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BSI Standards Publication

Construction Products — Assessment of release of dangerous substances — Content of regulated dangerous substances — Selection of analytical methods

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National foreword

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

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Foreword

This document (CEN/TR 16045:2010) has been prepared by Technical Committee CEN/TC 351 “Construction Products − Assessment of release of dangerous substances”, the secretariat of which is held by NEN.

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

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

Under Work Item 6, Mandate M/366 describes the need for CEN standards to test the chemical content of construction products. However, in the first meeting of CEN/BT WG 176, the predecessor to CEN/TC 351 (June 2005, Gouda, The Netherlands), it was decided that a Technical Report (TR) should be drafted first. This TR was for administrative reasons given work item (WI) number 14. The background and guidelines for carrying out this work are outlined in Annex A of this report:

— a wide range of methods exist, focus will be on existing documents;

— one of the criteria for the selection of standard test methods could be the information on validation;

— content determination should not be used for certification of emissions unless this is the only practicable or legally correct solution.

It is emphasized that the focus of the CPD is on the release of dangerous substances, not on content. Content testing may only be applied for product release/emissions certification of a material if emissions testing is prohibitively expensive or when it is specifically required by regulation – for example in the case of banned substances such as certain metals or asbestos.

However, content testing may be useful as a complementary quick screening method for in-house quality control of product emissions (e.g. as a routine check of product uniformity/conformity). Content tests can also be relevant within the scope of the continuous surveillance by the approved bodies or further testing of samples by the manufacturer (see Annex III of the CPD).

Content testing methods may or may not be relevant to predicting the release to soil, surface and groundwater or the emission into indoor air. However, there are precedents for content-testing-type methods being used as a guide to release and emissions.

An example for this concept is the German "regulation" for cementitious materials in contact with drinking water, which includes content values for some trace elements in cements as screening test (German DVGW Worksheet W 347, [2]). These values are not a criterion for exclusion, but the meaning is that leaching tests for trace elements on test pieces (mortar or concrete) are only necessary if the total trace element content in the cement is above these values.

Other examples of standards committees and industries that have followed this route in relation to compounds that could emit into indoor air include paints and varnishes (ref.: EN ISO 17895), wood-based panels (ref.: EN 120 and EN 717-2), toy testing (ref.: EN 71-11:2005, Annex B), the car industry for interior trim components (e.g. Method VDA 278 and similar standards) and hard disk drive manufacturers (various company-specific test protocols for emissions from PC components). Most of these methods use gas extraction at elevated temperatures combined with GC-MS as the analytical approach. This methodology has the advantage that it is similar to the analytical approach used in formal emissions test methods, which means that, in some instances, there is a degree of qualitative and quantitative

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correlation between the content-type test method and reference emissions test methods. There are however limitations. The VOC content will unlikely bear any relationship to an emission profile in the case of composite construction products or materials in which the VOCs are encapsulated or otherwise locked-in to the product to prevent emission. Content testing is also not relevant to assessing secondary emissions.

Because of the similarity of the analytical methods for digests and eluates from leaching, for reasons of completeness and efficiency (no separate report necessary) the analysis of eluates from leaching is also covered in this Technical Report. To make a separate report would lead to an almost full duplication of the present report. The additional benefit of addressing both aspects is the coherence that is becoming obvious from Figure 1.

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1 Scope

This Technical Report describes appropriate standard test methods for the determination of the content of regulated dangerous substances in construction products. Because of the similarity of the analytical methods for digests and eluates from leaching, the analysis of eluates from leaching is also covered.

This Technical Report is relevant to all substances covered by the provisions of the main body of Mandate M/366, i.e. those included in the work programme for the emission into indoor air, and release to surface water, ground water and soil.

The list of regulated substances provided by the Commission in document "Indicative list of regulated dangerous substances" [1] defines the substances, for which analytical methods for content will in principle be needed. This report will be limited to this list.

NOTE 1 Sampling for content analysis is addressed by applying the relevant product standards and or by applying WI 00351013, *Construction products — Assessment of release of dangerous substances — Complement to sampling* (TR 4) [7] in case the sampling protocol for technical properties does not adequately address requirements in testing posed by the assessment of release to soil, surface and groundwater.

NOTE 2 Based on this selection of appropriate test methods from other fields, horizontal test methods for analysing the chemical content of construction products will be developed as ENs.

NOTE 3 In Annex B a compilation is given of the content regulations for construction products for health or environmental reasons.

2 Abbreviations, terms and definitions

NOTE In this paragraph some of the abbreviations and terms used in this report, are defined.

2.1 Abbreviations

AES	atomic emission spectrometry
CPD	construction products directive
DOC	dissolved organic carbon
DS	dangerous substances
HPLC	high-performance liquid chromatography, high-pressure liquid chromatography
ICP	inductively coupled plasma
GC	gas chromatography
MS	mass spectrometry
OES	optical emission spectrometry
SVOC	semi-volatile organic compounds
TD	thermal desorption
TOC	total organic carbon
VOC	volatile organic compounds

VVOC very volatile organic compounds

NOTE There are several definitions of VVOC, VOC and SVOC in use:

a) by the World Health Organization (WHO):

VVOC
boiling point is in the range from < 0 °C (50 °C to 100 °C)

VOC
boiling point is in the range from (50 °C to 100 °C) to (240 °C to 260 °C)

SVOC
boiling point is in the range from (240 °C to 260 °C) to (380 °C to 400 °C)

b) by European Collaborative Action Report No 18:

VVOC
all compounds which, in a capillary column coated with 100 % dimethylpolysiloxane, are eluted before n-hexane

VOC
all volatile organic compounds which, in a capillary column coated with 100 % dimethylpolysiloxane, are eluted with a retention range between n-hexane and n-hexadecane

SVOC
all semi-volatile organic compounds which, in a capillary column coated with 100 % dimethylpolysiloxane, are eluted with a retention range between n-hexadecane and n-docosane

c) by some national regulations and RL 2004/42/EG:

VOC
any organic compound having an initial boiling point less than or equal to 250 °C measured at a standard pressure of 101,3 kPa

2.2 Terms and definitions

For the purposes of this document, the terms and definitions in the CEN/TC 351 document on Terminology (CEN/TC 351 N 0218, under development) and the following apply.

2.2.1
digest
solution resulting from acid digestion of a test sample

2.2.2
digestion
mineralization of the organic matter of a sample and dissolution of its mineral part (as completely as possible) when reacted with a reagent mixture

NOTE Usually done with a strong, concentrated acid like aqua regia or nitric acid to solve inorganic substances for chemical analysis.

2.2.3
eluate
solution obtained from a laboratory leaching test of a test sample

2.2.4
extract
solution resulting from extraction of a test sample with a solvent

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2.2.5
extraction
dissolution of substances from a sample into a solvent for subsequent chemical analysis

NOTE Usually done with an organic solvent to extract organic substances for chemical analysis or for special analysis of inorganic substances.

2.2.6
product matrix
main composition of the product dictating the manner of sample pre-treatment and the type of digestion or extraction for later chemical analysis

NOTE For construction products for example the following product matrices could be distinguished: silica-based products, bituminous products, metals, wood-based products, plastics and rubbers, sealants and adhesives, and paints and coatings.

3 Approach

The first question was how to group content test methods by type of target compound and sample matrix. The separation into different matrix types is related to the nature of the matrix, the ease of size reduction, mode of sample handling and the suitability for digestion by acids or extraction by organic solvents.

It was suggested that most construction products and materials fall into one or more of the following main categories of product matrices:

— silica-based products (S) (includes calcerous and stony like materials);

— bituminous products (B);

— metals (M);

— wood-based products (W);

— plastics and rubbers (P);

— sealants and adhesives (A);

— paints and coatings (C).

EXAMPLES Examples of products that could fall into more than one category are:

1) structured wall paper may contain wood-based material (paper) and plastics (PVC-P foam);

2) fibre-reinforced concrete containing silica (concrete) and wood-based (wood-fibres);

3) painted steel containing metal and paint or a coating;

4) pipes made from mineral-fibre-reinforced PVC (PVC-GF) containing plastics and silica.

When the materials can be separated easily, the product may be considered as consisting of two separately quantified constituents. When a material is made inseparable from the composite it can be regarded as one product to be tested as a whole. In the examples above example 1) and 3) would fall in the first group and 2) and 4) in the second group.

Similarly, the various target chemical analytes can be grouped as follows:

— volatile organics (primary interest for emissions to indoor air);

— semi- and non-volatile organics (interest for both emissions to indoor air and impact to soil and groundwater);

— inorganic substances – Metals and salts (primarily of interest for impact to soil and groundwater).

Product matrices and groups of analytes can also be categorised according to the typical preparation and analytical methods. These include:

— gas extraction of volatile organics from the sample matrix and analysis by GC-MS or HPLC;

— solvent extraction of organics from the sample matrix and analysis by GC-MS or HPLC;

— analysis of metals and salts almost always involves some form of matrix digestion followed by ICP-AES or ICP-MS;

— specific procedures of sample dissolution and analysis are required for some specific inorganic analysed items such as Cr (VI);

— other content properties such as fibres are described as a separate group.

These classifications are used to categorise the various available content test methods in the sections that follow.

Since the methods for analysing the chemical content of digests (inorganic substances) and organic extracts (organic substances) are not very different from the analytical methods needed for analysis of eluates from leaching tests, it is therefore most practical to integrate a summary of possible analytical methods for eluate analysis in the present document (see Figure 1). It must be realised, however, that water extracts from leaching normally require an additional solvent extraction step to concentrate the organic substances of interest for analysis. In addition, the analytical methods used for the analysis of VOC, VVOC and SVOC are similar to the methods used for analysing organic substances in extracts. In Figure 1 below the possible options for content analysis, digestion and extraction as well as trapping volatiles on sorbents is schematically shown.

NOTE 1 There are many standards in the field of the metal alloy composition. In Annex C a list is given. These standards are **not** considered in this report, as these methods are not focused on environmental questions, but rather on impurities of the metal.

NOTE 2 The water quality standards for metal content determination are given in Table 14 "Analytical methods for inorganic substances in eluates" (see 5.2).

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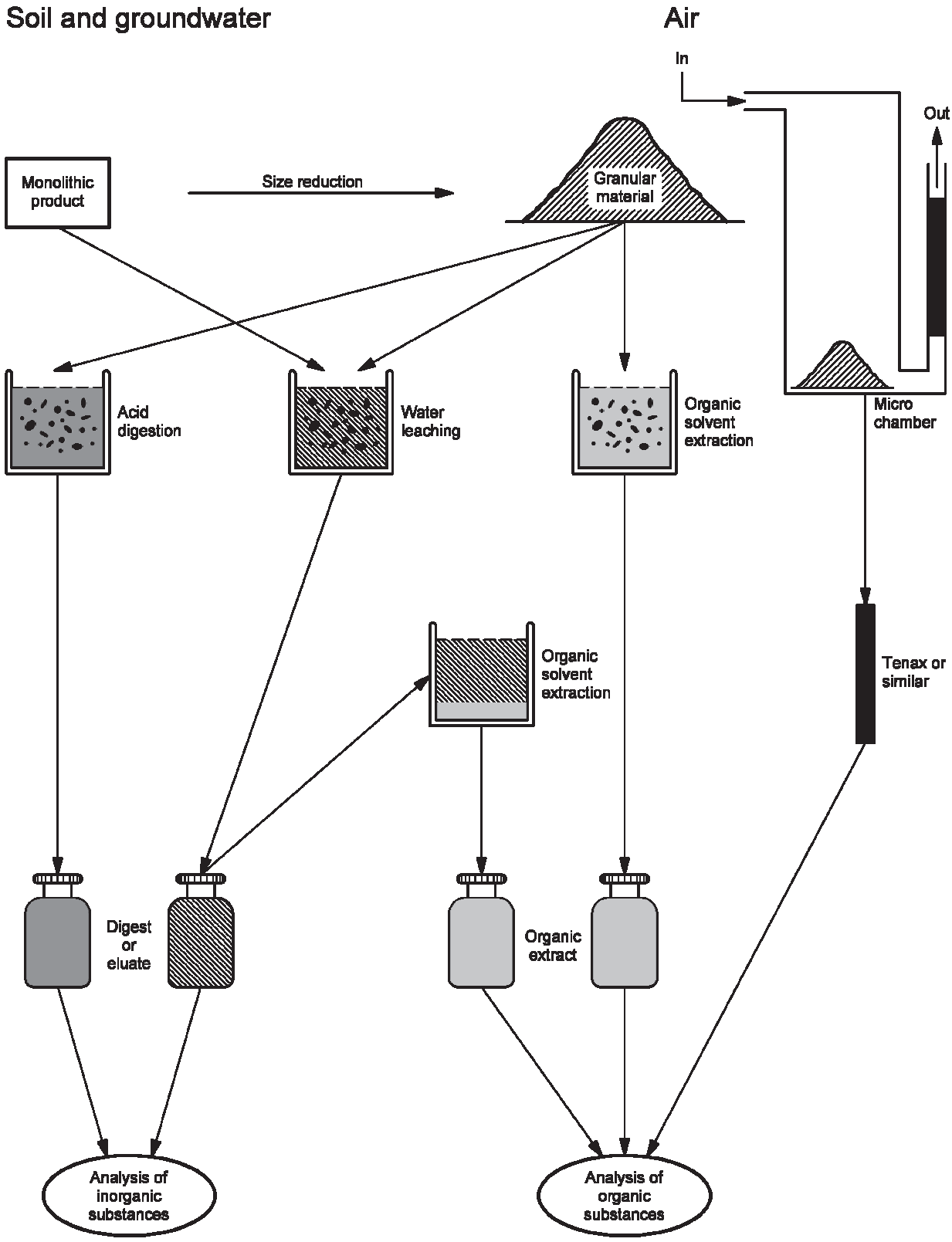

Figure 1 — Principles of horizontal analytical methods

4 Available content test methods

4.1 Introduction

The following tables of test methods are arranged following the approach outlined above.

The order of standards is EN, EN ISO, ISO, national and other documents. National and other methods are only mentioned when there is no EN, EN ISO or ISO available.

NOTE The documents named "CSS xxxxx" have been prepared by CEN/TC 400 "Project Committee − Horizontal standards in the fields of sludge, biowaste and soil" (formerly CEN/BT TF 151). They currently are in the process of being transposed into EN standards.

4.2 Inorganic substances

4.2.1 Major, minor and trace elements

4.2.1.1 General

The inorganic substances comprise all major, minor and trace elements listed in the "Indicative list of regulated dangerous substances" [1].

The methods given will generally be applicable to a wider range of inorganic substances than those listed in the "Indicative list of regulated dangerous substances" [1]. Table 1 is a draft list of metals and their compounds to be considered. The availability of methods for digestion and for analysis is indicated. The methods themselves are presented in more detail in the next paragraphs. 4.2.1.2 deals with digestion methods (Table 2); 4.2.1.3 with analytical methods (Table 3).

NOTE 1 For the analysis of inorganic substances in digests many regulations refer to the methods for the analysis of inorganic substances in water, even though digests have a much higher ionic strength. The methods for the analysis of inorganic substances in water are collected in 5.2.

NOTE 2 Some elements may not be relevant from a regulatory point of view, but may be very important for the characterization of the product. Hence methods for these elements are also given in this table.

4.2.1.2 Digestion methods for major, minor and trace elements

The digestion methods for major, minor and trace elements are given in Table 2. In the table seven different matrices are identified, for which the expected suitability of the listed method or uncertainties therein are indicated. Explanations are given in footnotes at the bottom of the table.

Several methods developed in the environmental field are multi-element methods. So instead of listing all elements in the table "major, minor and trace elements" is given as indication that the digestion methods are suitable for many elements, which may not all have been analysed. Chemical forms cannot be assessed, as the chemical form changes after relative aggressive digestions, such as aqua regia or nitric acid digestion, e.g. Cr (VI) cannot be assessed.

Methods for separation and subsequent analysis of minor or trace substances in metals have not been developed to address environmental concerns, but are mainly intended to measure impurities affecting the technical quality of a material. The methods generally have a narrow scope with the exception of EN 24242. In case of a small impurity of, for instance Ni in Zn, the main component Zn is the one to concentrate on from an environmental perspective and the Ni is of minor importance from an environmental perspective.

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Table 1 — Major, minor and trace elements to be considered under the CPD and available test methods

Substance or substance subgroup	Chemical Abstract Service Number (CAS)	Test methods for digestion available [a]	Test methods for analysis available
Multi-element, multi-matrix methods			
Major, minor and trace elements	n/a	CSS 99025A CSS 99025B	 CSS 99026 CSS 99027
Multi-element, single-matrix methods			
Major, minor and trace elements	n/a	CSS 99025A CSS 99025B DIN 53770-16 EN 12506 EN 13346 EN 13656 EN 13657 EN 14242 ISO 6713 ISO 11466 ISO 14869-1 ISO 14869-2 ISO 11047	 CSS 99026 CSS 99027 DIN 53770-16 EN 12506 EN 14242 ISO 11047
Single element methods [b]			
Chromium	7440-47-3	ISO 3856-6	ISO 3856-6
Selenium	7782-49-2	ISO 20280	ISO 20280
Lead and its compounds	7439-92-1	EN 12441-3 IEC 62321 ISO 3856-1 ISO 6503	 ISO 3856-1 ISO 6503
Cadmium	7440-43-9	EN 1122 EN 12441-3 IEC 62321 ISO 3856-4	EN 1122 ISO 3856-4
Nickel and its compounds	7440-02-0	EN 12441-9	EN ISO 17294-2
Mercury and its compounds	7439-97-6	CSS 99030 IEC 62321 ISO 16772	CSS 99030 ISO 16772
Tin	7440-31-5	EN 12441-7 EN 12441-8	EN 12506
Antimony	7440-36-0	EN 13656 ISO 3856-2 ISO 20280	EN ISO 17294-2 ISO 3856-2 ISO 20280
Arsenic	7440-38-2	ISO 20280	ISO 20280
Aluminium	7429-90-5	EN 12441-6 ISO 14869-1 ISO 14869-2	CSS 99026 CSS 99027
Calcium	7440-70-2	ISO 14869-2	CSS 99026 CSS 99027
Silicon	7440-21-3	EN 12441-2 ISO 14869-2	CSS 99026 CSS 99027

[a] Not all methods for analysis can be combined with all methods for extraction mentioned. Individual standards need to be checked.

[b] All multi-element methods can be applied to quantify single elements. Not all methods for analysis go with all methods for extraction mentioned.

Table 2 — Digestion methods for major, minor and trace elements

Standard	Title	Substance(s)	Digest from product matrices [a] [b]						
			S	B	M	W	P	A	C
Multi-element, multi-matrix methods									
CSS 99025A (To be published)	Digestion of soil sludge, biowaste and waste for the extraction of nitric acid soluble elements	Major, minor and trace elements	+	+	+	+	+ #	+ #	+
CSS 99025B (To be published)	Digestion of soil sludge, biowaste and waste for the extraction of aqua regia soluble elements	Major, minor and trace elements	+	+	+	+	+ #	+ #	+
Multi-element, single-matrix methods									
EN 13346	Characterization of sludges – Determination of trace elements and phosphorus – Aqua regia extraction methods	As, Cd, Cr, Cu, Hg, Ni, Pb, Se, Zn, P	+	+	+	+	+ #	+ #	+
EN 13656 [c]	Characterization of waste – Microwave assisted digestion with hydrofluoric (HF), nitric (HNO_3) and hydrochloric (HCl) acid mixture for subsequent determination of elements	Major, minor and trace elements	+	+	+	+	+ #	+ #	+
EN 13657	Characterization of waste – Digestion for subsequent determination of aqua regia soluble portion of elements	Major, minor and trace elements	+	+	+	+	+ #	+ #	+
EN 14242	Aluminium and aluminium alloys – Chemical analysis – Inductively coupled plasma optical emission spectral analysis	Si, Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Ga, V, Be, Bi, Ca, Cd, Co, Li, Na, Pb, Sb, Sn, Sr, Zr	0	0	+ @	0	0	0	0
EN 62321	Electrotechnical products – Determination of levels of six regulated substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ethers)	Pb, Hg, Cd, Cr (VI), PBB, PBDE	0	0	+?	0	0	0	0
ISO 6713	Paints and varnishes – Preparation of acid extracts from paints in liquid or powder form	Acid extracts	0	0	0	0	0	0	+
ISO 11047	Soil quality – Determination of cadmium, chromium, cobalt, copper, lead, manganese, nickel and zinc – Flame and electrothermal atomic absorption spectrometric methods	Cd, Cr, Co, Cu, Pb, Mn, Ni, Zn	+	0	0	0	0	0	0
ISO 11466	Soil quality – Extraction of trace elements soluble in aqua regia	Trace elements	+	0	0	0	0	0	0
ISO 14869-1	Soil quality – Dissolution for the determination of total element content – Part 1: Dissolution with hydrofluoric and perchloric acids	Al, Ba, Cd, Ca, Cs, Cr, Co, Cu, Fe, K, Li, Mg, Mn, Na, Ni, P, Pb, Sr, V, Zn	+	0	0	0	0	0	0
ISO 14869-2	Soil quality – Dissolution for the determination of total element content – Part 2: Dissolution by alkaline fusion	Na, K, Mg, Ca, Ti, Mn, Fe, Al, Si	+	0	0	0	0	0	0

Standard	Title	Substance(s)	Digest from product matrices [a] [b]						
			S	B	M	W	P	A	C
ISO 20280	Soil quality – Determination of arsenic, antimony and selenium in aqua regia soil extracts with electrothermal or hydride-generation atomic absorption spectrometry	As, Sb, Se	+	0	0	0	0	0	0
DIN 53770-16 (Can be made available in English)	Pigments and extenders – Determination of matter soluble in hydrochloric acid – Part 16: Determination of 12 elements by inductively coupled plasma atomic emission spectroscopy	As, Ba, Cd, Co, Cr, Cu, Mn, Ni, Pb, Sb, Se, Zn	0	0	0	0	0	0	+
Single element methods									
CSS 99030 (To be published)	Soil, sludge and treated biowaste – Determination of mercury in aqua regia and nitric acid digests – Cold vapour atomic absorption spectrometry and cold vapour atomic fluorescence spectrometry methods	Hg	+	+	0	+	+#	0	+
EN 1122	Plastics – Determination of cadmium – Wet decomposition method	Cd	0	0	0	0	+	0	0
EN 62321 [d]	Electrotechnical products – Determination of levels of six regulated substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ethers)	Pb, Hg, Cd, Cr (VI), PBB, PBDE	0	0	+?	0	0	0	0
ISO 3856-1	Paints and varnishes – Determination of "soluble" metal content – Part 1: Determination of lead content − Flame atomic absorption spectrometric method and dithizone spectrometric method	Pb	0	0	0	0	0	0	+
ISO 3856-2	Paints and varnishes – Determination of "soluble" metal content – Part 2: Determination of antimony content − Flame atomic absorption spectrometric method and Rhodamine B spectrophotometric method	Sb	0	0	0	0	0	0	+
ISO 3856-4	Paints and varnishes – Determination of "soluble" metal content – Part 4: Determination of cadmium content − Flame atomic absorption spectrometric method and polarographic method	Cd	0	0	0	0	0	0	+
ISO 3856-5	Paints and varnishes – Determination of "soluble" metal content – Part 5: Determination of hexavalent chromium content of the pigment portion of the liquid paint or the paint in powder form − Diphenylcarbazide spectrophotometric method	Cr (IV)	0	0	0	0	0	0	+

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Standard	Title	Substance(s)	Digest from product matrices [a b]						
			S	B	M	W	P	A	C
ISO 3856-6	Paints and varnishes – Determination of "soluble" metal content – Part 6: Determination of total chromium content of the liquid portion of the paint − Flame atomic absorption spectrometric method	Cr	0	0	0	0	0	0	+
ISO 6503	Paints and varnishes – Determination of total lead – Flame atomic absorption spectrometric method	Pb	0	0	0	0	0	0	+
ISO 6713	Paints and varnishes – Preparation of acid extracts from paints in liquid or powder form	Acid extracts	0	0	0	0	0	0	+
ISO 11047	Soil quality – Determination of cadmium, chromium, cobalt, copper, lead, manganese, nickel and zinc − Flame and electrothermal atomic absorption spectrometric methods	Trace elements	+	0	0	0	0	0	0
ISO 14869-1	Soil quality – Dissolution for the determination of total element content – Part 1: Dissolution with hydrofluoric and perchloric acids	Trace elements	+	0	0	0	0	0	0

[a] S – silica-based products; W – wood-based products; A – adhesives and sealants; B – bituminous products; P – plastics and rubbers; C – coatings and paints; M – metals

[b] + – suitable for the specified matrix; # – possibly after cryogenic size reduction; 0 – not relevant; ? – relevance not known yet; @ – only Al and Al alloys, Zn and Zn alloys

[c] Designed as single-matrix method, but probably suited for other matrices.

[d] This standard is a collection of different procedures.

4.2.1.3 Analytical methods for major, minor and trace elements

The most common analytical methods for major, minor and trace elements are given in Table 3. Content analysis for most inorganic substances is based on digestion in acid followed by analysis using an optical method. Recent developments have favoured multi-element analysis techniques such as ICP (inductively coupled plasma). For digestion, aqua regia is the most commonly applied acid mixture to extract inorganic substances. It is not a method that will provide a true total content, as generally a full digestion of the silicate matrix will be required for that. From an environmental perspective, however, aqua regia is more than adequate. Only when mass balance calculations are needed possibly true total content methods may be needed.

Methods for the analysis of substances in natural water are many, but may not be relevant for high concentrated extracts from construction products (methods for the analysis of eluates are indicated in 5.1). In the table seven different matrices are identified, for which the expected suitability of the listed method or uncertainties therein are indicated. Explanations are given in footnotes at the bottom of the table.

Table 3 — Analytical methods for major, minor and trace elements

Standard	Title	Substance(s)	Digest from product matrices [a] [b]						
			S	B	M	W	P	A	C
Multi-element, multi-matrix methods									
CSS 99026 (To be published)	Soils, sludges, sediments and treated bio-wastes – Trace elements – Method by inductively coupled plasma – Atomic Emissions Spectrometry (ICP-AES)	Major, minor and trace elements: Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Ce, Co, Cr, Cu, Fe, K, Hg, La, Li, Mg, Mn, Mo, Na, Nd, Ni, Ni, P, Pb, Pr, S, Sb, Sc, Se, Si, Sm, Sn, Sr, Te, Ti, Tl, U, V, W, Zn, Zr	+	+	+	+	+#	+#	+
CSS 99027 (To be published)	Soils, sludges, sediments and treated bio-wastes – Trace elements – Method by inductively coupled plasma – Mass Spectrometry (ICP-MS)	Major, minor and trace elements: Ag, Al, As, Au, B, Ba, Be, Bi, Ca, Cd, Ce, Co, Cr, Cs, Cu, Dy, Er, Eu, Fe,Ga, Gd, Ge, Hf, Hg, Ho, In, Ir, K, La, Li, Lu, Mg, Mn, Mo, Na, Nd, Ni, P, Pb, Pd, Pr, Pt, Rb, Re, Rh, Ru, S, Sb, Sc, Se, Si, Sm, Sn, Sr, Tb, Te, Th, Ti, Tl, Tm, U, V, W, Y, Yb, Zn, Zr	+	+	+	+	+#	+#	+
Multi-element, single-matrix methods									
EN 12506	Characterization of waste – Analysis of eluates – Determination of pH, As, Ba, Cd, Cl^-, Co, Cr, Cr (VI), Cu, Mo, Ni, NO_2^-, Pb, total S, SO_4^{2-}, V and Zn	As, Ba, Cd, Cl, Co, Cr, Cr (VI), Cu, Mo, Ni, NO_2, Pb, total S, SO_4^{2-}, V, Zn	+	?	+	+	?	?	+
EN 14242	Aluminium and aluminium alloys – Chemical analysis – Inductively coupled plasma optical emission spectral analysis	Si, Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Ga, V, Be, Bi, Ca, Cd, Co, Li, Na, Pb, Sb, Sn, Sr, Zr	0	0	+ @	0	0	0	0
ISO 11047	Soil quality – Determination of cadmium, chromium, cobalt, copper, lead, manganese, nickel and zinc in aqua regia extracts of soil – Flame and electrothermal atomic absorption spectrometric methods	Cd, Cr, Co, Cu, Pb, Mn, Ni, Zn	+	0	0	0	0	0	0
ISO 20280	Soil quality – Determination of arsenic, antimony and selenium in aqua regia soil extracts with electrothermal or hydride-generation atomic absorption spectrometry	As, Sb, Se	+	0	0	0	0	0	0

Standard	Title	Substance(s)	Digest from product matrices [a] [b]						
			S	B	M	W	P	A	C
DIN 53770-16 (Can be made available in English)	Pigments and extenders – Determination of matter soluble in hydrochloric acid – Part 16: Determination of 12 elements by inductively coupled plasma atomic emission spectroscopy	As, Ba, Cd, Co, Cr, Cu, Mn, Ni, Pb, Sb, Se, Zn							
Single element methods									
CSS 99030 (To be published)	Soil, sludge and treated biowaste – Determination of mercury in aqua regia and nitric acid digests – Cold vapour atomic absorption spectrometry and cold vapour atomic fluorescence spectrometry methods	Hg	+	+	0	+	+#	0	+
EN 1122	Plastics – Determination of cadmium – Wet decomposition method	Cd	0	0	0	0	+	0	0
ISO 3856-1	Paints and varnishes – Determination of "soluble" metal content – Part 1: Determination of lead content − Flame atomic absorption spectrometric method and dithizone spectrophotometric method	Pb	0	0	0	0	0	0	+
ISO 3856-2	Paints and varnishes – Determination of "soluble" metal content – Part 2: Determination of antimony content − Flame atomic absorption spectrometric method and Rhodamine B spectrophotometric method	Sb	0	0	0	0	0	0	+
ISO 3856-4	Paints and varnishes – Determination of "soluble" metal content – Part 4: Determination of cadmium content − Flame atomic absorption spectrometric method and polarographic method	Cd	0	0	0	0	0	0	+
ISO 3856-6	Paints and varnishes – Determination of "soluble" metal content – Part 6: Determination of total chromium content of the liquid portion of the paint − Flame atomic absorption spectrometric method	Cr	0	0	0	0	0	0	+
ISO 6503	Paints and varnishes – Determination of total lead – Flame atomic absorption spectrometric method	Pb	0	0	0	0	0	0	+
ISO 16772	Soil quality – Determination of mercury in aqua regia soil extracts with cold-vapour atomic spectrometry or cold-vapour atomic fluorescence spectrometry	Hg	+	0	0	0	0	0	0

Standard	Title	Substance(s)	Digest from product matrices [a] [b]						
			S	B	M	W	P	A	C

[a] S – silica-based products; W – wood-based products; A – adhesives and sealants; B – bituminous products; P – plastics and rubbers; C – coatings and paints; M – metals

[b] + – suitable for the specified matrix; # – possibly after cryogenic size reduction; 0 – not relevant; ? – relevance not known yet; @ – only Al and Al alloys, Zn and Zn alloys

4.2.2 Anions

4.2.2.1 General

The anions comprise substances like Cl^-, SO_4^{2-}, which generally require a different dissolution technique, since the anions added with the agua regia acid mixture (Cl^-, NO_3^-) interfere with the analysis of anions of interest. In Table 4 the inorganic substances to be considered according to the indicative list (N 0230) are listed, as are the available test methods.

Table 4 — Anions to be considered under the CPD and available test methods

Substance or substance subgroup	Chemical Abstract Service Number (CAS)	Test methods for digestion available [a]	Test methods for analysis available [a]
N-Compounds (Nitrate, Ammonium)	n/a	CSS 99019 EN ISO 787-13 EN ISO 787-19	 EN ISO 787-13 EN ISO 787-19
Bromide	n/a	CEN/TR 15018 EN 14582 EN ISO 15061	 EN 14582
Chloride	n/a	CEN/TR 15018 EN 1744-5 EN 14582 EN ISO 787-13 EN ISO 4615	 EN 1744-5 EN 14582 EN ISO 787-13 EN ISO 4615
Cyanide	57-12-5	CEN/TR 15018 ISO 11262 ISO 17380	 ISO 11262 ISO 17380
Fluoride	n/a	CEN/TR 15018 EN 14582	 EN 14582
Sulphate	n/a	CEN/TR 15018 EN 14582 EN ISO 787-13	 EN 14582 EN ISO 787-13

[a] Not all methods for analysis can be combined with all methods for extraction mentioned. Individual standards need to be checked.

4.2.2.2 Digestion methods for anions

The digestion and dissolution methods for anions are given in Table 5. In the table seven different matrices are identified, for which the expected suitability of the listed method or uncertainties therein are indicated. Explanations are given in footnotes at the bottom of the table, where appropriate.

Table 5 — Digestion methods for anions

Standard	Title	Substance(s)	Product matrices [a] [b]						
			S	B	M	W	P	A	C
CSS 99019	Soil, sludge and treated biowaste – Determination of ammonium nitrogen and nitrate nitrogen after extraction with 1 M potassium chloride	NH_4, NO_3	+	0	0	0	0	0	0
EN 1744-5	Tests for chemical properties of aggregates – Part 5: Determination of acid soluble chloride salts	Cl	+	?	0	0	?	?	+
EN 14582	Characterization of waste - Halogen and sulfur content – Oxygen combustion in closed systems and determination methods	Cl, Br, F, SO_4	+	+	0	+	+	+	+
CEN/TR 15018	Characterization of waste – Digestion of waste samples using alkali-fusion techniques	Cl, Br, F, SO_4, CN	+	?	+	+	?	?	+
EN ISO 787-13	General methods of test for pigments and extenders – Part 13: Determination of water-soluble sulfates, chlorides and nitrates (ISO 787-13:2002)	SO_4, Cl, NO_3	0	0	0	0	0	0	+
EN ISO 787-19	General methods of test for pigments - Part 19: Determination of water-soluble nitrates (Salicyclic acid method) (ISO 787-19:1974)	NO_3	0	0	0	0	0	0	+
EN ISO 4615	Plastics – Unsaturated polyesters and epoxide resins – Determination of total chlorine content (ISO 4615:1979)	Cl	0	0	0	0	+	0	0
ISO 11262	Soil quality – Determination of cyanide	CN	+	?	0	?	?	?	?
ISO 17380	Soil quality – Determination of total cyanide and easily released cyanide – Continuous-flow analysis method	CN	+	0	0	0	0	0	0

[a] S – silica-based products; W – wood-based products; A – adhesives and sealants; B – bituminous products; P – plastics and rubbers; C – coatings and paints; M – metals

[b] + – suitable for the specified matrix; ? – relevance not known yet; 0 – not relevant

4.2.2.3 Analytical methods for anions

The most common analytical methods for anions are given in Table 6. In the table seven different matrices are identified, for which the expected suitability of the listed method or uncertainties therein are indicated. Explanations are given in footnotes at the bottom of the table, where appropriate.

Table 6 — Analytical methods for anions

Standard	Title	Substance(s)	Digest from product matrices [a] [b]						
			S	B	M	W	P	A	C
Multi-element methods									
EN 14582	Characterization of waste – Halogen and sulfur content – Oxygen combustion in closed systems and determination methods	Cl, Br, F, S	+	+	0	+	+	+	+
EN ISO 787-13	General methods of test for pigments and extenders – Part 13: Determination of water-soluble sulfates, chlorides and nitrates (ISO 787-13:2002)	SO_4, Cl, NO_3	0	0	0	0	0	0	+
Single-element methods									
EN 1744-5	Tests for chemical properties of aggregates – Part 5: Determination of acid soluble chloride salts	Cl	+	?	0	0	?	?	+
EN ISO 787-19	General methods of test for pigments - Part 19: Determination of water-soluble nitrates (Salicyclic acid method) (ISO 787-19:1974)	NO_3	0	0	0	0	0	0	+
EN ISO 4615	Plastics – Unsaturated polyesters and epoxide resins – Determination of total chlorine content (ISO 4615:1979)	Cl	0	0	0	0	+	0	0
ISO 11262	Soil quality – Determination of cyanide	CN	+	?	0	?	?	?	?
ISO 17380	Soil quality – Determination of total cyanide and easily released cyanide – Continuous-flow analysis method	CN	+	0	0	0	0	0	0

[a] S – silica-based products; W – wood-based products; A – adhesives and sealants; B – bituminous products; P – plastics and rubbers; C – coatings and paints; M – metals

[b] + – suitable for the specified matrix; ? – relevance not known yet; 0 – not relevant

4.2.3 Special analysis of Cr (VI)

For the analysis of Cr (VI) a specific analytical approach is required (see Table 7). As mentioned earlier, digestion methods such as aqua regia and nitric acid will change the chemical speciation. This means that, for the analysis of specific chemical forms like chromate (Cr (VI)), special dissolution methods are required to maintain the chemical form as present in the sample. Chromate is of relevance as it is far more toxic than the trivalent form of Cr.

Table 7 — Specific element to be considered under the CPD and available test methods

Substance or substance subgroup	Chemical Abstract Service Number (CAS)	Test methods for extraction available [a]	Test methods for analysis available [a]
Chromium (VI)	18540-29-9	DIN 53770-8 EN 196-10 EN 15192 EN 15205 IEC 62321 ISO 3856-5	DIN 53770-8 EN 196-10 EN 15192 EN 15205 EN 62321 ISO 3856-5
[a] Not all methods for analysis can be combined with all methods for extraction mentioned. Individual standards need to be checked.			

Table 8 covers the available methods for the extraction and analysis of Cr (VI).

Table 8 — Methods for extraction and analysis of Cr (VI)

Standard	Title	Substance(s)	Product matrices [a b]						
			S	B	M	W	P	A	C
EN 196-10	Methods of testing cement – Part 10: Determination of the water-soluble chromium (VI) content of cement	Cr (VI)	+	0	0	0	0	0	0
EN 15192	Characterization of waste and soil – Determination of Chromium(VI) in solid material by alkaline digestion and ion chromatography with spectrophotometric detection	Cr (VI)	+	0	0	+	0	0	0
EN 15205 [c]	Determination of hexavalent chromium in corrosion protection layers – Qualitative analysis	Cr (VI)	0	0	0	0	0	0	+
EN 62321	Electrotechnical products – Determination of levels of six regulated substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ethers)	Pb, Hg, Cd, Cr (VI), PBB, PBDE	0	0	0	0	+	0	0
ISO 3856-5	Paints and varnishes – Determination of "soluble" metal content – Part 5: Determination of hexavalent chromium content of the pigment portion of the liquid paint or the paint in powder form − Diphenylcarbazide spectrophotometric method	Cr (VI)	0	0	0	0	0	0	+
DIN 53770-8 (Can be made available in English)	Pigments and extenders – Determination of matter soluble in hydrochloric acid – Part 8: Chromium (VI) content	Cr (VI)	0	0	0	0	0	0	+

[a] S – silica-based products; W – wood-based products; A – adhesives and sealants; B – bituminous products; P – plastics and rubbers; C – coatings and paints; M – metals;

[b] + – suitable for the specified matrix; 0 – not relevant

[c] Qualitative method not aimed for in ER 3.

4.2.4 Non-destructive methods

The non-destructive methods are given in Table 9. Non-destructive methods differ significantly from any of the other wet-chemical methods in that they require a completely different sample preparation, analytical equipment and data handling. As such it is justified to make this a separate category.

Table 9 — Instrumental quantification methods for major, minor and trace elements

Standard	Title	Substance(s)	Product matrices [a b]						
			S	B	M	W	P	A	C
EN 13925-2	Non-destructive testing – X-ray diffraction from polycrystalline and amorphous materials – Part 2: Procedures.	Lead and other heavy metals	0	0	0	0	+	0	+
EN 15309	Characterization of waste and soil – Determination of elemental composition by X-ray fluorescence	Major, minor and trace elements, including those in Table 1 which can be assessed with XRF	+	-	+	+	+?	+	+

[a] S – silica-based products; W – wood-based products; A – adhesives and sealants; B – bituminous products; P – plastics and rubbers; C – coatings and paints; M – metals

[b] + – suitable for the specified matrix; ? – relevance not known yet; 0 – not relevant

4.3 Total organic carbon

In Table 10 the pre-treatment and analytical methods for total organic carbon (TOC) are given. It is likely that EN 15936 (the former CSS 99024) and EN 13137 will be merged to one horizontal standard for TOC covering four matrices.

NOTE TOC is a different substance from organic substances and compounds (contaminants) like formaldehyde, VOCs, etc. Total organic carbon consists of organic matter like plant detritus, peat and other humic substances. It may occur in several construction products as a natural component, as a result of mixing or as remnants of a combustion process. The material is ill defined in terms of chemical formula in contrast to well defined substances like PAHs and PCBs. TOC is highly relevant for its retention capacity for organic contaminants as well as for metals.

Table 10 — Quantification methods for TOC

Standard	Title	Substance(s)	Product matrices [a b]						
			S	B	M	W	P	A	C
EN 13137	Characterization of waste – Determination of total organic carbon (TOC) in waste, sludges and sediments	TOC	+	+	0	+	?	?	+
prEN 15936 (the former CSS 99024)	Sludge, treated biowaste, soil and waste − Determination of total organic carbon (TOC) by dry combustion	TOC	+	+	0	+	?	?	+

[a] S – silica-based products; W – wood-based products; A – adhesives and sealants; B – bituminous products; P – plastics and rubbers; C – coatings and paints; M – metals

[b] + – suitable for the specified matrix; ? – relevance not known yet; 0 – not relevant

4.4 Organic substances

4.4.1 General

Content testing methods for all the organic substances listed in the "Indicative list" [1] (see Table 11) are divided into gas extraction procedures for volatile and some semi-volatile organic compounds (see 4.4.2) and solvent extraction methods, used predominantly for semi-volatile and non-volatile organic compounds (see 4.4.3). In either case, extracted organics are subsequently analysed by GC-MS or HPLC-MS. For the substances listed here, many standard methods cover both extraction and analysis.

NOTE 1 Some reactive organic compounds, such as formaldehyde, require an additional chemical derivatisation step prior to chromatographic analysis.

Gas or liquid extraction procedures can be applied directly to some sample matrices – for example: liquids, emulsions, pastes, resins, powders, granules, fibres and films. However, bulky or less homogeneous products (natural wood, bulk polymer, etc.) usually require some form of pre-treatment or sample preparation. The key is to ensure that the extract is representative of the whole sample and that the extraction process is either complete or at least that the organic concentrations in the extract are proportional to those in the sample. These two requirements generally demand either dissolution or slurrying, or grinding of the sample such that it has a high surface area to mass ratio (e.g. fibre, film, powder, granules).

NOTE 2 Rigid samples such as dense polymers must be kept cool during grinding, e.g. by the addition of solid carbon dioxide, to minimise loss of volatiles.

Liquid extraction (water or organic solvent) is often used before measuring/analysing the organic content of a material with respect to potential release to ground water and soil. Environmental methods, for example those describing the liquid extraction and measurement of organic chemical concentrations in soil or waste, may be applicable in this case.

Gas extraction is more commonly used to measure organic chemical content with respect to potential vapour-phase emissions to indoor air. In this case, environmental methods (such as headspace or purge-and-trap determinations of organic chemicals in soil) can provide a general guide, but are rarely directly applicable to construction products because the matrices of materials emitting to indoor air are significantly different to environmental samples. Industrial quality control methods (e.g. monomer in polymer or residual solvents in packaging film) are typically more applicable for measuring chemical content with respect to emissions to indoor air.

Content test data based on gas extraction may correlate with test results for emission to indoor air particularly in the case of relatively homogeneous products such as raw polymer film, beads or fibres, adhesives, particle board, paints and coatings, etc. In these cases it may be possible to consider such content tests as a quick, low-cost alternative to testing primary emissions. However, some products release secondary emissions under their intended conditions of use – for example due to chemical reactions during curing. Such secondary emissions cannot be observed or assessed by content testing.

NOTE 3 It is much less likely that content test data will correlate with emission test results for composite products such as laminate flooring, synthetic carpet, etc.

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Table 11 — Organic substances to be considered under the CPD and available test methods

Substance or substance group	Individual substance or substance group	Chemical Abstract Service Number (CAS)	Test methods for extraction and analysis available	
			Gas method	Solvent method
Formaldehyde		50-00-0	EN 717-2 ISO 15234	EN 120 EN ISO 4614
VVOC	Substances according to the definitions in 2.1, e.g. aliphatic hydrocarbons, aliphatic alcohols, amines, esters, acetone and aldehydes	n/a	ISO WD 12219-3 ASTM $WK_2$2044 GMW GUT	
VOC	Substances according to the definitions in 2.1, e.g. aromatic hydrocarbons, aliphatic hydrocarbons, terpenes, amines, aliphatic alcohols and ether, aromatic alcohols, glycols, glycolethers, aldehydes, ketones, acids, esters and lactones, chlorinated hydrocarbons, siloxanes, isothiazolones (CIT/MIT/BIT), phenols, cresols, naphthalene	n/a	EN ISO 787-2 EN ISO 11890-2 EN ISO 17895 ISO 15009 ISO 22155 ISO WD 12219-3 ASTM WK 22044 GMW	NEN 6893
SVOC	Substances according to the definitions in 2.1, e.g. phthalates, aliphatic hydrocarbons, organophosphorous compounds. See also Note 2	n/a	ISO 16000-25 ISO WD 12219-3 ASTM WK 22044 GMW VDA	
DDT (p,p ′-Dichlor-2,2-diphenyl-1,1,1-trichlorethan)		50-29-3		EN ISO 6468
Wood preservatives		n/a	[a] [b]	[a] [b]
Polycyclic aromatic hydrocarbons (PAH)	PAH	n/a		CSS 99015 ISO 13877 ISO 18287 NEN 7331
	Anthracene	120-12-7		
	Benzo[a]pyrene	50-32-8		
	Dibenz[a,h]anthracene	53-70-3		
	Benz(a)anthracene	218-01-9		
	Benzo[b]fluoranthene	205-99-2		
	Benzo[k]-fluoranthene	207-08-9		
	Benzo[ghi]perylene	191-24-2		
	Fluoranthene	206-44-0		
	Indeno(123-cd)pyrene	193-39-5		
	∑ Naphthalene and methylnaphthalenes	n/a		
	Naphthalene	91-20-3		
	Phenanthrene	85-01-8		
	Chrysene	56-55-3		

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Substance or substance group	Individual substance or substance group	Chemical Abstract Service Number (CAS)	Test methods for extraction and analysis available	
			Gas method	Solvent method
Polychlorinated biphenyls (PCB)		1336-36-3		CSS 99016 EN ISO 15318 ISO 16000-14 ISO 6468 ISO 10382
Polybrominated diphenylethers (PBDE)	Penta-bromodiphenylether	32534-81-9		EN 71-11 IEC 62321
	Octa-bromodiphenylether	32536-52-0		IEC 62321
	Decabromodiphenylether	1163-19-5		IEC 62321
Tetrabromobisphenol A (TBBPA)		79-94-7	[a] [b]	[a] [b]
Hexabromocyclododecane (HBCD)		25637-99-4 3194-55-6	[a] [b]	[a] [b]
Azodyes		118685-33-9	[a] [b]	[a] [b]
Polyhalogenated dibenzo-p-dioxins and polyhalogenated dibenzofurans (Dioxins and Furanes)		n/a		CSS 99045
Perfluorooctanesulfonate (PFOS)		45298-90-6		ISO 25101 [c]
Chlorobenzenes	Trichlorobenzenes	12002-48-1		ISO 6468
	1,2,4-trichlorobenzene	120-82-1		
	1,2,3-triclorobenzene	87-61-6		
	Other chlorobenzenes	108-90-7 95-50-1 541-73-1 106-46-7 87-61-6 120-82-1 108-70-3 634-66-2 634-90-2 95-94-3 608-93-5 188-74-1		
Chlorinated phenols		95-57-8 108-43-0 106-48-9 576-24-9 120-83-2 583-78-8 87-65-0 95-77-2 591-35-5 15950-66-0 933-78-8 933-75-5 95-95-4 609-19-8 88-06-2 4901-51-3 935-95-5 58-90-2 87-86-5		ISO 14154 NEN 6971 – NEN 6976

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Substance or substance group	Individual substance or substance group	Chemical Abstract Service Number (CAS)	Test methods for extraction and analysis available	
			Gas method	Solvent method
Volatile halogenated hydrocarbons	Halogenated C1- and C2-hydrocarbons, including trihalogenated methane and	n/a		ISO 5787 NEN 6971 – NEN 6976
	Methylchlorid	74-87-3		
	Bromomethane	74-83-9		
	Dibromomethane	74-95-3		
	1,1-dichloroethane	75-34-3		
	Chloroethane	75-00-3		
	1,2-dibromoethane	106-93-4		
	Tribromoethane	75-25-2		
	Dichloromethane (Methylen chloride)	75-09-2	[a]	[a] NEN 6971 – NEN 6976
	1,2-Dichloroethane (Ethylendichloride)	107-06-2	[a]	[a] NEN 6971 – NEN 6976
	Trichloromethane (Chloroform)	67-66-3	[a]	[a] NEN 6971 – NEN 6976
	Chloroethylene (vinyl chloride)	75-01-4	[a]	[a] NEN 6971 – NEN 6976
Partially and fully fluorinated hydrocarbons, perfluorocarbons (HFCs, FCs, PFCs)		n/a	[a b]	[a b]
C10-13-chloroalkanes (SCCP – short chain chlorinated paraffins)		85535-84-8	[a]	[a] NEN 6971 – NEN 6976
C14-17-chloroalkanes (MCCP – medium chained chlorinated paraffins)		85535-85-9	[a]	[a] NEN 6971 – NEN 6976
Organophosphorous compounds as a group		n/a	[a b]	[a b]
Tributyltin compounds		688-73-3		ISO 23161
Volatile aromatic hydrocarbons	BTEX: benzene, toluene, ethylbenzene, o-xylene, m-xylene p-xylene	 71-43-2 108-88-3 100-41-4 95-47-6 108-38-3 106-42-3	[a]	[a] NEN 7331
	Styrene	100-42-5	[a b]	[a b]
Epichlorohydrin		106-89-8	[a]	EN 14207 [d] NEN 6971 – NEN 6976
Acryl amide		79-06-1	[a]	[a] NEN 6971 – NEN 6976
Methyloacrylamide		924-42-5	[a]	[a] NEN 6971 – NEN 6976
Phenols	Nonylphenols	25154-52-3		CSS 99040
	4,4'-Isoproypylidenediphenol	80-05-7	[a b]	[a b]
	Phenol	108-95-2	[a b]	[a b]

Substance or substance group	Individual substance or substance group	Chemical Abstract Service Number (CAS)	Test methods for extraction and analysis available	
			Gas method	Solvent method
	Phenol index as a sum parameter	n/a	[a] [b]	[a] [b]
	Phenolic compounds	n/a		EN ISO 8974
Hydrocarbons (mineral oil)		n/a		EN 14039 NEN 6978
Phthalates	Di(2-ethyhexyl)phthalate (DEHP)	117-81-7		CSS 00042
	Dibutylphtalate (DBP)	84-74-2		CSS 00042
	Phthalates (total)	n/a		CSS 00042
Diisocyanates		n/a		EN ISO 10283
Chlorinated biocides	Pentachlorophenol (PCP)	87-86-5		CEN/TR 14823 EN ISO 15320
	Hexachlorobenzene	118-74-1	[a]	[a] NEN 6971 – NEN 6976
	Diuron	330-54-1	[a] [b]	[a] [b]
	Other biocides	n/a		EN 71-11
Hydrazine		302-01-2	[a] [b]	[a] [b]

[a] No EN or ISO standards identified.

[b] Whether there are national standards available shall be examined.

[c] ISO 25101 is in Table 15 for eluate analysis.

[d] EN 14207 is in Table 15 for eluate analysis..

Multi-substance methods for a single matrix (soil) have been developed using separate extraction and clean-up procedures for various organic substances (NEN 6971 – NEN 6976). This development is gaining as the multitude of extraction and clean-up methods for individual substances becomes unworkable.

Gas and liquid extraction method options are described in more detail below.

4.4.2 Gas extraction and analytical methods for measuring VOC (SVOC) content of products

Gas extraction options for (S)VOC include:

a) Static gas extraction – i.e. conventional equilibrium headspace (HS) analysis of samples weighed into sealed containers/vials. These methods are quantitative but not absolute. VOCs partition between the sample matrix and the gas phase (headspace) depending on temperature, analyte volatility and affinity for the sample matrix. However, once equilibrium has been reached, the concentration of a given analyte in the headspace is proportional to that in the sample matrix. HS-GC-MS can be readily automated and is widely used for volatiles in solid and liquid samples, but is not generally suited to semi-volatiles or trace constituents.

b) Dynamic gas extraction – variously referred to as headspace-trap, HS-TD, thermal desorption (TD) or thermal extraction, depending on type. This approach most closely resembles conventional emissions test methods and is perhaps the most broadly applicable to construction products. Methods fall into two sub-groups:

   1) HS-trap / HS-TD – As in a) above but with a flow of inert (purge) gas passing through the sample container and either through the sample itself or over the surface of the sample. Extracted chemicals are focused on an off-line or on-line sorbent trap/tube before TD-GC-MS analysis.

Such dynamic gas stripping allows exhaustive (complete) extraction of VOC content in some cases and certainly extends the sensitivity and volatility range relative to static headspace.

2) Thermal desorption (TD) / extraction – Samples, weighed into empty tubes or other containers, are heated with a flow of inert purge gas passing through the sample. Chemicals are completely or proportionally extracted into the gas stream, collected in an on- or off-line sorbent trap and analysed by TD-GC-MS.

These dynamic gas extraction methods can be applied to liquid or solid samples and to VOCs and lighter SVOCs. Commercial variants are available to accommodate sample sizes from tens of milligrams (e.g. direct TD) to several grams (thermal extraction or HS-trap). All can be integrated or combined with GC-MS analytical equipment and are readily automated. Off-line gas extraction technologies can also be combined with HPLC equipment. Though easier than with static headspace, it can still be difficult to completely (exhaustively) extract lower volatility organic chemicals from some materials using dynamic gas extraction. In this case, methods typically rely on proportional / partial extraction. Liquid extraction may be preferred if complete extraction of semi-volatiles is required.

Existing gas extraction methods relevant to quantification of the chemical content of materials prone to emit to indoor air are given in Table 12. Most of these are, as yet, unvalidated.

Table 12 — Gas extraction and analysis methods for measuring VOC (SVOC) content of products

Standard	Title	Substance(s)	Product matrices [a] [b]						
			S	B	M	W	P	A	C
EN 717-2	Wood-based panels – Determination of formaldehyde release – Part 2: Formaldehyde release by the gas analysis method	Formaldehyde	0	0	0	+	0	0	0
EN ISO 787-2	General methods of test for pigments and extenders – Part 2: Determination of matter volatile at 105 °C (ISO 787-2:1981)	VOC	0	0	0	0	0	0	+
EN ISO 11890-2	Paints and varnishes – Determination of volatile organic compound (VOC) content – Part 2: Gas-chromatographic method (ISO 11890-2:2006)	VOC	0	0	0	0	0	0	+
EN ISO 17895	Paints and varnishes – Determination of the volatile organic compound content of low-VOC emulsion paints (in-can VOC) (ISO 17895:2005)	VOC	0	0	0	0	0	0	+
ISO 15009	Soil quality – Gas chromatographic determination of the content of volatile aromatic hydrocarbons, naphthalene and volatile halogenated hydrocarbons – Purge-and-trap method with thermal desorption	Volatile (aromatic) hydrocarbons	+	0	0	0	0	0	0
ISO 15234	Paints and varnishes – Testing of formaldehyde-emitting coatings and melamine foams – Determination of the steady-state concentration of formaldehyde in a small test chamber	Formaldehyde	0	0	0	0	0	0	+

Standard	Title	Substance(s)	Product matrices [a b]						
			S	B	M	W	P	A	C
ISO 16000-25	Indoor air – Part 25: Determination of the emission of semi-volatile organic compounds by building products – Micro-chamber method	SVOC	+	0	0	+	+	+	+
ISO 22155	Soil quality − Gas chromatographic quantitative determination of volatile aromatic and halogenated hydrocarbons and selected ethers − Static headspace method	VOC	?	0	0	+	+	0	0
ISO WD 12219-3	Indoor air − Road vehicles − Part 3: Determination of the emissions of volatile organic compounds from car trim components − Micro-chamber method	VOCs, some VVOCs and SVOCs Range: ~C_4 to n-C_{26}	+	0	0	+	+	+	+
ASTM WK 22044 (draft)	Draft standard practice for micro-scale test chambers for rapid screening of vapour-phase organic compounds emitted by materials/products	VOCs, some VVOCs and SVOCs Range: ~C_4 to n-C_{26}	+	0	0	+	+	+	+
General Motors (World)	Specified test procedure for VOC and SVOC emissions from interior car trim components (Draft)	VOC, SVOC	0	0	0	+	+	+	+
GUT	Test method for screening VOC emissions from textile floor coverings	VOC	0	0	0	+	+	+	0
Verein Deutscher Automobiel-industrie (VDA) Method 278/277	Thermal desorption analysis of organic emissions from car trim components	VOC	0	0	0	+	+	+	+

[a] S – silica-based products; W – wood-based products; A – adhesives and sealants; B – bituminous products; P – plastics and rubbers; C – coatings and paints; M – metals

[b] + – suitable for the specified matrix; ? – relevance not known yet; 0 – not relevant

Some of the gas extraction content testing-type methods listed in Table 12 are (or can be) carried out at low to moderate temperatures. In these cases, results often correlate well with conventional reference tests for air emissions allowing them to be used, not strictly to determine chemical content but rather as a low-cost means of fast emissions screening. Examples of such methods currently used by industry to screen chemical emissions include:

— out gassing of emissions from PC components such as hard disk drives at 80 °C. Any volatile or semi-volatile organic vapours emitted are collected on sorbent tubes and subsequently analysed by thermal desorption (TD)-GC-MS (various proprietary procedures);

— direct low temperature TD-GC-MS analysis of volatiles and semi-volatiles (fogging compounds) from small samples of car interior trim materials (Method VDA 278);

— low temperature, thermal extraction of flooring or wall-covering surfaces in heated chamber / cell type devices (GUT method);

— EN 71-11:2005 (Annex A), for toys;

— EN 717-2, for testing formaldehyde emissions from wood based panels at elevated temperatures.

In this regard, these gas extraction methods fulfil a very useful function for manufacturing industry and the validation of similar procedures for construction products which can emit to indoor air, should be actively considered.

NOTE Additional information on gas extraction methods used for emissions screening is given in the secondary method section of the proposed CEN/TC 351 umbrella standard on emissions testing.

The following two VOC method types are likely to provide for all the necessary procedures. Ruggedness testing and validation will have to confirm this.

a) Dynamic gas extraction of dry or wet-applied construction products using micro-scale chambers at ambient or elevated temperatures, following either ISO WD 12219-3 or ASTM draft WK 22044. This type of procedure offers quantitative content testing but is more commonly used for quick and cheap emissions screening, is horizontal (applicable to multiple material types) and is more likely to correlate with regular emissions tests. This type of "content" method is therefore most likely to meet the Commission's need for low cost "initial" testing, screening, WFT testing of VOCs as specified in Mandate M/366.

b) EN ISO 11890-2 which is a true "content" method for paints and coatings by direct GC-MS. This is not a horizontal method, but it is very widely used and effective for the relatively small subset of wet applied construction products.

4.4.3 Solvent extraction and related analytical methods for measuring organic substances in solid matrices

Another approach to extraction of organics is dissolution or liquid extraction followed by direct injection into capillary GC-MS or HPLC. Liquid extraction methods are usually presumed to be absolute and complete and should therefore be at least 80 % efficient for each component of interest. Liquid extraction methods require minimal equipment (capital investment) but are often manual and time consuming. Limitations include potential loss of the most volatile components and poor or variable extraction efficiency. They are best suited to semi-volatiles and sample matrices which dissolve completely.

Solvent extraction methods can be applied both to construction products that have an impact on soil, surface water and groundwater and those that emit to indoor air. They are often multi-step procedures involving one or more liquid extraction step(s) (e.g. aqueous extraction followed by liquid/liquid extraction with solvent), extract "clean-up" and pre-concentration of the extract prior to analysis by gas or liquid chromatography, which is nowadays mostly combined with mass spectrometry for compound identification. In some cases, extracted chemicals need to be derivatised, to stabilise them prior to chromatographic analysis.

NOTE Environmental methods developed for water analysis lack the sample preparation and extraction step needed to bring the substances from a solid in solution for subsequent chemical analysis. Therefore methods developed in the environmental sector for soil, sludge, biowaste and wastes (wide spectrum of matrices) are generally considered more suitable. However, limited ruggedness evaluation will be needed when it comes to ensuring that all matrices can be size reduced and subsequently extracted properly. Cryogenic size reduction may be a solution to increase extraction efficiency.

Table 13 lists existing solvent extraction methods and associated analytical methods for measuring organic substances in solid matrices.

Table 13 — Solvent extraction and analytical methods for measuring organic substances in solid matrices

Standard	Title	Substance(s)	Product matrices [a] [b]						
			S	B	M	W	P	A	C
CSS 99015 [c]	Soil, sludge. treated biowaste and waste – Determination of Polyaromatic hydrocarbons (PAH)	PAH	+	+	0	+	+	+	+
CSS 99016 [c]	Soil, sludge, treated biowaste and waste – Determination of Polychlorinated biphenyls (PCB)	PCB	+	+	0	+	+	+	+
CSS 99040 (To be published)	Soil, sludge and treated biowaste – Determination of nonylphenols	Nonylphenols	+	+	0	+	+	+	+
CSS 99042 (To be published)	Soil, sludge and treated biowaste – Determination of selected phthalates by gas chromatography with mass selective detection (GC-MS)	DEHP	+	+	0	+	+	+	+
CSS 99045 (To be published)	Soil, sludge and treated biowaste – Determination of dioxins, furans and dioxin-like polychlorinated biphenyls by gaschromatography with high resolution mass selective detection (HR GC-MS)	Dioxins, furans and DL-PCB	+	+	0	+	+	+	+
EN 71-11	Safety of toys – Part 11: Organic chemical compounds – Methods of analysis	Flame retardants, colorants, monomers and solvents, primary aromatic amines, wood preservatives, preservatives, plasticisers	0	0	0	0	+	0	0
EN 120	Wood based panels – Determination of formaldehyde content – Extraction method called the perforator method	Formaldehyde	0	0	0	+	0	0	0
EN 14039	Characterization of waste – Determination of hydrocarbon content in the range of C10 to C40 by gas chromatography	Mineral oil	+	+	0	+	+	0	0
CEN/TR 14823	Durability of wood and wood-based products - Quantitative determination of pentachlorophenol in wood - Gas chromatographic method	PCP	0	0	0	+	+	0	0
EN ISO 4614	Plastics – Melamine-formaldehyde mouldings - Determination of extractable formaldehyde (ISO 4614:1977)	Formaldehyde	0	0	0	0	+	0	0
EN ISO 8974	Plastics – Phenolic resins – Determination of residual phenol content by gas chromatography (ISO 8974:2002)	Phenol	0	0	0	0	+	0	0

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Standard	Title	Substance(s)	Product matrices [a b]						
			S	B	M	W	P	A	C
EN ISO 10283	Binders for paints and varnishes – Determination of monomeric diisocyanates in isocyanate resins (ISO 10283:2007)	Diisocyanates	0	0	0	0	0	0	+
EN ISO 15318	Pulp, paper and board – Determination of 7 specified polychlorinated biphenyls (PCB) (ISO 15318:1999)	PCB	0	0	0	+	0	0	0
EN ISO 15320	Pulp, paper and board – Determination of pentachlorophenol in an aqueous extract (ISO 15320:2003)	PCP	0	0	0	+	0	0	0
EN 62321	Electrotechnical products – Determination of levels of six regulated substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ethers)	Pb, Hg, Cd, Cr (VI), PBB, PBDE	0	0	0	0	+	0	0
ISO 10382	Soil quality – Determination of organochlorine pesticides and polychlorinated biphenyls – Gas-chromatographic method with electron capture detection	Organochlorine compounds, PCB	+	0	0	0	0	+	0
ISO 13877	Soil quality – Determination of polynuclear aromatic hydrocarbons – Method using high-performance liquid chromatographic	PAH	+	0	0	0	0	0	0
ISO 14154	Soil quality – Determination of some selected chlorophenols – Gas-chromatographic method with electron-capture detection	Chlorophenols	+	0	0	0	0	0	0
ISO 18287	Soil quality – Determination of polycyclic aromatic hydrocarbons (PAH) – Gas chromatographic method with mass spectrometric detection (GC-MS)	PAH	+	0	0	0	0	0	0
ISO 16000-14	Indoor air – Part 14: Determination of total (gas and particle-phase) polychlorinated dioxin-like biphenyls (PCBs) and polychlorinated dibenzo-p-dioxins/dibenzofurans (PCDDs/PCDFs) – Extraction, clean-up and analysis by high-resolution gas chromatography and mass spectrometry	PCB, PCDD/PCDF	+	0	0	+	+	+	+
ISO 23161	Soil quality – Determination of selected organotin compounds – Gas-chromatographic method	Organo Sn compounds	+	0	0	0	0	0	0

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Standard	Title	Substance(s)	Product matrices [a b]						
			S	B	M	W	P	A	C
NEN 6893	Soil, sediment and water – Determination of volatile organic compounds in soil, sediment and water samples by GC-MS	VOC	+	0	0	0	0	0	0
NEN 6971 – NEN 6976	Soil quality – Extraction methods and clean up methods for determination of organic components	Various organic substances	+	0	0	0	0	0	0
NEN 6978	Soil quality – Quantitative determination of the content of mineral oil by using gas chromatography	Mineral oil	+	0	0	0	0	0	0
NEN 7331	Bitumen and bitumen containing materials – Determination of the content of polycyclic aromatic hydrocarbons (PAH) and of benzene, toluene, ethylbenzene and xylene (BTEX) – Gas-chromatographic method with mass spectrometric detection	PAH, benzene, toluene, ethylbenzene and xylene	0	+	0	0	0	0	0

[a] S – silica-based products W – wood-based products A – adhesives and sealants
B – bituminous products P – plastics and rubbers C – coatings and paints
M – metals

[b] + – suitable for the specified matrix
0 – not relevant

[c] The methods for PAH and PCB developed by BT/TF Horizontal are the same and are intended to be merged into one single horizontal standard with a scope covering soil, sludge, treated biowaste and waste.

5 Test methods for eluates obtained by leaching

5.1 Introduction

Although this report deals primarily with total content analysis, the analysis of eluates as obtained by leaching can be assessed by the same analytical methods as highlighted in 3.1 (Tables 3, 6 and 8) and in Figure 1 on analytical methods for analysis of digests.

In some instances it shall be noted that interferences may occur. This applies in particular at low L/S values as obtained in column experiments (first fractions). Detection limits are generally higher due to the smaller sample volume available and the higher soluble salt load in these fractions affecting the sensitivity of analysis.

The work on eluates as described here supports the work by CEN/TC 351/WG 1 dealing with test methods for assessing the release of substances from construction products by leaching. Any further work on standards development will be a task to be decided upon by CEN/TC 351/WG 1. Analysis of substances in air during emission measurements in test chambers is an integral part of the standards worked out by CEN/TC 351/WG 2.

The available methods are also here separated in inorganic and organic substances.

5.2 Inorganic substances in eluates

In Table 14 the most common analytical methods for inorganic substances in eluates are given.

Table 14 — Analytical methods for inorganic substances in eluates

Standard	Title	Substance(s)	Eluates from product matrices [a] [b]						
			S	B	M	W	P	A	C
Multi-element methods									
CSS 99026 (To be published)	Soils, sludges, sediments and treated bio-wastes – Trace elements – Method by inductively coupled plasma – Atomic Emissions Spectrometry (ICP-AES) – (extracts from digestion)	Major, minor and trace elements: Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Ce, Co, Cr, Cu, Fe, K, Hg, La, Li, Mg, Mn, Mo, Na, Nd, Ni, Ni, P, Pb, Pr, S, Sb, Sc, Se, Si, Sm, Sn, Sr, Te, Ti, Tl, U, V, W, Zn, Zr	+	+	+	+	+#	+#	+
CSS 99027 (To be published)	Soils, sludges, sediments and treated bio-wastes – Trace elements – Method by inductively coupled plasma – Mass Spectrometry (ICP-MS) (extracts from digestion)	Major, minor and trace elements: Ag, Al, As, Au, B, Ba, Be, Bi, Ca, Cd, Ce, Co, Cr, Cs, Cu, Dy, Er, Eu, Fe,Ga, Gd, Ge, Hf, Hg, Ho, In, Ir, K, La, Li, Lu, Mg, Mn, Mo, Na, Nd, Ni, P, Pb, Pd, Pr, Pt, Rb, Re, Rh, Ru, S, Sb, Sc, Se, Si, Sm, Sn, Sr, Tb, Te, Th, Ti, Tl, Tm, U, V, W, Y, Yb, Zn, Zr	+	+	+	+	+#	+#	+
EN 12506	Characterization of waste – Analysis of eluates – Determination of pH, As, Ba, Cd, Cl^-, Co, Cr, Cr VI, Cu, Mo, Ni, NO_2^-, Pb, total S, SO_4^{2-}, V and Zn	As, Ba, Cd, Cl, Co, Cr, Cr VI, Cu, Mo, Ni, NO_2, Pb, total S, SO_4^{2-}, V, Zn	+	?	+	+	?	?	+
EN 13370	Characterization of waste – Analysis of eluates – Determination of Ammonium, AOX, conductivity, Hg, phenol index, TOC, easily liberatable CN^-, F^-	Ammonium, AOX, Hg, phenol index, TOC, easily liberatable CN^-, F^-	+	?	+	+	?	?	+
EN ISO 10304-1	Water quality – Determination of dissolved anions by liquid chromatography of ions – Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulphate (ISO 10304-1:2007)	Br, Cl, F, nitrate, nitrite, phosphate and sulfate	+	+	+	+	+	+	+
EN ISO 10304-3	Water quality – Determination of dissolved anions by liquid chromatography of ions – Part 3: Determination of chromate, iodide, sulfite, thiocyanate and thiosulfate (ISO 10304-3:1997)	Chromate, I, sulphite, CNS and thiosulfate	+	+	+	+	+	+	+

Standard	Title	Substance(s)	Eluates from product matrices [a] [b]						
			S	B	M	W	P	A	C
EN ISO 10304-4	Water quality – Determination of dissolved anions by liquid chromatography of ions – Part 4: Determination of chlorate, chloride and chlorite in water with low contamination (ISO 10304-4:1997)	Chlorate, chloride and chlorite	+	+	+	+	+	+	+
EN ISO 11885	Water quality – Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007)	Major, minor and trace elements	+	+	+	+	+	+	+
EN ISO 17294-2	Water quality – Application of inductively coupled plasma mass spectrometry (ICP-MS) – Part 2: Determination of 62 elements (ISO 17294-2:2003)	Sb, As, Ba, B, Cd, Cr, Co, Cu, Mb, Ni, Se, Tl, V, Zn	+	0	0	0	0	0	0
Single-element methods									
EN 1233	Water quality – Determination of chromium – Atomic absorption spectrometric methods	Cr	+	0	0	0	0	0	0
EN 1483	Water quality – Determination of mercury – Method using atomic absorption spectrometry	Hg	+	?	+	+	?	?	+
EN 12338	Water quality – Determination of mercury – Enrichment methods by amalgamation	Hg	+	0	0	0	0	0	0
EN ISO 5961	Water quality – Determination of cadmium by atomic absorption spectrometry (ISO 5961:1994)	Cd	+	0	0	0	0	0	0
EN ISO 11969	Water quality – Determination of arsenic – Atomic absorption spectrometric method (hydride technique) (ISO 11969:1996)	As	+	0	0	0	0	0	0
EN ISO 14403	Water quality – Determination of total cyanide and free cyanide by continuous flow analysis (ISO 14403:2002)	CN^-	+	0	0	0	0	0	0
EN ISO 15061	Water quality – Determination of dissolved bromate – Method by liquid chromatography of ions (ISO 15061:2001)	BrO_3^-	+	0	0	0	0	0	0
EN ISO 15586	Water quality – Determination of trace elements using atomic absorption spectrometry with graphite furnace (ISO 15586:2003)	Trace elements	+	0	0	0	0	0	0
EN ISO 15682	Water quality – Determination of chloride by flow analysis (CFA and FIA) and photometric or potentiometric detection (ISO 15682:2000)	Cl^-	+	0	0	0	0	0	0
ISO 5666	Water quality – Determination of mercury	Hg	+	+	+	+	+	+	+

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Standard	Title	Substance(s)	Eluates from product matrices [a b]						
			S	B	M	W	P	A	C
ISO 22743	Water quality – Determination of sulfates – Method by continuous flow analysis (CFA)	SO_4^{2-}	+	0	0	0	0	0	0

[a] S – silica-based products; W – wood-based products; A – adhesives and sealants; B – bituminous products; P – plastics and rubbers; C – coatings and paints; M – metals

[b] + – suitable for the specified matrix; ? – relevance not known yet; 0 – not relevant; # – possibly after cryogenic size reduction

5.3 Organic substances in eluates

In Table 15 the most common analytical methods for organic substances in eluates are given. Normally, solvent extraction of the water is carried out to concentrate the organic substances in a smaller volume for analysis by GC-MS (see also Figure 1).

Table 15 — Analytical methods for organic substances in eluates

Standard	Title	Substance(s)	Eluates from product matrices [a b]						
			S	B	M	W	P	A	C
CSS 99015 [c]	Determination of Polyaromatic hydrocarbons (PAH)	PAH	+	+	0	+	+	+	+
CSS 99016 [c]	Determination of Polychlorinated biphenyls (PCB)	PCB	+	+	0	+	+	+	+
CSS 99042 (To be published)	Soil, sludge and treated biowaste – Determination of selected phthalates by gas chromatography with mass selective detection (GC-MS)	DEHP	+	+	0	+	+	+	+
CSS 99045 (To be published)	Soil, sludge and treated biowaste – Determination of dioxins, furans and dioxin-like polychlorinated biphenyls by gas chromatography with high resolution mass selective detection (HR GC-MS)	Dioxin and furan	+	+	0	+	+	+	+
EN 12673	Water quality – Gas chromatographic determination of some selected chlorophenols in water	Chlorophenol	+	+	0	+	+	+	+
EN 14039	Characterization of waste – Determination of hydrocarbon content in the range of C10 to C40 by gas chromatography	Mineral oil	+	+	0	+	+	0	0
EN 14207	Water quality – Determination of epichlorohydrin	C_3H_5ClO	+	+	0	+	+	+	+

Standard	Title	Substance(s)	Eluates from product matrices [a] [b]						
			S	B	M	W	P	A	C
EN 15308 [c]	Characterization of waste – Determination of selected polychlorinated biphenyls (PCB) in solid waste, soil and sludge by using capillary gas chromatography with electron capture or mass spectrometric detection	PCB	+	+	0	+	+	+	+
EN 15527 [c]	Characterization of waste - Determination of polycyclic aromatic hydrocarbons (PAH) in waste using gas chromatography mass spectrometry (GC/MS)	PAH	+	+	0	+	+	+	+
EN ISO 9562	Water quality – Determination of adsorbable organically bound halogens (AOX) (ISO 9562:2004)	AOX	+	+	0	+	+	+	+
EN ISO 10695	Water quality – Determination of selected organic nitrogen and phosphorus compounds – Gas chromatographic methods (ISO 10695:2000)	Organic N and P	+	0	0	0	0	0	0
EN ISO 17993	Water quality – Determination of 15 polycyclic aromatic hydrocarbons (PAH) in water by HPLC with fluorescence detection after liquid-liquid extraction (ISO 17993:2002)	PAH	?	0	0	0	0	0	0
EN ISO 18856	Water quality – Determination of selected phthalates using gas chromatography/mass spectrometry (ISO 18856:2004)	DEHP	+	+	0	+	+	+	+
ISO 6468	Water quality – Determination of certain organochlorine insecticides, polychlorinated biphenyls and chlorobenzenes – Gas chromatographic method after liquid-liquid extraction	PCBs, chlorobenzene, several types of chlorinated and not-chlorinated pesticides (sum)	?	0	0	0	0	0	0
ISO 8165-1	Water quality – Determination of selected monovalent phenols - Part 1: Gas-chromatographic method after enrichment by extraction	Phenol	+	+	0	+	+	+	+

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Standard	Title	Substance(s)	Eluates from product matrices [a] [b]						
			S	B	M	W	P	A	C
ISO 8165-2	Water quality – Determination of selected monovalent phenols – Part 2: Method by derivatization and gas chromatography	Phenol	+	0	0	0	0	0	0
ISO 11423-2	Water quality – Determination of benzene and some derivatives – Part 2: Method using extraction and gas chromatography	VOC: Benzene and some derivatives	?	0	0	0	0	0	0
ISO 17858	Water quality – Determination of dioxin-like polychlorinated biphenyls – Method using gas chromatography/mass spectrometry	DL PCB	+	+	0	+	+	+	+
ISO 18073	Water quality – Determination of tetra- to octa-chlorinated dioxins and furans – Method using isotope dilution HRGC/HRMS	Dioxin and furan	+	+	0	+	+	+	+
ISO 18857-1	Water quality – Determination of selected alkylphenols – Part 1: Method for non-filtered samples using liquid-liquid extraction and gas chromatography with mass selective detection	Alkylphenol	+	0	0	0	0	0	0
ISO 18857-2	Water quality – Determination of selected alkylphenols – Part 2: Gas chromatographic-mass spectrometric determination of alkylphenols, their ethoxylates and bisphenol A in non-filtered samples following solid-phase extraction and derivatisation	Alkylphenol	+	0	0	0	0	0	0
ISO 22032	Water quality – Determination of selected polybrominated diphenyl ethers in sediment and sewage sludge – Method using extraction and gas chromatography/mass spectrometry	PBDE	?	0	0	0	0	0	0
ISO 25101	Water quality – Determination of perfluorooctanesulfonate (PFOS) and perfluorooctanoate (PFOA) – Method for unfiltered samples using solid phase extraction and liquid chromatography/ mass spectrometry	PFOS and PFOA	+	+	0	+	+	+	+

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Standard	Title	Substance(s)	Eluates from product matrices [a] [b]						
			S	B	M	W	P	A	C
ISO/DIS 28540	Water quality – Determination of 16 polycyclic aromatic hydrocarbons (PAH) in water – Method using gas chromatography with mass spectrometric detection (GC-MS)	PAH	+	+	0	+	+	+	+

[a] S – silica-based products; W – wood-based products; A – adhesives and sealants; B – bituminous products; P – plastics and rubbers; C – coatings and paints; M – metals

[b] + – suitable for the specified matrix; ? – relevance not known yet; 0 – not relevant

[c] The methods for PAH and PCB developed by BT/TF Horizontal are the same and are intended to be merged into one single horizontal standard with a scope covering soil, sludge, treated biowaste and waste.

5.4 Method for dissolved organic matter (DOC)

In Table 16 the analytical method for dissolved organic carbon (DOC) is given. TOC in water is equal to DOC. This parameter is of relevance for eluate analysis as both metals and organic substances can be complexed by DOC. This complexation will mobilise otherwise insoluble or hardly soluble substances, which has consequences for their impact on the environment.

Table 16 — Quantification methods for DOC

Standard	Title	Substance(s)	Eluates from product matrices [a] [b]						
			S	B	M	W	P	A	C
EN 1484	Water analysis – Guidelines for the determination of total organic carbon (TOC) and dissolved organic carbon (DOC)	(TOC and) DOC	+	+	0	+	?	?	?

[a] S – silica-based products; W – wood-based products; A – adhesives and sealants; B – bituminous products; P – plastics and rubbers; C – coatings and paints; M – metals

[b] + – suitable for the specified matrix; ? – relevance not known yet; 0 – not relevant

6 Particles

6.1 Introduction

In Table 17 the particles that are of relevance for the CPD are given, as are the available test methods. These cover different types of asbestos particles and synthetic fibres.

Table 17 — Particles to be considered under the CPD and available test methods

Substance group or parameter	Substance or substance subgroup	Chemical Abstract Service Number (CAS)	Test methods available
Particles			
Asbestos	Actinolite	77536-66-4	EN ISO 16000-7 NEN 5896 VDI 3866-1, -2, -4, -5
	Amosite	12172-73-5	EN ISO 16000-7
	Anthophyllite	77536-67-5	EN ISO 16000-7
	Chrysotile	12001-29-5	EN ISO 16000-7
	Crocidolite	12001-28-4	EN ISO 16000-7
	Tremolite	77536-68-6	EN ISO 16000-7
Synthetic vitreous (silicate) fibres		n/a	No EN or ISO standards identified DIN 52340-2 BGIA workbook 7488

6.2 Asbestos

In Table 18 the methods for collection and analysis of asbestos are given.

Table 18 — Quantification methods for asbestos

Standard	Title	Substance(s)	Asbestos particles from product matrices [a] [b]						
			S	B	M	W	P	A	C
EN ISO 16000-7	Indoor air – Part 7: Sampling strategy for determination of airborne asbestos fibre concentrations (ISO 16000-7:2007)	Asbestos	+	+	0	0	0	0	0
NEN 5896	Qualitative analysis of asbestos in materials, using polarized light microscopy	Asbestos	+	0	0	0	0	0	0
VDI 3866-1, -2, -4, -5 (Available in English)	Determination of asbestos in technical products	Asbestos	+	0	0	0	0	0	0

[a] S – silica-based products; W – wood-based products; A – adhesives and sealants; B – bituminous products; P – plastics and rubbers; C – coatings and paints; M – metals

[b] + – suitable for the specified matrix; 0 – not relevant

6.3 Synthetic vitreous (silicate) fibres

Directive 97/69/EC (23rd amendment of directive 67/548/EEC) classifies two types of man-made vitreous (silicate) fibres as carcinogenic category 3 or 2 respectively. These are:

— Mineral wool, defined as [Man-made vitreous (silicate) fibres with random orientation with alkaline oxide and alkali earth oxide ($Na_2O+K_2O+CaO+ MgO+BaO$) content greater than 18 % by weight];

and

— Refractory Ceramic Fibres; Special Purpose Fibres defined as [Man-made vitreous (silicate) fibres with random orientation with alkaline oxide and alkali earth oxide ($Na_2O+K_2O+CaO+$ MgO+BaO), content less or equal to 18 % by weight].

Only for mineral wool exoneration criteria exist, i.e. the classification as carcinogenic category 3 does not apply if it can be shown that the criteria of well defined animal experiments are fulfilled (so called "exonerated fibres").

NOTE In Germany these criteria deviate in some details. Mineral wool not fulfilling the German criteria is banned.

For differentiation of the two mineral wool fibre types (exonerated and classified ones) and for proving the equivalence of a mineral wool fibre to an exonerated fibre type, the chemical composition of the mineral wool fibres must be known.

For that purpose, the oxides contained in the glass matrix have to be determined. Relevant oxides are especially the alkaline earth and alkali oxides, the alumina oxide, the iron oxide and the boron oxide. The institutes involved in the voluntary systems and installed for the control of the mineral wool production by industry in Europe and in Germany use DIN 52340-2, *Testing of glass — Chemical analysis of colourless soda-lime-glass with SiO_2, CaO, MgO and Na_2O as main constituents — Determination of SiO_2* and Guideline 7488 from the BGIA[1)] workbook "measurement of dangerous substances" for all (element) oxides, excluding boron oxide. Here, specially developed, non-standardised methods are used (basic digestion instead of acid digestion).

For (factory) industrial production control in the plants X-ray fluorescence spectrometry is used.

In Table 19 a collection of analytical methods for silicate fibres is listed.

Table 19 — Quantification methods for silicate fibres

Standard	Title	Substance(s)	Silicate fibres from product matrices [a] [b]						
			S	B	M	W	P	A	C
DIN 52340-2	Testing of glass – Chemical analysis of colourless soda-lime-glass with SiO_2, CaO, MgO and Na_2O as main constituents – Determination of SiO_2	SiO_2	+	0	0	0	0	0	0
BGIA workbook 7488 [c]	Measurement of dangerous substances – "Ermittlung des KI-Wertes von amorphen Mineralfasern" (in German) [d]	Na_2O, K_2O, CaO, MgO, BaO, Al_2O_3, Fe_2O_3	+	0	0	0	0	0	0

[a] S – silica-based products; W – wood-based products; A – adhesives and sealants; B – bituminous products; P – plastics and rubbers; C – coatings and paints; M – metals

[b] + – suitable for the specified matrix; 0 – not relevant

[c] See BGIA_Arbeitsmappe Messung von Gefahrstoffen [4].

[d] KI-Werte: Kanzerogenitätsindex-Werte.

1) BGIA = Berufsgenossenschaftliches Institut für Arbeitssicherheit, the German Institute for Occupational Safety and Health in Sankt Augustin (Germany).

7 Performance of methods

At this point the performance characteristics of the methods in terms of detection or determination limits and intra-/inter-lab variability have not yet been extracted from the standards. As very few of these methods have been validated for construction products, this will need to be done, particularly, to ensure the methods are applicable to all matrices encountered in the field of construction. Ruggedness testing will be needed to identify if proposed size reduction and extraction methods are suitable for all product groups falling under the CPD.

The validation of multi-element and multi-matrix digestion and analysis methods for inorganic parameters can be achieved by selecting representative samples from the identified product matrices and running an interlaboratory comparison on a selection of relevant DS from the "Indicative list" [1]. For anions (like Cl^-, F^-, SO_4^{2-}) in the same set of product matrices, an alkali fusion is recommended followed by quantification using ion chromatography.

The performance of methods for assessing organic components in construction products will also require a validation exercise covering the various classes of construction product and one or more gas or liquid extraction and associated analytical procedure in each case. It is recommended that such a validation exercise be carried out in parallel with horizontal reference "emission tests" of replicate samples. This will allow simultaneous assessment of the performance characteristics of the quick ‘content’ test methods and the degree of correlation between these tests and the reference emission tests.

Given the fundamental similarity between dynamic gas extraction procedures and reference emissions tests it is likely that, when validated, these methods will be shown to be horizontal to some degree – i.e. applicable to a relatively wide range of analytes and sample types. However, this will need to be confirmed and is unlikely to be the case for equilibrium headspace or liquid extraction methods which are much more matrix dependent.

8 Conclusions and recommendations

8.1 Conclusions

8.1.1 General

Based on the evaluation of the completed tables, it can be concluded that:

— the standards identified in the report are derived mostly from fields other than the construction sector, this implies that both the title and scope of already existing horizontal standards need to be extended to cover construction products (or a range of construction products). Alternatively new standards, based on the methods indentified in this report need to be defined with a title and scope covering construction products;

— for only a very limited number of substances in specific matrices methods are available to meet regulatory requirements (e.g. EN 1122 on Cd in plastics; ISO 6503 on Pb in paints);

— in this context the development of horizontal modules for specific measurements steps, such as pre-treatment, digestion/extraction and analysis, is likely to be the most efficient way of covering the range of construction products falling under the CPD rather than developing a series of methods covering all aspects of digestion/extraction and analysis;

— pre-treatment will often be needed prior to digestion/extraction and analysis. Size reduction is the most prominent pre-treatment needed to allow digestion/extraction of test specimen. In case of matrices like bitumen and adhesives, cryogenic size reduction may be necessary. Volatilisation losses of substances as a result of heating up the sample may also be a concern (Hg, organic substances);

— validation will not need to cover all substances in all matrices, but a limited number of substances in a selection of matrices sufficiently representative for the field of construction will suffice.

8.1.2 Specific comments for specific substances

8.1.2.1 Inorganic substances

— In comparison with the substances specified as regulated dangerous substances in the "Indicative list" [1], for which methods are needed, all inorganic substances are covered by existing methods, although the methods need to be validated for the spectrum of different construction products.

— Multi-element, multi-matrix digestion and analysis method for major, minor, trace elements (CSS 99025B or CSS 99025A for digestion and CSS 99026 or CSS 99027 for analysis) are the most adequate to cover the needs of CEN/TC 351 for total content analysis methods. A limited amount of ruggedness testing work will be needed to demonstrate suitability of the identified methods for the range of construction product groups that needs to be covered. This relates in particular to pre-treatment techniques to make materials suitable for digestion. This may imply methods describing cryogenic size reduction to be able to properly extract substances of interest from matrices like adhesives, plastic and rubber.

— Multi-element, multi-matrix digestion and analysis method for anions (CEN/TR 15018 for digestion and EN 12506, EN 13370, or EN ISO 10304-1 for analysis) are the most adequate to cover the needs of CEN/TC 351 for total content analysis methods. Also here a limited amount of ruggedness testing work will be needed to demonstrate suitability of the identified methods for the range of construction product groups that needs to be covered. This relates in particular to pre-treatment techniques to make materials suitable for digestion. This may imply methods describing cryogenic size reduction to be able to properly extract substances of interest from matrices like adhesives, plastic and rubber.

— The water analysis methods are often the basis for the analysis of digests, but a main aspect missing in the water analysis standards relates to interferences from other elements present in the digest. Therefore reference is made mainly to analysis procedures adapted for digest analysis.

— For analysis of Cr (VI), the method EN 15192 seems a suitable starting point as it already covers two matrices comparable to construction products.

— In case of metals the main element forms the potential environmental concern, hardly the minor impurities that are associated with the metal and which are relevant from a metal quality perspective.

— Intercomparison validation to demonstrate suitability of the methods for inorganic parameters developed in other fields for the wide spectrum of construction products will be feasible within a reasonable time frame and without too much effort as already a lot of experience exists with these methods.

8.1.2.2 Organic substances

a) In comparison with the substances specified as regulated dangerous substances in the "Indicative list" [1], for which methods are needed, all organic substances are covered by existing test methods, although the methods need to be validated for the spectrum of different construction products. However, in contrast to the inorganic substances, some of these methods have not reached the full standards stage (yet). In some cases national standards are available. Methods currently in development as work items in TCs have not been covered in this Technical Report.

b) For non-volatile or semi-volatile substances single- or multi-step extraction with water and/or organic solvents will be necessary depending on the substances of interest and the product matrix from which the extraction needs to be carried out.

c) Recently developed multi-matrix methods for the determination of non- and semi-volatile organic substances that are available for soil, sludge, treated biowaste and waste, are considered suitable for construction products – particularly with respect to release to water and soil. These methods are for instance CSS 99015 (PAH), CSS 99016 (PCB) and CSS 99045 (DL PCB PCDD, PCDF, expand)). Ruggedness testing and intercomparison validation will be needed to demonstrate this for a suitable range of construction products.

d) For some matrices (e.g. bitumen, adhesives) sample pre-treatment will be necessary to obtain a test portion that can be subjected to extraction.

e) Industries outside the construction sector have "blazed the trail" for using content-testing-type gas extraction methods for low-cost emissions screening of volatile and semi-volatile organics, particularly with respect to emissions to air. The following two VOC method types will provide for all the necessary procedures, assuming ruggedness testing and validation will give satisfactory results:

   1) ISO/WD 12219-3 for dynamic gas extraction of dry or wet-applied construction products using micro-scale chambers at ambient or elevated temperatures; and

   2) EN ISO 11890-2, a method for paints and coatings by direct GC-MS.

f) Individual methods are available for testing a variety of organic substances in specific sample matrices and it may be possible to expand these to a wider spectrum of construction products given the right sample pre-treatment. However, using this approach to cover all substances of interest for the CPD would be a multi year task (see recommendations).

8.1.2.3 Eluate analysis for leachate

Methods for eluate analysis are very comparable with the methods used for digest analysis. In several cases also eluates suffer similar interferences as observed in digests and extract. Methods are available for both inorganic and organic contaminants. It is expected that only limited ruggedness work will be needed. Intercomparison validation is needed to ensure that the methods proposed are indeed fit for purpose.

8.1.2.4 DOC and TOC

For DOC and TOC, methods are available and can be validated for use in the construction sector.

8.1.2.5 Fibres

For the determination of asbestos and silicate vitreous fibres, methods are available. For the latter, these are available in German only.

8.2 Recommendations

— There is a preference now to select digestion/extraction and analysis methods that are suitable for a wide range of substances, instead of dedicated methods for specific substances. The latter will make the testing unnecessarily costly. In the field of inorganic substances this trend has resulted in generic digestion methods (aqua regia digestion) and multi-element analysis methods based on ICP OES or MS (documents prepared in project Horizontal (CEN/BT TF 151, now CEN/TC 400) for soil, sludge, treated biowaste and waste). It is recommended to use these methods as the basis for the content of inorganic substances in construction products. There is a choice between extending the scope of the multi-element, multi-matrix standards to an even wider range of materials and products, or to adopt the standards as basis for standards with only construction products in title and scope. Sufficient information is available to define validation requirements.

— Like the digestion and analysis methods for inorganic components, there is a benefit to develop generic extraction and cleanup methods for organic contaminants followed by GC-MS (or sometimes

HPLC-MS) as the detection/quantification method (see for instance NEN series 6971 to 6976). With the multitude of organic substances, the development of numerous protocols for individual organic substances is highly inefficient. Currently, methods for testing non-volatile and semi-volatile organics such as PAH, PCB, DL-PCB, PCDD, PCDF and PBDE, have many aspects in common and it should therefore be possible to develop horizontal content-testing procedures for construction products based on these principles. Sufficient information is available to define validation requirements.

— Similarly, dynamic gas extraction procedures followed by GC-MS analysis should offer a horizontal approach to assessing volatile and semi-volatile components in a range of construction product types – particularly with respect to likely emissions to indoor air. It is recommended to carry out the validation in parallel with an assessment of the degree of correlation with reference emission tests. Sufficient information is available to define validation requirements.

— Single substance liquid extraction protocols for organic components should be replaced by generic organic contaminant extraction, clean-up and detection methods. A limited selection of organic solvents for a specific class of substances can be defined. In all cases the final analysis will be by some form of GC-MS or HPLC-MS. More method development work is needed in this area before validation requirements can be defined.

— Lack of methods at standardisation level is also a reason for the recommendation to develop horizontal extraction, cleanup, analysis methods for organics.

— Current development of methods should take a more horizontal approach to make them adequate for a wider spectrum of matrices.

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Annex A
(informative)

Background to CEN/TC 351/WIs 6/14 Content

A.1 Description in mandate M/366 (CEN/TC 351 N 004)

2.2 Work Package 3: horizontal standards: content of regulated dangerous substances in construction products

1. Horizontal standard on the measurement of the content of regulated dangerous substances and particles in construction products.

26. This standard shall be applicable to all substances relevant in accordance with the provisions of the main body of this mandate, i.e. those included in the work programme for the emission into indoor air, surface water, ground water and soil (see Annexes 4 and 5).

The concrete list of substances will depend on the screening of the database (see: IV.2, IV.7, IV.8, IV.13).

A.2 Description in the work programme of CEN/TC 351, as drafted by CEN/BT WG 176 in June 2005 and confirmed by CEN/TC 351 (CEN/TC 351 N 0026)

WI 6 *Construction Products — Assessment of release of dangerous substances — Content of regulated dangerous substances in construction products*

This horizontal standard describes the methods for the determination of the content of regulated dangerous substances in construction products.

This standard is applicable to all substances relevant in accordance with the provisions of the main body of Mandate M/366, i.e. those included in the work programme for the emission into indoor air, and release to surface water, ground water and soil.

NOTE 1 The selection of appropriate test method standards from those already available will be based on a TR, which will be prepared prior to the drafting of the standard.

NOTE 2 Analysis of content may include non-destructive and destructive methods for potential release of dangerous substances. Analysis of extracts resulting from destructive methods are analysed according to the standards coming from WI 8 and/or WI 10.

NOTE 3 The procedures described in WI 6 and WI 8 or in WI 9 and WI 10 will cover all the steps from the reception of the laboratory sample to the final result (storage, preparation of the test portion, pre-treatment, extraction, analysis and reporting).

The issues mentioned are:

— a wide range of methods exist, focus on existing documents;

— the list of existing standards attached to the business plan, will be completed by AFNOR based on the information provided by all members of CEN/TC 351;

— one of the criteria for selection of the standard test methods could be the information on validation.

Attention should only be given to content determination when this is the only practicable or legally correct solution.

A.3 Draft proposal to activate WI 00351007 (CEN/TC 351/WG 5 N 022)

This Technical Report describes appropriate test method standards for the determination of the content of regulated dangerous substances in construction products.

This Technical Report is applicable to all substances relevant in accordance with the provisions of the main body of Mandate M/366, i.e. those included in the work programme for the emission into indoor air, and release to surface water, ground water and soil.

NOTE 1 Based on this selection of appropriate test method standards from those already available, an EN on the horizontal test methods will be developed.

NOTE 2 Analysis of content may include non-destructive and destructive methods for potential release of dangerous substances. Analysis of extracts resulting from destructive methods are analysed according to the standards coming from WI 8 and/or WI 10.

Annex B
(informative)

Compilation of content regulations for construction products for health or environmental reasons

B.1 Introduction

The original basis for this Technical Report was the "Indicative list of regulated dangerous substances possibly associated with construction products under the CPD (DS 041/051 rev.8, dd 31 October 2006)". This list named only the names of the regulated substances, not the type of regulation (release or content).

In the updated version of the indicative list of May 2009 (DS 041/051 rev.9, dd 29 May 2009) [1] additionally the specific type of regulation (release or content) is mentioned for every substance.

For information of CEN/TC 351 the following table shows an extract of the content regulations actually existing for construction products. The regulations are very different, so a careful look to the original documents is inevitable. The differences lay – amongst others – in the following items:

— some regulations are on a European level, other regulations are only national;

— some regulations concern all types of products, many other regulations cover only specific construction products;

— most regulations for content refer to single substances, but some regulations refer to "substance groups", like "no substances which are carcinogenic, mutagenic or toxic to reproduction", or "no biocides without authorisation". For such "substance groups", no identification of the single components is given in Table C.1;

— most regulations restrict a substance, but other regulations only request the declaration of a substance (like the REACH Candidate-List). In both cases, no threshold values are given in Table B.1. They can be found in the original documents.

Declaration duties are only mentioned, if they refer to construction products which are "articles" under the chemical legislation of the EU, or if they go further than the declaration duties for construction products which are ‘mixtures’ under the chemical legislation of the EU.

The declarations duties under the chemical legislation of the EU for dangerous substances in construction products which are "mixtures" are not included. These duties are laid down in Directive 1999/45/EC and in Regulation (EC) No 1272/2008.

NOTE No legal responsibility is taken for the correctness of the given information.

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B.2 Regulated substances

Table B.1 — Content regulated substances in the l"Indicative list"

Substance	Regulation	Matrices covered by the regulation (expert guess)
Inorganic substances		
Arsenic / Arsenic Compounds	REACH Annex XVII Nr. 19	wood
	2001-450-D	waste wood
	2005-735-FIN	concrete chippings, fly and bottom ash
Barium	2005-735-FIN	fly and bottom ash
Cadmium and its Components	REACH Annex XVII Nr. 23	use restrictions in plastics, paints and varnishes, metal surfaces
	2001-200-A	elastic flooring materials
	2001-450-D	waste wood
	2005-735-FIN	concrete chippings, fly and bottom ash
Chloride	2001-450-D	waste wood
Chromium	2001-450-D	waste wood
	2002-9093-N	wood
	2005-735-FIN	concrete chippings, fly and bottom ash
Chromium (VI)	REACH Annex XVII Nr. 47	cement
	2001-200-A	elastic flooring materials
	1996-PL	inadmissible in building materials
CMR-Substances Cat. 1 and 2	REACH Annex XVII Nr. 28, 29, 30	mixtures available for consumers
CMRs and toxic, very toxic or environmentally hazardous substances	2006-90-D	concrete / concrete compounds
Carcinogenic, mutagenic, toxic and very toxic substances	2005-255-D	floor coverings and adhesives
Copper	2001-450-D	waste wood
	2005-735-FIN	concrete chippings, fly and bottom ash
Fluoride	2001-450-D	waste wood
Lead	REACH Annex XVII Nr. 16,17	paints
	2001-450-D	waste wood
	2001-200-A	elastic flooring materials
	2005-735-FIN	concrete chippings, fly and bottom ash
	2006-557-NL	building materials
	1996-PL	anti-corrosive agents
Molybdenum	2005-735-FIN	fly and bottom ash
Mercury	REACH Annex XVII Nr. 18	wood, biocides in varnishes
	2001-450-D	waste wood
	2001-200-A	elastic flooring materials
TOC	2004-71-D	aggregates for road construction
	2005-735-FIN	concrete chippings, fly and bottom ash
Vanadium	2005-735-FIN	fly and bottom ash
Zinc	2005-735-FIN	concrete chippings, fly and bottom ash
Organic substances		
Acrylamide and Methyloacrylamide	1998-9034-N	grouting agents
Anthracen	REACH Candidate-List	all articles (mostly used in plastics and rubber)
Benzene	REACH Annex XVII, Nr. 5	all mixtures

Substance	Regulation	Matrices covered by the regulation (expert guess)
	1995-213-A	paints, varnishes, wood preservatives, buildings preservation materials (including bitumen cold adhesives), adhesives, paint strippers, antifouling and underwater coatings
	2006-557-NL	stony building materials
	1996-PL	Admissible content in building materials up to 0,1 % by mass
Benzyl butyl phthalate (BBP)	REACH Candidate-List	all articles (plasticiser mostly used in plastics, paints and coatings, sealants and adhesives)
Biocides	Consolidated list [a] of existing active substances for which a decision of non-inclusion into Annex I or IA of Directive 98/8/EC has been adopted and which may no longer be placed on the market (Commission Decision 2007/565/EC of 14 August 2007, Commission Decision 2007/598/EC of 27 August 2007, Commission Decision 2008/681/EC of 28 July 2008, Commission Decision 2008/809/EC of 14 October 2008)	existing active substances for which a decision of non-inclusion into Annex I or Ia of Directive 98/8/EC has been adopted. Products containing these active substances shall no longer be placed on the market for the relevant product-types
BTXE	2005-283-NL	building materials
C10-13-Chloroalkanes (SCCP)	REACH Candidate-List	all articles (mainly used as plasticiser or flame retardant)
	Commission Decision 2004/1/EC	paints, sealants, adhesives, plastics, rubbers
C14-17-chloroalkanes (MCCP)	2007-9016-N	consumer products
CMR-Substances Cat. 1 and 2	REACH Annex XVII Nr. 28, 29, 30	mixtures available for consumers
CMRs and substances classified as toxic, very toxic or environmentally hazardous	2006-90-D	concrete / concrete compounds
Carcinogenic, mutagenic, toxic and very toxic substances	2005-255-D	floor coverings and adhesives
Ethylbenzene	2006-557-NL	stony building materials
Decabromodiphenylether (DecaBDE)	2005-9020-N	all products (used as flame retardant)
	2005-255-D	floor coverings and adhesives
Dibutyl phthalate	REACH Candidate-List	all products (plasticiser mostly used in plastics, paints and coatings, sealants and adhesives)
p,p'-Dichlor-2,2-diphenyl-1,1,1-trichlorethan (DDT)	Regulation (EC) 2004/850/EC	all products (used as biocide)
	2002-90-D	concrete / concrete compounds
Di(2-ethylhexyl)phthalate (DEHP)	REACH Candidate-List 2007-9016-N	all products (plasticiser mostly used in plastics, paints and coatings, sealants and adhesives)
Dioxins and Furanes	Regulation (EC) 2004/850/EC	all products
	1993-141-D	all products
EOX	2004-71-D	aggregates for road construction
Fluorinated hydrocarbons, perfluorocarbons (HFCs, FCs, PFCs, SF6)	2001-121-DK	all products (used mainly in foams and windows)
	2002-37 A	foams, insulation materials
Formaldehyde	1987-125-F	foams for indoor use
Hexabromocyclododecane	REACH Candidate-List	all products (flame retardant mostly used in plastics, coatings)
	2007-9016-N	consumer products

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Substance	Regulation	Matrices covered by the regulation (expert guess)
Mineral Oil	2006-557-NL	stony building materials
	2004-71-D	aggregates for road construction
Octabromodiphenylether (OctaBDE)	REACH Annex XVII Nr. 45	all products (flame retardant mostly used in plastics, coatings)
Pentabromodiphenylether (PentaBDE)	REACH Annex XVII Nr. 44	all products (flame retardant mostly used in plastics, foams)
Pentachlorophenol (PCP)	REACH Annex XVII Nr. 22	use restriction (for substances and preparations)
	Comm. Dec. 1994/783/EC	use restriction (additionally for articles)
	Comm. Dec. 1996/211/EC	use restriction (additionally for articles)
	Comm. Dec. 1999/831/EC	use restriction (additionally for articles)
	2001-450-D	waste wood
	1996-PL	inadmissible content in building materials used inside buildings
Perfluoroctanesulfonate (PFOS)	REACH Annex XVII Nr. 53	all products
Phenol	2006-557-NL	stony building materials
Phthalates (total)	2006-557-NL	stony building materials
Polybrominated Diphenyl Ether (PBDE)	2005-255-D	floor coverings and adhesives
Polycyclic Aromatic Hydrocarbons (PAH)	REACH Annex XVII Nr. 31 (distillation products of coke or petrol)	wood
	2004-71-D	aggregates for road construction
	2005-735-FIN	concrete chippings, fly and bottom ash
	2006-557-NL (individual substances and sum)	stony building materials
	2007-385-A, 2007-653-A	recycled building materials
Polychlorinated Biphenyls (PCB)	(EC) 2004/850/EC	all products
	2001-450-D	waste wood
	2005-735-FIN	concrete chippings, fly and bottom ash
	2006-90-D	concrete / concrete compounds
	2006-557-NL	stony building materials
Tetrabromobisphenol A (TBBPA)	2007-9016-N	consumer products
Tin compounds (Organostannic compounds)	REACH Annex XVII, Nr. 20	unbound paints, uses under water
Tributyltin compounds	2007-9016-N	consumer products
Tributyltinoxide (TBTO)	REACH Candidate-List	all articles (mainly used as biocide in wood preservatives and antifouling coatings)
Triphenyltin compounds	2007-9016-N	consumer products
Toluene	2006-557-NL	stony building materials
Very Volatile Organic Compounds (VVOC)	2004/42/EC	paints and varnishes
Volatile Organic Compounds (VOC)	2004/42/EC	paints and varnishes
	1995-213-A	paints, varnishes, wood preservatives, buildings preservation materials (including bitumen cold adhesives), adhesives, paint strippers, antifouling and underwater coatings
Wood Preservatives	1996-183-D	rules for wood preservation
Xylenes (sum)	2006-557-NL	stony building materials

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Substance	Regulation	Matrices covered by the regulation (expert guess)
Particles / Fibres		
Asbestos	REACH Annex XVII Nr. 6	pure asbestos and all articles containing asbestos
	1996-PL	construction materials, facilities and components of furniture in rooms intended for human residence
	1997-527-DK	all products in indoor air (also a general ban in Denmark exists)
	2004-294-NL	all products
	2006-557-NL	stony building materials
Synthetic vitreous (silicate) fibres	1998-156-D	special qualities of mineral wool for insulation
[a] See: http://ec.europa.eu/environment/biocides/pdf/list_dates_product_phasing_out.pdf.		

B.3 Regulations

All EU-Legislation can be found under http://eur-lex.europa.eu [5].

All notified regulations can be found under http://ec.europa.eu/enterprise/tris/index_en.htm [6].

Table B.2 — Regulations regarding content in the 'indicative list'

Regulation	Title
European Regulations	
Directive 98/8/EC	Directive 98/8/EC of the Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market
Directive 2004/42/EC	Directive 2004/42/CE of the European Parliament and of the Council of 21 April 2004 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC
Regulation (EC) 2004/850/EC	Regulation (EC) 2004/850/EC of the European Parliament and of the Council of 29 April 2004 on Persistent Organic Pollutants
Regulation (EC) 1907/2006 (REACH)	Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
REACH Candidate-List	http://echa.europa.eu/chem_data/authorisation_process/candidate_list_table_en.asp
Commission Decisions	
1994/783/EC	Commission Decision of 14 September 1994 concerning the prohibition of PCP notified by the Federal Republic of Germany
1996/211/EC	Commission Decision of 26 February 1996 concerning the prohibition of pentachlorophenol (PCP) notified by Denmark
1999/831/EC	Commission Decision of 26 October 1999 concerning the national provisions notified by the Kingdom of the Netherlands concerning the limitations of the marketing and use of pentachlorophenol (PCP)
2004/1/EC	Commission Decision of 16 December 2003 concerning national provisions on the use of short-chain chlorinated paraffins notified by the Kingdom of the Netherlands under Article 95(4) of the EC Treaty
2007/565/EC	Commission Decision of 14 August 2007 concerning the non-inclusion in Annex I, IA or IB to Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocidal products on the market of certain substances to be examined under the 10-year work programme referred to in Article 16(2) thereof
2007/598/EC	Commission Decision of 27 August 2007 concerning the non-inclusion of guazatine triacetate in Annex I, IA or IB to Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocidal products on the market

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Regulation	Title
2008/681/EC	Commission Decision of 28 July 2008 concerning the non-inclusion of certain substances in Annexes I, IA or IB to Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocidal products on the market
2008/809/EC	Commission Decision of 14 October 2008 concerning the non-inclusion of certain substances in Annex I, IA or IB to Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocidal products on the market
National (notified) Regulations	
1987-125-F	Décret 88-683 0f 06/05/1988 on the use of urea-formaldehyd foams in buildings intended for permanent or semi-permanent human occupation. Arrêté of 06/05/1988 fixing a maximum content of formaldehyde foams in buildings intended for a permanent or semi permanent human occupation.
1993/141/D	Prohibition of materials, preparations and products containing certain polyhalogenated dibenzo-p-dioxins (PHDDs) or certain polyhalogenated dibenzofuranes (PHDFs) (extension of applicability) order
1995-188-DK	Building regulations
1995-213-A	Regulation of the Federal Minister for the Environment concerning bans and restrictions of organic solvents (Lösungsmittelverordnung (Solvent Regulation) LMVO 1995)
1996-PL	Monitor Polski Nr 19/1996, poz. 231: ORDINANCE OF THE MINISTER OF HEALTH AND SOCIAL WELFARE of 12 March 1996 on the permitted concentrations and intensities of agents harmful for health emitted by construction materials, facilities and components of furniture in rooms intended for human residence http://isip.sejm.gov.pl/servlet/Search?todo=file&id=WMP19960190231&type=2&name=M19960231.pdf
1996-183-D	Specimen introductory order for the sample list of Technical Building Provisions
1997-527-DK	Building regulations for small houses
1998-156-D	Order amending the Orders on chemical law
1998-9034-N	A proposal for regulations relating to a permanent prohibition against the use of acryl amide based grouting agents for the sealing against water leakages in connection with construction works (incorporated into 2002-9039-N)
2001-121-DK	Order regulating certain industrial green house gases
2001-200-A	Quality regulations for elastic flooring materials
2001-450-D	Order on the disposal of waste wood
2002-37-A	Order of the Federal Minister for Agriculture and Forestry, the Environment and Water Management concerning bans and restrictions on partially fluorinated and fully fluorinated hydrocarbons as well as sulphur hexafluoride (HFC/FC/SF6 Order)
2002-9039-N	Regulations relating to restrictions on certain dangerous chemicals and products
2004-71-D	Technical Terms of Delivery for aggregates used in road construction (German designation: TL Gestein-StB 04)
2004-294-NL	Draft Decree regulating asbestos and products containing asbestos (Asbestos Products Decree)
2005-255-D	Principles for the health assessment of construction products used in interiors, as at April 2005
2005-283-NL	Regulation amending the Regulation implementing the Building Materials (Soil and Surface Water Protection) Decree
2005-735-FIN	Council of State Decree concerning the recovery of certain wastes in earth construction products
2005-9020-N	Regulation amending regulation of 1 June 2004 No 922 relating to restrictions on the use of chemicals dangerous to health and environment and other products (Product regulations)
2006-90-D	Principles for assessing the effects of construction products on soil and groundwater
2006-557-NL	Preliminary Draft of the Soil Quality Regulation
2007-385-A	Guidelines for recycled building materials (7th edition)
2007-653-A	Guidelines for recycled building materials from building demolition waste (1st edition)
2007-9016-N	Draft of new chapter concerning consumer products in the Norwegian Product Regulations: Hazardous substances in consumer products

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Annex C
(informative)

Standards for metals in alloys

The standards mentioned in this annex are not relevant in respect to environmental aspects; they are for metallurgic quality control purposes. The list is presented for reasons of completeness of this CEN/TR.

Table C.1 — List of standards for metals in alloys, etc.

Standard	Title	Substance(s)
EN 10071	Chemical analysis of ferrous materials – Determination of manganese in steels and irons – Electrometric titration method	Mn
EN 10188	Chemical analysis of ferrous materials – Determination of chromium in steels and irons – Flame atomic absorption spectrometric method	Cr (IV)
EN 10212	Chemical analysis of ferrous materials – Determination of arsenic in steel and iron – Spectrophotometric method	As
EN 12441-1	Zinc and zinc alloys – Chemical analysis – Part 1: Determination of aluminium in zinc alloys – Titrimetric method	Al
EN 12441-2	Zinc and zinc alloys – Chemical analysis – Part 2: Determination of magnesium in zinc alloys – Flame atomic absorption spectrometric method	Mg
EN 12441-3	Zinc and zinc alloys – Chemical analysis – Part 3: Determination of lead, cadmium and copper – Flame atomic absorption spectrometric method	Pb, Cd, Cu
EN 12441-4	Zinc and zinc alloys – Chemical analysis – Part 4: Determination of iron in zinc alloys – Spectrophotometric method	Fe
EN 12441-5	Zinc and zinc alloys – Chemical analysis – Part 5: Determination of iron in primary zinc – Spectrophotometric method	Fe
EN 12441-6	Zinc and zinc alloys – Chemical analysis – Part 6: Determination of aluminium and iron – Flame atomic absorption spectrometric method	Al, Fe
EN 12441-7	Zinc and zinc alloys – Chemical analysis – Part 7: Determination of tin – Flame atomic absorption spectrometric method after extraction	Sn
EN 12441-8	Zinc and zinc alloys – Chemical analysis – Part 8: Determination of tin in secondary zinc – Flame atomic absorption spectrometric method	Sn
EN 12441-9	Zinc and zinc alloys – Chemical analysis – Part 9: Determination of nickel in zinc alloys – Flame atomic absorption spectrometric method	Ni
EN 12441-10	Zinc and zinc alloys – Chemical analysis – Part 10: Determination of chromium and titanium in zinc alloys – Spectrophotometric method	Cr, Ti
EN 12441-11	Zinc and zinc alloys – Chemical analysis – Part 11: Determination of silicon in zinc alloys – Spectrophotometric method	Si
EN 14935	Copper and copper alloys – Determination of impurities in pure copper – ET AAS method	Ag, As, Bi, Cd, Co, Cr, Fe, Mn, Ni, Pb, Sb, Se, Sn, Te, Zn
EN 14936-1	Copper and copper alloys – Determination of aluminium content – Part 1: Titrimetric method	Al
EN 14936-2	Copper and copper alloys – Determination of aluminium content – Part 2: FAAS method	Al
EN 14937-1	Copper and copper alloys – Determination of antimony content – Part 1: Spectrometric method	Sb
EN 14937-2	Copper and copper alloys – Determination of antimony content – Part 2: FAAS method	Sb
EN 14938-2	Copper and copper alloys – Determination of bismuth content – Part 2: Flame atomic absorption spectrometric method (FAAS)	Bi
CEN/TS 14940-1	Copper and copper alloys – Determination of chromium content – Part 1: Titrimetric method	Cr

Standard	Title	Substance(s)
EN 14940-2	Copper and copper alloys – Determination of chromium content – Part 2: FAAS method	Cr
EN 14941	Copper and copper alloys – Determination of cobalt content –FAAS method	Co
EN 14942-2	Copper and copper alloys – Determination of arsenic content – Part 2: FAAS method	As
CEN/TS 15022-2	Copper and copper alloys – Determination of tin content – Part 2: Spectrophotometric method	Sn
EN 15022-3	Copper and copper alloys – Determination of tin content – Part 3: Low tin content – Flame atomic absorption spectrometry method (FAAS)	Sn
EN 15023-3	Copper and copper alloys – Determination of nickel content – Part 3: Flame atomic absorption spectrometric method (FAAS)	Ni
EN 15024-2	Copper and copper alloys – Determination of zinc content – Part 2: Flame atomic absorption spectrometry method (FAAS)	Zn
EN 15025	Copper and copper alloys – Determination of magnesium content – Flame atomic absorption spectrometric method (FAAS)	Mg
EN 15622	Copper and copper alloys – Determination of lead content – Flame atomic absorption spectrometric method (FAAS)	Pb
EN 15690-2	Copper and copper alloys – Determination of iron content – Part 2: Flame atomic absorption spectrometric method (FAAS)	Fe
EN 24938	Steel and iron – Determination of nickel content – Gravimetric or titrimetric method (ISO 4938:1988)	Ni
EN 24943	Chemical analysis of ferrous metal – Determination of copper content – Flame atomic absorption spectrometric method (ISO 4943:1985)	Cu
EN 24946	Steel and cast iron – Determination of copper content – 2,2'-Diquinolyl spectrophotometric method (ISO 4946:1985)	Cu
ISO 1976	Zinc alloys – Determination of copper content – Electrolytic method	Cu

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[1] "Indicative list of regulated dangerous substances possibly associated with construction products under the CPD (DS 041 051 rev9), 29 May 2009" (CEN/TC 351 N 0230^{rev} dated 2009-07-13.)

NOTE [1] is the updated version of "Indicative list of regulated dangerous substances possibly associated with construction products under the CPD (DS 041 051 rev8), 31 October 2006" (CEN/TC 351 N 0054 dated 2006-11-03.)

[2] German DVGW Worksheet W 347 Hygienische Anforderungen an zementgebundene Werkstoffe im Trinkwasserbereich – Prüfung und Bewertung (Hygienic requirements applying to cementitious materials in the drinking water sector - testing and evaluation). Arbeitsblatt W 347, Deutsche Vereinigung des Gas- und Wasserfaches e. V. Wirtschafts- und Verlagsgesellschaft Gas und Wasser mbH, Bonn (2006)

[3] HORIZONTAL standards, under development by CEN/TC 400 (formerly CEN/BT TF 151): www.ecn.nl/horizontal

[4] Arbeitsmappe Messung von Gefahrstoffen; BGIA_ARBEITSMAPPEdigital www.dguv.de/bgia/de/pub/mappe/index.jsp; BGIA, Berufsgenossenschaftliches Institut für Arbeitssicherheit (the German Institute for Occupational Safety and Health), Sankt Augustin, Germany

[5] http://eur-lex.europa.eu

[6] http://ec.europa.eu/enterprise/tris/index_en.htm

[7] WI 00351013, *Construction products — Assessment of release of dangerous substances — Complement to sampling* (TR 4).

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