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Characterization of waste - Sampling of waste materials - Part 2: Guidance on sampling techniques

Charakterisierung von Abfall - Probenahme - Teil 2: Anwendung von Probenahmetechniken

Caractérisation des déchets - Prélèvement des déchets - Partie 2 : Guide relatif aux techniques d'échantillonnage

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Charakterisierung von Abfall - Probenahme - Teil 2: Anwendung von Probenahmetechniken

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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Contents

Page

Foreword ... 3
Introduction ... 4
1 Scope ... 5
2 Normative references ... 5
3 Terms and definitions ... 5
4 Principle of sampling technique selection ... 8
5 Route maps for the selection of sampling techniques ... 9
6 Sampling of mobile liquid waste ... 22
6.1 Sampling from a drum or a cask ... 22
6.2 Sampling from a small container or flexible walled container ... 25
6.3 Sampling from a vertical uniform tank or irregular tank ... 25
6.4 Sampling from a horizontal cylindrical tank ... 27
6.5 Sampling a moving liquid within a pipeline ... 28
6.6 Sampling from a lagoon or pit ... 29
7 Sampling liquids and solids rendered mobile by heat ... 30
7.1 Sampling from a container ... 30
7.2 Sampling from a pipeline ... 31
8 Sampling viscous liquids ... 31
9 Sampling sludges ... 31
9.1 Sampling from a drum or cask ... 31
9.2 Sampling from a small container (less than 20 l capacity) ... 31
9.3 Sampling from a vertical uniform tank ... 32
9.4 Sampling from a horizontal cylindrical tank ... 32
9.5 Sampling from a pipeline ... 32
9.6 Sampling from a large container, pit or lagoon ... 32
10 Sampling paste-like substances ... 33
10.1 Sampling static material from drum or block up to 500 kg ... 33
10.2 Taking samples in motion ... 34
11 Sampling powders, granules and small crystals ... 35
11.1 Sampling small static volumes from hoppers, heaps and silos ... 35
11.2 Sampling large static volumes from hoppers, heaps and silos ... 35
11.3 Sampling from a falling stream ... 36
11.4 Sampling from a band conveyor ... 37
11.5 Sampling from a screw conveyor ... 38
12 Sampling coarse or lumpy solid materials ... 39
12.1 Sampling small volumes from a bag, keg or drum ... 39
12.2 Sampling large volumes from hoppers or silos ... 40
12.3 Sampling a large stockpile ... 40
12.4 Sampling coarse or lumpy materials in motion ... 41
12.5 Sampling a small amount from a massive piece ... 41
12.6 Sampling from a pile of large pieces ... 41
12.7 Sampling large pieces in motion ... 42
12.8 Incorporation in the Sampling Plan ... 42
Annex A (informative) Support on the selection of equipment and apparatus ... 43
A.1 General ... 43
A.2 Common issues for all sampling equipment and apparatus ... 43
Bibliography ... 64

Foreword

This Technical Report (CEN/TR 15310-2:2006) 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, dealing with sampling techniques and procedures, which provide essential information 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.

This Technical Report describes a range of techniques that could be used to sample a range of waste types from a variety of locations and arisings. Information is also provided on the selection and preparation of equipment and apparatus needed to complete the sampling exercise.

This report does not attempt to provide a definitive procedure for each and every situation that may arise from sampling a given waste type or specific analytical requirement, rather it aims to expose the factors that influence the selection of these practical field activities to ensure the most appropriate procedure is selected for any given sampling scenario. The most appropriate approach, tools, and methodology, in the absence of an existing recognised Sampling Plan should be chosen on a scenario-specific basis. However, this does not present a barrier to technical innovation, and there is no reason why methodologies other than those detailed in this Technical Report cannot be substituted.

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 2 of the Sampling Plan process map and describes a selection of sampling techniques that can be used in the recovery of a sample for a wide variety of waste types and arisings. The sampling technique is the physical procedure employed by the sampler to collect part or parts of a discarded or secondary material for subsequent investigations. Specifically this Technical Report provides information to support 4.2.8.1 (Identify the sampling technique) of the Framework Standard.

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 15310-4, 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.

1 Scope

This Technical Report describes techniques for sampling liquid and granular waste material, including paste-like materials and sludges, found in a variety of locations. The Technical Report provides information to allow the selection and preparation of equipment and apparatus to be used in the sampling activity.

NOTE 1 This Technical Report provides a shop shelf of example sampling techniques that can be selected to meet a wide range of sampling situations. For a specific situation one of the presented procedures may be appropriate.

NOTE 2 The procedures listed in this Technical Report reflect current best practice, but these are not exhaustive and other procedures may be equally relevant.

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*

3 Terms and definitions

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

3.1
bottom sediment
solid layer of material on the bottom of liquid storage tanks

3.2
characteristic
property, which helps to identify or differentiate between items of a given population
[ISO 3534-1]

NOTE The characteristic may be either quantitative (by variables) or qualitative (by attributes).

3.3
composite sample
two or more increments/sub-samples mixed together in appropriate proportions, either discretely or continuously (blended composite sample), from which the average value of a desired characteristic may be obtained
[ISO 11074]

3.4
column sample
type of sample, more specifically related to the sampling of liquids where column samplers are used

NOTE A column of material is of equal length to the depth of the sub-population at that sampling point.

3.5
core sample
type of sample, more specifically related to the sampling of solids where augers and other core samplers are used

NOTE A vertical or direction sample is taken through the material whereby the integrity of the sub-population is maintained.

3.6
directional sample
geometric sample, usually in only one dimension, which is related to the single principal axis of variability of material in the sampling unit/lot

3.7
laboratory sample
sample sent to or received by the laboratory (IUPAC)

3.8
geometric sample
type of sample of specific shape, whose dimensions are related to the axes of variability of material in a sampling unit/lot

3.9
heterogeneity
degree to which a property or a constituent is not uniformly distributed throughout a quantity of material

NOTE 1 A material may be homogeneous with respect to one analyte or property but heterogeneous with respect to another.

NOTE 2 The degree of heterogeneity (the inverse of homogeneity) is the determining factor in sampling error.

3.10
homogeneity
degree to which a property or a constituent is uniformly distributed throughout a quantity of material. [ISO 11074]

3.11
increment
individual portion of material collected by a single operation of a sampling device

NOTE 1 Increments may be reduced and tested individually or combined with other increments, with the resulting composite reduced in size and tested as a single unit.

NOTE 2 Increments are created by the sampling operation and are usually taken from parts of a lot separated in time or space.

3.12
judgemental sampling
sampling undertaken from a practically convenient (perhaps relatively small) sub-population, not conducted fully in accordance with the statistical principles of sampling

3.13
laboratory sample
sample(s) or sub-sample(s) sent to or received by the laboratory

NOTE 1 When the laboratory sample is further prepared (reduced) by subdividing, mixing, grinding, or by combinations of these operations, the result is the test sample. When no preparation of the laboratory sample is required, the laboratory sample is the test sample.

NOTE 2 The laboratory sample is the final sample from the point of view of sample collection but it is the initial sample from the point of view of the laboratory.

NOTE 3 Several laboratory samples may be prepared and sent to different laboratories or to the same laboratory for different purposes. When sent to the same laboratory, the set is generally considered as a single laboratory sample and is documented as a single sample.

3.14
population
totality of items under consideration
[ISO 3534-1]

3.15
probabilistic sampling
sampling conducted according to the statistical principles of sampling

3.16
representative
sample resulting from a sampling plan that can be expected to reflect adequately the properties of interest in the parent population
[ISO 11074]

3.17
sample
an amount of material taken from a population and intended to provide information on the population

3.18
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]

3.19
sampler
person carrying out the sampling procedures at the sampling locality
[ISO 11074]

NOTE Tools and other devices to obtain samples are sometimes also designated ‘samplers’. In this case it is recommended to write ‘sampling devices’ or ‘sampling equipment’.

3.20
stratified sampling
in a population which can be divided into mutually exclusive and exhaustive strata (i.e. sub-populations), sampling carried out in such a way that specified proportions of the sample are drawn from the different strata and each stratum is sampled with at least one sampling unit
[ISO 3534-1]

NOTE The objective of taking stratified samples is to obtain a more representative sample than that which might otherwise be obtained by random sampling.

3.21
sub-population
defined part of the population that will be targeted for the purposes of sampling

3.22
sub-sample
sample taken from a sample of a population
[ISO 3534-1]

3.23
test sample/analytical sample
sample, prepared from the laboratory sample, from which test portions are removed for testing or for analysis

3.24
viscous liquid
liquid with high viscosity, resulting in slow flow and adhering to containers and sampling equipment

3.25
sludge
mixture of solid particles within a liquid, either in suspension or as a colloidal mixture, resulting in physical characteristics which are different to the parent liquid, particularly increased viscosity

4 Principle of sampling technique selection

This Technical Report details a wide range of sampling techniques that can be used to take a sample. The procedures identified in this document target two fundamental objectives of sampling, as outlined in the Framework Standard EN 14899:

— probabilistic sampling - the preferred method of sampling or recovering material where a quantifiable level of reliability is required in the results for the population being tested. The basis for probabilistic sampling is that each element within the population being sampled has an equal chance of being sampled. This means that the Sampler has access to the whole population and can collect a sample that is representative of that population;

— judgemental sampling – this is used where representative sampling from the whole population is practically impossible, given available resources (time or money) or when sampling is required to target a specific item or point within the population.

The sampling techniques identified in this Technical Report form only part of the approach required to achieve probabilistic sampling, reference should be made to the remaining Technical Reports in this series to ensure all requirements have been fulfilled. For example, key advice on the design of an appropriate Sampling Plan and selection of an appropriate sampling pattern, numbers samples and sample size needed to meet the requirements of probabilistic sampling can be found in CEN/TR 15310-5 and CEN/TR 15310-1 respectively.

Sampling procedures are provided from a wide range of process streams and common storage conditions. The preferred sampling technique will depend on a combination of different characteristics of the material and circumstances encountered at the sampling location. Relevant determining factors include:

— the type of material / the physical state of the material (e.g. solid, liquid, paste, sludge);

— the situation at the sampling location / the way in which the material occurs (e.g. in a tank, a stockpile, on a conveyer belt);

— the (expected) degree of heterogeneity (e.g. homogeneous liquids, layered liquids, segregated sludges, mixtures of solid materials);

— the level of testing, which may influence the approach to the selection of composite or individual samples as detailed in CEN/TR 15310-1.

A series of process maps or flow charts provide route maps to the user to relevant clauses in the document for a wide range of potential sampling situations that arise when the range of different waste types, locations and storage vessels are considered. This approach allows the tools, and methodology to be chosen on a scenario-specific basis. The procedures listed in this Technical

Report reflect current best practice, but these are not exhaustive and other procedures may be equally relevant.

5 Route maps for the selection of sampling techniques

This Technical Report has been structured to address the selection of sampling techniques and equipment by physical form (e.g. liquid, sludge or solid) and nature of the arising (e.g. drum, hopper, pile). This Technical Report does not present a definitive process, but reflects current practice for commonly occurring scenarios, this, however, does not mean that other solutions are not available. The selection of an appropriate sampling technique should be related to the objectives for sampling and the physical form and chemical characteristic to be sampled. The route maps presented in this document supports the guidance provided in EN 14899 - A Framework for the preparation and application of a Sampling Plan. The following flow diagrams guide the reader to the appropriate clauses within the Technical Report.

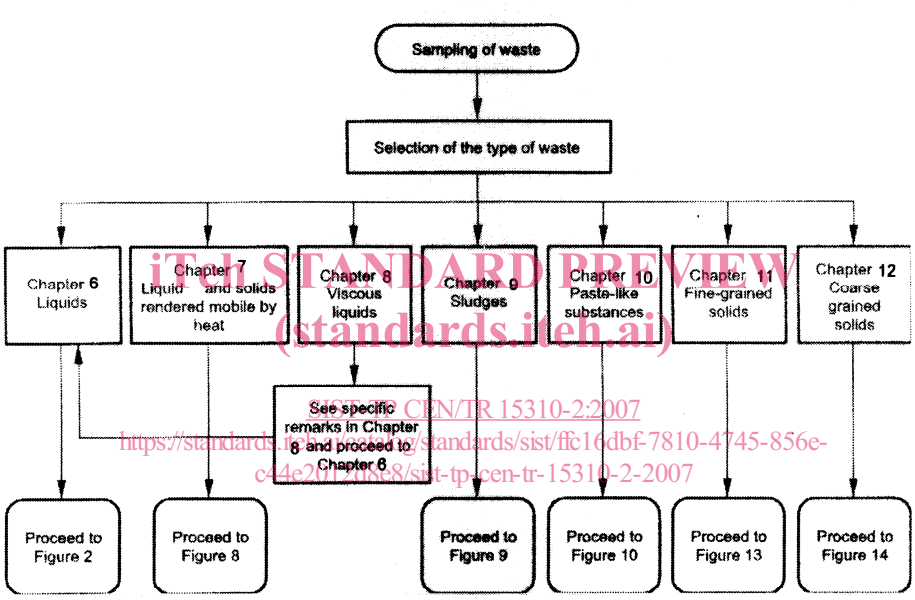

Figure 1 — Generic process map for sampling

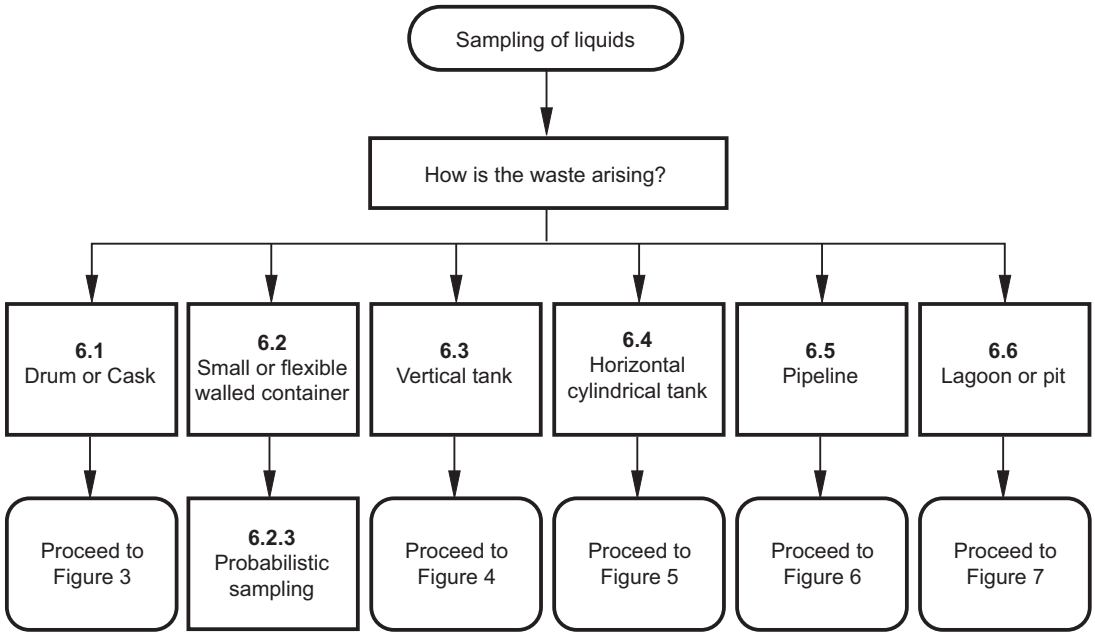

Figure 2 — Sampling of liquids

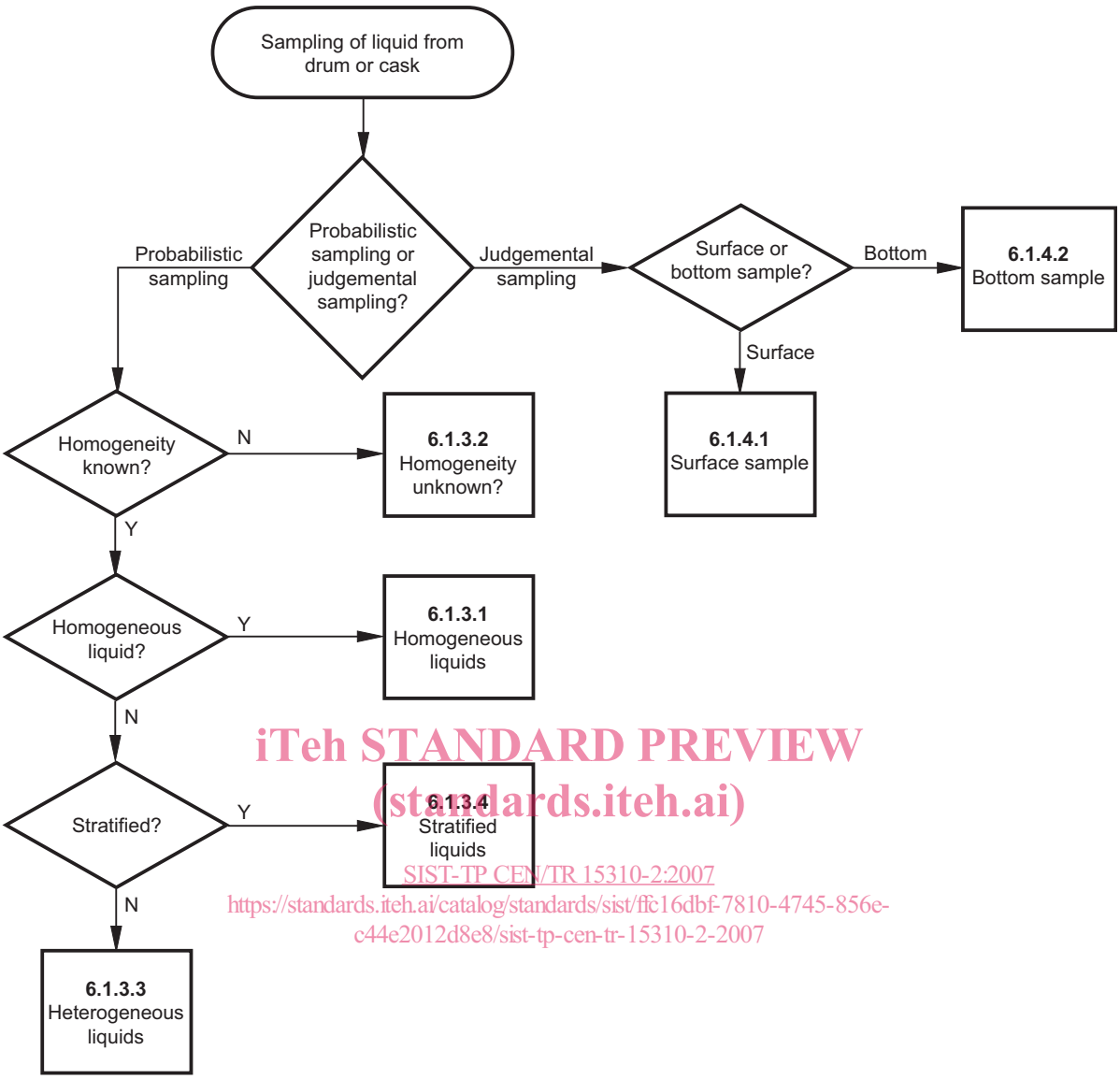

Figure 3 — Sampling of a liquid from a drum or cask

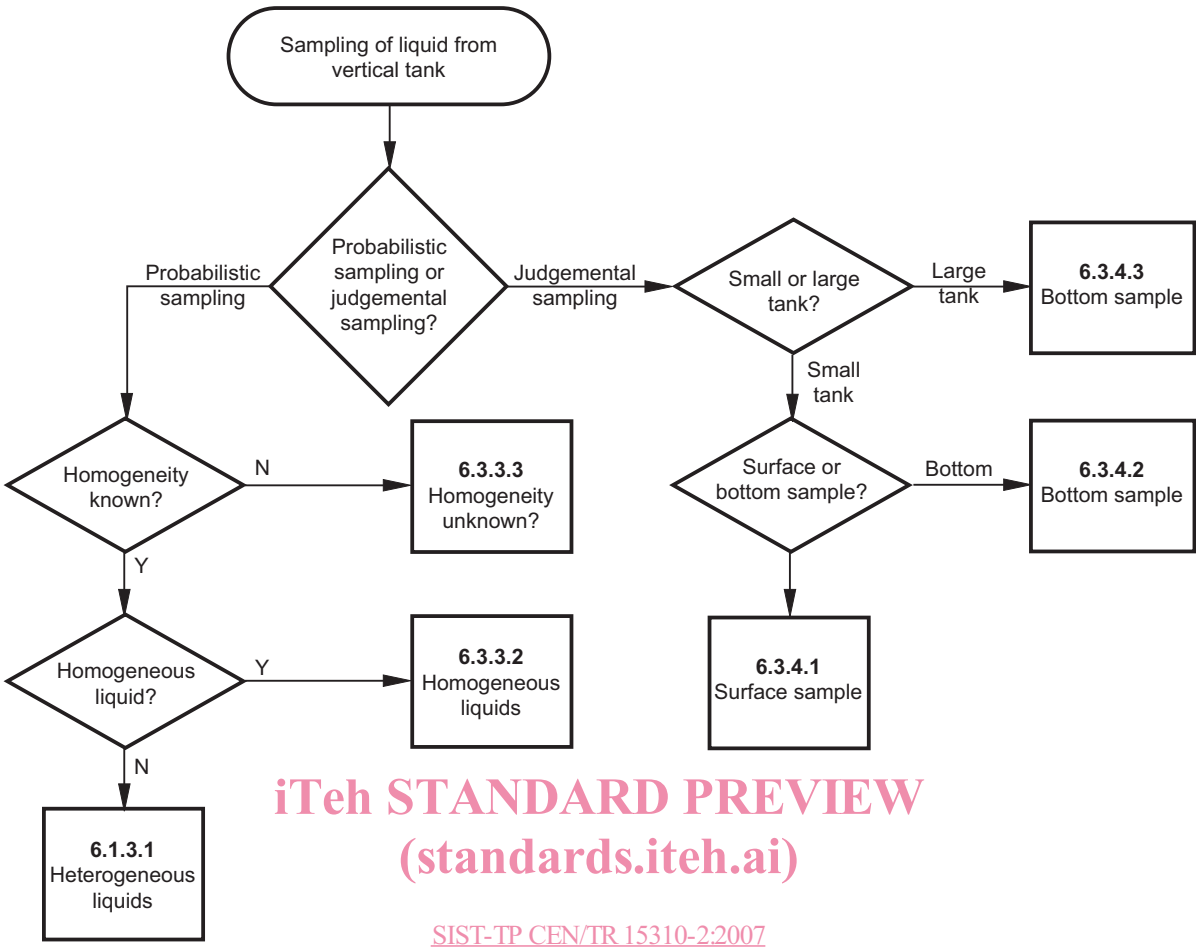

Figure 4 — Sampling of a liquid from a vertical tank

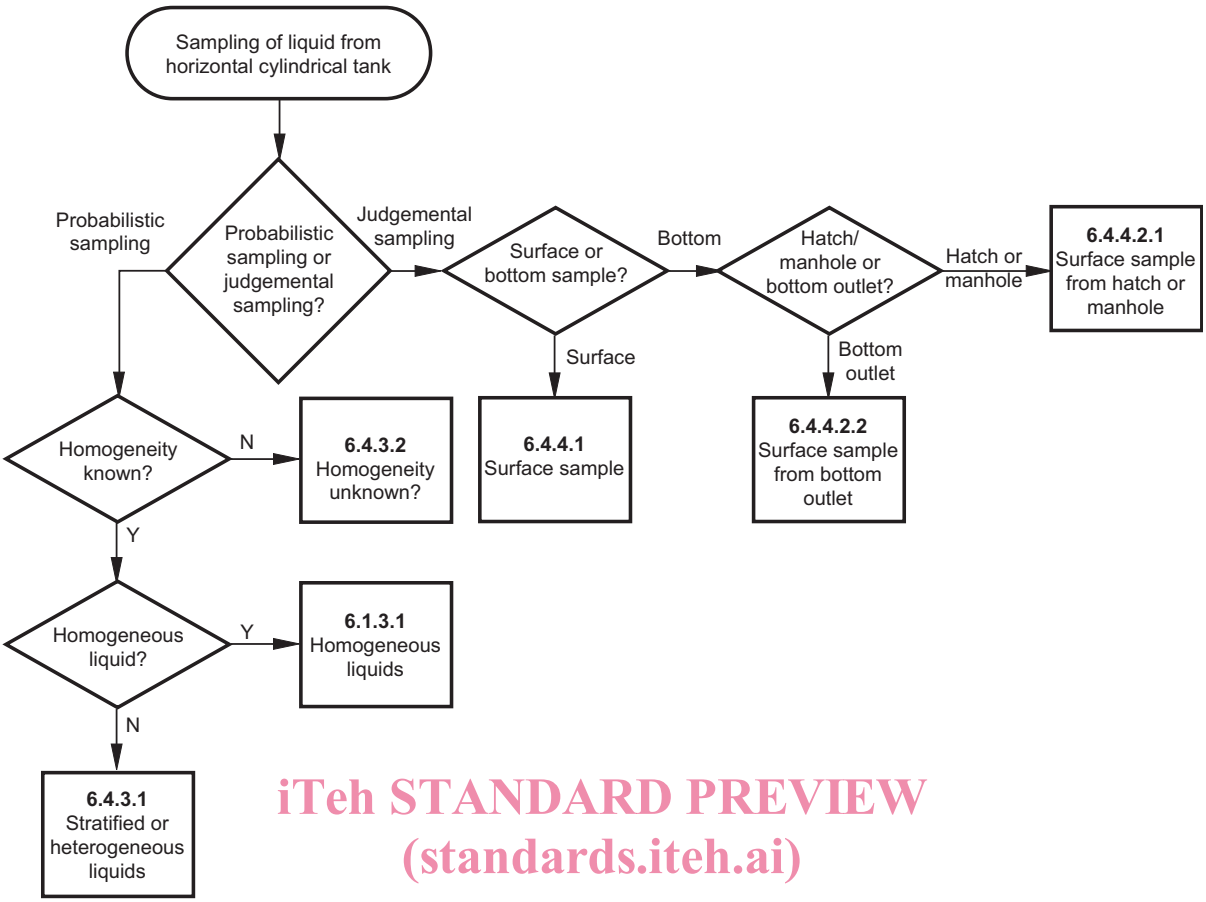

Figure 5 — Sampling liquids in a horizontal cylindrical tank