SLOVENSKI STANDARD
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Gradbeni proizvodi - Ocenjevanje sproščanja nevarnih snovi - Dopolnilo k vzorčenju

Construction products - Assessment of release of dangerous substances - Complement to sampling

Bauprodukte - Bewertung der Freisetzung von gefährlichen Substanzen - Ergänzung zur Probenahme

Produits de construction - Evaluation de l'émission de substances dangereuses - Complément relatif à l'échantillonnage

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Construction products - Assessment of release of dangerous substances - Complement to sampling

Produits de construction - Evaluation de l'émission de substances dangereuses - Complément relatif à l'échantillonnage

Bauprodukte - Bewertung der Freisetzung von gefährlichen Substanzen - Ergänzung zur Probenahme

This Technical Report was approved by CEN on 24 April 2011. It has been drawn up by the Technical Committee CEN/TC 351.

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Foreword

This document (CEN/TR 16220:2011) has been prepared by Technical Committee CEN/TC 351 “Construction products: Assessment of release of dangerous substances”, the secretariat of which is held by NEN.

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

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0 Introduction

0.1 Objective

This CEN/TR provides a complement to the sampling of construction products. Sampling of construction products for other characteristics than the release or emission of regulated dangerous substances is described in product standards and ETAs[1)]. This CEN/TR is based on mandate M366 of the European Commission[2)]. It provides requirements which are specific for the sampling of construction products for the determination of the release or emission of regulated dangerous substances. The mandate implies that existing sampling standards from product TCs, or sampling instruction in product standards from product TCs, are to be used as much as possible. Consequently this CEN/TR and the sampling parts of the standards prepared by WG 1 and WG 2 of CEN/TC 351 (see below 0.3) should be used as a *complement* to the sampling of construction products as described in existing standards and ETAs. It does not provide full guidance to sampling of construction products.

NOTE 1 As a consequence of the fact that this CEN/TR is a *complement* to existing standards of product TCs, some instructions that would be an integral part of a full sampling standard, are missing in this CEN/TR. An obvious example thereof is the fact that this CEN/TR contains no instructions for actually taking a sample.

Existing sampling standards and instructions[3)] for the sampling of construction products are to be compared with this CEN/TR, in order to determine if the requirements recommendations for sampling as described in this CEN/TR can be met with the existing sampling standards and instructions. If not, product TCs may have to adapt their sampling standards and instructions following appropriate provisions included in the standards to be produced by WG 1 and WG 2. For this purpose this CEN/TR contains a checklist in Annex G.

NOTE 2 Product TCs should be aware of the fact that sampling for the determination of the emission and/or release of dangerous substances, might differ from their current sampling procedures which are used to determine product characteristics.

0.2 Terminology

It is essential that a number of key terms, as mentioned in Clause 2, are well understood when working with this CEN/TR. These key terms are defined in Annex A, which annex also contains Figure A.1 that depicts the relation between these key terms.

0.3 Relation with the deliverables of CEN/TC 351/WG 1 and WG 2

At the time that this CEN/TR is developed, CEN/TC 351 comprises two Working Groups (WGs): CEN/TC 351/WG 1: Release from construction products into soil, ground water and surface water and CEN/TC 351/WG 2: Emissions from construction products into indoor air. Both WGs have to, within their scope, deliver a complete test procedure of which sampling is just a part. The interface between these sampling parts, product standards and this TR have been defined in TC 351 resolution 81[4)]. The test results are to be used for CE-marking (and corresponding AoC) and are produced according to WG 1 and WG 2

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1) ETA: European Technical Approval issued by the European Organisation for Technical Approvals (EOTA).

2) Mandate M366 "Development of horizontal standardised assessment methods for harmonized approaches relating to dangerous substances under the Construction Products Directive"; European Commission, DG Enterprise, Brussels 16 March 2005.

3) This document refers both to sampling standards as published by product TCs as well as to product standards that contain sampling instructions as part of an overall test procedure.

4) Resolution 81 taken by CEN/TC 351 on 23-24 April 2008 reads: CEN/TC 351 confirms the recommendation 1 of TG 4 taken at its March 2008 meeting as given in document N 149, which is "It is the responsibility of product TCs to specify the detailed procedure for sampling. However, they have to follow the general requirements provided by WG 1 and WG 2 that are to be based on the technical report prepared by TG 4." The decision was taken by unanimity.

standards. Since it is not possible to test all possible conditions, WG 1 and WG 2 establish reference conditions under which the test results are expressed.

0.4 Users of this CEN/TR

This CEN/TR is intended to be used by two principal users:

— CEN/TC 351/WG 1 (Release from construction products into soil, ground water and surface water) and CEN/TC 351/WG 2 (Emissions from construction products into indoor air).

— CEN/TCs and EOTA committees responsible for the development and maintenance of standards for products under the Construction Products Directive (CPD). These CEN product TCs fall under the framework of mandate M366 on the “Emission of dangerous substances from construction products into indoor air, soil, surface water and ground water". This mandate is a “horizontal complement” to the construction product mandates.

Additionally, this CEN/TR might for instance be used as a reference document by individual producers when indirect test procedures are derived e.g. for Factory Production Control (FPC).

0.5 Two sampling domains

Two different sampling domains are relevant to regulated dangerous substances:

— sampling of the construction product to obtain a quantity of the product which is used in a test;

— sampling of the air (emission) or water (release) with which a quantity of the product has been in contact.

This CEN/TR is only of relevance to the first sampling domain, the sampling of the construction product. At the same time, restrains which result from the second sampling domain might impose boundary conditions on the first sampling domain.

NOTE To avoid confusion, this Technical Report often uses the term 'product sampling' for the first sampling domain.

0.6 Uncertainty and statistical testing

The number and type of samples to be taken relates directly to the accepted uncertainty of the test result(s). A number of individual sources of uncertainty can be identified, which can be clustered in three groups: the variability of the product, the variability introduced due to sampling activities and the variability introduced by the laboratory activities.

NOTE 1 In most situations the uncertainty caused by the variability of the product dominates the other sources of uncertainty.

NOTE 2 The variability of the release or emission of dangerous substances often differs from the other characteristics tested by product TCs.

Variability of the product results in uncertainty of the obtained test result(s). By taking account of the variability when sampling, a representative test result can be obtained. Representative within the context of this CEN/TR means the acceptance of a certain level of uncertainty. The level of uncertainty should at least be such that the chance that another sample would result in another assessment of conformity than the original sample is acceptably small.

NOTE 3 This means that the test result obtained from the sample can be used to assess the sampled product, while the uncertainty of that assessment is sufficiently small: the risk of false positive or false negative results is acceptable.

This CEN/TR focuses on obtaining an individual laboratory sample that is representative for a defined quantity of the construction product. Implementation of the guidance of this CEN/TR provides individual samples which are sufficiently representative. Whenever repetitive sampling is necessary, for example to quantify the risk of

exceeding a limit value, a second source of variability in the product is introduced. This is the variability of the relevant product properties over a period of (production) time. This CEN/TR does not provide the necessary guidance to deal with that level of uncertainty, nor does it provide the tools to define the statistical testing that does.

NOTE 4 Considering the fact that the uncertainty of the actual test and measurement often is much smaller than the uncertainty that is due to the heterogeneity of the sampled construction product, it is important to realise that the quantity of the product represented by the test portion / test specimen should be sufficiently large to incorporate that heterogeneity.

In Annex B, more information is provided with respect to the assessment of the uncertainty related to sampling activities as part of the overall test procedure.

0.7 Structure of this CEN/TR

This CEN/TR consists, apart from the scope in Clause 1, of two main parts:

— Clause 2 describes in general the principle requirements for sampling construction products for the determination of the release or emission of dangerous substances. It provides explanatory texts on the key issues that are to be covered in sampling standards and sampling instructions for construction products;

— Clause 3 provides a practical translation between the theoretical principles as described under Clause 2, and the test procedures as developed by CEN/TC 351/WG 1 and WG 2, as well as the product standards as developed and maintained by product TCs.

In addition to these two clauses a number of annexes provide background information and examples:

— Annex A provides definitions for the key terms on sampling as used in this CEN/TR;

— Annex B discusses the assessment of the uncertainty resulting from sampling as part of the overall test procedure;

— Annex C provides help for the estimation of the minimum increment and sample mass when applying probabilistic sampling;

— Annex D provides methods for the calculation of the required number of increments and samples when applying probabilistic sampling;

— Annex E provides some details on sample containers and storage conditions;

— Annex F provides example forms for the sampling plan, the field report and the chain of custody report;

— Annex G provides a checklist for the product TCs to assess their existing sampling standards or sampling paragraph against the essential elements as identified in this CEN/TR.

1 Scope

This Technical Report covers the specific requirements for sampling construction products to determine the release or emission of dangerous substances in their intended use. It is complementary to existing sampling standards and sampling instruction in product standards or test methods for construction products of CEN product TCs and EOTA committees which fall under the CPD.

The scope of this Technical Report covers all activities related to product sampling, starting with the initial planning of sampling until the delivery and formal transfer of the laboratory sample at the laboratory.

This Technical Report:

— does not deal with sub-sampling in the laboratory as a step towards the preparation of the test portion / test specimen[5)];

— does not deal with the second sampling domain in which a sample is to be taken from the air (emission) or water (release) with which the test portion / test specimen has been in contact;

— does not deal with the statistical testing of a construction product against (legislative) limit values, nor does it deal with the definition of repetitive sampling, suitable for fulfilling requirements with respect to a minimum level of uncertainty in a series of test results.

This Technical Report focuses on obtaining a single sample. Repetitive sampling is outside the scope as the boundary conditions for routine testing against a limit are not yet defined (e.g. the necessary reliability). Despite the fact that repetitive sampling is not covered, the conditions provided in this Technical Report apply for an individual sample, as well as for a sample that is part of a series.

2 Key concepts

2.1 Introduction

2.1.1 Key terms

A number of key terms for product sampling are introduced in this clause, including: population, sub-population, scale, increment, composite sample, sample, laboratory sample and test portion / test specimen. The definition of these key terms is independent whether the release or emission of dangerous substances is to be assessed.

NOTE 2.1 gives a general description of some of the key terms and Annex A gives a formal definition together with a figure showing the relationship between some of these terms.

2.1.2 Representativeness

The ultimate goal of product sampling is obtaining a representative portion of the sampled construction product; maintaining the representativeness is essential in all steps where a (partial) sample of the product is involved. Whenever there is variability in the product, measures are to be taken in order to ensure the representativeness of the sample.

NOTE 1 When it comes to maintaining the representativeness of the sampled product, the full test procedure needs to be taken into account.

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5) This document regularly refers both to the term 'test portion' and the term 'test specimen' which are equivalent terms. However, as the term 'test portion' is used in the field of release to soil and water, and the term 'test specimen' is used in the field of emissions to indoor air, both are referred to.

NOTE 2 The same set of samples may show a different distribution of test results for different properties.

The degree of variability encountered, depends on the quantity of the product for which a sample is representative.

EXAMPLE A simple numerical example might be four tiles with a slightly different characteristic property, represented by single numbers. Observations are available for three series of four individual tiles:

Series 1	3	7	5	9
Series 2	5	6	4	8
Series 3	2	1	5	7

The mean and standard deviation for these three series are:
Series 1: mean 6,0 standard deviation 2,6
Series 2: mean 5,8 standard deviation 1,7
Series 3: mean 3,8 standard deviation 2,8
The overall mean and standard deviation are 5,2 and 2,4 respectively.
When, instead of individual tiles, a group of four tiles is tested in a single test, the mean values for these three series would become the new measurements. The standard deviation between these three measurements is decreased to 1,2 (instead of 2,4 when measuring all individual tiles). Using a bigger quantity of product (four tiles) reduces observed variability from 2,4 to 1,2. The results are less variable when a larger quantity of the product is tested. Consequently the product might comply more easily.

In order to obtain comparable test results, it is important that in a harmonized product standard a choice is made with respect to the quantity of product (the scale) on which that product is tested. See also 2.4.4.

Representativeness of the test portion / test specimen is ensured differently for the release to soil and water and the emission to indoor air, reflecting the different nature of influencing factors (see below). For the determination of the release, incremental sampling and subsequent use of a composite sample is possible when sampling particulate products. Even for monolithic and shaped products this is still a potential, although less simple, option, when assessing the release to soil and water.

NOTE 3 Sampling might well result in a laboratory sample of 10 kg, while the size of the test portion / test specimen can only be 1 kg. This implies that maintaining the representativeness of the sample is essential, in order to ensure that the test result of the 1 kg test portion / test specimen indeed represents the original laboratory sample of 10 kg. As should the laboratory sample of 10 kg actually be a representative portion of the original product. Maintaining representativeness throughout the whole test procedure, from the first stage of sampling until the actual testing, is therefore essential.

NOTE 4 The size of the test portion / test specimen might put demands on the size of the laboratory sample, i.e. the laboratory sample should at least be sufficiently large to accommodate all test portions / test specimens necessary.

Especially when determining the emission into indoor air, probabilistic sampling may result in less effective sample selection at higher costs than educated or skilled selection of samples. Such sampling is to be based on knowledge of the key parameters influencing emissions properties of a certain piece of sample. The emission of dangerous substances across a certain amount of product often does not follow a statistically describable distribution, showing rather distinct changes depending on parameters such as actual composition, raw materials used, details of manufacturing process and storage conditions (e.g. temperature control, drying period), age of product and more.

NOTE 5 Some examples: Use of another source of tree may influence emissions of a wood based product. Purchase of nominally identical resin or dispersion from a different supplier may influence emissions of a water-based adhesive.

Changing to cement from another mill may influence emissions of a cement-based product. Slightly elevated temperature due to sunshine on the roof of a manufacturing plant may influence remaining volatiles in the final product.

Additionally, incremental sampling shall be avoided when cutting is essential to obtain the individual increments, because the cutting edges creates fresh surfaces which potentially may disturb the release or emission test result.

Thirdly, products manufactured in a discontinuous manner are not always available as freshly manufactured products (although some products need aging before testing).

Therefore, the alternative approach comprises a targeted and informed selection of sampling date and sampling site, such that the sampled product represents either typical emission properties, or worst case elevated release or emission properties, taking into account the availability of the product at the selected sampling site. In this approach, specific technological knowledge is used to ensure representativeness instead of statistical observations.

The key terms as used in this CEN/TR are defined in Annex A.

2.1.3 Uncertainty

The associated uncertainty of the final test result is of major importance when assessing the release or emission of dangerous substances. The uncertainty is the result of variability in the obtained test result. Although often only one test result is obtained, that test result still is affected by the different sources of variability. When there is only one test result available, the variability is unknown; nevertheless the test result is partly determined by that variability.

Each activity necessary to obtain a test result has an effect on the variability and consequently on the uncertainty of that test result. Additionally, the variability of the product itself also contributes to the uncertainty. The sources of uncertainty of sampling are identified:

- Variability in the product (over time and / or space);
- Variability introduced by sampling activities and all subsequent activities until delivery of the sample to the laboratory;
- Variability introduced by laboratory activities up to the reporting of the results.

This CEN/TR deals with the first two sources of variability.

Sampling is at the very start of the assessment of a product. A series of subsequent steps is necessary to obtain the test result, based on which the actual assessment is performed. Starting at the end of that chain, the chemical analysis, and moving towards the first step of sampling, the quantification of the uncertainty associated with each of these individual steps become more and more difficult and costly. Consequently it is practically almost impossible to separate the uncertainty of sampling from the uncertainty of the subsequent steps.

There is no specific level of uncertainty that can be considered as being acceptable. The acceptability of a certain degree of uncertainty depends on the risk of non-compliance. If the risk of non-compliance becomes too big, the overall uncertainty associated with the test result(s) should be smaller in order to still be able to come to a decision. The risk of non-compliance is determined by the 'distance' of the obtained test result to the limit / limit value against which the product is assessed, and the variability of these test results (or potential test results if only one result is available). So, a relatively large degree of uncertainty is acceptable when the risk of non-compliance is low, while only a small amount of uncertainty is acceptable when there is a large risk of non-compliance.

With respect to the uncertainty see also Annex B.

2.1.4 Sampling under various stages for CE-marking

This CEN/TR provides guidance with respect to sampling for the product declaration under CE-marking although it does not cover the repetitive sampling which might be necessary.

NOTE 1 In the process of CE marking various stages can be identified, amongst which Initial Type Testing (ITT) and Factory Production Control (FPC), which result in a need for product sampling.

This CEN/TR provides guidance to obtain a sample, either by a single sampling operation or by incremental sampling in which increments are joined into a composite sample. This CEN/TR provides guidance to ensure that the obtained (composite) sample is sufficiently representative for the quantity of product it represents. As such it provides a basis for the CE-marking.

NOTE 2 The user expects that a product under CE-marking fulfils the specified requirements on the level of the individual product. While for consumer products, testing of each individual product might be an option, for environmental characteristics of construction products this often is not realistic.

NOTE 3 Repetitive sampling and subsequent assessment of a series of test result against limit values set by national authorities are highly related. This CEN/TR does not deal with the statistics necessary to determine whether a product complies with the limit values. As, at the time this CEN/TR was developed, no statistically defined objectives are set for determining if a test results complies, it is not possible to provide concrete guidance on the number of samples or test frequency necessary.

Whenever repetitive sampling is applied, not only the representativeness of a sample for a chosen quantity of product is of importance, but also the variations that occur over time. These are the variations that occur on the level of the quantity for which a sample is representative (see also 2.1.2). Consequently, the producer might be providing proof on the compliance of the product on a different quantity of product than the user expects. When making choices with respect to product sampling, this should be taken into consideration. The producer has to ensure that what is sampled is representative for the CE-marked product that is to be assessed.

NOTE 4 A consumer who buys a bag of cement of 25 kg assumes that this product fulfils the requirements. The consumer is unaware of the fact that the producer tests the product for quantities of for example 25 tons. Consequently, there is a certain, undefined risk that the quantity bought by the consumer does in fact not meet the requirements. The producer should be aware of this when defining the sampling (and testing) procedure.

2.1.5 Series of steps

A full test procedure can be described as a series of steps, i.e. definition of a sampling plan, taking of sample, on site sample pre-treatment, packaging, preservation, storage and transportation, delivery, storage and preservation, preparation of the test portion / test specimen, test to determine the release or emission, analysis / quantification, data management and reporting. These steps should be closely interlinked. This CEN/TR only provides guidance on the first few steps, from defining the sampling plan up to the delivery of the laboratory sample to the laboratory. This is depicted in Figure 1, wherein the main steps are numbered (1 to 7).

When defining part of this whole chain of activities, the implications of the whole chain should be taken into consideration in order to ensure that the test result is fit for purpose.

EXAMPLE When for example the release of dangerous substances from a construction product is strongly dependent on the presence of new surface, the sampling and subsequent preparation of the test portion / test specimen should be such that no new surface is created or measures are to be taken to isolate new surfaces prior to testing.

NOTE 1 The preparation of the test portion / test specimen might by itself consist of a number of steps.

NOTE 2 The preparation of the test portion / test specimen is often referred to as 'sample pre-treatment', but in this CEN/TR that term is exclusively related to on site sample pre-treatment, aimed to obtain a representative laboratory sample of acceptable size.

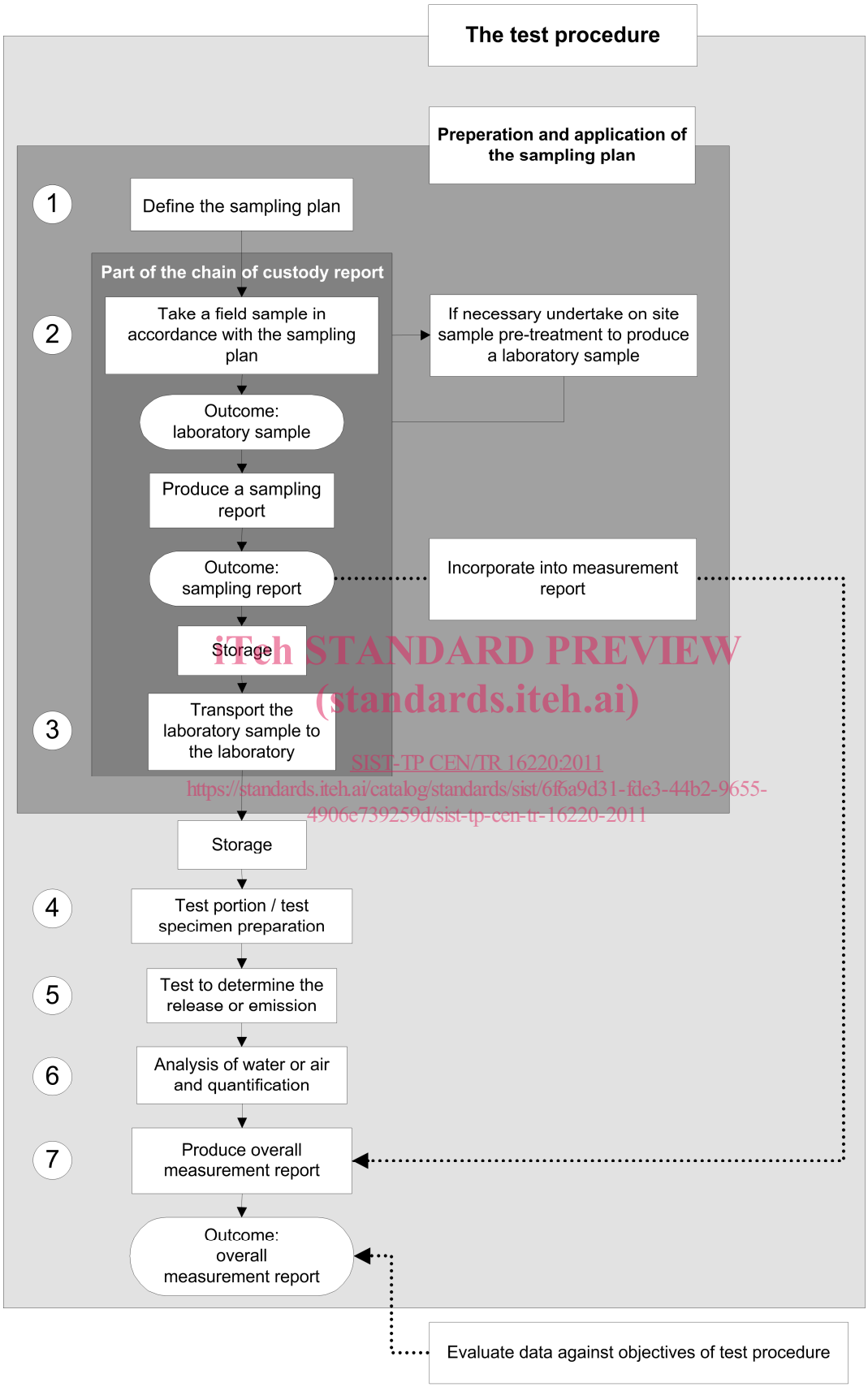

Figure 1 — Links between the essential elements of a test procedure wherein the main steps are numbered (1 to 7)

2.2 Objective of sampling

The objective of sampling the construction product is to obtain a sample that is:

— sufficiently representative of the quantity of product being assessed, see 2.1.4;

— fulfils the prerequisites for the test(s) to be performed.

See, with respect to being sufficiently representative, 2.1.2 and 2.1.3.

2.3 Preparation of a sampling plan

A sampling plan is to be completed prior to undertaking any product sampling.

By providing specific and practical instructions, the sampling plan defines the boundaries and logistics of product sampling as part of the test procedure.

The principles laid out in this CEN/TR can be used to produce a sampling plan for any test procedure within the framework of the CPD.

These principles can be used in:

— the development of a full test procedure by CEN/TC 351/WG 1 and WG 2 (see Clause 3);

— the development of a sampling standard or sampling instructions in a product standard by product TCs (see Clause 3);

— the production of standardized sampling plans for use under routine circumstances.

NOTE 1 The latter may be applied for example by an individual producer for application within the context of FPC.

In the process of defining a sampling plan, the key steps of the test procedure (as shown in Figure 2) are to be addressed. The definition process should:

a) Identify those individuals and organizations with an interest and detail the proposed sampling design in agreement with the requirements as specified by those involved parties;

b) Identify the requirements arising from other key steps in the test procedure;

c) Establish specific instructions for when and where, and how many samples and / or increments should be taken;

d) Identify all safety precautions that are to be taken.

NOTE 2 The specific details contained within any sampling plan differ according to the objectives of the test procedure, the product to be sampled and the sampling circumstances.