
Characterization of waste - Sampling of waste materials - Part 5: Guidance on the process of defining the sampling plan

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Charakterisierung von Abfall - Probenahme - Teil 5: Verfahren zur Aufstellung eines Probenahmeplans

Caractérisation des déchets - Prélèvement des déchets - Partie 5 : Guide relatif au processus d'élaboration d'un plan d'échantillonnage

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ICS:

13.030.10	Trdni odpadki	Solid wastes
13.030.20	Vlaga [a] a [a]	Liquid wastes. Sludge

SIST-TP CEN/TR 15310-5:2007 en

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Verfahren zur Aufstellung eines Probenahmeplans

This Technical Report was approved by CEN on 21 February 2006. It has been drawn up by the Technical Committee CEN/TC 292.

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Foreword

This Technical Report (CEN/TR 15310-5:2006) has been prepared by Technical Committee CEN/TC 292 "Characterization of waste", the secretariat of which is held by NEN.

This Technical Report has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This Technical Report is one of a series of five Technical Reports dealing with sampling techniques and procedures, and provides essential information and instructions for the application of the EN-standard:

EN 14899 Characterisation of waste - Sampling of waste materials - Framework for the preparation and application of a Sampling Plan.

The principal component of the EN Standard is the mandatory requirement to prepare a Sampling Plan. This EN 14899 standard can be used to:

- produce standardised sampling plans for use in regular or routine circumstances (i.e. the elaboration of daughter/derived standards dedicated to well defined sampling scenarios);
- incorporate specific sampling requirements into national legislation;
- design and develop a Sampling Plan on a case by case basis.

The Technical Reports display a range of potential approaches and tools to enable the project manager to tailor his sampling plan to a specific testing scenario (i.e. a 'shop shelf' approach to sampling plan development for waste testing). This approach allows flexibility in the selection of the sampling approach, sampling point, method of sampling and equipment used.

In practice, confusion can arise when translating the objective of the testing programme, which is often couched at a relative abstract level (e.g. 'the waste needs to be assessed to fulfil the demands of waste regulation') into an unambiguous technical instruction in the Sampling Plan, that will provide data to meet that objective (e.g. 'the mean concentration of each truck load should comply with a specified concentration level'). This Technical Report attempts to clarify the 'grey area' between the definition of an overall testing objectives and the definition of the practical Sampling Plan. It specifically provides guidance on the policy aspects that may be relevant for defining the objective of the testing programme, and how this will define the technical methods that can be used to prepare the Sampling Plan.

Introduction

Wastes are materials, which the holder discards, or intends or is required to discard, and which may be sent for final disposal, reuse or recovery. Such materials are generally heterogeneous and it will be necessary therefore to specify in the testing programme the amount of material for which the characteristics of interest need to be defined. The testing of wastes allows informed decisions to be made on how they should be treated (or not), recovered or disposed. In order to undertake valid tests, some sampling of the waste is required.

The principal component of the standard EN 14899 is the mandatory requirement to prepare a Sampling Plan, within the framework of an overall testing programme as illustrated in Figure 1 of EN 14899:2005. This standard can be used to:

- produce standardised sampling plans for use in regular or routine circumstances (i.e. the elaboration of daughter/derived standards dedicated to well defined sampling scenarios);
- incorporate specific sampling requirements into national legislation;
- design and develop a Sampling Plan on a case by case basis.

The development of a Sampling Plan within this framework involves the progression through three steps or activities.

- 1) Define the Sampling Plan;
- 2) Take a field sample in accordance with the Sampling Plan;
- 3) Transport the laboratory sample to the laboratory.

This Technical Report provides information to support Key Step 1 of the Sampling Plan process map and describes the selection of sampling approach that can be used in the recovery of a sample for a wide variety of waste types and arisings. Specifically CEN/TR 15310-1 provides information to support 4.2.7 (select sampling approach) of the Framework Standard. Due consideration and selection of statistical criteria is of key importance in the production of a Sampling Plan as it provides the sole means of ensuring that, wherever possible, the type and number of samples taken will address a clearly identified objective and will provide results that achieve a tolerable level of reliability.

In the process of defining the Sampling Plan (step 1 in Figure 1 of EN 14899:2005), the objective of the testing programme is translated into specific and concrete technical instructions for the sampler. Using these instructions the sampler will take the type and number of samples that are adequate to meet the objective of the testing programme, ultimately providing the decision maker with the required information on the waste material under investigation.

The process of defining the Sampling Plan, which takes into consideration both policy and technical requirements to produce technical instructions to the sampler, is therefore a fundamental step in sampling of a waste material.

In practice, problems arise when translating the objective of the testing programme, which is couched at a relative abstract level (e.g. 'the waste needs to be assessed to fulfil the demands of waste regulation') into a technical instruction that corresponds with that same objective (e.g. 'the mean concentration of each truck load should comply with a specified concentration level'). There is a 'gap' between the definition of the need to evaluate the waste material and the technical methods that should be applied in order to make an adequate evaluation possible.

This Technical Report aims to 'bridge the gap' between the chosen objective of the testing programme in policy terms, and that same objective defined in technical terms for sampling. It provides information and guidance on the process of defining a Sampling Plan. It deals specifically with the policy aspects relevant for defining the objective of the testing programme, and provides guidance for the definition of the Sampling Plan.

In addition to the main body of the Technical Report, an annex provides worked examples of Sampling Plans for a number of frequently occurring waste materials and situations in which these waste materials arise. Thereby the examples provide background to the main body of this Technical Report.

These examples clarify the process of defining the Sampling Plan. A number of assumptions have been made to produce each individual example, and therefore – although the examples represent actual daily practice – they are case specific and are not necessarily directly applicable to other similar generic situations.

This Technical Report is written for two distinctive groups of users:

- policy makers involved in sampling. For example, people working for the central, regional or local authority, government or administration, the management of a company involved in the production or disposal of waste, etc. Essentially, these people are, directly or indirectly, involved in making policy decisions that are based on the technical information gathered through sampling. Their interest lies in the requirement for testing a waste material to gain (general) knowledge about the waste material or to comply to national, regional or local legislation. They have – in general – no technical knowledge of sampling, but are responsible for making the right choices. They therefore need help to understand the definition of the testing programme in technical terms, in order to be able to judge if the suggested testing programme is adequate for the purpose.
- sampling specialists (specifically the project manager). These are the people who have to translate the objective of the testing programme, as defined by the policy maker, into a technically unambiguous Sampling Plan that will instruct the sampler on what to do in the field. The project manager is therefore confronted with the problem that not only technical information is necessary for the definition of the Sampling Plan, but also policy information.

Incorporated within the text of this Technical Report is an example. Each individual step of the process of defining the Sampling Plan made in this Technical Report is illustrated by the same step in this example. The example is meant to clarify the text of the individual paragraphs in more practical terms.

Example of a waste to be tested

Due to the incineration of residuals from paper production, filter dust is collected. The dust is trapped in an air filter unit and put into stockpiles before transport to the landfill. In order to allow land filling, the concentrations of a number of key constituents should comply with the acceptance criteria of that landfill. Therefore the waste must be sampled.

This Technical Report should be read in conjunction with the Framework Standard for the preparation and application of a Sampling Plan as well as the other Technical Reports that contain essential information to support the Framework Standard. The full series comprises:

- EN 14899 Characterization of waste - Sampling of waste materials - Framework for the preparation and application of a Sampling Plan;
- CEN/TR 15310-1, Characterization of waste – Sampling of waste materials – Part 1: Guidance on selection and application of criteria for sampling under various conditions;
- CEN/TR 15310-2, Characterization of waste – Sampling of waste materials – Part 2: Guidance on sampling techniques;
- CEN/TR 15310-3, Characterization of waste – Sampling of waste materials – Part 3: Guidance on procedures for sub-sampling in the field;

CEN/TR 15310-5:2006 (E)

- CEN/TR 15310-4, Characterization of waste – Sampling of waste materials – Part 4: Guidance on procedures for sample packaging, storage, preservation, transport and delivery;

CEN/TR 15310-5, Characterization of waste – Sampling of waste materials – Part 5: Guidance on the process of defining the Sampling Plan.

The Technical Reports contain procedural options (as detailed in Figure 2 of EN 14899:2005) that can be selected to match the sampling requirements of any testing programme.

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1 Scope

This Technical Report provides guidance on process of defining of a Sampling Plan based on the objective of the testing programme. It specifically deals with the strategic decisions that are needed, based on the sampling objective.

NOTE 1 Given the great variety of waste types, sampling situations and objectives, this Technical Report cannot provide definitive instructions that cover all scenarios. Instead, it discusses the basic statistical approach to be followed, and provides statistical tools that can be applied to determine the amount and type of sampling (e.g. number of samples and sample size) in any given situation to achieve results of adequate reliability (i.e. precision and confidence).

NOTE 2 The document provides considerable detail on current best practice, but is not exhaustive.

NOTE 3 To clarify the text, the document provides a number of worked examples.

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.

EN 13965-1:2004, *Characterization of waste - Terminology - Part 1: Material related terms and definitions*

EN 13965-2:2004, *Characterization of waste - Terminology - Part 2: Management related terms and definitions*

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3 Terms and definitions SIST-TP CEN/TR 15310-5:2007

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For the purposes of this Technical Report, the following terms and definitions given in EN 13965-1:2004 and EN 13965-2:2004 and the following apply.

3.1 background information

information that is essential to understanding the setting of sampling

NOTE Among others, it consists of information on the production process of the waste, the nature of the waste, policy aspects and compliance levels set in legislation.

3.2 basic characterisation

sampling that has the goal to describe the character or quality of a population of waste

3.3 compliance testing

process of testing whether sample values meet a pre-defined set of criteria

3.4 composite sample

two or more increments mixed together in appropriate portions either discretely or continuously (blended composite sample), from which the average value of a discrete characteristic may be obtained [ISO 11074:2005]

3.5

confidence interval

interval within which the value of a particular population parameter may be stated to lie at a specific confidence level. The bounds of the confidence interval are termed the upper and lower confidence limits

3.6

confidence level

value $100(1-\alpha)$ of the percentage probability associated with a confidence interval (after ISO 3534-1)

3.7

constituent

an essential part (component, element) of the waste

3.8

decision maker

party that makes a decision based on the results of the testing programme

NOTE In most cases the regulator is the decision maker, but it can also be the waste producer or waste manager.

3.9

field sample

quantity (mass or volume) of material obtained through sampling without any sub-sampling

3.10

increment

individual portion of material collected by a single operation of a sampling device which will not be analysed / investigated as a single entity, but will be mixed with other increments in a composite sample prior to analysis

3.11

involved parties

individuals who have an interest in the results of the sampling and who should therefore be involved in the (iterative) process relating to the exchange of information regarding the testing programme

3.12

laboratory analyst

person conducting the analysis of the laboratory sample

3.13

laboratory sample

sample sent to or received by the laboratory (IUPAC)

3.14

legislator

body responsible for the definition of the rules that should be obeyed

3.15

objective

underlying motivation for investigating a (potential) waste material

3.16

on-site verification

normally simple test to evaluate if the involved waste material is indeed the type of material expected

3.17

overall population

totality of items

3.18**population**

totality of items under consideration
[ISO 3534-1]

3.19**policy maker**

person working for the central, regional or local authority, government or administration, the management of a company

3.20**project manager**

person who is responsible for deriving and / or fulfilling the testing programme

3.21**regulator**

body responsible for controlling if the rules of the legislator are met

3.22**reliability**

extent to which a test measures consistently

NOTE For scaled scores, a reliability coefficient of 1.00 indicates a test that is perfectly reliable.

3.23**sample**

portion of material selected from a larger quantity of material
[ISO 11074:2005]

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NOTE The use of the term 'sample' should be avoided as far as possible as it does not imply to what step of the total sampling procedure it is related.

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3.24**sampler**

person carrying out the sampling procedures at the sampling locality
[ISO 11074:2005]

NOTE Tools and devices to obtain samples are sometimes also referred to as 'samplers'. In this case it is recommended to write 'sampling devices' or 'sampling equipment'.

3.25**sampling plan**

predetermined procedure for the selection, withdrawal, preservation, transportation and preparation of the portions to be removed from a population as a sample
[ISO 11074:2005]

3.26**scale**

quantity (mass or volume), defined in space and / or time, of material represented by the sample and considered relevant for the assessment of the material

3.27**sub-population**

defined part of a population
[ISO 3534-1]

3.28**technical goals**

objective translated into specific, measurable, action oriented, realistic, timely (SMART) goals

3.29

testing programme

total sampling operation, from the first step in which the objectives of sampling are defined to the last step in which data is analysed against the objectives

3.30

waste

material, which the holder discards, or intends or is required to discard, and which may be sent for final disposal, reuse or recovery

3.31

waste manager

company or organisation that accepts the waste

3.32

waste producer

company or organisation that produces the waste

4 The process of defining the Sampling Plan

4.1 General description of the process

The project manager is responsible for the process, which defines the Sampling Plan. The first step is to identify the parties that have an interest in the results of the sampling and to ensure their full participation.

The involved parties come from various backgrounds and may have conflicting interests. Supported by the project manager, they must reach agreement on the objective of the testing programme, the translation of this objective into realistic technical goals and the translation of these technical goals into unambiguous instructions for the sampler. The project manager then records these instructions in the Sampling Plan.

The objective of the testing programme determines, directly or indirectly, the desired level of information (e.g. basic characterization, compliance testing or on-site verification) and the desired reliability of the sampling results.

Technical goals include statistical terms like the characteristic to be determined (e.g. a percentile value), the population, the scale, the confidence level and confidence interval to be reached and technical terms like the constituents of the waste that are to be determined; the moment when; or location where; the waste will be sampled. Therefore part of these technical goals provide direct input for the Sampling Plan, while others (e.g. the scale, the confidence level) still have to be translated into practical terms like the type of sampling, the sampling pattern and location, the number of increments and samples and the sizes of increments and samples.

Commonly, the reliability of the results improves when the number of samples is increased. This invariably leads to higher sampling and analysis costs. In short, the heterogeneous character of waste invokes the necessity to balance the desired reliability with the financial input. In fact, balancing the reliability and costs, may well be the most important decision the involved parties have to make in the process of defining a Sampling Plan.

A draft of the Sampling Plan should be discussed with all involved parties. By doing so, the practical implications of the choices that were made in the process of defining and translating the objectives become clear. For practical reasons, unrealistic objectives may be subject to change.

The process of defining the Sampling Plan may well be an iterative process that is repeated several times before it results in an accepted final version of the Sampling Plan. The project manager should actively manage this process.

The process of defining the Sampling Plan is provided in Figure 1.

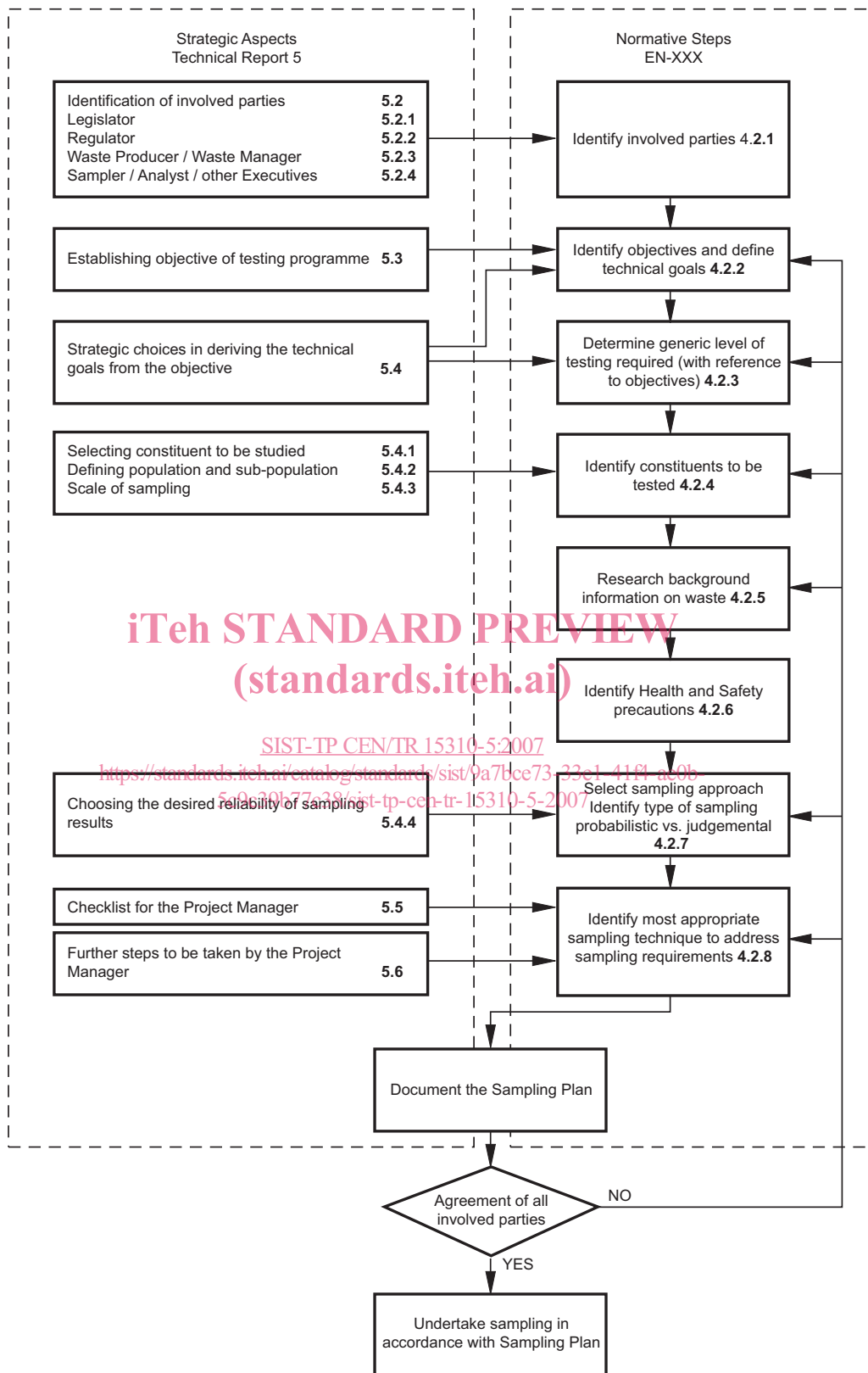


Figure 1 – The process of defining the Sampling Plan, providing information on the elements that are specified in the European Standard and this Technical Report