendment 2
ISO 18674-1:2015	NA	NA	Geotechnical investigation and testing — Geotechnical monitoring by field instrumentation — Part 1: General rules
ISO 18674-2:2016	NA	NA	Geotechnical investigation and testing — Geotechnical monitoring by field instrumentation — Part 2: Measurement of displacements along a line: Extensometers

ISO 18674-3:2017	NA	NA	Geotechnical investigation and testing — Geotechnical monitoring by field instrumentation — Part 3: Measurement of displacements across a line: Inclinometers
ISO 18674-3:2017/Amd 1:2020	NA	NA	Geotechnical investigation and testing — Geotechnical monitoring by field instrumentation — Part 3: Measurement of displacements across a line: Inclinometers — Amendment 1
ISO 18674-4:2020	NA	NA	Geotechnical investigation and testing — Geotechnical monitoring by field instrumentation — Part 4: Measurement of pore water pressure: Piezometers
ISO 18674-5:2019	NA	NA	Geotechnical investigation and testing — Geotechnical monitoring by field instrumentation — Part 5: Stress change measurements by total pressure cells (TPC)
ISO/FDIS 18674-7	NA	NA	Geotechnical investigation and testing — Geotechnical monitoring by field instrumentation — Part 7: Measurement of strains: Strain gauges
ISO 23470:2018	Soil analysis	CEC_[Co(NH3)6]3+	Soil quality — Determination of effective cation exchange capacity (CEC) and exchangeable cations using a hexamminecobalt(III)chloride solution
ISO/TS 5594:2022	Soil monitoring	Ring tests	Soil and water quality — Guidance and requirements for designing an interlaboratory trial for validation of biotests
ISO/FDIS 7303	Soil pollution	Oral bioaccessibility metals	Simplified method for prediction of the oral bioaccessibility of metals and metalloids in soils
ISO 8259:2024	Soil pollution	Oral bioaccessibility organic	Soil quality — Bioaccessibility of organic and inorganic pollutants from contaminated soil and soil-like materials
ISO/TS 10832:2009	Soil pollution	mycorrhizal	Soil quality — Effects of pollutants on mycorrhizal fungi — Spore germination test
ISO 11063:2020	Soil biodiversity	DNA	Soil quality — Direct extraction of soil DNA
ISO 11266:1994	Soil analysis	Biodegradation organic chemicals	Soil quality — Guidance on laboratory testing for biodegradation of organic chemicals in soil under aerobic conditions
ISO 11267:2023	Soil pollution	Collembola	Soil quality — Inhibition of reproduction of Collembola (Folsomia candida) by soil contaminants
ISO 11268-1:2012	Soil pollution	Earthworms	Soil quality — Effects of pollutants on earthworms — Part 1: Determination of acute toxicity to Eisenia fetida/Eisenia andrei
ISO 11268-2:2023	Soil pollution	Earthworms	Soil quality — Effects of pollutants on earthworms — Part 2: Determination of effects on reproduction of Eisenia fetida/Eisenia andrei and other earthworm species
ISO 11268-3:2014	Soil pollution	Earthworms	Soil quality — Effects of pollutants on earthworms — Part 3: Guidance on the determination of effects in field situations
ISO 11269-1:2012	Soil pollution	Flora	Soil quality — Determination of the effects of pollutants on soil flora — Part 1: Method for the measurement of inhibition of root growth
ISO 11269-2:2012	Soil pollution	Flora	Soil quality — Determination of the effects of pollutants on soil flora — Part 2: Effects of contaminated soil on the emergence and early growth of higher plants
ISO 14238:2012	Soil analysis	Nitrogen mineralization and nitrification	Soil quality — Biological methods — Determination of nitrogen mineralization and nitrification in soils and the influence of chemicals on these processes
ISO 14239:2017	Soil analysis	Organic chemicals mineralization	Soil quality — Laboratory incubation systems for measuring the mineralization of organic chemicals in soil under aerobic conditions
ISO 14240-1:1997	Soil biodiversity	Respiration method	Soil quality — Determination of soil microbial biomass — Part 1: Substrate-induced respiration method

ISO 14240-2:1997	Soil biodiversity	Fumigation	Soil quality — Determination of soil microbial biomass — Part 2: Fumigation-extraction method
ISO 15473:2002	Soil analysis	Biodegradation organic chemicals	Soil quality — Guidance on laboratory testing for biodegradation of organic chemicals in soil under anaerobic conditions
ISO 15685:2012	Soil analysis	Nitrogen nitrification	Soil quality — Determination of potential nitrification and inhibition of nitrification — Rapid test by ammonium oxidation
ISO 15952:2018	Soil pollution	Snails	Soil quality — Effects of pollutants on juvenile land snails (Helicidae) — Determination of the effects on growth by soil contamination
ISO 16072:2002	Soil biodiversity	Soil respiration	Soil quality — Laboratory methods for determination of microbial soil respiration
ISO 16198:2015	Soil pollution	Bioavailaty metals with plants	Soil quality — Plant-based test to assess the environmental bioavailability of trace elements to plants
ISO 16387:2023	Soil pollution	Enchytraeidae	Soil quality — Effects of contaminants on Enchytraeidae (Enchytraeus sp.) — Determination of effects on reproduction
ISO 16712:2005	NA	NA	Water quality — Determination of acute toxicity of marine or estuarine sediment to amphipods
ISO 16751:2020	Soil pollution	Non-polar OC	Soil quality — Environmental availability of non-polar organic compounds — Determination of the potentially bioavailable fraction and the non-bioavailable fraction using a strong adsorbent or complexing agent
ISO 17126:2024	Soil pollution	Flora	Soil quality — Determination of the effects of pollutants on soil flora — Screening test for emergence of lettuce seedlings (Lactuca sativa L.)
ISO 17155:2012	Soil biodiversity	Microflora	Soil quality — Determination of abundance and activity of soil microflora using respiration curves
ISO 17512-1:2008	Soil quality	Earthworms	Soil quality — Avoidance test for determining the quality of soils and effects of chemicals on behaviour — Part 1: Test with earthworms (Eisenia fetida and Eisenia andrei)
ISO 17512-2:2011	Soil quality	Collembolans	Soil quality — Avoidance test for determining the quality of soils and effects of chemicals on behaviour — Part 2: Test with collembolans (Folsomia candida)
ISO 17601:2016	Soil biodiversity	DNA	Soil quality — Estimation of abundance of selected microbial gene sequences by quantitative PCR from DNA directly extracted from soil
ISO/FDIS 17601	Soil biodiversity	DNA	Soil quality — Estimation of abundance of selected microbial gene sequences by quantitative polymerase chain reaction (qPCR) from DNA directly extracted from soil
ISO 17924:2018	Risk assessment	Human Health	Soil quality — Assessment of human exposure from ingestion of soil and soil material — Procedure for the estimation of the human bioaccessibility/bioavailability of metals in soil
ISO 18187:2024	Soil pollution	NVOCs	Soil quality — Contact test for solid samples using the dehydrogenase activity of Arthrobacter globiformis
ISO 18311:2016	Soil pollution	Microorganism	Soil quality — Method for testing effects of soil contaminants on the feeding activity of soil dwelling organisms — Bait-lamina test
ISO 18763:2016	Soil pollution	Germination	Soil quality — Determination of the toxic effects of pollutants on germination and early growth of higher plants
ISO 20130:2018	Soil biodiversity	Colorimetric	Soil quality — Measurement of enzyme activity patterns in soil samples using colorimetric substrates in micro-well plates
ISO/TS 20131-1:2018	Soil analysis	Denitrification	Soil quality — Easy laboratory assessments of soil denitrification, a process source of N2O emissions — Part 1: Soil denitrifying enzymes activities

ISO/TS 20131-2:2018	Soil analysis	Denitrification	Soil quality — Easy laboratory assessments of soil denitrification, a process source of N2O emissions — Part 2: Assessment of the capacity of soils to reduce N2O
ISO 20963:2005	Soil pollution	larvae	Soil quality — Effects of pollutants on insect larvae (Oxythyrea funesta) — Determination of acute toxicity
ISO 21285:2019	Soil pollution	Soil mite	Soil quality — Inhibition of reproduction of the soil mite (Hypoaspis aculeifer) by soil contaminants
ISO 21286:2019	Soil biodiversity	DNA barcoding	Soil quality — Identification of ecotoxicological test species by DNA barcoding
ISO 21479:2019	Soil pollution	Flora	Soil quality — Determination of the effects of pollutants on soil flora — Leaf fatty acid composition of plants used to assess soil quality
ISO 22030:2005	Soil pollution	Toxicity high plants	Soil quality — Biological methods — Chronic toxicity in higher plants
ISO 22190:2020	Soil pollution	Metals bioavailability	Soil quality — Use of extracts for the assessment of bioavailability of trace elements in soils
ISO/TS 22939:2019	Soil biodiversity	Enzyme activity	Soil quality — Measurement of enzyme activity patterns in soil samples using fluorogenic substrates in micro-well plates
ISO 23265:2022	Soil pollution	SOM decomposition	Soil quality — Test for estimating organic matter decomposition in contaminated soil
ISO 23266:2020	Soil pollution	Oribatid mites	Soil quality — Test for measuring the inhibition of reproduction in oribatid mites (Oppia nitens) exposed to contaminants in soil
ISO 23611-1:2018	Soil biodiversity	Invertebrates	Soil quality — Sampling of soil invertebrates — Part 1: Hand-sorting and extraction of earthworms
ISO/DIS 23611-1	Soil biodiversity	Invertebrates	Soil quality — Sampling of soil invertebrates — Part 1: Hand-sorting and extraction of earthworms
ISO 23611-2:2024	Soil biodiversity	Invertebrates	Soil quality — Sampling of soil invertebrates — Part 2: Sampling and extraction of micro-arthropods (Collembola and Acarina)
ISO 23611-3:2019	Soil biodiversity	Invertebrates	Soil quality — Sampling of soil invertebrates — Part 3: Sampling and extraction of enchytraeids
ISO 23611-4:2022	Soil biodiversity	Invertebrates	Soil quality — Sampling of soil invertebrates — Part 4: Sampling, extraction and identification of soil-inhabiting nematodes
ISO 23611-5:2024	Soil biodiversity	Invertebrates	Soil quality — Sampling of soil invertebrates — Part 5: Sampling and extraction of soil macro-invertebrates
ISO 23611-6:2012	Soil biodiversity	Invertebrates	Soil quality — Sampling of soil invertebrates — Part 6: Guidance for the design of sampling programmes with soil invertebrates
ISO/DIS 23611-6	Soil biodiversity	Invertebrates	Soil quality — Sampling of soil invertebrates — Part 6: Guidance for the design of sampling programmes with soil invertebrates
ISO 23753-1:2019	Soil biodiversity	Dehydrogenases activity	Soil quality — Determination of dehydrogenases activity in soils — Part 1: Method using triphenyltetrazolium chloride (TTC)
ISO 23753-1:2019/Amd 1:2020	Soil biodiversity	Dehydrogenases activity	Soil quality — Determination of dehydrogenases activity in soils — Part 1: Method using triphenyltetrazolium chloride (TTC) — Amendment 1
ISO 23753-2:2019	Soil biodiversity	Dehydrogenases activity	Soil quality — Determination of dehydrogenases activity in soils — Part 2: Method using iodotetrazolium chloride (INT)
ISO 23753-2:2019/Amd 1:2020	Soil biodiversity	Dehydrogenases activity	Soil quality — Determination of dehydrogenases activity in soils — Part 2: Method using iodotetrazolium chloride (INT) — Amendment 1
ISO 24032:2021	Soil pollution	Snails	Soil quality — In situ caging of snails to assess bioaccumulation of contaminants

ISO 29200:2013	Soil pollution	Higher plants	Soil quality — Assessment of genotoxic effects on higher plants — Vicia faba micronucleus test
ISO/TS 29843-1:2010	Soil biodiversity	Microbial diversity	Soil quality — Determination of soil microbial diversity — Part 1: Method by phospholipid fatty acid analysis (PLFA) and phospholipid ether lipids (PLEL) analysis
ISO/TS 29843-2:2021	Soil biodiversity	Microbial diversity	Soil quality — Determination of soil microbial diversity — Part 2: Method by phospholipid fatty acid analysis (PLFA) using the simple PLFA extraction method
ISO 10573:1995	Soil analysis	Water content	Soil quality — Determination of water content in the unsaturated zone — Neutron depth probe method
ISO 11274:2019	Soil analysis	Water retention	Soil quality — Determination of the water-retention characteristic — Laboratory methods
ISO 11275:2004	Soil analysis	Water retention	Soil quality — Determination of unsaturated hydraulic conductivity and water-retention characteristic — Wind's evaporation method
ISO 11276:1995	Soil analysis	Pore water pressure	Soil quality — Determination of pore water pressure — Tensiometer method
ISO 11461:2001	Soil analysis	Water content	Soil quality — Determination of soil water content as a volume fraction using coring sleeves — Gravimetric method
ISO 15175:2018	Soil pollution	Contaminated soils and groudwater protection	Soil quality — Characterization of contaminated soil related to groundwater protection
ISO 15709:2002	Soil analysis	Soil water	Soil quality — Soil water and the unsaturated zone — Definitions, symbols and theory
ISO 16383-1:2025	NA	NA	Geotechnical investigation and testing — Laboratory testing of rock — Part 1: Determination of water content
ISO 16586:2003	Soil analysis	Water Content	Soil quality — Determination of soil water content as a volume fraction on the basis of known dry bulk density — Gravimetric method
ISO 16586:2003/Cor 1:2009	Soil analysis	Water Content	Soil quality — Determination of soil water content as a volume fraction on the basis of known dry bulk density — Gravimetric method — Technical Corrigendum 1
ISO 17312:2005	Soil analysis	Hydraulic conductivity	Soil quality — Determination of hydraulic conductivity of saturated porous materials using a rigid-wall permeameter
ISO 17313:2004	Soil analysis	Hydraulic conductivity	Soil quality — Determination of hydraulic conductivity of saturated porous materials using a flexible wall permeameter
ISO 15176:2019	Soil analysis	Excavated soils	Guidance on characterization of excavated soil and other materials intended for re-use
ISO 15799:2019	Risk assessment	Ecotoxicological risks	Soil quality — Guidance on the ecotoxicological characterization of soils and soil materials
ISO 15800:2019	Risk assessment	Human Health	Soil quality — Characterization of soil with respect to human exposure
ISO/FDIS 18589-7	Soil pollution	Radionucleids	Measurement of radioactivity in the environment — Soil — Part 7: In situ measurement of gamma-emitting radionuclides
ISO 19258:2018	Soil pollution	Background levels	Soil quality — Guidance on the determination of background values
ISO 28901:2011	Soil biodiversity	Burial carcasses	Soil quality — Guidance for burial of animal carcasses to prevent epidemics
ISO/TR 33402:2025	Soil analysis	Reference material	Good practice in reference material preparation
ISO 28901:2011	Soil biodiversity	Burial carcasses	Soil quality — Guidance for burial of animal carcasses to prevent epidemics

ISO/IEC 17025:2017	Soil analysis	Quality control	General requirements for the competence of testing and calibration laboratories
ISO 17034:2016	Soil analysis	Quality control	General requirements for the competence of reference material producers
ISO 17298:2025	Soil biodiversity	Requirments and guidelines	Biodiversity — Considering biodiversity in the strategy and operations of organizations — Requirements and guidelines

Source: This report

Annex II. EPA standards included in the study

Section	Topic	Method	Chemical or Method Description	title
Soil pollution	Mercury	0245.5 CL	Mercury in soil/sediment - manual cold vapor	0245.5 CLMercury in soil/sediment - manual cold vapor
Soil pollution	Cyanide	0335.2 CL	Total Cyanide in water, soil/sediment	0335.2 CLTotal Cyanide in water, soil/sediment
Soil pollution	PCBs	680	PCBs & pesticides in water & soil/sediment - GCMS	680PCBs & pesticides in water & soil/sediment - GCMS
Soil pollution	Dioxins, etc	681	Dioxins & Furans, Chlorinated (CDD & CDF) - Soil	681Dioxins & Furans, Chlorinated (CDD & CDF) - Soil
Soil pollution	Pesticides	1556A	Organohalide pesticides -ww, soil, tissue-GC/HSD	1556AOrganohalide pesticides -ww, soil, tissue-GC/HSD
Soil pollution	Organohalides	1656A	Organohalides-ww, soil, sludge, sediment, tissue	1656AOrganohalides-ww, soil, sludge, sediment, tissue
Soil pollution	Organophosphorus	1657A	Organo-Phosphorus in ww, soil, sed, tissue	1657AOrgano-Phosphorus in ww, soil, sed, tissue
Soil pollution	PCBs	1668	PCBs in Water, Soil - Isotope Dilution HRGC/HRMS	1668PCBs in Water, Soil - Isotope Dilution HRGC/HRMS
Soil pollution	Acid digestion	3050B	Acid Digestion of Sediments, Sludges and Soils	3050BAcid Digestion of Sediments, Sludges and Soils
Soil pollution	Microwave digestion	3051	Microwave Assisted Acid Digestion/Sludges, Soils	3051Microwave Assisted Acid Digestion/Sludges, Soils
Soil pollution	Microwave digestion	3051A	Microwave Asst Acid Digestion Sediments/Soil/Oil	3051AMicrowave Asst Acid Digestion Sediments/Soil/Oil
Soil pollution	Total pollutants	3200	Organic, inorganic & total mercury in soils	3200Organic, inorganic & total mercury in soils
Soil pollution	TPH	4030	Petroleum Hydrocarbons Soil Screen by Immunoassy	4030Petroleum Hydrocarbons Soil Screen by Immunoassy
Soil pollution	PAHs	4035	PAHs Soil Screening by Immunoassy	4035PAHs Soil Screening by Immunoassy
Soil pollution	Toxaphene	4040	Toxaphene Soil Screening by Immunoassy	4040Toxaphene Soil Screening by Immunoassy
Soil pollution	Chlordane	4041	Chlordane Soil Screening by Immunoassy	4041Chlordane Soil Screening by Immunoassy
Soil pollution	DDT	4042	DDT Soil Screening by Immunoassy	4042DDT Soil Screening by Immunoassy
Soil pollution	TNT	4050	TNT Explosives in Water and Soils by Immunoassy	4050TNT Explosives in Water and Soils by Immunoassy
Soil pollution	Hexahydro-1,3,5-trinitro-1,3,5-triazine	4051	RDX in Soil and Water by Immunoassay	4051RDX in Soil and Water by Immunoassay
Soil pollution	PCBS, dioxins, PAH	4425	PCBs, Dioxins/Furans PAH - HRGS	4425PCBs, Dioxins/Furans PAH - HRGS
Soil pollution	Mercury	4500	Mercury in Soil by Immunoassay	4500Mercury in Soil by Immunoassay
Soil pollution	Lead	4510	Lead in water & soil by immunoassay	4510Lead in water & soil by immunoassay

Soil pollution	VOCs	8265	VOCs in water, soil, soil gas, air by DSITMS	8265VOCs in water, soil, soil gas, air by DSITMS
Soil pollution	TNT	8515	TNT in Soil by Coloimetric Screening	8515TNT in Soil by Coloimetric Screening
Soil analysis	pH	9045D	Soil and Waste pH	9045DSoil and Waste pH
Soil pollution	TPH	9074	Petroleum Hydrocarbons in Soil by Turbidmetric	9074Petroleum Hydrocarbons in Soil by Turbidmetric
Soil pollution	PCBs	9078	PCBs in Soil Screening Test	9078PCBs in Soil Screening Test
Soil analysis	CEC	9080	Cation-Exchange Capacity of Soils (Ammonium)	9080Cation-Exchange Capacity of Soils (Ammonium)
Soil analysis	CEC	9081	Cation-Exchange Capacity of Soils (Sodium)	9081Cation-Exchange Capacity of Soils (Sodium)
Soil pollution	Asbestos	ASBESTO Asbestos Screening for Soil & Sediment	ASBESTO Asbestos Screening for Soil & Sediment	ASBESTO Asbestos Screening for Soil & SedimentASBESTO Asbestos Screening for Soil & Sediment
Soil pollution	Pesticides	ECM	Pesticides in soil & water	ECMPesticides in soil & water
Soil sampling	Gas	FM-10	Soil Gas Sampling, Passive - Industrial Hygiene	FM-10Soil Gas Sampling, Passive - Industrial Hygiene
Soil sampling	Gas	FM-11	Soil Gas Sampling - Mini-Barrel Sampler	FM-11Soil Gas Sampling - Mini-Barrel Sampler
Soil sampling	Gas	FM-12	Soil Gas Sampling - One-Liter Syringe	FM-12Soil Gas Sampling - One-Liter Syringe
Soil sampling	Gas	FM-13	Soil Gas Sampling - Direct Injection Stopper	FM-13Soil Gas Sampling - Direct Injection Stopper
Soil sampling	Gas	FM-14	Soil Gas Sampling - Perforated Tube	FM-14Soil Gas Sampling - Perforated Tube
Soil sampling	Gas	FM-15	Soil Gas Sampling - Tenax Tubes	FM-15Soil Gas Sampling - Tenax Tubes
Soil sampling	Gas	FM-16	Soil Gas Sampling - Downhole Profiling	FM-16Soil Gas Sampling - Downhole Profiling
Soil sampling	Gas	FM-17	Soil Gas Sampling - Direct Injection Auger	FM-17Soil Gas Sampling - Direct Injection Auger
Soil monitoring	Soil and foliar	MONITO	Soil & Foliar in Long-Term Environ Monitoring	MONITOSoil & Foliar in Long-Term Environ Monitoring
Soil monitoring	VZS	MONITO	Vadose Zone Soil-Solute/Gas (9.1.1-9.5.2)	MONITOVadose Zone Soil-Solute/Gas (9.1.1-9.5.2)
Soil pollution	Radionucleids	RA-LV-Pl Plutonium, uranium & thorium / soil, air, tissue	EMSL-LV-0539-	RA-LV-Pl Plutonium, uranium & thorium / soil, air, tissueEMSL-LV-0539-
Soil pollution	Radionucleids	RA-LV-Ra Radium-226 & Radium-228 / soil, air, tissue	EMSL-LV-0539-	RA-LV-Ra Radium-226 & Radium-228 / soil, air, tissueEMSL-LV-0539-
Soil pollution	Radionucleids	RA-LV-Str Strontium-89 & -90 / vegetation, soil, tissue	EMSL-LV-0539-	RA-LV-Str Strontium-89 & -90 / vegetation, soil, tissueEMSL-LV-0539-
Soil pollution	Explosives	SAMPLIN Explosives in Soil - Field Sampling- RDX/TNT/HMX	540/R-97-501	SAMPLIN Explosives in Soil - Field Sampling- RDX/TNT/HMX540/R-97-501

Soil sampling	Lead	SAMPLIN Lead Sampling - Collect Soil & Dust Wipe/Vacuum	747/R-95-001	SAMPLIN Lead Sampling - Collect Soil & Dust Wipe/Vacuum747/R-95-001
Soil sampling	Auger	SAMPLIN Soil Samplers - Auger, Sampling Trier	600/2-80-018	SAMPLIN Soil Samplers - Auger, Sampling Trier600/2-80-018
Soil sampling	Guidance	SAMPLIN Soil sampling guidance -Superfund	540/R-95-141	SAMPLIN Soil sampling guidance - Superfund540/R-95-141
Soil sampling	Protocols	SAMPLIN Soil Sampling Protocols	600/R-92-128	SAMPLIN Soil Sampling Protocols600/R-92-128
Soil sampling	Description	SAMPLIN Soils - Description & Sampling Field Guide	625/12-91-002	SAMPLIN Soils - Description & Sampling Field Guide625/12-91-002
Soil sampling	Veihmeyer	SAMPLIN Veihmeyer Soil Sampler	600/2-80-018	SAMPLIN Veihmeyer Soil Sampler600/2-80-018
Soil sampling	Quality assurance	SOIL Soil Sampling Quality Assurance User's Guide	600/8-89-046	SOIL Soil Sampling Quality Assurance User's Guide600/8-89-046
Soil sampling	Soil analysis VOCs	SOIL VOC Soil Sampling & Analysis	540/4-91-001	SOIL VOC Soil Sampling & Analysis540/4-91-001
Soil toxicology	marine amphipod	SOIL Tox Sediment 28-d chronic toxicity - marine amphipod	600/R-01-020	SOIL Tox Sediment 28-d chronic toxicity - marine amphipod600/R-01-020
Soil analysis	Adsorption	SOIL-ATT Adsorption, Batch-Type - Soil Attenuation	530/SW-87-006	SOIL-ATT Adsorption, Batch-Type - Soil Attenuation530/SW-87-006
Soil analysis	Gas	SOIL-GAS Off-Site / Portable Gas Chromatograph	600/8-87-036	SOIL-GAS Off-Site / Portable Gas Chromatograph600/8-87-036
Soil analysis	Gas	SOIL-GAS Portable THC Analyzer	600/8-87-036	SOIL-GAS Portable THC Analyzer600/8-87-036
Soil analysis	Gas	SOIL-GAS Soil Gas Sampling, Grab of VOCs - LGAS	600/2-87-027	SOIL-GAS Soil Gas Sampling, Grab of VOCs - LGAS600/2-87-027
Soil analysis	Gas	SOIL-GAS VOC Analyzer - Adsorbent	600/8-87-036	SOIL-GAS VOC Analyzer - Adsorbent600/8-87-036
Soil analysis	Gas	SOIL-GAS VOC Analyzer - Flame Inization Detector (FID)	600/8-87-036	SOIL-GAS VOC Analyzer - Flame Inization Detector (FID)600/8-87-036
Soil analysis	Gas	SOIL-GAS VOC Analyzer - Photoionization Detector (PID)	600/8-87-036	SOIL-GAS VOC Analyzer - Photoionization Detector (PID)600/8-87-036
Soil analysis	Gas	SOIL-GAS VOC Analyzer - Whole Air	600/8-87-036	SOIL-GAS VOC Analyzer - Whole Air600/8-87-036
Soil analysis	Gas	SOIL-GAS VOC Portable Analyzer - Non-dispersive Infrared	600/8-87-036	SOIL-GAS VOC Portable Analyzer - Non-dispersive Infrared600/8-87-036

Soil analysis	Gas	SOIL-GAS VOCs, Subsurface - Soil-Gas Passive Sampling	600/2-87-027	SOIL-GAS VOCs, Subsurface - Soil-Gas Passive Sampling600/2-87-027
Soil sampling	Soil analysis VOCs	SOP Field screening for VOC in aqueous, soil & drum		SOP Field screening for VOC in aqueous, soil & drum
Soil sampling	Sampling	SOP #2012Soil Sampling		SOP #2012Soil Sampling
Soil analysis	Gas	SOP #2149Soil Gas Sampling		SOP #2149Soil Gas Sampling
Soil pollution	Dioxins	TCDD Dioxin - 2,3,7,8-TCDD in Soil & Sediment		TCDD Dioxin - 2,3,7,8-TCDD in Soil & Sediment
Soil pollution	Acid digestion	Acid Digestion of Sediments, Sludges and Soils	3050B	Acid Digestion of Sediments, Sludges and Soils3050B
Soil analysis	Adsorption	Adsorption, Batch-Type - Soil Attenuation	SOIL-ATT	Adsorption, Batch-Type - Soil AttenuationSOIL-ATT
Soil pollution	Asbestos	Asbestos Screening for Soil & Sediment	ASBESTO	Asbestos Screening for Soil & SedimentASBESTO
Soil analysis	CEC	Cation-Exchange Capacity of Soils (Ammonium)	9080	Cation-Exchange Capacity of Soils (Ammonium)9080
Soil analysis	CEC	Cation-Exchange Capacity of Soils (Sodium)	9081	Cation-Exchange Capacity of Soils (Sodium)9081
Soil pollution	DDT	DDT Soil Screening by Immunoassy	4042	DDT Soil Screening by Immunoassy4042
Soil pollution	Dioxins	Dioxin - 2,3,7,8-TCDD in Soil & Sediment	TCDD	Dioxin - 2,3,7,8-TCDD in Soil & SedimentTCDD
Soil pollution	Dioxins	Dioxins & Furans, Chlorinated (CDD & CDF) - Soil	681	Dioxins & Furans, Chlorinated (CDD & CDF) - Soil681
Soil sampling	Explosives	Explosives in Soil - Field Sampling- RDX/TNT/HMX	SAMPLIN	Explosives in Soil - Field Sampling- RDX/TNT/HMXSAMPLIN
Soil pollution	Hexahydro-1,3,5-trinitro-1,3,5-triazine	Field Method for RDX in Soil	8510	Field Method for RDX in Soil8510
Soil pollution	VOCs	Field screening for VOC in aqueous, soil & drum	SOP	Field screening for VOC in aqueous, soil & drumSOP
Soil pollution	Lead	Lead in water & soil by immunoassay	4510	Lead in water & soil by immunoassay4510
Soil sampling	Lead	Lead Sampling - Collect Soil & Dust Wipe/Vacuum	SAMPLIN	Lead Sampling - Collect Soil & Dust Wipe/VacuumSAMPLIN
Soil pollution	Mercury	Mercury in Soil by Immunoassay	4500	Mercury in Soil by Immunoassay4500
Soil pollution	Mercury	Mercury in soil/sediment - manual cold vapor	0245.5 CL	Mercury in soil/sediment - manual cold vapor0245.5 CL
Soil pollution	Acid digestion	Microwave Assisted Acid Digestion/Sludges, Soils	3051	Microwave Assisted Acid Digestion/Sludges, Soils3051

Soil pollution	Acid digestion	Microwave Asst Acid Digestion Sediments/Soil/Oil	3051A	Microwave Asst Acid Digestion Sediments/Soil/Oil3051A
Soil Gas	Off site	Off-Site / Portable Gas Chromatograph	SOIL-GAS 600/8-87-036	Off-Site / Portable Gas ChromatographSOIL-GAS 600/8-87-036
Soil pollution	Total pollutants	Organic, inorganic & total mercury in soils	3200	Organic, inorganic & total mercury in soils3200
Soil pollution	Pesticides	Organohalide pesticides -ww, soil, tissue-GC/HSD	1556A	Organohalide pesticides -ww, soil, tissue-GC/HSD1556A
Soil pollution	Organohalides	Organohalides-ww, soil, sludge, sediment, tissue	1656A	Organohalides-ww, soil, sludge, sediment, tissue1656A
Soil pollution	Organphophorus	Organo-Phosphorus in ww, soil, sed, tissue	1657A	Organo-Phosphorus in ww, soil, sed, tissue1657A
Soil pollution	PAHs, PCBs	PAHs and PCBs in Soils/Sludges by TE/GC/MS	8275A	PAHs and PCBs in Soils/Sludges by TE/GC/MS8275A
Soil pollution	PAHs	PAHs Soil Screening by Immunoassy	4035	PAHs Soil Screening by Immunoassy4035
Soil pollution	PCBs and pesticides	PCBs & pesticides in water & soil/sediment -GCMS	680	PCBs & pesticides in water & soil/sediment -GCMS680
Soil pollution	PCBs	PCBs in Soil Screening Test	9078	PCBs in Soil Screening Test9078
Soil pollution	PCBs	PCBs in Water, Soil - Isotope Dilution HRGC/HRMS	1668	PCBs in Water, Soil - Isotope Dilution HRGC/HRMS1668
Soil pollution	Pesticides	Pesticides in soil & water	ECM	Pesticides in soil & waterECM
Soil pollution	TPH_turbidimetry	Petroleum Hydrocarbons in Soil by Turbidimetric	9074	Petroleum Hydrocarbons in Soil by Turbidimetric9074
Soil pollution	TPH_immunoassay	Petroleum Hydrocarbons Soil Screen by Immunoassy	4030	Petroleum Hydrocarbons Soil Screen by Immunoassy4030
Soil pollution	Radionucleids	Plutonium, uranium & thorium / soil, air, tissue	RA-LV-Pl	Plutonium, uranium & thorium / soil, air, tissueRA-LV-Pl
Soil Gas	THC Analyzer	Portable THC Analyzer	SOIL-GAS 600/8-87-036	Portable THC AnalyzerSOIL-GAS 600/8-87-036
Soil pollution	Radionucleids	Radium-226 & Radium-228 / soil, air, tissue	RA-LV-Ra EMSL-LV-0539	Radium-226 & Radium-228 / soil, air, tissueRA-LV-Ra EMSL-LV-0539
Soil pollution	Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX in Soil and Water by Immunoassay	4051	RDX in Soil and Water by Immunoassay4051
Soil toxicology	marine amphipod	Sediment 28-d chronic toxicity - marine amphipod	SOIL Tox	Sediment 28-d chronic toxicity - marine amphipodSOIL Tox
Soil monitoring	Soil and foliar	Soil & Foliar in Long-Term Environ Monitoring	MONITO	Soil & Foliar in Long-Term Environ MonitoringMONITO
Soil analysis	pH	Soil and Waste pH	9045D	Soil and Waste pH9045D
Soil sampling	Gas	Soil Gas Sampling	SOP #2149	Soil Gas SamplingSOP #2149

Soil sampling	Gas	Soil Gas Sampling - Direct Injection Auger	FM-17	Soil Gas Sampling - Direct Injection AugerFM-17
Soil sampling	Gas	Soil Gas Sampling - Direct Injection Stopper	FM-13	Soil Gas Sampling - Direct Injection StopperFM-13
Soil sampling	Gas	Soil Gas Sampling - Downhole Profiling	FM-16	Soil Gas Sampling - Downhole ProfilingFM-16
Soil sampling	Gas	Soil Gas Sampling - Mini-Barrel Sampler	FM-11	Soil Gas Sampling - Mini-Barrel SamplerFM-11
Soil sampling	Gas	Soil Gas Sampling - One-Liter Syringe	FM-12	Soil Gas Sampling - One-Liter SyringeFM-12
Soil sampling	Gas	Soil Gas Sampling - Perforated Tube	FM-14	Soil Gas Sampling - Perforated TubeFM-14
Soil sampling	Gas	Soil Gas Sampling - Tenax Tubes	FM-15	Soil Gas Sampling - Tenax TubesFM-15
Soil sampling	Gas	Soil Gas Sampling, Grab of VOCs - LGAS	SOIL-GAS 600/2-87-027	Soil Gas Sampling, Grab of VOCs - LGASSOIL-GAS 600/2-87-027
Soil sampling	Gas	Soil Gas Sampling, Passive - Industrial Hygiene	FM-10	Soil Gas Sampling, Passive - Industrial HygieneFM-10
Soil sampling	Auger	Soil Samplers - Auger, Sampling Trier	SAMPLIN	Soil Samplers - Auger, Sampling TrierSAMPLIN
Soil sampling	Sampling	Soil Sampling	SOP #2012	Soil SamplingSOP #2012
Soil sampling	Guidance	Soil sampling guidance - Superfund	SAMPLIN	Soil sampling guidance -SuperfundSAMPLIN
Soil sampling	Protocols	Soil Sampling Protocols	SAMPLIN	Soil Sampling ProtocolsSAMPLIN
Soil sampling	Quality assurance	Soil Sampling Quality Assurance User's Guide	SOIL	Soil Sampling Quality Assurance User's GuideSOIL
Soil sampling	Description	Soils - Description & Sampling Field Guide	SAMPLIN	Soils - Description & Sampling Field GuideSAMPLIN
Soil pollution	Radionucleids	Strontium-89 & -90 / vegetation, soil, tissue	RA-LV-Str EMSL-LV-0539	Strontium-89 & -90 / vegetation, soil, tissueRA-LV-Str EMSL-LV-0539
Soil pollution	TNT	TNT Explosives in Water and Soils by Immunoassy	4050	TNT Explosives in Water and Soils by Immunoassy4050
Soil pollution	TNT	TNT in Soil by Coloimetric Screening	8515	TNT in Soil by Coloimetric Screening8515
Soil pollution	Cyanide	Total Cyanide in water, soil/sediment	0335.2 CL	Total Cyanide in water, soil/sediment0335.2 CL
Soil pollution	Toxaphene	Toxaphene Soil Screening by Immunoassy	4040	Toxaphene Soil Screening by Immunoassy4040
Soil monitoring	VZS	Vadose Zone Soil-Solute/Gas (9.1.1-9.5.2)	MONITO	Vadose Zone Soil-Solute/Gas (9.1.1-9.5.2)MONITO
Soil sampling	Veihmeyer	Veihmeyer Soil Sampler	SAMPLIN	Veihmeyer Soil SamplerSAMPLIN

Soil pollution	VOCs	VOC Analyzer - Adsorbent	SOIL-GAS 600/8-87-036	VOC Analyzer - AdsorbentSOIL-GAS 600/8-87-036
Soil pollution	VOCs	VOC Analyzer - Flame Inization Detector (FID)	SOIL-GAS 600/8-87-036	VOC Analyzer - Flame Inization Detector (FID)SOIL-GAS 600/8-87-036
Soil pollution	VOCs	VOC Analyzer - Photoionization Detector (PID)	SOIL-GAS 600/8-87-036	VOC Analyzer - Photoionization Detector (PID)SOIL-GAS 600/8-87-036
Soil pollution	VOCs	VOC Analyzer - Whole Air	SOIL-GAS 600/8-87-036	VOC Analyzer - Whole AirSOIL-GAS 600/8-87-036
Soil pollution	VOCs	VOC Soil Sampling & Analysis	SOIL	VOC Soil Sampling & AnalysisSOIL
Soil pollution	VOCs	VOCs in Soils/Solid Matrices by Equilibrium Head	5021	VOCs in Soils/Solid Matrices by Equilibrium Head5021
Soil pollution	VOCs	VOCs in water, soil, soil gas, air by DSITMS	8265	VOCs in water, soil, soil gas, air by DSITMS8265
Soil pollution	VOCs	VOCs, Subsurface - Soil-Gas Passive Sampling	SOIL-GAS 600/2-87-027	VOCs, Subsurface - Soil-Gas Passive SamplingSOIL-GAS 600/2-87-027
Soil pollution	VOCs	Volatiles in low level soils	5035 CLP-	Volatiles in low level soils5035 CLP-

Source: This report

Annex III. CEN standards included in the study

Reference	Section	Topic	Title
No_code available	Soil analysis	Pretreatment	Environmental solid matrices – Guidance for sample pretreatment
No_code avialable	Soil pollution	Microplastics	Soil, sediment and sludge — Sampling, pre-treatment and analysis of microplastics
CEN ISO/TS 16558-2:2015	Soil pollution	SMVOC	Soil quality - Risk-based petroleum hydrocarbons - Part 2: Determination of aliphatic and aromatic fractions of semi-volatile petroleum hydrocarbons using gas chromatography with flame ionization detection (GC/FID) (ISO/TS 16558-2:2015)
CEN ISO/TS 29843-1:2014	Soil biodiversity	Microbial diversity	Soil quality - Determination of soil microbial diversity - Part 1: Method by phospholipid fatty acid analysis (PLFA) and phospholipid ether lipids (PLEL) analysis (ISO/TS 29843-1:2010)
CEN ISO/TS 29843-2:2021	Soil biodiversity	Microbial diversity	Soil quality - Determination of soil microbial diversity - Part 2: Method by phospholipid fatty acid analysis (PLFA) using the simple PLFA extraction method (ISO/TS 29843-2:2021)
CEN/TR 16176:2011	Soil pollution	Characterization of waste	Characterization of waste - Screening methods for elemental composition by X-ray fluorescence spectrometry for on-site verification
CEN/TR 16193:2013	Risk assessment	Escherichia coli	Sludge, treated biowaste and soil - Detection and enumeration of Escherichia coli
CEN/TS 15937:2013	Soil analysis	EC1:5	Sludge, treated biowaste and soil - Determination of specific electrical conductivity
CEN/TS 16177:2012	Soil analysis	NH_4, NO_3^-,NO_2^-	Sludge, treated biowaste and soil - Extraction for the determination of extractable ammonia, nitrate and nitrite
CEN/TS 16182:2012	Soil pollution	nonyphenols and diethosylates	Sludge treated biowaste and soil - Determination of nonylphenols (NP) and nonylphenol-mono- and diethoxylates using gas chromatography with mass selective detection (GC-MS)
CEN/TS 16183:2012	Soil pollution	phatalates	Sludge, treated biowaste and soil - Determination of selected phthalates using capillary gas chromatography with mass spectrometric detection (GC-MS)
CEN/TS 16189:2012	Soil pollution	alkylbenzene	Sludge, treated biowaste and soil - Determination of linear alkylbenzene sulfonates (LAS) by high-performance liquid chromatography (HPLC) with fluorescence detection (FLD) or mass selective detection (MS)
CEN/TS 16800:2020	Soil analysis	validation physo-chemical methods	Guideline for the validation of physico-chemical analytical methods
CEN/TS 17883:2024	Risk assessment	elutates	Environmental characterization of eluates from leaching of waste and soil using reproductive and toxicological gene expression in Daphnia magna
EN 13656:2020	Soil pollution	Total element	Soil, treated biowaste, sludge and waste - Digestion with a hydrochloric (HCl), nitric (HNO3) and tetrafluoroboric (HBF4) or hydrofluoric (HF) acid mixture for subsequent determination of elements
EN 15309:2007	Soil pollution	XRF	Characterization of waste and soil - Determination of elemental composition by X-ray fluorescence
EN 15934:2012	Soil analysis	Dry matter	Sludge, treated biowaste, soil and waste - Calculation of dry matter fraction after determination of dry residue or water content
EN 15935:2021	Soil analysis	SOC_LoI	Soil, waste, treated biowaste and sludge - Determination of loss on ignition
EN 15936:2022	Soil analysis	SOC_combustion	Soil, waste, treated biowaste and sludge - Determination of total organic carbon (TOC) by dry combustion
EN 16166:2021	Soil pollution	Halogens	Soil, treated biowaste and sludge - Determination of adsorbed organically bound halogens (AOX)
EN 16168:2012	Soil analysis	Total Nitrogen_combustion	Sludge, treated biowaste and soil - Determination of total nitrogen using dry combustion method
EN 16169:2012	Soil analysis	Nitrogen_Kjeldahl	Sludge, treated biowaste and soil - Determination of Kjeldahl nitrogen
EN 16173:2012	Soil pollution	HNO3	Sludge, treated biowaste and soil - Digestion of nitric acid soluble fractions of elements

EN 16175-1:2016	Soil pollution	Mercury_CV-AAS	Sludge, treated biowaste and soil - Determination of mercury - Part 1: Cold-vapour atomic absorption spectrometry (CV-AAS)
EN 16175-2:2016	Soil pollution	Mercury_CV-AFS	Sludge, treated biowaste and soil - Determination of mercury - Part 2: Cold-vapour atomic fluorescence spectrometry (CV-AFS)
EN 16179:2012	Soil analysis	Pretreatment	Sludge, treated biowaste and soil - Guidance for sample pretreatment
EN 16190:2018	Soil pollution	Dioxins and Furans	Soil, treated biowaste and sludge - Determination of dioxins and furans and dioxin-like polychlorinated biphenyls by gas chromatography with high resolution mass selective detection (HR GC-MS)
EN 17503:2022	Soil pollution	PAHs	Soil, sludge, treated biowaste and waste - Determination of polycyclic aromatic hydrocarbons (PAH) by gas chromatography (GC) and high performance liquid chromatography (HPLC)
EN 17505:2023	Soil analysis	SOC_different T400_T900	Soil and waste characterization - Temperature dependent differentiation of total carbon (TOC400, ROC, TIC900)
EN ISO 10390:2022	Soil analysis	pH	Soil, treated biowaste and sludge - Determination of pH (ISO 10390:2021)
EN ISO 10693:2014	Soil analysis	Carbonates	Soil quality - Determination of carbonate content - Volumetric method (ISO 10693:1995)
EN ISO 10930:2013	Soil analysis	Soil aggregates	Soil quality - Measurement of the stability of soil aggregates subjected to the action of water (ISO 10930:2012)
EN ISO 11063:2020	Soil biodiversity	DNA	Soil quality - Direct extraction of soil DNA (ISO 11063:2020)
EN ISO 11074:2025	Soil quality	Glossary	Soil quality - Vocabulary (ISO 11074:2025)
EN ISO 11260:2018	Soil analysis	CEC_$BaCl_2$	Soil quality - Determination of effective cation exchange capacity and base saturation level using barium chloride solution (ISO 11260:2018)
EN ISO 11265:2025	Soil analysis	EC1:5	Environmental solid matrices - Determination of the specific electrical conductivity (ISO 11265:2025)
EN ISO 11266:2020	Soil pollution	biodegradation organic chemicals	Soil quality - Guidance on laboratory testing for biodegradation of organic chemicals in soil under aerobic conditions (ISO 11266:1994)
EN ISO 11267:2023	Soil pollution	Collembolans	Soil quality - Inhibition of reproduction of Collembola (Folsomia candida) by soil contaminants (ISO 11267:2023)
EN ISO 11268-1:2015	Risk assessment	Earthworms	Soil quality - Effects of pollutants on earthworms - Part 1: Determination of acute toxicity to Eisenia fetida/Eisenia andrei (ISO 11268-1:2012)
EN ISO 11268-2:2023	Risk assessment	Earthworms	Soil quality - Effects of pollutants on earthworms - Part 2: Determination of effects on reproduction of Eisenia fetida/Eisenia andrei and other earthworm species (ISO 11268-2:2023)
EN ISO 11268-3:2015	Risk assessment	Earthworms	Soil quality - Effects of pollutants on earthworms - Part 3: Guidance on the determination of effects in field situations (ISO 11268-3:2014)
EN ISO 11269-1:2012	Risk assessment	Flora	Soil quality - Determination of the effects of pollutants on soil flora - Part 1: Method for the measurement of inhibition of root growth (ISO 11269-1:2012)
EN ISO 11269-2:2013	Risk assessment	Flora	Soil quality - Determination of the effects of pollutants on soil flora - Part 2: Effects of contaminated soil on the emergence and early growth of higher plants (ISO 11269-2:2012)
EN ISO 11272:2017	Soil analysis	Bulk density	Soil quality - Determination of dry bulk density (ISO 11272:2017)
EN ISO 11274:2019	Soil analysis	Water retention	Soil quality - Determination of the water-retention characteristic - Laboratory methods (ISO 11274:2019)
EN ISO 11275:2014	Soil analysis	Water retention	Soil quality - Determination of unsaturated hydraulic conductivity and water-retention characteristic - Wind's evaporation method (ISO 11275:2004)
EN ISO 11276:2014	Soil analysis	Water retention	Soil quality - Determination of pore water pressure - Tensiometer method (ISO 11276:1995)
EN ISO 11461:2014	Soil analysis	Water retention	Soil quality - Determination of soil water content as a volume fraction using coring sleeves - Gravimetric method (ISO 11461:2001)

EN ISO 11465:2025	Soil analysis	Water retention	Sludge and solid environmental matrices - Determination of dry residue or water content and calculation of the dry matter fraction on a mass basis (ISO 11465:2025)
EN ISO 11504:2017	Risk assessment	TPH	Soil quality - Assessment of impact from soil contaminated with petroleum hydrocarbons (ISO 11504:2017)
EN ISO 11508:2017	Soil analysis	particle density	Soil quality - Determination of particle density (ISO 11508:2017)
EN ISO 11916-3:2021	Soil pollution	Explosives	Soil quality - Determination of selected explosives and related compounds - Part 3: Method using liquid chromatography-tandem mass spectrometry (LC-MS/MS) (ISO 11916-3:2021)
EN ISO 12404:2021	Soil analysis	Soil screening	Soil and waste - Guidance on the selection and application of screening methods (ISO 12404:2021)
EN ISO 12782-1:2012	Soil analysis	Amorphous Iron and Al	Soil quality - Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials - Part 1: Extraction of amorphous iron oxides and hydroxides with ascorbic acid (ISO 12782-1:2012)
EN ISO 12782-2:2012	Soil analysis	Amorphous Iron and Al	Soil quality - Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials - Part 2: Extraction of crystalline iron oxides and hydroxides with dithionite (ISO 12782-2:2012)
EN ISO 12782-3:2012	Soil analysis	Amorphous Iron and Al	Soil quality - Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials - Part 3: Extraction of aluminium oxides and hydroxides with ammonium oxalate/oxalic acid (ISO 12782-3:2012)
EN ISO 12782-4:2012	Soil analysis	Humic substances	Soil quality - Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials - Part 4: Extraction of humic substances from solid samples (ISO 12782-4:2012)
EN ISO 12782-5:2012	Soil analysis	Humic substances	Soil quality - Parameters for geochemical modelling of leaching and speciation of constituents in soils and materials - Part 5: Extraction of humic substances from aqueous samples (ISO 12782-5:2012)
EN ISO 13196:2015	Soil pollution	XRF	Soil quality - Screening soils for selected elements by energy-dispersive X-ray fluorescence spectrometry using a handheld or portable instrument (ISO 13196:2013)
EN ISO 14238:2013	Soil analysis	Nitrogen mineralization and nitrification	Soil quality - Biological methods - Determination of nitrogen mineralization and nitrification in soils and the influence of chemicals on these processes (ISO 14238:2012)
EN ISO 14239:2020	Soil analysis	Organic chemicals mineralization	Soil quality - Laboratory incubation systems for measuring the mineralization of organic chemicals in soil under aerobic conditions (ISO 14239:2017)
EN ISO 14240-1:2011	Soil biodiversity	Respiration method	Soil quality - Determination of soil microbial biomass - Part 1: Substrate-induced respiration method (ISO 14240-1:1997)
EN ISO 14240-2:2011	Soil biodiversity	Soil microbial mass	Soil quality - Determination of soil microbial biomass - Part 2: Fumigation-extraction method (ISO 14240-2:1997)
EN ISO 14254:2018	Soil analysis	Acidity_$BaCl_2$ available fraction	Soil quality - Determination of exchangeable acidity using barium chloride solution as extractant (ISO 14254:2018)
EN ISO 15009:2016	Soil pollution	Volatile compounds	Soil quality - Gas chromatographic determination of the content of volatile aromatic hydrocarbons, naphthalene and volatile halogenated hydrocarbons - Purge-and-trap method with thermal desorption (ISO 15009:2016)
EN ISO 15175:2018	Soil pollution	Contaminated soils and groudwater protection	Soil quality - Characterization of contaminated soil related to groundwater protection (ISO 15175:2018)
EN ISO 15192:2025	Soil pollution	Cr(VI)	Soil and waste - Determination of chromium(VI) in solid material by alkaline digestion and ion chromatography with spectrophotometric detection (ISO 15192:2025)
EN ISO 15473:2020	Soil analysis	Biodegradation organic chemicals	Soil quality - Guidance on laboratory testing for biodegradation of organic chemicals in soil under anaerobic conditions (ISO 15473:2002)
EN ISO 15685:2020	Soil analysis	Nitrogen nitrification	Soil quality - Determination of potential nitrification and inhibition of nitrification - Rapid test by ammonium oxidation (ISO 15685:2012)

EN ISO 15799:2022	Risk assessment	Ecological risk assessment	Soil quality - Guidance on the ecotoxicological characterization of soils and soil materials (ISO 15799:2019)
EN ISO 15952:2018	Risk assessment	Snails	Soil quality - Effects of pollutants on juvenile land snails (Helicidae) - Determination of the effects on growth by soil contamination (ISO 15952:2018)
EN ISO 16072:2011	Soil biodiversity	Soil respiration	Soil quality - Laboratory methods for determination of microbial soil respiration (ISO 16072:2002)
EN ISO 16133:2018	Soil monitoring	Programmes	Soil quality - Guidance on the establishment and maintenance of monitoring programmes (ISO 16133:2018)
EN ISO 16198:2015	Risk assessment	Bioavailaty metals with plants	Soil quality - Plant-based test to assess the environmental bioavailability of trace elements to plants (ISO 16198:2015)
EN ISO 16387:2023	Risk assessment	Enchytraeidae	Soil quality - Effects of contaminants on Enchytraeidae (Enchytraeus sp.) - Determination of effects on reproduction (ISO 16387:2023)
EN ISO 16558-1:2015	Soil pollution	VOCs	Soil quality - Risk-based petroleum hydrocarbons - Part 1: Determination of aliphatic and aromatic fractions of volatile petroleum hydrocarbons using gas chromatography (static headspace method) (ISO 16558-1:2015)
EN ISO 16558-1:2015/A1:2020	Soil pollution	VOCs	Soil quality - Risk-based petroleum hydrocarbons - Part 1: Determination of aliphatic and aromatic fractions of volatile petroleum hydrocarbons using gas chromatography (static headspace method) - Amendment 1 (ISO 16558-1:2015/Amd 1:2020)
EN ISO 16703:2011	Soil pollution	TPH	Soil quality - Determination of content of hydrocarbon in the range C10 to C40 by gas chromatography (ISO 16703:2004)
EN ISO 16965:2025	Soil pollution	ICP-MS	Environmental solid matrices - Determination of elements using inductively coupled plasma mass spectrometry (ICP-MS) (ISO 16965:2025)
EN ISO 17155:2020	Soil biodiversity	Microflora	Soil quality - Determination of abundance and activity of soil microflora using respiration curves (ISO 17155:2012)
EN ISO 17184:2014	Soil analysis	Nitrogen_NIRS	Soil quality - Determination of carbon and nitrogen by near-infrared spectrometry (NIRS) (ISO 17184:2014)
EN ISO 17380:2013	Soil pollution	Cyanide	Soil quality - Determination of total cyanide and easily liberatable cyanide - Continuous-flow analysis method (ISO 17380:2013)
EN ISO 17402:2011	Risk assessment	Screening methods for bioavailability	Soil quality - Requirements and guidance for the selection and application of methods for the assessment of bioavailability of contaminants in soil and soil materials (ISO 17402:2008)
EN ISO 17512-1:2020	Risk assessment	Earthworms	Soil quality - Avoidance test for determining the quality of soils and effects of chemicals on behaviour - Part 1: Test with earthworms (Eisenia fetida and Eisenia andrei) (ISO 17512-1:2008)
EN ISO 17512-2:2020	Risk assessment	Collembolans	Soil quality - Avoidance test for determining the quality of soils and effects of chemicals on behaviour - Part 2: Test with collembolans (Folsomia candida) (ISO 17512-2:2011)
EN ISO 17601:2025	Soil biodiversity	DNA	Soil quality - Estimation of abundance of selected microbial gene sequences by quantitative polymerase chain reaction (qPCR) from DNA directly extracted from soil (ISO 17601:2025)
EN ISO 17616:2022	Risk assessment	Ecological risk assessment	Soil quality - Guidance on the choice and evaluation of bioassays for ecotoxicological characterization of soils and soil materials (ISO 17616:2019)
EN ISO 18187:2024	Soil biodiversity	Dehydrogenases activity	Soil quality - Contact test for solid samples using the dehydrogenase activity of Arthrobacter globiformis (ISO 18187:2024)
EN ISO 18311:2018	Risk assessment	Microorganism	Soil quality - Method for testing effects of soil contaminants on the feeding activity of soil dwelling organisms - Bait-lamina test (ISO 18311:2016)
EN ISO 18475:2025	Soil pollution	PCBs	Environmental solid matrices - Determination of polychlorinated biphenyls (PCB) by gas chromatography - mass selective detection (GC-MS) or electron-capture detection (GC-ECD) (ISO 18475:2023)

EN ISO 18763:2020	Risk assessment	Germination	Soil quality - Determination of the toxic effects of pollutants on germination and early growth of higher plants (ISO 18763:2016)
EN ISO 18772:2014	Risk assessment	Ecotoxicology	Soil quality - Guidance on leaching procedures for subsequent chemical and ecotoxicological testing of soils and soil materials (ISO 18772:2008)
EN ISO 19204:2022	Risk assessment	Ecological risk assessment	Soil quality - Procedure for site-specific ecological risk assessment of soil contamination (soil quality TRIAD approach) (ISO 19204:2017)
EN ISO 19258:2018	Soil pollution	Background levels	Soil quality - Guidance on the determination of background values (ISO 19258:2018)
EN ISO 20130:2020	Soil biodiversity	Colorimetric	Soil quality - Measurement of enzyme activity patterns in soil samples using colorimetric substrates in micro-well plates (ISO 20130:2018)
EN ISO 20963:2011	Risk assessment	larvae	Soil quality - Effects of pollutants on insect larvae (Oxythyrea funesta) - Determination of acute toxicity (ISO 20963:2005)
EN ISO 21268-1:2019	Risk assessment	Leaching tests	Soil quality - Leaching procedures for subsequent chemical and ecotoxicological testing of soil and soil-like materials - Part 1: Batch test using a liquid to solid ratio of 2 l/kg dry matter (ISO 21268-1:2019)
EN ISO 21268-2:2019	Risk assessment	Leaching tests	Soil quality - Leaching procedures for subsequent chemical and ecotoxicological testing of soil and soil-like material - Part 2: Batch test using a liquid to solid ratio of 10 l/kg dry matter (ISO 21268-2:2019)
EN ISO 21268-3:2019	Risk assessment	Leaching tests	Soil quality - Leaching procedures for subsequent chemical and ecotoxicological testing of soil and soil-like materials - Part 3: Up-flow percolation test (ISO 21268-3:2019)
EN ISO 21268-4:2019	Risk assessment	Leaching tests	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 (ISO 21268-4:2019)
EN ISO 21285:2020	Risk assessment	Soil mite	Soil quality - Inhibition of reproduction of the soil mite (Hypoaspis aculeifer) by soil contaminants (ISO 21285:2019)
EN ISO 21286:2020	Soil biodiversity	DNA barcoding	Soil quality - Identification of ecotoxicological test species by DNA barcoding (ISO 21286:2019)
EN ISO 21365:2020	Soil pollution	Contaminated sites	Soil quality - Conceptual site models for potentially contaminated sites (ISO 21365:2019)
EN ISO 21479:2020	Risk assessment	Flora	Soil quality - Determination of the effects of pollutants on soil flora - Leaf fatty acid composition of plants to assess soil quality (ISO 21479:2019)
EN ISO 22030:2011	Risk assessment	Toxicity high plants	Soil quality - Biological methods - Chronic toxicity in higher plants (ISO 22030:2005)
EN ISO 22036:2024	Soil analysis	ICP-OES	Environmental solid matrices - Determination of elements using inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 22036:2024)
EN ISO 22155:2016	Soil pollution	Organic compounds	Soil quality - Gas chromatographic determination of volatile aromatic and halogenated hydrocarbons and selected ethers - Static headspace method (ISO 22155:2016)
EN ISO 22892:2011	Soil pollution	GC-MS	Soil quality - Guidelines for the identification of target compounds by gas chromatography and mass spectrometry (ISO 22892:2006)
EN ISO 23161:2018	Soil pollution	Organotin	Soil quality - Determination of selected organotin compounds - Gas-chromatographic method (ISO 23161:2018)
EN ISO 23266:2021	Risk assessment	Oribatid mites	Soil quality - Test for measuring the inhibition of reproduction in oribatid mites (Oppia nitens) exposed to contaminants in soil (ISO 23266:2020)
EN ISO 23470:2018	Soil analysis	CEC_$[Co(NH_3)_6]_3^+$	Soil quality - Determination of effective cation exchange capacity (CEC) and exchangeable cations using a hexamminecobalt trichloride solution (ISO 23470:2018)
EN ISO 23611-1:2018	Soil biodiversity	Invertebrates	Soil quality - Sampling of soil invertebrates - Part 1: Hand-sorting and extraction of earthworms (ISO 23611-1:2018)

EN ISO 23611-2:2024	Soil biodiversity	Invertebrates	Soil quality - Sampling of soil invertebrates - Part 2: Sampling and extraction of micro-arthropods (Collembola and Acarina) (ISO 23611-2:2024)
EN ISO 23611-3:2019	Soil biodiversity	Invertebrates	Soil quality - Sampling of soil invertebrates - Part 3: Sampling and extraction of enchytraeids (ISO 23611-3:2019)
EN ISO 23611-4:2022	Soil biodiversity	Invertebrates	Soil quality - Sampling of soil invertebrates - Part 4: Sampling, extraction and identification of soil-inhabiting nematodes (ISO 23611-4:2022)
EN ISO 23611-5:2024	Soil biodiversity	Invertebrates	Soil quality - Sampling of soil invertebrates - Part 5: Sampling and extraction of soil macro-invertebrates (ISO 23611-5:2024)
EN ISO 23611-6:2013	Soil biodiversity	Invertebrates	Soil quality - Sampling of soil invertebrates - Part 6: Guidance for the design of sampling programmes with soil invertebrates (ISO 23611-6:2012)
EN ISO 23753-1:2019	Soil biodiversity	Dehydrogenases activity	Soil quality - Determination of dehydrogenases activity in soils - Part 1: Method using triphenyltetrazolium chloride (TTC) (ISO 23753-1:2019)
EN ISO 23753-1:2019/A1:2020	Soil biodiversity	Dehydrogenases activity	Soil quality - Determination of dehydrogenases activity in soils - Part 1: Method using triphenyltetrazolium chloride (TTC) - Amendment 1 (ISO 23753-1:2019/Amd 1:2020)
EN ISO 23753-2:2019	Soil biodiversity	Dehydrogenases activity	Soil quality - Determination of dehydrogenases activity in soils - Part 2: Method using iodotetrazolium chloride (INT) (ISO 23753-2:2019)
EN ISO 23753-2:2019/A1:2020	Soil biodiversity	Dehydrogenases activity	Soil quality - Determination of dehydrogenases activity in soils - Part 2: Method using iodotetrazolium chloride (INT) - Amendment 1 (ISO 23753-2:2019/Amd 1:2020)
EN ISO 24032:2021	Risk assessment	Snails	Soil quality - In situ caging of snails to assess bioaccumulation of contaminants (ISO 24032:2021)
EN ISO 24212:2024	Soil remediation	Contaminated sites	Remediation techniques applied at contaminated sites (ISO 24212:2024)
EN ISO 25177:2019	Soil sampling	Field soil description	Soil quality - Field soil description (ISO 25177:2019)
EN ISO 28258:2013	Soil monitoring	Data	Soil quality - Digital exchange of soil-related data (ISO 28258:2013)
EN ISO 28258:2013/A1:2019	Soil monitoring	Data	Soil quality - Digital exchange of soil-related data - Amendment 1 (ISO 28258:2013/Amd 1:2019)
EN ISO 29200:2020	Risk assessment	Higher plants	Soil quality - Assessment of genotoxic effects on higher plants - Vicia faba micronucleus test (ISO 29200:2013)
EN ISO 54321:2021	Soil pollution	Aqua_regia	Soil, treated biowaste, sludge and waste - Digestion of aqua regia soluble fractions of elements (ISO 54321:2020)
FprEN ISO 18227	Soil pollution	XRF	Environmental solid matrices - Determination of elemental composition by X-ray fluorescence spectrometry (ISO/FDIS 18227:2025)
prEN 15309 rev	Soil pollution	XRF	Environmental solid matrices – Determination of elemental composition by X-ray fluorescence spectrometry
prEN ISO 10693 rev	Soil analysis	Carbonates	Soil quality — Determination of carbonate content — Volumetric method
prEN ISO 11268-1 rev	Risk assessment	Earthworms	Soil quality — Effects of pollutants on earthworms — Part 1: Determination of acute toxicity to Eisenia fetida/Eisenia andrei
prEN ISO 11461 rev	Soil analysis	Water content	Soil quality — Determination of soil water content as a volume fraction using coring sleeves — Gravimetric method
prEN ISO 13196	Soil pollution	XRF	Soil quality - Screening soils for selected elements by energy-dispersive X-ray fluorescence spectrometry using a handheld or portable instrument (ISO/DIS 13196:2025)
prEN ISO 15799 rev	Risk assessment	Ecological risk assessment	Soil quality — Guidance on the ecotoxicological characterization of soils and soil materials

prEN ISO 15936	Soil analysis	SOC_combustion	Soil, waste, treated biowaste and sludge - Determination of total organic carbon (TOC) by dry combustion (ISO/DIS 15936:2025)
prEN ISO 16703	Soil pollution	Hydrocarbons	Environmental Solid Matrices - Determination of hydrocarbon content in the range of C10 to C40 by gas chromatography (ISO/DIS 16703:2024)
prEN ISO 17184 rev	Soil analysis	SOC and N_NIRS	Soil quality — Determination of carbon and nitrogen by near-infrared spectrometry (NIRS)
prEN ISO 19204 rev	Risk assessment	Ecological risk assessment	Soil quality - Procedure for site-specific ecological risk assessment of soil contamination (soil quality TRIAD approach)
prEN ISO 21251	Soil analysis	SOC_stocks	Guidance for estimating organic carbon stocks in soils according to their biogeochemical stability or or residence time
prEN ISO 21285 rev	Risk assessment	Soil mite	Soil quality — Inhibition of reproduction of the soil mite (Hypoaspis aculeifer) by soil contaminants
prEN ISO 23161 rev	Soil pollution	Organotin	Soil quality — Determination of selected organotin compounds — Gas-chromatographic method
prEN ISO 23611-1	Soil biodiversity	Invertebrates	Soil quality - Sampling of soil invertebrates - Part 1: Hand-sorting and extraction of earthworms (ISO/DIS 23611-1:2025)
prEN ISO 23611-6	Soil biodiversity	Invertebrates	Soil quality - Sampling of soil invertebrates - Part 6: Guidance for the design of sampling programmes with soil invertebrates (ISO/DIS 23611-6:2025)
EN ISO/IEC 17025:2017	Soil analysis	Quality control	General requirements for the competence of testing and calibration laboratories
prEN ISO 25652	Soil pollution	PFAS	Sediment, Soil, sludge and waste - Analysis of PFAS by HPLC and mass spectrometry(ISO/DIS 25652:2025)

Source: This report

Annex IV. GLOSOLAN standard included in the study

Soil indicator	Section	Topic	Code
Soil sample pre-treatment	Soil sampling	Pre-treatment	GLOSOLAN-SOP-01
Soil pH	Soil analysis	pH	GLOSOLAN-SOP-06
Soil analysis. Boron	Soil analysis	Boron	GLOSOLAN-SOP-24
Soil analysis. Diluted EC	Soil analysis	EC1:5	GLOSOLAN-SOP-07
Soil analysis. Saturated EC	Soil analysis	EC_saturated	GLOSOLAN-SOP-08
Standard operating procedure for soil available micronutrients (Cu, Fe, Mn, Zn) and heavy metals (Ni, Pb, Cd), DTPA extraction method	Soil pollution	DTPA	GLOSOLAN-SOP-21
Standard operating procedure for cation exchange capacity and exchangeable bases 1N ammonium acetate, pH 7.0 method	Soil analysis	CEC	GLOSOLAN-SOP-17
Standard operating procedure for soil total nitrogen Dumas dry combustion method	Soil analysis	Nitrogen_combustion	GLOSOLAN-SOP-13
Standard operating procedure for soil nitrogen Kjeldahl method	Soil analysis	Nitrogen_Kjeldahl	GLOSOLAN-SOP-14
Standard operating procedure for quasi total elements in soil by acid digestion, including heavy metals	Soil pollution	Metals Aqua regia	GLOSOLAN-SOP-19
Standard operating procedure for soil available phosphorus Bray I and Bray II method	Soil analysis	Phosphorus_Bray	GLOSOLAN-SOP-09
Standard operating procedure for soil available phosphorus Mehlich I Method	Soil analysis	Phosphorus_Mehlich	GLOSOLAN-SOP-11
Standard operating procedure for soil bulk density Cylinder method	Soil analysis	Bulk density	GLOSOLAN-SOP-22
Standard operating procedure for soil moisture content by gravimetric method	Soil analysis	Moisture	GLOSOLAN-SOP-20
Standard operating procedure for soil microbial biomass (carbon)	Soil analysis	S microbial mass	GLOSOLAN-SOP-23
Standard operating procedure for soil respiration rate	Soil Analysis	Soil respiration	GLOSOLAN-SOP-18
Standard operating procedure for soil enzyme activities	Soil Biodiversity	Enzyme acivities	https://doi.org/10.4060/cd2462en
Standard operating procedure for soil organic carbon Walkley-Black method	Soil analysis	SOC_Walkey	GLOSOLAN-SOP-02
Standard operating procedure for soil organic carbon Tyurin spectrophotometric method	Soil analysis	SOC_Tyurin	GLOSOLAN-SOP-16
Standard operating procedure for soil available phosphorus Olsen method	Soil analysis	Phosphorus_Olsen	GLOSOLAN-SOP-10

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