

Measurement of radioactivity in the environment — Soil —

Part 2: Guidance for the selection of the sampling strategy, sampling and pre-treatment of samples

ICS 13.080.01; 17.240

National foreword

This British Standard is the UK implementation of ISO 18589-2:2007.

The UK participation in its preparation was entrusted to Technical Committee NCE/2, Radiation protection and measurement.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Part 2:

Guidance for the selection of the sampling strategy, sampling and pre-treatment of samples

Mesurage de la radioactivité dans l'environnement — Sol —

*Partie 2: Lignes directrices pour la sélection de la stratégie
d'échantillonnage, l'échantillonnage et le prétraitement des échantillons*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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

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

ISO 18589-2 was prepared by Technical Committee ISO/TC 85, *Nuclear energy*, Subcommittee SC 2, *Radiation protection*.

ISO 18589 consists of the following parts, under the general title *Measurement of radioactivity in the environment — Soil*:

- *Part 1: General guidelines and definitions*
- *Part 2: Guidance for the selection of the sampling strategy, sampling and pre-treatment of samples*
- *Part 3: Measurement of gamma-emitting radionuclides*
- *Part 4: Measurement of plutonium isotopes (plutonium 238 and plutonium 239+240) by alpha spectrometry*
- *Part 5: Measurement of strontium 90*
- *Part 6: Measurement of gross alpha and gross beta activities*

Introduction

This International Standard is published in several parts to be used jointly or separately according to needs. Parts 1 to 6, concerning the measurements of radioactivity in the soil, have been prepared simultaneously. These parts are complementary and are addressed to those responsible for determining the radioactivity present in soils. The first two parts are general in nature. Parts 3 to 5 deal with radionuclide-specific measurements and Part 6 with non-specific measurements of gross alpha or gross beta activities.

Additional parts may be added to ISO 18589 in the future if the standardization of the measurement of other radionuclides becomes necessary.

Measurement of radioactivity in the environment — Soil —

Part 2:

Guidance for the selection of the sampling strategy, sampling and pre-treatment of samples

1 Scope

This part of ISO 18589 specifies the general requirements, based on ISO 11074 and ISO/IEC 17025, for all steps in the planning (desk study and area reconnaissance) of the sampling and the preparation of samples for testing. It includes the selection of the sampling strategy, the outline of the sampling plan, the presentation of general sampling methods and equipment, as well as the methodology of the pre-treatment of samples adapted to the measurements of the activity of radionuclides in soil.

This part of ISO 18589 is addressed to the people responsible for determining the radioactivity present in soil for the purpose of radiation protection. It is applicable to soil from gardens, farmland, urban or industrial sites, as well as soil not affected by human activities.

This part of ISO 18589 is applicable to all laboratories regardless of the number of personnel or the range of the testing performed. When a laboratory does not undertake one or more of the activities covered by this part of ISO 18589, such as planning, sampling or testing, the corresponding requirements do not apply.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 31-9, *Quantities and units — Part 9: Atomic and nuclear physics*

ISO 10381-2, *Soil quality — Sampling — Part 2: Guidance on sampling techniques*

ISO 11074, *Soil quality — Vocabulary*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ISO 18589-1, *Measurement of radioactivity in the environment — Soil — Part 1: General guidelines and definitions*

3 Terms, definitions and symbols

For the purpose of this document, the terms, definitions and symbols given in ISO 31-9, ISO 18589-1, ISO 11074 and the following apply.

e thickness of the layer sampled

m_{ss} wet mass of the sorted sample

m'_{ss}	wet mass of a subsample of the sorted sample
m_{ts}	dry mass of the test sample
a	activity per unit of mass of the test sample
A_S	activity per unit area
S	surface area sampled

4 Principle

The purpose of the measurement of soil radioactivity is to monitor the environmental impact of radioactive substances [1] and/or to assess the radiological impact on the population [2], [3], [4], [5].

The main objectives of the measurement of radionuclides in soil (see ISO 18589-1) are the following:

- characterization of radioactivity in the environment;
- routine surveillance of the impact of radioactivity released from nuclear installations or of the general evolution of the radioactivity in a region;
- investigations of accidents and incidents;
- planning and surveillance of remedial action;
- decommissioning of installations or the disposal of materials.

Consequently, measurements of soil radioactivity are performed in a variety of situations, but a generic approach can be described, with the following steps as outlined in this part of ISO 18589:

a) Planning process — Selection of the sampling strategy

The selection of the sampling strategy depends on the main objectives and on the results of the initial investigation of the area. The sampling strategy shall lead to the knowledge of the nature, activity concentrations, spatial distribution, as well temporal evolution, of the radionuclides, taking into account changes caused by migration, atmospheric conditions and land/soil use.

An initial investigation of the area shall be carried out to determine the sampling strategy.

ISO 10381-1 gives general guidance on the selection of the sampling strategy; ISO 10381-4 gives specific guidance for the investigation of natural, near-natural and cultivated areas; and ISO 10381-5 deals with the investigation of soil contamination at urban and industrial sites.

Details are given in Clause 5 and a scheme for the selection of the sampling strategy is given in Annex A.

b) Planning process — Sampling plan

The sampling plan shall be developed according to the sampling strategy selected. It shall specify the selection of sampling areas and units, the sampling pattern, the sampling points, the types of samples, the sampling procedures and equipment, as well as the safety requirements for the personnel.

Definitions of the types of sample are given in ISO 18589-1. The relationship between sample types is given in Annex B. Details, such as the selection of sampling areas and the sampling units that result from the type of grid applied to these areas, are given in Clause 6.

c) Sampling process — Collection of samples

The collection of any soil samples in the field shall conform to the established sampling plan.

- For sampling of the top layer, a *single sample* or *increments* of a defined thickness are taken from each of the selected sampling units.
- For vertical sampling of several soil layers, samples are taken at increasing depth vertically below the surface sampling point. A *single sample* or *increments* are collected from the various soil layers with different thicknesses according to the sampling depth. Special care should be exercised in order not to mix samples from different soil layers.

Details are given in Clauses 6 and 7.

d) Sampling process — Preparation of the sorted sample

The preparation of *sorted samples* is carried out by reduction of single or composite samples. A sorted sample should be representative of the average value of one or more given soil characteristics. The identification, labelling, packaging and transport procedures of sorted samples to the laboratory shall guarantee the preservation of their characteristics.

Details are given in 7.2, 7.3 and 7.4.

e) Laboratory process — Handling of the laboratory sample

After arrival at the laboratory, the sorted samples are considered as *laboratory samples* for storage and further pre-treatment before their analysis.

Details are given in Clause 8.

f) Laboratory process — Preparation of the test sample

Before any testing, the laboratory samples are pre-treated by drying, crushing, sieving and homogenization to produce *test samples* in the form of a fine, homogeneous powder. Pre-treatment shall guarantee that the physical and chemical characteristics of the test sample are constant over time, thus rendering the results easier to interpret. Representative subsamples with masses determined by the specifications of the different radioactivity measurements shall be isolated from the test sample as test portions.

Details are given in Clause 8.

If some material is stored for future investigations or for the purpose of settling a potential dispute, subsamples shall be taken from the laboratory sample or the test sample in an acceptable and documented manner.

5 Sampling strategy

During the planning process, the sampling strategy for the site under investigation is determined according to the objectives described in 4 a), resulting in the definition of a sampling plan [6], [7], [8].

5.1 Initial investigation

Whatever the objective of the work being carried out, certain preliminaries shall be undertaken during the initial investigation phase to help define the sampling strategy, such as the following:

- analysis of historical and administrative data, company archives, previous studies, and interviews with former employees, which help identify potential sources of radioactive contamination;