BS EN 16457:2014

BSI Standards Publication

Characterization of waste — Framework for the preparation and application of a testing programme — Objectives, planning and report

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National foreword

This British Standard is the UK implementation of EN 16457:2014.

The UK participation in its preparation was entrusted to Technical Committee B/508/3, Characterization of waste.

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.

ISBN 978 0 580 79083 6

ICS 13.030.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2014.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16457

March 2014

ICS 13.030.01

English Version

Characterization of waste - Framework for the preparation and application of a testing programme - Objectives, planning and report

Caractérisation des déchets - Procédure-cadre pour l'élaboration et la mise en oeuvre d'un programme d'essai - Objectifs, planification et rapport

Charakterisierung von Abfällen - Rahmenbedingungen für die Vorbereitung und Anwendung eines Untersuchungsprogramms - Ziele, Planung und Bericht

This European Standard was approved by CEN on 20 December 2013.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 16457:2014) has been prepared by Technical Committee CEN/TC 292 “Characterization of waste”, the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2014 and conflicting national standards shall be withdrawn at the latest by September 2014.

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.

It is to be noted that for Germany an A-deviation applies (see Annex B).

This document has been prepared by the ad hoc group “Testing programme” of CEN/TC 292. It has been decided by CEN/TC 292 to prepare the present document and to consider separately other issues supporting this document. This would finally result in a set of four documents on waste testing as listed in the Introduction.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This European Standard was elaborated as a help for those who have to organize and apply a waste testing programme. Often several parameters need to be determined in a waste sample and for each parameter different testing steps of a different nature need to be coordinated and performed. This is done in accordance with dedicated standards developed by CEN/TC 292 (e.g. standards for the steps of sampling, extraction, leaching and analysis of eluates or extracts). In order to cope with these different parameters to be tested and with these different testing steps of different nature, the testing of a waste generally refers to different standards which should be used (and elaborated) in a coherent and coordinated way in a testing programme. This European Standard is designed for specifying such overall testing programmes.

This European Standard may be used by different interested parties in waste testing: plant operators, testing institutes, accreditation bodies, etc. as well as by industries to address the waste testing part of their contracts and by regulators to address the waste testing part of their regulations.

This European Standard can be used to:

— produce a standardized testing programme for use in regular or routine circumstances (elaboration of daughter/derived standards dedicated to well defined testing scenarios);

— incorporate the specific testing requirements of European and national legislation;

— design and develop a waste testing programme for use on a case by case basis.

This European Standard provides requirements on the programme, objective, plan and report for the execution of a waste testing programme. This is done with the intent to ensure reliable and comparable results when using the reference methods that have been developed by CEN/TC 292 in accordance with the principles specified in this standard and in the supporting documents (listed below).

As shown in Figures 2 and 3, for waste testing, the tests to be performed consist (see also the supporting documents listed below) of two main works: the sampling in the field and the analysis-quantification in the laboratory. The needed coordination and interface is the responsibility of the programme manager (see 4.4). It is also the responsibility of the programme manager to design the testing programme, to authorize the testing report and to submit it to the customer.

This European Standard includes one normative annex and one informative annex which are part of this standard. This European Standard is intended to become a part of a set of documents consisting of the present document:

— EN 16457, *Characterization of waste – Framework for the preparation and application of a testing programme – Objective, planning and report*

and of three supporting documents providing important information:

— CEN/TS (WI 00292082), *Characterization of waste – Framework for the preparation and application of a testing programme – Application of EN ISO/IEC 17025 (in preparation)*

— CEN/TS (WI 00292085), *Characterization of waste – Framework for the preparation and application of a testing programme – Guidelines for the elaboration of standardised testing methods (in preparation)*

— CEN/TR (WI 00292084), *Characterization of waste – Framework for the preparation and application of a testing programme – General information on content tests and leaching tests (in preparation)*

1 Scope

This European Standard specifies requirements for a waste testing programme regarding mainly objectives, planning and report with the intent to ensure reliable and comparable results when using the reference methods that have been developed and/or adopted by CEN/TC 292.

The planning and report aspects of this European Standard are applicable to any waste testing programme dedicated to the determination of one or several parameters. They are also applicable to all testing steps for each parameter from sampling up to reporting whether these steps are taking place in the field (e.g. sampling) or in the laboratory (e.g. analysis-quantification).

This European Standard does not address aspects of safety for activities in the field and inside laboratory.

NOTE The term planning a testing programme is used here with the general meaning of organizing a testing programme and being in accordance with the terms testing plan, sampling plan, laboratory plan used in the present European Standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.[1)]

EN 12457-1, *Characterisation of waste - Leaching - Compliance test for leaching of granular waste materials and sludges - Part 1: One stage batch test at a liquid to solid ratio of 2 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction)*

EN 12457-2, *Characterisation of waste - Leaching - Compliance test for leaching of granular waste materials and sludges - Part 2: One stage batch test at a liquid to solid ratio of 10 l/kg for materials with particle size below 4 mm (without or with size reduction)*

EN 12457-3, *Characterisation of waste - Leaching - Compliance test for leaching of granular waste materials and sludges - Part 3: Two stage batch test at a liquid to solid ratio of 2 l/kg and 8 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction)*

EN 12457-4, *Characterisation of waste - Leaching - Compliance test for leaching of granular waste materials and sludges - Part 4: One stage batch test at a liquid to solid ratio of 10 l/kg for materials with particle size below 10 mm (without or with size reduction)*

EN 13137, *Characterization of waste - Determination of total organic carbon (TOC) in waste, sludges and sediments*

EN 13656, *Characterization of waste - Microwave assisted digestion with hydrofluoric (HF), nitric (HNO3) and hydrochloric (HCl) acid mixture for subsequent determination of elements*

EN 13657, *Characterization of waste - Digestion for subsequent determination of aqua regia soluble portion of elements*

EN 14039, *Characterization of waste - Determination of hydrocarbon content in the range of C10 to C40 by gas chromatography*

EN 14345, *Characterization of waste - Determination of hydrocarbon content by gravimetry*

[1)] Useful information may be found in several CEN/TRs as mentioned in Annex A. The use of CEN/TRs is not mandatory and other sources of information may be used provided that the requirements of the basic EN or CEN/TS are fulfilled. The list of such CEN/TR is given in the Bibliography, references [5] to [15].

EN 14346, *Characterization of waste - Calculation of dry matter by determination of dry residue or water content*

CEN/TS 14405, *Characterization of waste - Leaching behaviour tests - Up-flow percolation test (under specified conditions)*

prEN 14429, *Characterisation of waste - Leaching behaviour test - Influence of pH on leaching with initial acid/base addition*

EN 14582, *Characterization of waste - Halogen and sulfur content - Oxygen combustion in closed systems and determination methods*

EN 14735, *Characterization of waste - Preparation of waste samples for ecotoxicity tests*

EN 14899, *Characterization of waste - Sampling of waste materials - Framework for the preparation and application of a Sampling Plan*

prEN 14997, *Characterisation of waste - Leaching behaviour test - Influence of pH on leaching with continuous pH control*

EN 15002, *Characterization of waste - Preparation of test portions from the laboratory sample*

EN 15169, *Characterization of waste - Determination of loss on ignition in waste, sludge and sediments*

EN 15192, *Characterisation of waste and soil - Determination of Chromium(VI) in solid material by alkaline digestion and ion chromatography with spectrophotometric detection*

EN 15308, *Characterization of waste - Determination of selected polychlorinated biphenyls (PCB) in solid waste by using capillary gas chromatography with electron capture or mass spectrometric detection*

EN 15309, *Characterization of waste and soil - Determination of elemental composition by X-ray fluorescence*

EN 15216, *Characterization of waste - Determination of total dissolved solids (TDS) in water and eluates*

CEN/TS 15364, *Characterization of waste - Leaching behaviour tests - Acid and base neutralization capacity test*

EN 15527, *Characterization of waste - Determination of polycyclic aromatic hydrocarbons (PAH) in waste using gas chromatography mass spectrometry (GC/MS)*

CEN/TS 15862, *Characterisation of waste - Compliance leaching test - One stage batch leaching test for monoliths at fixed liquid to surface area ratio (L/A) for test portions with fixed minimum dimensions*

prEN 15863, *Characterisation of waste - Leaching behaviour test for basic characterisation - Dynamic monolithic leaching test with periodic leachant renewal, under fixed conditions*

CEN/TS 15864, *Characterisation of waste - Leaching behaviour test for basic characterisation - Dynamic monolithic leaching test with continuous leachant renewal under conditions relevant for specified scenario(s)*

EN 15875, *Characterization of waste - Static test for determination of acid potential and neutralisation potential of sulfidic waste*

CEN/TS 16023, *Characterization of waste - Determination of gross calorific value and calculation of net calorific value*

EN 16192, *Characterization of waste - Analysis of eluates*

CEN/TS 16229, *Characterization of waste - Sampling and analysis of weak acid dissociable cyanide discharged into tailings ponds*

EN 16377, *Characterization of waste - Determination of brominated flame retardants (BFR) in solid waste*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.[2)]

3.1
additional parameter (AP)
parameter that needs to be tested so that the test results could be calculated and/or interpreted

Note 1 to entry: For instance, the dry matter for expressing the test results on a dry basis, or pH in eluate to be able to understand and check consistency of test data and to understand/investigate unexpected outcome or unexpected variations.

3.2
analysis / quantification
step in the testing programme where the magnitude of the parameters is determined and the obtained data can be directly delivered for final use and reporting or from which the data can be delivered for further calculations

EXAMPLE Measuring the length with a measuring tape, measuring the temperature with a thermometer, determining (analysing) the concentrations of substances in an extract or eluate.

Note 1 to entry: In the last example, the concentration of the substance in a material or the leachable fraction from a material would be calculated, using the data on the concentrations in the extract or the eluate.

3.3
customer
organization or person that orders for a test and that receives the final test report

[SOURCE: EN ISO 9000:2005, 3.3.5]

3.4
involved parties
individuals and organizations that are directly or indirectly involved in the specification of the testing programme and or in the execution of the programme

[SOURCE: EN 14899:2005, 2.7, modified]

Note 1 to entry: Such parties include, for instance, the customer, (e.g. the producer or the user of the material), the regulator, a certification body, the sampler, the analyst, the laboratory. The person responsible for the final specification of the testing programme and the final test report is the programme manager.

3.5
laboratory plan
plan, which is part of the testing plan, including all the required steps and relevant information pertinent to a particular laboratory activity

Note 1 to entry: The laboratory plan includes the preparation of the test sample(s), the extraction, leaching or other activity with the sample(s), analysis, calculations and reporting.

Note 2 to entry: The laboratory plan includes specification of the tests to be executed, the laboratory (or laboratories) involved, and the planning.

2) The terms and definitions listed in this clause are needed for the present European Standard with regards to the design and execution of a testing programme. In many other standardized documents useful terms and definitions are available and these will not be repeated here. The supporting document *Guidelines for the elaboration of standardized testing methods (in preparation)* referred to in the Introduction would consolidate and harmonize the definitions in all CEN/TC 292 standards.

3.6
parameter
measurable property whose value is a determinant of the characteristics of a waste material

Note 1 to entry: For instance, relevant parameters for waste material may be substances (e.g. cadmium, mercury, lead, salt, PAH), pH, temperature, humidity, compressive strength, grain size, etc.

3.7
programme manager
individual responsible for the development of the testing programme (including the sampling plan and the laboratory plan) the execution of the testing programme including the preparation and submission of the final report

Note 1 to entry: The programme manager may be directly concerned with the sampling work and/or the laboratory work as employee of a sampling organization and/or a laboratory organization. He/she also may be a 'third party' just organizing the whole process and responsible for the final reporting.

3.8
records
written and/or electronic files in which, during the sampling procedure, testing procedure, test results, time, place and instruments of testing, and observations are recorded

Note 1 to entry: Records (also named testing files or work files) are the basis for calculations and for drafting the final test programme report. The report includes relevant data and observations; usually it is not necessary to include all complete testing files in the final report. It is important that the testing files be available upon request, for example, when in a later stage questions arise on the testing and the testing report.

3.9
sampling plan
all the information pertinent to a particular sampling activity

Note 1 to entry: The sampling plan includes the taking of the sample, the production of a laboratory sample, and the transport (to the laboratory), and may include the storage of the laboratory sample.

Note 2 to entry: In case the measurement can be done directly in the field, transport and storage might not be necessary and then will not be elaborated further in the sampling plan.

[SOURCE: EN 14899:2005, 3.18, modified]

3.10
sampling report
report providing information on all field activities during waste sampling and including any important observation of the sampler

Note 1 to entry: A sampling report is prepared for each sampling operation.

Note 2 to entry: Sampling plan and sampling report can both summarize their information in a form, including nearly the same items, which facilitates reporting during the sampling activities and which facilitates comparison of planned activities and the way the sampling was executed.

3.11
testing programme
total test operation, from the first step in which the objectives of the test(s) are defined to the last step in which data are analysed and reported

Note 1 to entry: The test programme may include analyses of the data, evaluation and statistical treatment of the data and comparison with the legal, scientific or other requirements.

Note 2 to entry: A testing programme may include data from several tests with each its own test report, e.g. in production control where each month one batch of one day's production is tested and the testing programme provides information and conclusions on the performance of the product over the whole of the year.

Note 3 to entry: If the test results are to be used for formal evaluation, such as requirements from legislation, permits, certification procedures, the objectives and requirements on the methods to be used may directly come from such formal requirements.

Note 4 to entry: The testing programme objectives amongst others include specification of the location and material to be investigated, the scale of material to be tested, the parameters to be investigated, the required reliability, the reference test methods. The objectives of the testing programme need to be specified by the customer.

[SOURCE: EN 14899:2005, 3.24, modified]

3.12
testing plan
plan, containing both the sampling plan and the laboratory plan

3.13
testing steps
main parts of the testing programme which include:

1) defining or further specifying the testing plan,

2) taking the sample,

3) sample preparation, transport to the laboratory and storage,

4) test sample and test portion preparation,

5) required treatment of the test portion, such as extraction, leaching, testing for compressive strength,

6) analysis, quantification,

7) elaborating the overall report

Note 1 to entry: For all or most of the steps, specific standardized methods exist or are under development that cover that step as reference method (see 4.5 and Table A.1).

Note 2 to entry: In some cases, instructions for different steps are combined in one specific standard, e.g. the extraction and the analysis of substances specified in one test standard. Often a standard on a specific step includes instructions on the final reporting of the results and observations of that step.

Note 3 to entry: It might be possible that a number of parameters need to be measured which are covered by different measurement standards; however, the production of the laboratory sample may be the same for all of the parameters. In such cases, all parameters can be covered by a single testing programme.

4 Defining a waste testing programme

4.1 Principles

In order to secure reliable and comparable results representative of the tested waste, the testing programme with its objectives shall be based on the following principles:

a) the testing programme and its objectives are available before execution tasks are carried out;

b) a sampling plan is specified in the testing programme to meet the objective and the sampling sites/locations are identified to enable representative sample(s) to be taken;

c) the laboratory testing requirements are specified in the testing plan to ensure acceptance by the laboratory and guarantee that the specified tests can be performed on the samples to be provided;

d) the standards specified in this standard and covering the different steps of all processes involved in the testing programme are applied. Other methods may be used in the framework of this standard provided that their comparability/traceability to the standardized methods referred in 4.5 and listed in Annex A is demonstrated in accordance with the testing objectives and with the considered and specific field of application;

NOTE 1 Other methods than the ones specified in Annex A may provide adequate information, even if it is not equally precise or if it provides other information, for instance if the performance level of a waste is rather low, compared with a limit value.

e) a report of the results is produced which includes all relevant information, including description and justification of any possible deviation from the applied standards;

f) competent samplers and competent laboratories are used with clear identification of their responsibilities;

NOTE 2 Requirements on the competence of laboratories are specified in EN ISO/IEC 17025 and in the supporting documents (listed in the Introduction).

g) competence and responsibilities of the programme manager should be considered / specified before finalizing the testing programme, and where appropriate, should be included in the testing programme.

4.2 Structure of a waste testing programme

4.2.1 First actions and overview of a waste testing programme

The first action to be undertaken in a waste testing programme is the specification of the objectives of the testing programme. This also requires the identification of the programme manager (see 4.4).

In this first action the objectives of the testing programme are specified by the customer in consultation with the involved parties. All relevant information shall be collected from the involved parties and considered before finalizing the testing programme.

NOTE Such involved parties include, for instance, the sampler and/or the analyst and/or the customer and/or the regulator and/or the waste producer.

In a second action the testing programme is defined by the programme manager according to the objectives of the testing programme and the relevant/applicable legal requirements.

The testing programme contains all relevant information for coordination and describes the relevant steps and actions. It is illustrated in Figure 1 showing an overview of a waste testing programme.

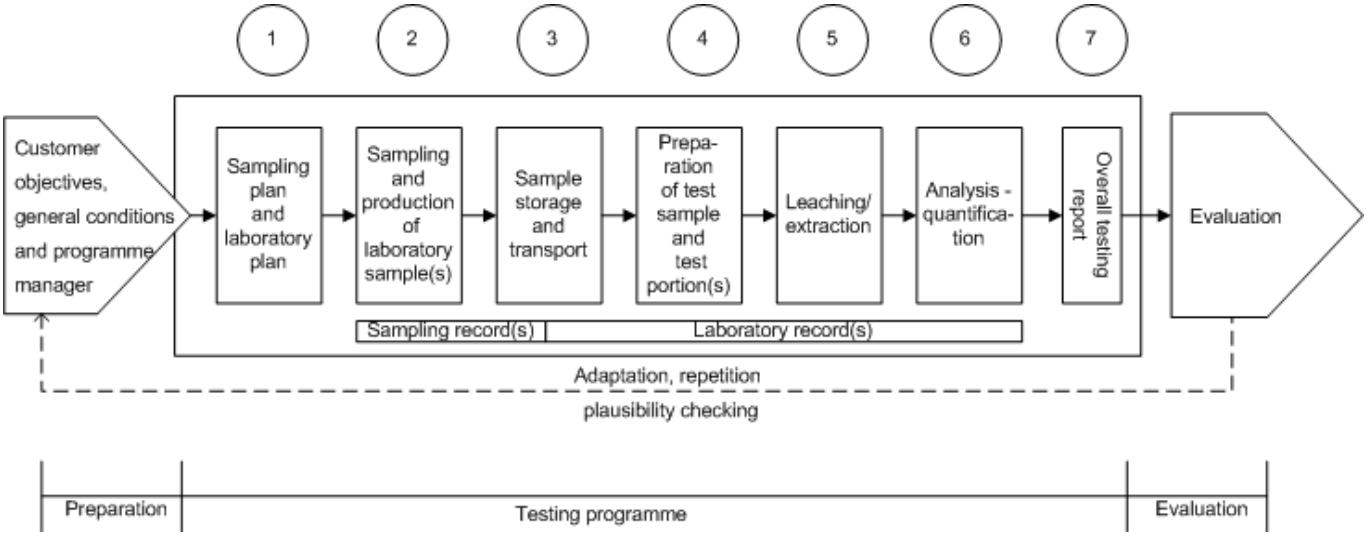

Figure 1 — Overview of a waste testing programme

4.2.2 The seven testing steps of a waste testing programme

In the field of waste testing, each test consists typically of seven steps:

1) Testing plan (sampling plan and laboratory plan);

2) Taking field sample and production of laboratory sample(s);

3) Packaging, transport and storage (from field to the laboratory);

4) Preparation of test sample and test portion;

5) Leaching, extraction;

6) Analysis, quantification;

7) Overall testing report.

In Figure 1, the testing steps 2 and 3 are in the field activities while the testing steps 3, 4, 5 and 6 are in the laboratory activities.

In Figure 2, the seven testing steps are shown for testing a single parameter.

NOTE 1 Depending on the nature of the parameter to be tested, the testing step 5 is not always performed for instance for density, dry matter …etc. This may also apply to other steps.

NOTE 2 A waste testing programme may require the testing of additional parameters, for instance dry matter in order to express the content of a substance in mg/kg on a dry matter basis (see notes in Table A.1).

Before the testing programme is designed and executed, the customer appoints a programme manager. The objectives of the testing programme shall be specified by the customer. The testing programme objectives amongst others include specification of the location and material to be investigated, the scale of material to be tested, the parameters to be investigated, the required reliability and the reference test methods.

NOTE 3 If the test results are to be used for formal evaluation, such as requirements from legislation, permits, certification procedures, the objectives and requirements on the methods to be used may directly come from such formal requirements.

The activities from step 2 up to and including step 6 are recorded in one or more records. These records are written and/or electronic files in which, during the sampling procedure and testing procedure observations such as for instance name, location, used techniques, test results, time, place and instruments of testing, and other relevant information and data are recorded.

In step 7, it is the responsibility of the programme manager to check the results against the objectives.

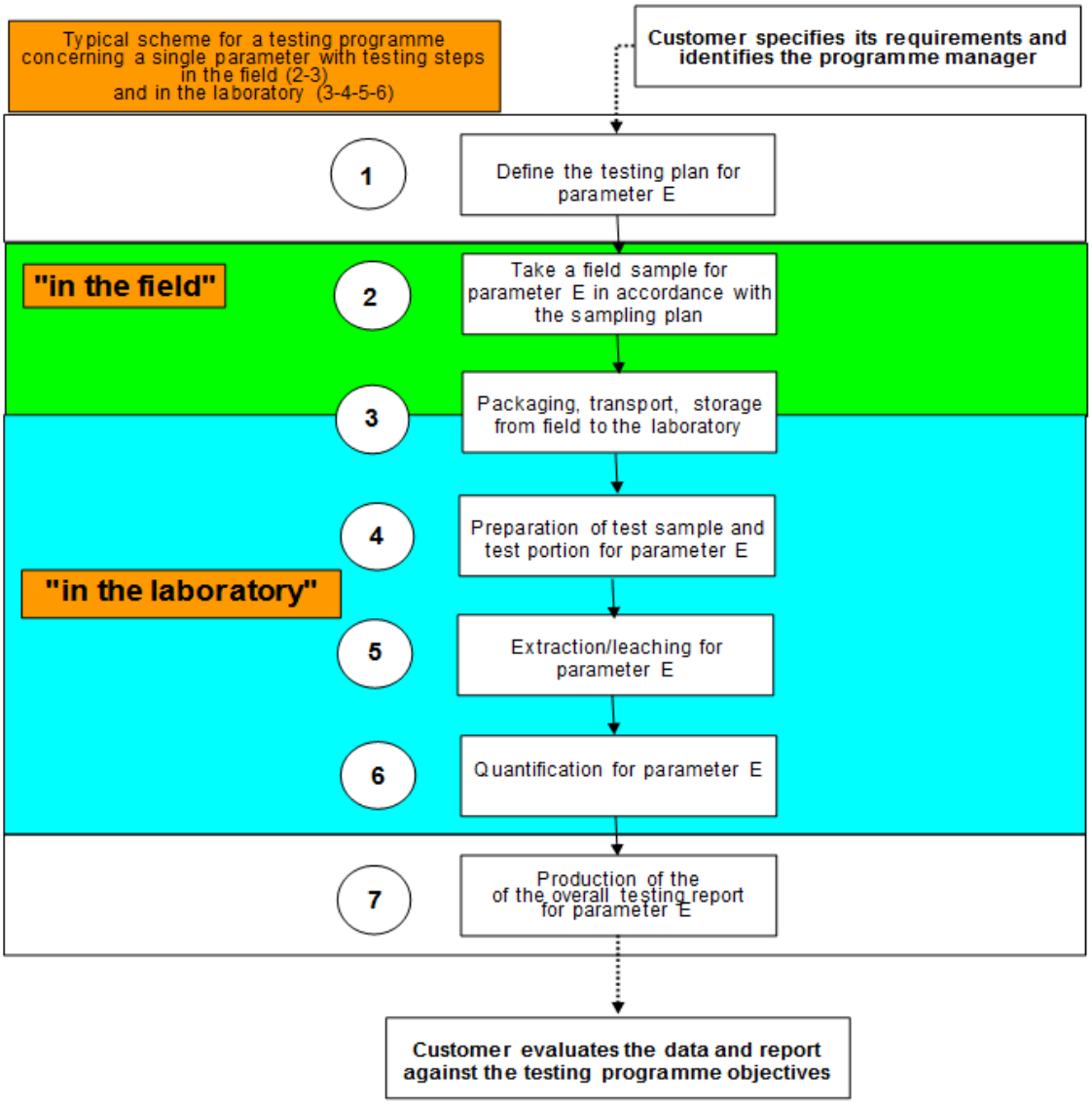

Figure 2 — Illustration of the testing steps in a waste testing programme addressing a single parameter to be tested (informative)

4.3 Parameters to be tested for a waste

In a waste testing programme, the set of parameters to be tested usually consist of different types of parameters.

The different requirements of the analytical standards shall be taken into account and shall be coordinated before developing a sampling plan. The amount and number of field samples, the different conservation needs shall be laid down in advance.

In Figure 3, the testing programme is illustrated in detail with an example more complex than in the overview given in Figure 1 or the case of a single parameter in Figure 2. It addresses the usual case of the determination of several parameters to be tested for the considered waste. In the example in Figure 3, the objective of the testing programme is the testing of four different parameters of the considered waste.

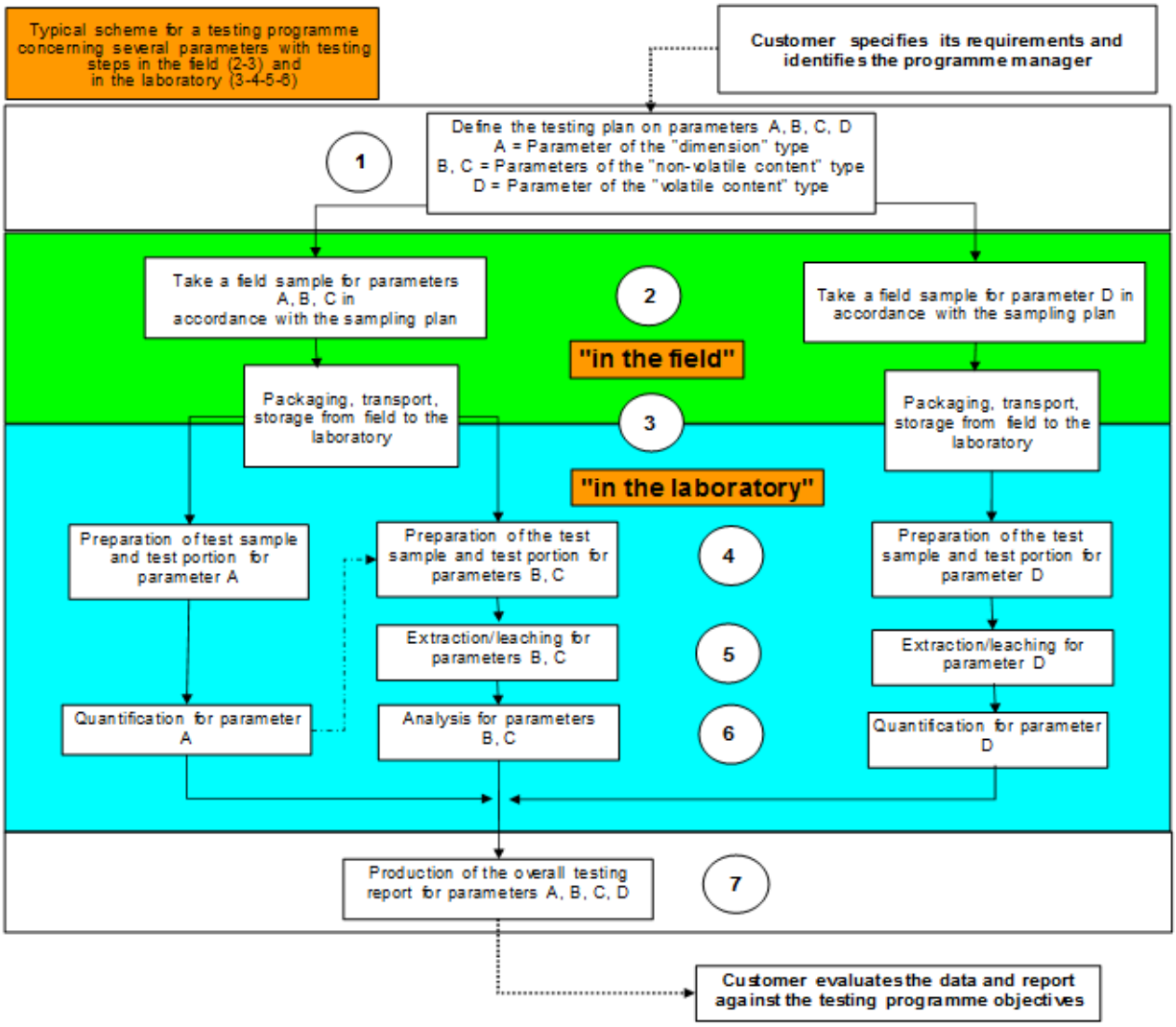

Figure 3 — Illustration of the testing steps in a usual waste testing programme addressing several parameters to be tested (informative)

The complexity of a testing programme that addresses several parameters to be tested is illustrated in Figure 3. In some cases, the testing programme requires different samples to be taken in the field. For instance, when volatile and non-volatile substances need to be quantified the sampling and packaging requires different handling of the samples. Cases B and C correspond to content type and leachable fraction type. These measurements are destructive. On the contrary, case A may correspond to a non-destructive measurement such as size distribution. Another type is shown on Figure 3 as case D requiring for instance an amount of material such as is needed for volatiles.

Furthermore, other parameters, for instance biological ones, leachable fraction, bulk density, etc. may exhibit in the laboratory plan different requirements than chemical or physical parameters. Another important aspect to be considered in the sampling part are the scale, i.e. the amount of material upon which the parameter is defined.

4.4 Responsibilities and programme manager

The programme manager shall translate and document the objective(s) of the waste testing programme (i.e. the sampling plan) into practical and achievable technical goals and the laboratory plan, like the parameters to be analysed, necessary reliability of the results (confidence level, confidence interval), the population, the scale, sampling location and time, numbers of samples, etc. These technical goals can be linked to specific data analysis requirements and a selected number of statistical analytical tools that provide a consistent means of assessing and

interpreting testing data. Such tools may provide the means to verify whether the testing objective(s) have been met or not.

NOTE In the field of waste testing, the testing to be performed consists of two main activities: the sampling in the field and the preparation-analysis-quantification in the laboratory.

In all cases, the programme manager is responsible for coordination of all steps of the testing programme. The programme manager shall be appointed at the very start of the work. All the necessary information for coordination is laid down in the waste testing programme. In general, in accordance with the customer, the programme manager will mandate the execution activities to samplers and one or more laboratories.

The programme manager is responsible for the interface requirements between the different activities, if any. It is the responsibility of the samplers and analysts performing a part of the required activities to cope with the requirements, as specified in the relevant standards for the sampling or analytical activities. They should be clearly documented. By these means, the tasks to be audited in any auditing and/or accreditation process should be clearly identified. As far as the activities fall under auditing and accreditation requirements in the testing programme this should be included and clearly specified what this means for the procedures. Finally, it is the responsibility of the programme manager to produce or ask a third party to produce the final report. It remains the responsibility of the project manager to authorize the overall testing report and to submit it to the customer after having checked the results against the objectives, including plausibility check of all data and control. The different responsibilities are illustrated in Table 1 which reads “the programme manager is aware of requirements” or “the sampling work applies the testing programme”.

Table 1 — Responsibilities of the programme manager and of the different works

	waste testing programme	**sampling steps 1–2–3**	**laboratory steps 3–4–5–6**	**requirements for the reporting step 7 plus steps 1–2–3–4–5–6**
programme manager	designs the testing programme, defines and monitors interfaces between the different activities	is aware of	is aware of	Is responsible for the production and authorizes the overall report with the contributions of the different activities
samplers (in the field)	applies	applies and produces sampling record(s)	is aware of	produces a sampling report on the sampling steps 2–3
analysts (in the laboratory)	applies	is aware of	applies and produces laboratory record(s)	produces one or more testing reports on the analytical steps 3–4–5–6

4.5 Standards to be used

The standards to be used are specified in Annex A in a matrix ‘testing steps versus parameters’ unless otherwise specified by the customer in the waste testing programme.

In the framework of this standard, laboratories may elect to use other methods than the ones specified in Annex A provided that the customer accepts the use of such methods and provided that their comparability/traceability to the standardized methods referred in Annex A is demonstrated in accordance with the testing objectives and with the considered and specific field of application.

NOTE 1 Other methods than the ones specified in Annex A may provide adequate information, even if it is not equally precise or if it provides other information, for instance if the performance level of a waste is rather low, compared with a limit value and when it is only necessary to show that the limit value is not exceeded.

NOTE 2 In its present version, this European Standard includes parameters for which CEN/TC 292 has developed and published standards regarding the different testing steps at the time when this document was adopted. For standards developed and published later on by CEN/TC 292, they will be included in updates of Annex A. The same applies with regard to relevant changes in existing standards referred to in Annex A. It is helpful to remember this when drafting a testing programme.

NOTE 3 This European Standard also includes parameters for which CEN/TC 292 has not developed standards for all the testing steps and has elected to use standards developed in another TC in coordination and coherence with CEN/TC 292 standards. Regarding the standards under development at the time when this document was adopted, they are indicated as under development since they may be adopted and published in a short timeframe.

NOTE 4 Several methods specified in Annex A produce similar information. For example, it is not necessary to apply all standards of the EN 12457 series and it will not be necessary to apply both prEN 14429 and prEN 14997. The choice of the parts to be selected lies with the programme manager or specifications by the customer. It requires an understanding of the interrelationships between the parts and between individual standards to make adequate choices. Information on these issues will be found in the supporting document listed in the Introduction of the present European Standard.

5 Carrying out a waste testing programme

The objective specified in the contract with the customer shall be identified by the programme manager and confirmed by the sampler(s) and the testing laboratory before starting the work. This shall include the parameters to be tested (for instance calorific value, leaching of copper, lead and sulphates, sulfur, cadmium or chlorine content), the amount of waste to be tested, the scale, the number of laboratory samples and the needed reliability of the results. This also includes the designated (standardized) methods to be used and considered as reference for this testing programme (see 4.5 and Annex A).

Testing including sampling shall be carried out in compliance with the (standardized) methods specified in the testing programme.

6 Overall testing report

The overall testing report shall provide a comprehensive account of all steps of the testing programme for the different tested parameters.

The report shall provide sufficient detail to enable the results to be traced back through the calculations to the collected basic data and process operating conditions.

The overall testing report to be transmitted to the customer does not contain all details specified in the applied standards and which are included in the records, individual testing file or work file. Such detail should be available upon request.

NOTE If waste testing is undertaken for regulatory purposes, the competent authority may have elected to specify the use of a standard report format.

The reporting requirements of individual standards shall be taken into account, including for the sampling.

An overall waste testing report shall include at least the following items marked with a star (*). Items without star shall be available upon request:

a) a summary (*) providing a general overview of the work and results including, e.g.:

   1) operator’s name and the address of the process plant/site where the sampling was made (*);

   2) name and address of the testing bodies having performed the sampling work and the analytical work (*);

   3) name and affiliation of the programme manager (*);

   4) for each parameter, the testing results and other relevant data necessary for interpreting the results (*);

b) reference to the testing programme and specification (summary) of the testing objective(s) (*);

c) description of the waste (*);

d) sampling report (*) (summary addressing the sampling plan and sampling location and date day-month-year);

e) sample preparation in the field and the laboratory, conditions of transport and storage, if any;

f) date of reception of sample at the laboratory (*) and date of analysis in the laboratory (*);

g) test methods and apparatus used in accordance with individual testing standards;

h) documentation and justification of any deviation from the testing programme or from the sampling plan or from the standardized test methods being used (*);

i) testing uncertainties (*);

j) calculation procedures.

Annex A
(normative)

Matrix testing steps versus parameters specifying the standards to be used in a waste testing programme

In the matrix below, the first column on the left lists the different parameters for which CEN/TC 292 has developed and/or adopted the needed standards to cover all the testing steps specified in 4.2.2. Columns 2 to 8 correspond each to one of these seven testing steps. Consequently this matrix should be read horizontally, for instance the first line regards the parameter 'total organic carbon content (TOC)'. Testing such parameter requires a preparation step for which EN 15002 and EN 13137 are to be applied. This is found in the box in line 1 (the parameter line) and in the column step 4 (the preparation step column).

For some parameters, additional parameters shall be tested so that the test results could be calculated and/or interpreted, for instance the dry matter for expressing the test results on a dry basis. In such case (AP) is added to the parameter name in column one.

NOTE 1 In its present version this European Standard includes parameters for which CEN/TC 292 has developed and published standards regarding the different testing steps at the time when this document was adopted. For standards developed and published later on by CEN/TC 292, they may informatively include the list of standards applicable to address the other measurement steps.

NOTE 2 This document includes also parameters for which CEN/TC 292 has not developed standards for all the testing steps and has elected to use standards developed in another TC in coordination and coherence with CEN/TC 292 standards. Regarding the standards under development at the time when this document was adopted, they are indicated as under development since they may be adopted and published in a short timeframe.

NOTE 3 Several methods specified in Annex A produce similar information. For example, it is not necessary to apply all standards of the EN 12457 series and it will not be necessary to apply both prEN 14429 and prEN 14997. The choice of the parts to be selected lies with the programme manager or specifications by the customer. It requires an understanding of the interrelationships between the parts and between individual standards to make adequate choices. Information on these issues will be found in the supporting documentation listed in the Introduction of the present European Standard.

It is to be noted that standards are being revised regularly and that standards published in the future should be added to the table when available.

Table A.1

Parameters in waste testing (CEN/TC 292)	**Step 1** Prepare sampling plan	**Step 2** Take sample(s) and produce laboratory sample(s)	**Step 3** Store, transport and store laboratory sample(s)	**Step 4** Prepare test sample(s) and/or test portion(s)	**Step 5** Perform extraction or leaching	**Step 6** Quantify or analyse	**Step 7** Prepare and submit testing report
(*) – Information on sampling plan preparation are given in the informative CEN/TR 15310 parts 1 and 5 (**) – Information on sample taking and reduction to laboratory sample are given in the informative CEN/TR 15310 parts 2, 3, 4 and 5 (***) – Information on a third digestion method, the alkali-fusion technique, is given in CEN/TR 15018. (****) – EN 14735 is dedicated to the preparation of waste samples for ecotoxicity tests and provides information in its Annex B on 23 ecotoxicity tests that were considered while CEN/TR 16110 is informative and gives guidance for specifying an ecotox test battery. (*****) – Information is given in the informative CEN/TR 16365.							
ORGANICS CONTENT							
total organic carbon content (TOC)	EN 14899 (*)	(**)	(**)	EN 15002 EN 13137	EN 13137	EN 13137	EN 13137
hydrocarbon content in the range of C10 to C40 by gas chromatography	EN 14899 (*)	(**)	(**)	EN 15002 EN 14039	EN 14039	EN 14039	EN 14039
hydrocarbon content by gravimetry	EN 14899 (*)	(**)	(**)	EN 15002 EN 14345	EN 14345	EN 14345	EN 14345
content of selected polychlorinated biphenyls (PCB) in solid waste by using GC-ECD or MS	EN 14899 (*)	(**)	(**)	EN 15002 EN 15308	EN 15308	EN 15308	EN 15308
content of polycyclic aromatic hydrocarbons (PAH) using GC-MS	EN 14899 (*)	(**)	(**)	EN 15002 EN 15527	EN 15527	EN 15527	EN 15527

Parameters in waste testing (CEN/TC 292)	**Step 1** Prepare sampling plan	**Step 2** Take sample(s) and produce laboratory sample(s)	**Step 3** Store, transport and store laboratory sample(s)	**Step 4** Prepare test sample(s) and/or test portion(s)	**Step 5** Perform extraction or leaching	**Step 6** Quantify or analyse	**Step 7** Prepare and submit testing report
(*) – Information on sampling plan preparation are given in the informative CEN/TR 15310 parts 1 and 5 (**) – Information on sample taking and reduction to laboratory sample are given in the informative CEN/TR 15310 parts 2, 3, 4 and 5 (***) – Information on a third digestion method, the alkali-fusion technique, is given in CEN/TR 15018. (****) – EN 14735 is dedicated to the preparation of waste samples for ecotoxicity tests and provides information in its Annex B on 23 ecotoxicity tests that were considered while CEN/TR 16110 is informative and gives guidance for specifying an ecotox test battery. (*****) – Information is given in the informative CEN/TR 16365.							
determination of brominated flame retardants (BFR) in solid waste						EN 16377	
INORGANICS CONTENT							
elemental composition by X-ray fluorescence	EN 14899 (*)	(**)	(**)	EN 15002 EN 15309	NA	EN 15309	EN 15309
content of chromium(VI) in solid material by alkaline digestion and ion chromatography with spectrophotometric detection	EN 14899 (*)	(**)	(**)	EN 15002 EN 15192	EN 15192	EN 15192	EN 15192
halogen and sulfur content by oxygen combustion in closed systems and determination methods	EN 14899 (*)	(**)	(**)	EN 15002 EN 14582	NA	EN 14582	EN 14582
elemental content by digestion and subsequent analysis	EN 14899 (*)	(**)	(**)	EN 15002	EN 13656 or EN 13657 (***)	?	?

Parameters in waste testing (CEN/TC 292)	**Step 1** Prepare sampling plan	**Step 2** Take sample(s) and produce laboratory sample(s)	**Step 3** Store, transport and store laboratory sample(s)	**Step 4** Prepare test sample(s) and/or test portion(s)	**Step 5** Perform extraction or leaching	**Step 6** Quantify or analyse	**Step 7** Prepare and submit testing report
(*) – Information on sampling plan preparation are given in the informative CEN/TR 15310 parts 1 and 5 (**) – Information on sample taking and reduction to laboratory sample are given in the informative CEN/TR 15310 parts 2, 3, 4 and 5 (***) – Information on a third digestion method, the alkali-fusion technique, is given in CEN/TR 15018. (****) – EN 14735 is dedicated to the preparation of waste samples for ecotoxicity tests and provides information in its Annex B on 23 ecotoxicity tests that were considered while CEN/TR 16110 is informative and gives guidance for specifying an ecotox test battery. (*****) – Information is given in the informative CEN/TR 16365.							
LEACHING PÄRAMETERS							
leachable fractions by a one stage batch test at a liquid to solid ratio of 2 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction) (AP)	EN 14899 (*)	(**)	(**)	EN 12457–1	EN 12457–1	EN 16192 + EN 15216	EN 12457–1
leachable fractions by a one stage batch test at a liquid to solid ratio of 10 l/kg for materials with particle size below 4 mm (without or with size reduction) (AP)	EN 14899 (*)	(**)	(**)	EN 12457–2	EN 12457–2	EN 16192 + EN 15216	EN 12457–2
leachable fractions by a two stage batch test at a liquid to solid ratio of 2 l/kg and 8 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction) (AP)	EN 14899 (*)	(**)	(**)	EN 12457–3	EN 12457–3	EN 16192 + EN 15216	EN 12457–3

Parameters in waste testing (CEN/TC 292)	**Step 1** Prepare sampling plan	**Step 2** Take sample(s) and produce laboratory sample(s)	**Step 3** Store, transport and store laboratory sample(s)	**Step 4** Prepare test sample(s) and/or test portion(s)	**Step 5** Perform extraction or leaching	**Step 6** Quantify or analyse	**Step 7** Prepare and submit testing report
(*) – Information on sampling plan preparation are given in the informative CEN/TR 15310 parts 1 and 5 (**) – Information on sample taking and reduction to laboratory sample are given in the informative CEN/TR 15310 parts 2, 3, 4 and 5 (***) – Information on a third digestion method, the alkali-fusion technique, is given in CEN/TR 15018. (****) – EN 14735 is dedicated to the preparation of waste samples for ecotoxicity tests and provides information in its Annex B on 23 ecotoxicity tests that were considered while CEN/TR 16110 is informative and gives guidance for specifying an ecotox test battery. (*****) – Information is given in the informative CEN/TR 16365.							
leachable fractions by a one stage batch test at a liquid to solid ratio of 10 l/kg for materials with particle size below 10 mm (without or with size reduction) (AP)	EN 14899 (*)	(**)	(**)	EN 12457–4	EN 12457–4	EN 16192 + EN 15216	EN 12457–4
leachable fractions under the influence of pH on leaching with initial acid/base addition (AP)	EN 14899 (*)	(**)	(**)	prEN 14429	prEN 14429	EN 16192 + EN 15216	prEN 14429
leachable fractions under the influence of pH on leaching with continuous pH-control (AP)	EN 14899 (*)	(**)	(**)	prEN 14997	prEN 14997	EN 16192 + EN 15216	prEN 14997
acid and base neutralization capacity (AP)	EN 14899 (*)	(**)	(**)	CEN/TS 15364	NA	CEN/TS 15364	CEN/TS 15364
leachable fractions under an up-flow percolation (under specified conditions) (AP)	EN 14899 (*)	(**)	(**)	CEN/TS 14405	CEN/TS 14405	EN 16192 + EN 15216	CEN/TS 14405

Parameters in waste testing (CEN/TC 292)	**Step 1** Prepare sampling plan	**Step 2** Take sample(s) and produce laboratory sample(s)	**Step 3** Store, transport and store laboratory sample(s)	**Step 4** Prepare test sample(s) and/or test portion(s)	**Step 5** Perform extraction or leaching	**Step 6** Quantify or analyse	**Step 7** Prepare and submit testing report
(*) – Information on sampling plan preparation are given in the informative CEN/TR 15310 parts 1 and 5 (**) – Information on sample taking and reduction to laboratory sample are given in the informative CEN/TR 15310 parts 2, 3, 4 and 5 (***) – Information on a third digestion method, the alkali-fusion technique, is given in CEN/TR 15018. (****) – EN 14735 is dedicated to the preparation of waste samples for ecotoxicity tests and provides information in its Annex B on 23 ecotoxicity tests that were considered while CEN/TR 16110 is informative and gives guidance for specifying an ecotox test battery. (*****) – Information is given in the informative CEN/TR 16365.							
leachable fractions by a one stage batch leaching test for monoliths at fixed liquid to surface area ratio (L/A) for test portions with fixed minimum dimensions	EN 14899 (*)	(**)	(**)	CEN/TS 15862	CEN/TS 15862	EN 16192 + EN 15216	CEN/TS 15862
leachable fractions by a dynamic monolithic leaching test with periodic leachant renewal, under fixed test conditions	EN 14899 (*)	(**)	(**)	prEN 15863	prEN 15863	EN 16192 + EN 15216	prEN 15863
leachable fractions by a dynamic monolithic leaching test with continuous leachant renewal under conditions relevant for specified scenario(s)	EN 14899 (*)	(**)	(**)	CEN/TS 15864	CEN/TS 15864	EN 16192 + EN 15216	CEN/TS 15864
GENERAL PARAMETERS							
acid and neutralization potential of sulfidic waste by static test	EN 14899 (*) (*****)	(**) (*****)	(**) (*****)	EN 15002 EN 15875	EN 15875 (*****)	EN 15875 (*****)	EN 15875 (*****)

Parameters in waste testing (CEN/TC 292)	**Step 1** Prepare sampling plan	**Step 2** Take sample(s) and produce laboratory sample(s)	**Step 3** Store, transport and store laboratory sample(s)	**Step 4** Prepare test sample(s) and/or test portion(s)	**Step 5** Perform extraction or leaching	**Step 6** Quantify or analyse	**Step 7** Prepare and submit testing report
(*) – Information on sampling plan preparation are given in the informative CEN/TR 15310 parts 1 and 5 (**) – Information on sample taking and reduction to laboratory sample are given in the informative CEN/TR 15310 parts 2, 3, 4 and 5 (***) – Information on a third digestion method, the alkali-fusion technique, is given in CEN/TR 15018. (****) – EN 14735 is dedicated to the preparation of waste samples for ecotoxicity tests and provides information in its Annex B on 23 ecotoxicity tests that were considered while CEN/TR 16110 is informative and gives guidance for specifying an ecotox test battery. (*****) – Information is given in the informative CEN/TR 16365.							
weak acid dissociable (WAD) cyanide discharged into tailing ponds	EN 14899 (*) (*****)	(**) (*****)	(**) (*****)	EN 15002 CEN/TS 16229	CEN/TS 16229 (*****)	CEN/TS 16229 (*****)	CEN/TS 16229 (*****)
assessing acid generation potential of sulfidic waste from extractive industries by kinetic testing	EN 14899 (*) (*****)	(**) (*****)	(**) (*****)	EN 15002 CEN/TR 16363	CEN/TR 16363	CEN/TR 16363	CEN/TR 16363
on-site verification						CEN/TR 16130	CEN/TR 16130
screening methods for elemental composition by X-ray fluorescence for on-site verification						CEN/TR 16176	CEN/TR 16176
content of dry matter by determination of dry residue or water content	EN 14899 (*)	(**)	(**)	EN 15002 EN 14346	NA	EN 14346	EN 14346
calorific value	EN 14899 (*)	(**)	(**)	EN 15002 CEN/TS 16023	NA	CEN/TS 16023	CEN/TS 16023
loss on ignition	EN 14899 (*)	(**)	(**)	EN 15002 EN 15169	NA	EN 15169	EN 15169

Parameters in waste testing (CEN/TC 292)	**Step 1** Prepare sampling plan	**Step 2** Take sample(s) and produce laboratory sample(s)	**Step 3** Store, transport and store laboratory sample(s)	**Step 4** Prepare test sample(s) and/or test portion(s)	**Step 5** Perform extraction or leaching	**Step 6** Quantify or analyse	**Step 7** Prepare and submit testing report
(*) – Information on sampling plan preparation are given in the informative CEN/TR 15310 parts 1 and 5 (**) – Information on sample taking and reduction to laboratory sample are given in the informative CEN/TR 15310 parts 2, 3, 4 and 5 (***) – Information on a third digestion method, the alkali-fusion technique, is given in CEN/TR 15018. (****) – EN 14735 is dedicated to the preparation of waste samples for ecotoxicity tests and provides information in its Annex B on 23 ecotoxicity tests that were considered while CEN/TR 16110 is informative and gives guidance for specifying an ecotox test battery. (*****) – Information is given in the informative CEN/TR 16365.							
ecotoxicity tests	EN 14899 (*)	EN 14735 (**)	EN 14735 (**)	EN 14735 EN 15002	EN 14735 (****)	EN 14735 (****)	EN 14735 (****)
bulk density	EN 14899 (*)	(**)	(**)	EN 15002 EN ISO 60	NA	EN ISO 60	EN 15002, Clause 7 and EN ISO 60
(AP) Additional parameters shall be tested so that the test results could be calculated and/or interpreted. (NA) Step not applicable for the considered parameter.							

Annex B
(informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN national member.

This European Standard does not fall under any Directive of the EU.

In the relevant CEN countries these A-deviations are valid instead of the provisions of the European Standard until they have been removed.

Germany	
Deviation	**National Regulation**
The standards, cited in EN 16457 and given in the normative Annex A are not in line with the investigation programme of the German waste legislation. The very complex investigation strategies, which are necessary for the German waste legislation, are also not reflected in EN 16457. Moreover, EN 14899, and especially CEN/TR 15310–1 to −5 cited in the Bibliography are not usable for implementation as administrative measure.	In Germany the following regulations are valid: Verordnung über Deponien und Langzeitlager (Deponieverordnung - DepV) 27.04.2009, (Vollzitat: 'Deponieverordnung vom 27. April 2009 (BGBl. I S. 900), die zuletzt durch Artikel 5 Absatz 28 des Gesetzes vom 24. Februar 2012 (BGBl. I S. 212) geändert worden ist'). LAGA Mitteilung 32, LAGA PN 98 'Richtlinie für das Vorgehen bei physikalischen, chemischen und biologischen Untersuchungen im Zusammenhang mit der Verwertung / Beseitigung von Abfällen', 2001–12–00 and LAGA Mitteilung 35, KW/04, 2009–12–15 'Bestimmung des Gehaltes an Kohlenwasserstoffen in Abfällen – Untersuchungs- und Analysenstrategie'.

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[4] EN ISO/IEC 17025:2005, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2005)*

[5] CEN/TR 15018, *Characterization of waste - Digestion of waste samples using alkali-fusion techniques*

[6] 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*

[7] CEN/TR 15310-2, *Characterization of waste - Sampling of waste materials - Part 2: Guidance on sampling techniques*

[8] CEN/TR 15310-3, *Characterization of waste - Sampling of waste materials - Part 3: Guidance on procedures for sub-sampling in the field*

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

[10] CEN/TR 15310-5, *Characterization of waste - Sampling of waste materials - Part 5: Guidance on the process of defining the sampling plan*

[11] CEN/TR 16110, *Characterization of waste - Guidance on the use of ecotoxicity tests applied to waste*

[12] CEN/TR 16130, *Characterization of waste - On-site verification*

[13] CEN/TR 16176, *Characterization of waste - Screening methods for elemental composition by X-ray fluorescence spectrometry for on-site verification*

[14] CEN/TR 16363, *Characterization of waste - Kinetic testing for assessing acid generation potential of sulfidic waste from extractive industries*

[15] CEN/TR 16365, *Characterization of waste - Sampling of waste from extractive industries*

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